Interim Site Management Plan
BASF Manufacturing Plant Site
Operable Unit No. 1 (OU-1)

Former BASF Manufacturing Plant
36 Riverside Avenue
Rensselaer, New York

December 5, 2019

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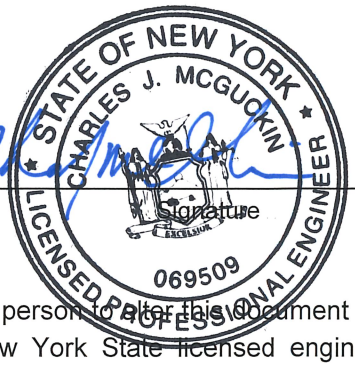
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Certification

I, Charles McGuckin, certify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Charles McGuckin, P.E.
NYS Professional Engineer #069509

December 5, 2019
Date



Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law

Acronyms List

Acronym	Definition
AOC	Area of Concern
AWQSGV	Ambient Water Quality Standards and Guidance Values
CAMP	Community Air Monitoring Plan
CCP	Construction Contingency Plan
COC	Certificate of Completion
EC	Engineering Control
EWP	Excavation Work Plan
FS	Feasibility Study
GCS	Groundwater Collection System
HASP	Health and Safety Plan
IC	Institutional Control
IRM	Interim Remedial Measure
O&M	Operation and Maintenance
MI&M	Monitoring, Inspection and Maintenance
MRC™	Metals Remediation Compound
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PD	Pre-Design
P&ID	Process and Instrumentation Diagram
PRAP	Proposed Remedial Action Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SAIC	Science Applications International Corporation
SESC	Soil Erosion and Sedimentation Control
SMP	Site Management Plan
SVOCs	Semivolatile Organic Compounds
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

Executive Summary

The BASF Corporation entered into an Order on Consent (10/20/2003) with the New York State Department of Environmental Conservation (NYSDEC) for implementation of the remedy for Operable Unit 01 described in the Record of Decision (09/11/2003) at their property at 36 Riverside Avenue in Rensselaer, New York. After the remedial work, some residual contamination remains in the subsurface. To manage the remaining contamination and address the potential for future exposure to any residual contamination, Institutional Controls (ICs) in the form of a deed restriction have been placed on the property.

This Interim Site Management Plan (SMP) was prepared to manage future activities at the BASF Manufacturing Plant Site (Site), and specifies the methods to ensure compliance with all the ICs and Engineering Controls (ECs) that are or may be required by the Site-specific Deed Restriction. The SMP has been approved by the NYSDEC, in consultation with the New York State Department of Health (NYSDOH), and compliance with this SMP by BASF, the property owner (as well as successors and assigns), is required per the aforementioned deed restriction. This SMP may only be revised with the approval of the NYSDEC.

Before any activities are undertaken at the property, all parties should be aware of the following restrictions and Site-specific management requirements:

- Any development or change of use of the property must be preceded by a "Change of Use" notification to the NYSDEC as required by regulation, currently found at 6NYCRR Part 375-1.11(d). (Note that transfer of ownership of all or part of the property is considered a "change of use.") Procedures for this notification can be found on the NYSDEC's internet web page. The property may be only used for commercial or industrial purposes, currently defined in regulation at 6NYCRR Part 375-1.8(g)(2), unless an express written waiver is obtained from the NYSDEC or Relevant Agency.
  - The Site Engineering Controls (Composite Cover System and Groundwater Treatment System) and the Site Institutional Controls (Compliance with the Deed Restriction) is detailed in Section 2 of the SMP.
  - Specific Site restrictions that apply to the Controlled Property are:
    - The property may only be used for Industrial/Commercial use provided that the long-term Engineering and Institutional Controls included in this SMP are employed.
    - The property may not be used for a higher level of use, such as Restricted Residential use without additional remediation and amendment of the Deed Restriction, as approved by the NYSDEC.
    - All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with this SMP.
    - The use of the groundwater underlying the property is prohibited without treatment rendering it safe for intended use.
    - The potential for vapor intrusion must be evaluated for any buildings developed on the Site, and any potential impacts that are identified must be monitored or mitigated.
    - Vegetable gardens and farming on the property are prohibited.
    - The site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order

to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable. Certification procedures are found in Section 5 of this SMP.

- Monitoring of the composite cover system, soil vapor, and groundwater is detailed in Section 3.
- Any person responsible for construction or excavation activities at the Site must follow the prior notification procedures detailed in Section 3.2 and Appendix D of this SMP. Any excavation work will be expected to adhere to the details found in the Excavation Work Plan, which is part of this SMP (Appendix D).
- Operation and Maintenance of the on-site Groundwater Treatment System (GWTS), the EC, is detailed in Section 4 of the SMP. The criteria for termination of the GWTS are discussed in Section 2.2.2.

1. Introduction and Description of Remedial Program

1.1 Introduction

This document is required as an element of the remedial program at BASF Rensselaer Manufacturing Plant Operable Unit 1 ("OU1") located in Rensselaer, New York, which is shown on Figures 1 and 2 (hereafter referred to as the "Site") under the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program, administered by New York State Department of Environmental Conservation (NYSDEC). The Site was remediated in accordance with Order on Consent Index #A4-0490-0703, Site #4-42-027, which was executed on October 31, 2003.

OU1 includes the former manufacturing area (i.e., Main Plant) and the two former wastewater treatment lagoons. The Metes and Bounds Site description for OU1 is included as Appendix A.

After completion of various remedial activities performed at the Site, some contamination was left in the subsurface at this Site, which is hereafter referred to as "remaining contamination." This SMP was prepared to manage remaining contamination at the Site until the Deed Restriction (Appendix B) is extinguished in accordance with ECL Article 71, Title 36.

This SMP was prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of BASF, in accordance with the general requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated November, 2009 (NYSDEC, 2009), and the guidelines provided by NYSDEC. Site No. 4-42-027 is defined in the September 2003 Record of Decision ("ROD") (NYSDEC, 2003b) issued by the New York State Department of Environmental Conservation ("NYSDEC"). Once the ROD was issued, BASF entered into a Consent Order on October 20, 2003 (NYSDEC, 2003c) for the implementation of the remedy for OU1 described in the ROD.

This SMP addresses the means for implementing the Institutional Controls ("ICs") and Engineering Controls ("ECs") that are required by the Deed Restriction for the Site.

1.1.1 Purpose

The site contains contamination left after completion of the various remedial activities performed at the Site. Engineering Controls have been incorporated into the site remedy to control exposure to remaining contamination during the use of the Site to ensure protection of public health and the environment. A Deed Restriction recorded with the Rensselaer County Clerk will require compliance with this SMP and all ECs and ICs placed on the site. The ICs place restrictions on Site use, and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. This SMP specifies the methods necessary to ensure compliance with all ECs and ICs required by the Deed Restriction for contamination that remains at the site. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Deed Restriction and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

This SMP provides a detailed description of all procedures required to manage remaining contamination at the site after completion of the Remedial Action, including: (1) implementation and management of all Engineering and Institutional Controls; (2) media monitoring; (3) operation and maintenance of the on-site groundwater treatment system; (4) performance of periodic inspections, certification of results, submittal of Periodic Review Reports; and (5) defining criteria for termination of the groundwater treatment system.

To address these needs, this SMP includes three plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; and (3) an Operation and Maintenance Plan for the on-site groundwater treatment system.

This plan also includes a description of Periodic Review Reports for the periodic submittal of data, information, recommendations, and certifications to NYSDEC.

It is important to note:

- This SMP details the Site-specific implementation procedures that are required by the Deed Restriction. Failure to properly implement the SMP is a violation of the Deed Restriction, which is grounds for revocation of the Certificate of Completion ("COC"); and
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375, and thereby subject to applicable penalties.

1.1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. In accordance with the Deed Restriction for the Site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files. At a minimum, it is anticipated that this Interim SMP will be revised or updated when the remediation in OU-2 is completed and a final engineering report is approved. An SMP will be created that incorporates both operable units OU-1 and OU-2.

1.2 Site Background

This section provides a description of the location and history of the Site, where applicable, nature and extent of contamination, and the remedial action.

1.2.1 Site Location and Description

The BASF Manufacturing Plant (#442027), which includes the lagoon area as part of the site, is located in the City of Rensselaer, Rensselaer County, and is 35 acres in size. The manufacturing plant and lagoon area is zoned heavy industrial, and is physically located next to the Hudson River. The manufacturing plant and lagoon area is bordered by Albany Molecular (formerly Sterling Organics) to the north, by a Coastal power plant to the south-west, by the two other BASF sites (the nine acre landfill, #442004, and the 40 acre South 40 Site, #442022) to the southeast, by railroad tracks to the east, and the Hudson River to the west (see Figures 1 and 2). The site was separated into two operable units. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release, or exposure pathway resulting from the site contamination. OU1 includes on site contamination in the manufacturing plant and lagoon area (as described above). The second operable unit (OU2) will include off site contamination in those areas outside OU1 with potential impacts resulting from the: 1) migration of contaminated groundwater off-site to the west via the storm sewer bedding

and/or through the shallow water bearing unit; 2) discharges directly from the site or through the groundwater which may have impacted sediments in the Hudson River; 3) migration of site related contaminants to soils adjacent to the lagoon area along Riverside Avenue, and 4) airborne contamination from air emissions or particulate migration.

1.2.2 Site History

In 1881 the Hudson River Aniline and Color Works began use of the facility that is currently the BASF manufacturing plant in Rensselaer. In 1905 the Hudson River Aniline and Color Works facility began to supplement its dyestuffs with pharmaceuticals and aspirin. In 1913 the official name was changed to the Bayer Company. The facility was seized by the United States government during both world wars, and functioned as part of the war economy. In 1968 the official name was changed to the GAF Corporation, and in 1978 BASF purchased the manufacturing plant from the GAF Corporation. The facility ceased all operations and closed in December 2000.

In 1992, the NYSDEC listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. In June 1994, a baseline environmental assessment of the wastewater lagoons was performed. This assessment included the installation of monitoring wells to determine if groundwater had been impacted by site operations and historical disposal practices. It concluded that VOCs and soluble arsenic were detected in groundwater exceeding New York State Class GA Standards. This groundwater contamination was primarily located on the manufacturing plant, up gradient of the lagoons. BASF entered into a Consent Order (described in Section 4) on February 24, 1998. In April 1998, a RI Work Plan for the site was developed. The scope of the RI Work Plan was agreed upon by the NYSDEC and BASF in a Scope of Work (SOW) and modified by subsequent letters of understanding. Two additional phases of investigation for the site were performed to further define the extent of the contamination. These two phases were identified as the supplemental RI (SRI) and the additional RI activities.

1.2.3 Site Geologic Conditions

The regional flow of groundwater is to the west (toward the Hudson River). Utilities, sewers, and storm water pipes have caused localized anomalies to this westerly flow. The depth to the shallow water bearing unit averages from 5 feet (along the eastern boundary) to 15 feet (near the Hudson River) below the ground surface. The impacted groundwater associated with OU1 is located within the shallow water-bearing unit. A clay layer separates this shallow groundwater from a deeper water bearing unit. The clay layer is approximately 18 feet below the ground surface at the treatment lagoons (where it is 40 feet thick), and approximately 5 feet below the ground surface at the eastern boundary (where it is 10 feet thick). The deep water bearing unit is a 10 feet thick layer of sand just above a layer of glacial till, which is just above the shale bedrock.

Except for the detection of benzene at 2 parts per billion (ppb) (versus the AWQS of 1 ppb) in one of the two deep monitoring wells, only the shallow groundwater was found to have contamination. The transmissivity (or movement) of water on-site is minimal and this fact is evident in two on-site areas that were found to have no water within the shallow water bearing unit.

A geologic cross-section is shown in Plate 1.

The generalized direction of groundwater flow is shown in Plate 2.

1.3 Summary of Remedial Investigation Findings

A Remedial Investigation (RI) was performed to characterize the nature and extent of contamination at the site. The results of the RI are described in detail in the following reports:

- Remedial Investigation/ Supplemental Remedial Investigation Report, submitted on November 13, 2000 to the NYSDEC (Roux Associates, 2000b).
- Additional RI Activities Report, which was submitted on August 3, 2001 to the NYSDEC (Roux Associates, 2001b).

Remedial Design/ Remedial Action ("RD/RA") Work Plan for OU1, which was submitted on September 13, 2004 to the NYSDEC (Roux Associates, 2004) and contains the findings from a supplemental Pre-Design Investigation. As described in the RI reports, many soil, groundwater, waste process residue, and lagoon sludge samples were collected to characterize the nature and extent of contamination. The main categories of contaminants that exceeded their respective SCGs were VOCs, SVOCs, and metals.

The VOC contaminants of concern (COCs) in soil, groundwater, and/or waste sludge were identified:

- Acetone
- Benzene
- Ethylbenzene
- Toluene
- Xylenes
- Chlorobenzene
- 1,2-Dichloroethane
- 1,2-Dichlorobenzene
- 1,2,4-Trichlorobenzene

The SVOC COCs in soil, groundwater, and/or waste sludge were identified:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)anthracene
- Benzo(k)anthracene
- Chrysene
- 4-Chloroaniline
- Dibenzo(a,h)anthracene
- Indeno(1,2,3-c,d)anthracene
- 2-Methylnaphthalene
- 4-Nitroaniline
- 4-Nitrophenol
- Phenol

The metal COCs in soil, groundwater, and/or waste sludge were identified:

- Arsenic
- Chromium
- Lead
- Mercury
- Zinc

This section describes the findings of the investigation for all environmental media investigated. Chemical concentrations are reported in parts per million (ppm) for water, soil, and waste sludge samples.

The following are the media that were investigated and a summary of the findings of the RI. The concentration included in the parentheses after the COC is the highest concentration detected in the media for that area of the site.

Basement Process Waste Residues and Underlying Contaminated Soils

The residues from operational processes were mixed and co-mingled via overflows and leaks from building sewer systems into three separate basements located in Buildings 84, 87, and 93 (Figure 3). The waste material varied in thickness from being not present to 18 inches thick in some locations. The process residues were sampled at nine locations during the RI (Figure 4), each sample was analyzed for VOCs, SVOCs, and metals.

The following results are for the process waste residue found in the building basements. The VOCs detected included benzene (2.2 ppm), chlorobenzene (40.1 ppm), 1,2-dichlorobenzene (48.5 ppm), 1,2-dichloroethane (11 ppm), 1,2,4-trichlorobenzene (514 ppm), toluene (11 ppm), and xylenes (11 ppm); SVOCs detected include phenol (80 ppm), and the following poly-aromatic hydrocarbons (PAHs): benzo(a)anthracene (41.7 ppm), benzo(a)pyrene (26.6 ppm), and dibenzo[a,h]anthracene (6.58 ppm); and metals detected include arsenic (73.9 ppm), chromium (27,500 ppm), lead (3,280 ppm), mercury (10.6 ppm), and zinc (1,560 ppm).

The soils below the process waste residues were also sampled at 12 locations to a depth of 1.5 feet below the process residues. Each sample was analyzed for VOCs, SVOCs, and metals. The same contaminants found in the process residues were detected in the underlying soil. The VOCs reported above the Recommended Soil Cleanup Objectives from the tables within TAGM 4046 (RSCOs) included benzene (6.4 ppm), toluene (6.4 ppm), xylenes (6.4 ppm) chlorobenzene (200 ppm), 1,2 dichlorobenzene (120 ppm), 1,2-dichloroethane (6.4 ppm), and 1,2,4- trichlorobenzene (81 ppm); SVOCs detected above RSCOs include phenol (2.7 ppm) and the following PAHs: benzo(a)anthracene (2.2 ppm) benzo(a)pyrene (2.4 ppm), and dibenzo(a,h)anthracene (4 ppm); and metals detected above RSCOs include arsenic (57.6 ppm), chromium (1,590 ppm), lead (1,510 ppm), mercury (1.5 ppm), and zinc (815 ppm).

The NYSDEC has determined the process waste residue and underlying soils contain listed hazardous wastes.

Lagoon Sludge

The two lagoons located on the west side of Riverside Avenue contained sludge which had accumulated over the years of operation of the wastewater treatment system. The sludge had been investigated on several occasions with the most recent work in 2002. During these investigations it was determined that the sludge in the lagoons was approximately 3 to 6 feet thick with an estimated volume that ranges from 12,570 to 18,600 cubic yards. Samples of the sludge were collected from various locations and depths throughout the lagoons on two different occasions. Samples were analyzed for VOCs, SVOCs, and metals. The VOCs detected included acetone (77 ppm), benzene (22 ppm), chlorobenzene (590 ppm), 1,2-dichlorobenzene (86 ppm), ethylbenzene (24 ppm), toluene (660 ppm), 1,2,4 trichlorobenzene (17 ppm) and xylenes (130 ppm); SVOCs detected include benzoic acid (120 ppm), bis(2-ethylhexyl)phthalate (82 ppm), 4-chloroaniline (160 ppm), 2-methylnaphthalene (23 ppm), 4-nitroaniline (30 ppm), 4-nitrophenol (39 ppm), and phenol (140 ppm); and metals detected include arsenic (197 ppm), chromium (4,830 ppm), mercury (19 ppm), and zinc (987 ppm).

The NYSDEC has determined that the sludge in the lagoons contains hazardous waste derived from characteristically hazardous wastes that were generated and discarded from various plant operations. These derived hazardous wastes became subject to land disposal restrictions (LDRs) after April 8, 1996. The NYSDEC ultimately considered the sludge to be a source area that would require remediation.

Subsurface Soil

During the performance of the RI, over 90 percent of the site was covered with buildings or pavement. Soils collected from the borings at that time therefore were considered subsurface soils. The RI identified areas of concern that contained the highest concentrations of several contaminants detected throughout the Main Plant property (See Figure 5). These areas of concern were addressed by the Soil Excavation IRM described in Section 5.2. Outside the areas of concern, COCs were detected in the subsurface soils at lower concentrations and more dispersed locations. Subsurface soil samples were analyzed for VOCs, SVOCs, metals, pesticides and PCBs (see Tables 1 through 6 and Plates 3 through 6). Pesticides and PCBs were not detected at elevated levels during initial investigations and were not included in the subsequent investigations. The VOCs detected above RSCOs included benzene (0.9 ppm), chlorobenzene (19 ppm), xylene (3 ppm), 1,2 dichlorobenzene (44 ppm), 1,2-dichloroethane (5 ppm) and 1,2,4 trichlorobenzene (19 ppm); SVOCs detected above RSCOs include phenol (3 ppm) and the following PAHs: benzo(a)anthracene (11 ppm),benzo(a)pyrene (9 ppm), benzo(b)fluoranthene (9ppm), benzo(k)fluoranthene (3ppm), chrysene (10 ppm), dibenzo[a,h] anthracene (3 ppm), and indeno(1,2,3 - c,d)pyrene (6 ppm); and metals detected above RSCOs in subsurface soils outside the areas of concern include arsenic (623 ppm), chromium (833 ppm), lead (660 ppm), mercury (52.5 ppm) and zinc (602 ppm).

Background soil samples were taken, at a depth of 0 to 2 feet below the ground surface, along the eastern boundary (MP-SB-19 and MP-SB-20) and at the far south-west corner of the site (MP-SB- 48, MP-SB-49, and MP-SB-50) where no potential areas of concern were identified. RSCO values or the background values (whichever is higher) are typically used as the guidance values for individual COCs. PAHs are ubiquitous in the Main Plant and the concentrations of these compounds were not indicative of waste disposal. Soil samples that were visibly contaminated within the boring, or had relatively high photo-ionization detector readings, were selected for laboratory analysis. The following paragraphs describe the sample results for several areas of the site impacting groundwater.

Area 1

This area was located in the southeastern part of the Main Plant (See Figure 5) adjacent to the nine acre closed landfill site (# 442004). The work conducted during the RI included the collection of 26 soil samples from various intervals to a depth of 6 feet where the water table was encountered. The VOCs of concern detected above RSCOs included benzene (34 ppm), chlorobenzene (8,440 ppm), ethylbenzene (123 ppm), xylene (841 ppm), 1,2 dichlorobenzene (1,990 ppm), and 1,2,4 trichlorobenzene (630 ppm). The following SVOCs were reported as undetected at elevated detection limits in most sample locations due to the presence of high levels of some VOCs. The SVOCs of concern that were not detected at detection limits above RSCOs include phenol (26 ppm) and the following PAHs: benzo(a)anthracene (26 ppm), benzo (a)pyrene (86 ppm), and dibenzo[a,h]anthracene (86 ppm). The metals of concern detected above RSCOs include arsenic (1,260 ppm), chromium (239,000 ppm), and lead (19,200 ppm).

The VOCs and some SVOCs detected in Area 1 soils were contributing to groundwater contamination in this area. An IRM, discussed in Section 5.2, was completed in 2002 and addressed these contaminants.

Area 2

This area was located in the western part of the Main Plant area adjacent to Building 81 (see Figure 5). The work conducted during the RI included the collection of seven samples from various intervals to a depth of approximately 6 feet where the water table was encountered. The samples were analyzed for VOCs, SVOCs, and metals. The VOCs detected above RSCOs included chlorobenzene (455 ppm), 1,2 dichloroethane (296 ppm), ethylbenzene (93 ppm), toluene (46 ppm), and xylenes (634 ppm); SVOCs detected above RSCOs include phenol (0.5 ppm) and the following PAHS: benzo(a)anthracene (11 ppm), benzo(a)pyrene (9 ppm), and dibenzo[a,h]anthracene (3 ppm).

The metals detected at low concentrations (slightly above RSCOs) include arsenic (48 ppm) and chromium (20 ppm).

The VOCs detected in Area 2 soils were contributing to groundwater contamination in this area. An IRM, discussed in Section 5.2, was completed in 2002 and addressed these contaminants.

Area 4B

This area was located in the western part of the Main Plant north of Building 81 (See Figure 5). The work conducted during the RI included the collection of five samples from various intervals to a depth of approximately 6 feet where the water table was encountered. The samples were analyzed for VOCs, SVOCs, and metals. The VOCs including benzene (0.07 ppm), chlorobenzene (20 ppm), and 1,2-dichloroethane (5 ppm) were detected at concentrations above RSCOs in one location. The SVOCs detected above RSCOs include phenol l(1.2 ppm) and the following PAHs: benzo[a]anthracene (31 ppm), benzo(a)pyrene (4 ppm), dibenzo[a,h]anthracene (4 ppm). The predominant COC in this area was arsenic which was detected at a concentration of 1,560 ppm. Other metals of concern, including chromium (30.9 ppm), lead (491 ppm), mercury (1 ppm), and zinc (243 ppm) were detected at concentrations slightly above RSCOs. The arsenic detected in this area was contributing to groundwater contamination in this area. An IRM (discussed in Section 5.2) was completed in 2002 and addressed these contaminants.

Area 4A

This area was located across Riverside Ave in the lagoon area (See Figure 5). The work conducted during the RI included the collection of samples from various intervals to a depth of approximately 14 feet where the water table was encountered. The samples were analyzed for arsenic only based upon previous investigatory work. Arsenic (127,000 ppm) was detected at high concentrations along the northeastern portion of the lagoon property along Riverside Ave.

The arsenic detected in this area was contributing to groundwater contamination in this area along the Hudson River. An IRM (discussed in Section 5.2), completed in 2002, addressed a large portion of these contaminants.

Groundwater

The groundwater on the Main Plant, east of Riverside Avenue and including the landfill, has been impacted by VOCs. Tables 7 through 11 summarize the groundwater data and compare it to the appropriate groundwater standard. VOCs detected in groundwater include: benzene (15 ppm), ethylbenzene (1.8 ppm), toluene (0.14 ppm), xylene (3 ppm), chlorobenzene (170 ppm), 1,2-dichloroethane (20 ppm), 1,2-dichlorobenzene (0.12 ppm), and 1,2,4-trichlorobenzene (1.5 ppm) (Plates 7 through 10).

SVOCs and metals other than arsenic have been detected sporadically on the Main Plant property. The SVOC of concern include: benzo(a)anthracene (0.003 ppm), and phenol (0.58 ppm); and the metals of concern include: chromium (164 ppm) and lead (472 ppm). Hexavalent chromium was included in the second round of sampling and was reported as undetected in 40 unfiltered groundwater samples and 16 filtered groundwater samples; 8 unfiltered groundwater samples with elevated detection limits, and 3 filtered groundwater samples with elevated detection limits. Hexavalent chromium was only detected in one unfiltered groundwater sample at a concentration of 60 ppb compared to a standard of 50 ppb. Arsenic has been detected in monitoring wells on the western side of the Main Plant, and in the lagoon area west of Riverside Avenue. It has been detected at concentrations up to 24.3 ppm in the lagoon area and 2.16 ppm in the Main Plant area.

Site related contaminants have also been detected in the sewer bedding that borders the property along the southern and western boundaries of the Main Plant. Most notably, water samples taken from location LG-MH-7 contain benzene and chlorobenzene at 0.130 ppm and 2.6 ppm, respectively. These two compounds have also been detected in the groundwater in the landfill property which is most likely the source for the contamination.

1.4 Summary of Remedial Actions

The following is a summary of the Remedial Actions performed at the site:

1. Excavation of soil/fill that was serving as sources areas to impacted groundwater.
2. Construction and maintenance of a soil cover system consisting of vegetative caps to prevent human exposure to remaining contaminated soil/fill remaining at the site.
3. Execution and recording of a Deed Restriction to restrict land use and prevent future exposure to any contamination remaining at the site.
4. Construction of a groundwater containment and treatment system.
5. Development and implementation of a Site Management Plan for long term management of remaining contamination as required by the Deed Restriction, which includes plans for: (1)

Institutional and Engineering Controls, (2) monitoring, (3) operation and maintenance and (4) reporting.

Remedial activities were completed at the site in August 2012.

Remedial activities completed within the limits of OU1 are briefly summarized in the following subsections of this SMP.

1.4.1 Soil IRM Program

Soil Interim Remedial Measure ("IRM") Program as documented in the Roux Associates "Interim Remedial Measure Remedial Action Completion Report" submitted to the NYSDEC on December 16, 2005 (Roux Associate, 2005a). The objective of the Soil IRM (including the remediation of Area 4C) was to remove and dispose of impacted soil from Areas 1, 2 and 4 that may be serving as sources of dissolved volatile organic compounds ("VOCs") and arsenic to groundwater beneath the Manufacturing Plant and Lagoon areas. During the course of implementing the Soil IRM, 13,687.96 tons of non-hazardous waste and 12,322.3 tons of hazardous waste were excavated and disposed of off-site. Areas where the IRM excavation was performed are shown in Figure 6.

The Former Building 81 area was identified as the likely source of the 1,2-DCA based on the remedial investigation results and discussions with BASF personnel, as detailed in the "Work Plan for a 1,2-Dichloroethane Source Area Investigation – Former Building 81," submitted to the NYSDEC on June 28, 2012. In October 2014, in the vicinity of former Building 81, approximately 1,200 cubic yards of 1,2-dichloroethane (1,2-DCA) impacted soil was removed from below the water table (6 to 12 feet bls) staged and property characterized for off-site disposal. Areas where the 1,2-DCA source area excavation was performed are shown in Figure 7. The fill material from above the impacted soils was excavated, staged and reused as backfill in the excavation areas.

1.4.2 Process Building IRM

Process Building IRM Program as documented in the Roux Associates "Interim Remedial Measure Remedial Action Completion Report" submitted to the NYSDEC on December 16, 2005 (Roux Associate, 2005a). The objective of the Process Buildings IRM was to remove and dispose of impacted soil and process residue from Former Process Buildings 84, 87 and 93 that may have been serving as sources of dissolved VOCs to groundwater beneath the Manufacturing Plant. During the course of implementing the Process Building IRM, 4,425 tons of hazardous waste were excavated and disposed of off-site.

1.4.3 Remediation of Lagoon Areas

Remediation of the Northern and Southern Lagoon Areas was documented in the Roux Associates "North and South Lagoon Remedial Action Completion Report" submitted to the NYSDEC on October 27, 2005 (Roux Associates, 2005b). The objective of this remedial effort was to remove and dispose of impacted sediments within each lagoon. During this remediation effort, 13,924.29 tons of hazardous waste was removed and disposed of off-site. 6,347,000 gallons of wastewater was generated through the processing of the lagoon wastewater/ sludge matrix that was classified as non-hazardous and discharged to the RCSD. Approximately, 1,020 cubic yards of screened riprap was utilized for the partial backfilling of the North Lagoon. In addition, in situ treatments were performed as described below:

- Two rounds of *in situ* treatment of arsenic-impacted groundwater with Metals Remediation Compound ("MRC™") as summarized in the Roux Associates report titled "Remedial Action Report and Remedial Action Work Plan for Lagoon Area Groundwater" that was submitted to the NYSDEC on August 22, 2007 (Roux Associates, 2007).
- A third round of *in situ* treatment of arsenic-impacted groundwater with MRC™ in accordance with the Roux Associates "Revised Work Plan for Supplemental Treatment of Arsenic in Lagoon Area Groundwater" submitted to the NYSDEC on February 25, 2008 (Roux Associates, 2008).
- The remediation of the Lagoon Area groundwater was further evaluated in the Focused Feasibility Study submitted to the NYSDEC on July 19, 2010 (Roux Associates, 2010).

Filling and capping of the lagoons was performed as part of the 2008 Remedial Action Work Plan (Roux Associates, 2008). Removal of all sludge within the lagoons and testing of the remaining clay liner was completed in 2005, with NYSDEC's approval. Capping of the former lagoons was completed during 2009 and 2010, as described below in Section 1.4.9.

1.4.4 GCS Trench Construction

The groundwater collection system ("GCS") trenches were installed during implementation of the Soil IRM from July 2002 through August 2003 along the northern and western boundaries of the Main Plant and around the northern, western and southern boundaries of the Closed Landfill. The design, installation and testing of the GCS is summarized in the Roux Associates report titled "Remedial Design/ Remedial Action Work Plan for OU1 that was submitted to the NYSDEC in 2004 (Roux Associates, 2004). The GCS trenches were constructed at the following 7 areas within and along the perimeter of the Site:

- GCS Area 1: north of Former Building 65
- GCS Area 2: north of the Lagoon Area
- GCS Area 3: west of Former Building 81
- GCS Area 4: north of the Closed Landfill
- GCS Area 5: southwest corner of the parking lot
- GCS Area 6: south of the Closed Landfill
- GCS Area 7: north and west of the Closed Landfill

Plate 11 shows the locations of the GCS trenches and pumping locations.

1.4.5 Groundwater Treatment System Construction

Since 2004, BASF has been operating a treatment system at the Site that extracts groundwater from a set of extraction wells. In 2016, the treatment system was upgraded.

The former GWTS experienced significant operational problems, mostly related to clogging of the air diffusers and encrustation of the carbon beds due to high levels of dissolved solids, calcium carbonate, iron, and manganese. In the summer of 2016, the former trailer-based groundwater treatment system) was decommissioned and demolished, and a new, skid-mounted GWTS was constructed in a 40 x 40 foot structure on the existing 60 x 60 foot concrete containment pad.

The new on-site GWTS, extracts groundwater via a system of seven (7) individual wells located within the GCS trenches which combine in a single influent stream, which is then routed to an equalization tank. The groundwater is treated via filtration, UV disinfection, iron and hardness removal, air stripping, and carbon adsorption before being re-injected into the onsite re-injection galleries. The system was designed to operate at a constant pumping rate of 25 gallons per minute (gpm) with a maximum flow rate of 35 gpm. The average system flowrate is between 11-13 gpm. The treatment system is located in the southwest corner of the Site and startup of the new system was achieved in July of 2016. The current GCS layout is shown on Plate 11.

1.4.6 Decommissioning of the Pretreatment System

Decommissioning of the Pretreatment System is documented in the Roux Associates report titled "Closure Certification Report - BASF Pretreatment Facility" submitted to the NYSDEC on June 22, 2009 (Roux Associates, 2009a). The primary treatment process units included a diversion chamber, two wet wells, two grit chambers, three neutralization tanks, and an effluent flume and chamber. These process units were located adjacent to former Building No. 42 and were all large, open concrete structures. All chambers are below grade except for the grit chambers, which are above-ground structures.

As part of the decommissioning effort, all flow entering the system was eliminated, which was accomplished by closing the two manholes (MH-11 and MH-14A) immediately prior to the pretreatment system; closing 52 catch basins that were connected to the combined sewer system in place; and cleaning and decommissioned all pipes associated with the pretreatment system. The actual pretreatment system was cleaned and closed in-place by demolishing all above-grade structures, and filling all below-grade voids with demolition debris.

1.4.7 Demolition of On-Site Process Buildings

The onsite buildings that were present as of the Remedial Investigation were demolished between May and November 2010. The boiler stack was removed in March 2011.

1.4.8 Implementation of Interim Stormwater Management Plan

Implementation of an interim stormwater management plan in accordance with the "BASF Rensselaer Sewer Closure and Interim Stormwater Management Plan" prepared by Roux Associates on July 2, 2009 (Roux Associates, 2009b). The stormwater management plan was designed to reduce stormwater volume through evapotranspiration mechanisms and enhance stormwater quality. This Work consisted of the following specific construction elements (Refer to Plate 12):

- construction of vegetated swales that direct runoff overland towards newly created detention areas and the existing overflow catch basin in the parking lot;
- construction of vegetated filter strips along the southern boundary that are sloped easterly to convey overflow to the existing catch basin located near the southeast corner of the Closed Landfill; and
- construction of multiple vegetative shallow stormwater detention areas.

1.4.9 Completion of Site-Wide Composite Cover System

Completion of a Site-wide cap ("the composite cover system") consisting of the following components (Refer to Figure 8, Plates 13 and 14), which is described in greater detail below:

- Existing Surface Cap

  - Existing Natural & Landscaped Area Cap
  - Existing Asphalt, Concrete, Gravel & Railroad Track Areas
- Main Plant Excavation Areas 2 and 4B - Gravel Cap
- Former Buildings Foundation Cap
  - Former Buildings without Basements - Concrete Cap
  - Former Buildings with Basements - Low Permeability Soil Cap
- Former Building 67 - Elastocoat Cap
- Constructed Lagoon Area Vegetative Cap
  - Lagoon Stormwater Detention Area Cap
  - Lagoon Vegetative Soil Cap
- Constructed Main Plant Vegetative Cap
  - Gravel Vegetated Swales
  - Grassed Stormwater Detention Areas

1.4.9.1 Existing Surface Cap

The existing surface cap consists of either natural or landscaped vegetation areas, asphalt, gravel or railroad tracks and it covers all areas of the Site that were not disturbed during any remediation, capping, building demolition work or the lagoon closure work.

1.4.9.2 Main Plant Excavation Areas

The main plant excavation areas cap consists of two areas onsite that were disturbed during remediation of the main plant. These two areas (designated as Areas 2 and 4B) were excavated to the water table and backfilled with clean fill and eight inches of gravel.

1.4.9.3 Former Buildings Foundation Cap

There are three types of former building foundation caps used across the Site: 1.) Concrete, 2.) Impermeable Clay, and 3.) Elastocoat. Following completion of the building demolition, the building basements were filled with building demolition debris and capped with a layer of finely crushed demolition debris, which includes primarily crushed brick and concrete, to fill void spaces, an orange demarcation layer, a 12-inch layer of compacted, impermeable clay and a 4-inch layer of topsoil vegetated with grass. The layers were sloped to ensure positive drainage from the capped area. For those buildings that did not have basements, the existing concrete slab was left in place.

The footprint of Former Building 67 (Plate 13) was capped similar to the other buildings in that the basement was filled with crushed demolition debris and capped with a layer of finely crushed demolition debris to fill the void spaces and an orange demarcation layer. The final cap layer consists of a non-woven geotextile coated with an 80-mil spray elastomer treatment (XS-350 provided by Line-X). The geotextile was anchored using an anchor trench of 2 feet wide by 1 foot deep of clean backfill.

1.4.9.4 Lagoon Area Vegetative Cap

Capping of the former Lagoon Area was performed during 2009 and 2010. The capping design for the former lagoon area consists of multiple fill layers vegetated with indigenous plant species such that the combination of grading, soil moisture storage, and evapotranspiration provides an equivalent degree of prevention of recharge as the low permeable cap specified in the OU-1 ROD. The Lagoon Area capping design was accepted by the NYSDEC in a July 8, 2008 letter to BASF.

The Lagoon Area Vegetative Cap consists of the following fill layers (minimum 30-inch total thickness):

- 6-inch biota barrier;
- 18-inch common fill layer; and
- 6-inch topsoil layer.

The cap was then vegetated with a diversity of native species with high ecological value. Cross sections of the cap components are provided in Plate 14.

A portion of the south lagoon is being used as a detention basin. In this area, a 40-mil HDPE liner has been installed above a 2-foot clay liner to allow for future use as a stormwater detention basin. Below the liners are the same fill layers as above to provide stabilized pond slopes. Additional details regarding the Capping of the former Lagoon Area can be found in the "Focused Feasibility Study Lagoon Area Groundwater" report submitted to the NYSDEC on July 19, 2010.

1.4.9.5 Main Plant Vegetative Cap

The Main Plant Vegetative Cap consists of a 6-inch common fill layer and 12-inch topsoil layer that will be vegetated with a diversity of native species with high ecological value. These vegetated areas include: three grassed shallow stormwater detention areas, two gravel swale areas (6-inch common fill layer and 6-inch topsoil layer) and three grass capped areas.

1.5 Remaining Contamination

All of the fill material that was impacted above criteria outside of the excavation areas is contained below the composite cover system described in Section 1.4.9. The demarcation layer for each component of the composite cover system is summarized below:

Element of Composite Cover System	Demarcation Layer	Depth of Demarcation Layer
Existing Surface Cap	Top of existing soil	Varies
Main Plant Excavation Areas	Top of existing soil	8 inches
Former Buildings Foundation Cap With basements (impermeable clay)	Orange demarcation layer	16 inches

Element of Composite Cover System	Demarcation Layer	Depth of Demarcation Layer
Former Buildings Foundation Cap Without basements (concrete)	Former Buildings concrete foundation	Varies
Former Building 67 Elastocoat Cap	Orange demarcation layer	Immediately below the elastocoat and geotextile
Lagoon Area Vegetative Soil Cap	Biota Barrier	Varies (minimum of 30 inches)
Main Plant Vegetative Soil Cap	Bottom of Topsoil Layer	Varies (minimum of 6 inches)

2. Engineering and Institutional Control Plan

2.1 Introduction

2.1.1 General

Since remaining contaminated soil, soil vapor and groundwater exist beneath the Site, Engineering Controls and Institutional Controls (EC/ICs) are required to protect human health and the environment. This Engineering and Institutional Control Plan describes the procedures for the implementation and management of all EC/ICs at the Site. The EC/IC Plan is one component of the SMP and is subject to revision by NYSDEC.

2.1.2 Purpose

This plan provides:

- A description of all EC/ICs on the site;
- The basic implementation and intended role of each EC/IC;
- A description of the key components of the ICs set forth in the Deed restriction;
- A description of the features to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of EC/ICs, such as the implementation of the Excavation Work Plan ("EWP") (Appendix D) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the Site; and
- Any other provisions necessary to identify or establish methods for implementing the EC/ICs required by the Site remedy, as determined by the NYSDEC.

2.2 Engineering Controls

2.2.1 Engineering Control Systems

2.2.1.1 Composite Cover System

Exposure to remaining contamination in soil/fill at the site is prevented by a composite cover system that covers remaining contamination as described in Section 1.4.9. The composite cover system (Figure 8, Plates 13 and 14) consists of the following components:

- Existing Surface Cap;
  - Existing Natural & Landscaped Area Cap
  - Existing Asphalt, Concrete, Gravel & Railroad Track Areas
- Main Plant Excavation Areas 2 and 4B - Gravel Cap;
- Former Buildings Foundation Cap;
  - Former Buildings without Basements - Concrete Cap
  - Former Buildings with Basements - Low Permeability Soil Cap
- Former Building 67 Elastocoat Cap

- Constructed Lagoon Area Vegetative Cap; and
  - Lagoon Stormwater Detention Area Cap
  - Lagoon Vegetative Soil Cap
- Constructed Main Plant Vegetative Cap
  - Gravel Vegetated Swales

The EWP that appears in Appendix D outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed and/or any underlying remaining contamination is disturbed. For reference purposes, the proposed post-remediation criteria for onsite reuse of excavated materials/imported fill materials within the composite cap is provided in Table 12. Procedures for the inspection and maintenance of this cover are provided in the Monitoring Plan included in Section 3 of this SMP.

2.2.1.2 On-Site Groundwater Treatment System

The groundwater treatment system was installed to treat groundwater collected from the Site GCS trenches. The primary contaminants found in the groundwater are chlorinated benzenes, benzene, chlorinated ethanes (primarily 1,2-dichloroethane), and arsenic. BASF has been operating a groundwater treatment system at the Site since 2004 that extracted groundwater from a set of extraction wells. The former treatment system experienced significant operational problems, mostly related to clogging of the air diffusers and encrustation of the carbon beds due to high levels of dissolved solids, calcium carbonate, iron, and manganese. In the summer of 2016, the former trailer-based groundwater treatment system (GWTS) was decommissioned and demolished, and a new skid-mounted system in a 40 x 40 foot structure on the existing 60 x 60 foot concrete containment pad was constructed. In the new system, water is treated using filtration, air stripping, and carbon adsorption before being reinjected into the onsite re-injection galleries.

The system was designed to operate at a constant pumping rate of 25 gallons per minute (gpm) with a maximum flow rate of 35 gpm. The average system flowrate is between 11-13 gallons per minute (gpm).

Seven (7) extraction wells (EW-3, EW-6, EW-8, EW-12, EW-14, EW-15, and EW-16) pump water from well sumps to the GWTS. The extraction wells each enter the GWTS through separate lines, passing through individual flow meters, before combining via a manifold into a single influent line routed to an influent equalization tank. Two (2) of the extraction wells (EW-3 and EW-8) first pass through a separate closed loop configuration of filter cartridges for solids removal and an ultraviolet disinfection assembly, before being routed to the influent equalization tank.

The groundwater treatment system consists of the following key components:

- Filter cartridge filtration and bacteria destruction via ultraviolet disinfection (UV) for extraction wells 3 and 8 only;
- Influent flow equalization;
- Chemical injection for iron and hardness removal;
- Filter cartridge filtration;
- Volatile organic compound (VOC) and semi-volatile organic compound (SVOC) removal via air-stripping;
- Off-Gas treatment via vapor-phase carbon and ion exchange;

- Filter cartridge filtration and;
- Liquid granular activated carbon.

The filtration processes provide solids removal. UV disinfection provides bacteria destruction for extraction wells 3 and 8 only. The chemical injection process promotes metal precipitation and is used to alleviate equipment fouling due to iron and hardness deposits. The VOC and SVOC removal process follows the metals precipitation process and is accomplished by using an air stripper. The air stripper off-gas is then routed through a series of vapor-phase granular activated carbon units (VGAC) and an ion-exchange unit for the purpose of off-gas treatment. The process water is routed through additional filter housings for solids removal prior to liquid phase granular activated carbon (LGAC) treatment and discharge to two infiltration galleries within the zone of capture of the extraction system. The LGAC vessels are backwashed with water from a 1,500-gallon vertical tank. The backwash water is transferred to a 1,600-gallon cone bottom tank for settling and removal of supernatant water is recycled back to the influent flow equalization tank.

Currently, all treated water is discharged directly to re-injection galleries using a Goulds model 616L SS centrifugal transfer pump (P-301) connected to a variable drive that allows the operator to modulate flow based on the rate of influent flow to the system. Pump P-301 (overflow pump) is designed to send flow to the storm sewer for eventual discharge into Hudson River. However, the system has never discharged to the Hudson River. P-301 is instead used to provide treated water to other parts of the system since there is no potable water supply.

All of the groundwater equipment is contained inside of a pre-fabricated GWTS building. The air stripper off-gas treatment is located on the containment pad outside of the GWTS building. Additional detail on the construction, operation, maintenance and monitoring of the groundwater treatment system is discussed in the O&M Manual (Appendix C of this SMP). Procedures for monitoring the system performance are included in the Monitoring Plan (Section 3 of this SMP). The Monitoring Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the site, occurs.

2.2.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

2.2.2.1 Composite Cover System

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

2.2.2.2 Groundwater Treatment System

Groundwater treatment and monitoring activities will continue, until residual groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

2.3 Institutional Controls

A series of Institutional Controls is required by the ROD to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the site to restricted industrial/commercial uses only. Adherence to these Institutional Controls on the site is required by the Deed Restriction and will be implemented under this Site Management Plan. The Institutional Controls and Site restrictions that apply to the Site are:

- Compliance with the Deed Restriction and this SMP by the Grantor and the Grantor's successors and assigns.
- All Engineering Controls must be operated and maintained as specified in this SMP.
- All Engineering Controls on the Controlled Property must be inspected at a frequency and in a manner defined in the SMP.
- Groundwater, soil vapor and other environmental or public health monitoring must be performed as defined in this SMP.
- Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in this SMP.

Institutional Controls identified in the Deed Restriction may not be discontinued without an amendment to or extinguishment of the Deed Restriction.

The site has a series of Institutional Controls in the form of site restrictions. Adherence to these Institutional Controls is required by the Deed Restriction. Site restrictions that apply to the Controlled Property are:

- The property may only be used for Industrial/Commercial use provided that the long-term Engineering and Institutional Controls included in this SMP are employed.
- The property may not be used for a higher level of use, such as Restricted Residential use without additional remediation and amendment of the Deed Restriction, as approved by the NYSDEC.
- All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with this SMP.
- The use of the groundwater underlying the property is prohibited without treatment rendering it safe for intended use.
- The potential for vapor intrusion must be evaluated for any buildings developed on the Site, and any potential impacts that are identified must be monitored or mitigated.
- Vegetable gardens and farming on the property are prohibited.
- The site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

2.3.1 Excavation Work Plan

The site has been remediated for restricted Industrial/Commercial use. Any future intrusive work that will penetrate the soil cover or cap, or encounter or disturb the remaining contamination, including any modifications or repairs to the existing cover system will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix D to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the site. A sample HASP is attached as Appendix E to this SMP that is in current compliance with DER-10, and 29 CFR 1910, 29 CFR 1926, and all other applicable Federal, State and local regulations. The general CAMP for OU1 is provided in Appendix F. Based on future changes to State and federal health and safety requirements, and specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted with the notification provided in Section A-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the periodic inspection and certification reports submitted under the Site Management Reporting Plan (See Section 5).

The site owner and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of excavation de-water, control of runoff from open excavations into remaining contamination, and for structures that may be affected by excavations (such as building foundations and bridge footings). The site owner will ensure that site development activities will not interfere with, or otherwise impair or compromise, the engineering controls described in this SMP.

2.3.2 Soil Vapor Intrusion Evaluation

Prior to the construction of any enclosed structures located onsite, an SVI evaluation will be performed to determine whether any mitigation measures are necessary to eliminate potential exposure to vapors in the proposed structure. Alternatively, an SVI mitigation system may be installed as an element of the building foundation without first conducting an investigation. This mitigation system will include a vapor barrier and passive sub-slab depressurization system that is capable of being converted to an active system.

Prior to conducting an SVI investigation or installing a mitigation system, a work plan will be developed and submitted to the NYSDEC and NYSDOH for approval. This work plan will be developed in accordance with the most recent NYSDOH “Guidance for Evaluating Vapor Intrusion in the State of New York”. Measures to be employed to mitigate potential vapor intrusion will be evaluated, selected, designed, installed, and maintained based on the SVI evaluation, the NYSDOH guidance, and construction details of the proposed structure.

Preliminary (unvalidated) SVI sampling data will be forwarded to the NYSDEC and NYSDOH for initial review and interpretation. Upon validation, the final data will be transmitted to the agencies, along with a recommendation for follow-up action, such as mitigation. If the property is owned by a third party, include the following: Validated SVI data will be transmitted to the property owner within 30 days of validation. SVI sampling results, evaluations, and follow-up actions will also be summarized in the next Periodic Review Report.

Soil Vapor Monitoring

Soil vapor monitoring was performed in April 2012. The purpose of the soil vapor monitoring was to assess the potential for offsite migration of VOCs in soil vapor once the cap had been installed at the Site.

Nine soil vapor points were installed along the perimeter of the Site. The locations of the soil vapor points are shown on Figure 9. All points were constructed in accordance with Figure 2.2 from the "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (NYSDOH, October 2006).

Analytical results were compared to the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October, 2006 and United States Environmental Protection Agency (USEPA) Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating Soil Vapor Intrusion to Indoor Pathways from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) where applicable. A summary of the analytical data is provided in Table 13.

Based upon a review of the laboratory results, with the exception of a detection of carbon tetrachloride at 11 micrograms per cubic meter (µg/m^3) compared to a NYSDEC guidance value of 5 µg/m^3, all VOCs were either not-detected or present at concentrations below their respective NYSDOH/USEPA OSWER soil vapor intrusion guidance values.

The soil vapor points that were installed cannot be located and will need to be replaced prior to the construction of any enclosed structures located onsite for the evaluation of potential soil vapor intrusion.

2.4 Inspections and Notifications

2.4.1 Inspections

Inspections of all remedial components installed at the site will be conducted at the frequency specified in the SMP Monitoring Plan schedule (see Section 3). A comprehensive Site-wide inspection will be conducted annually, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether Engineering Controls continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Deed restriction;
- Achievement of remedial performance criteria;
- Sampling and analysis of appropriate media during monitoring events, if applicable;
- If Site records are complete and up to date; and
- Changes, or needed changes, to the remedial or monitoring system.

Inspections will be conducted in accordance with the procedures set forth in the Monitoring Plan of this SMP (Section 3). The reporting requirements are outlined in the Periodic Review Reporting section of this plan (Section 5).

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the Site will be conducted within 5 days of the event to verify the effectiveness of the EC/ICs implemented at the Site by a qualified environmental professional as determined by NYSDEC.

2.4.2 Notifications

Notifications will be submitted by the property owner to the NYSDEC as needed for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the Order on Consent, 6NYCRR Part 375, and/or Environmental Conservation Law.
- 7-day advance notice of any proposed ground-intrusive activities pursuant to the EWP.
- Notice within 48-hours of any damage or defect to the foundations or structures that reduces or has the potential to reduce the effectiveness of other Engineering Controls and likewise any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of Engineering Controls in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of the Order on Consent, and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing.

2.5 Contingency Plan

Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions. A general Contingency Plan is provided as Appendix G that outlines requirements for addressing these types of contingency problems.

2.5.1 Emergency Telephone Numbers

In the event of any environmentally related situation or unplanned occurrence requiring assistance, the Owner or Owner's representative(s) should contact the appropriate party from the contact list below. For emergencies, appropriate emergency response personnel should be contacted. Prompt contact should also be made to the Owner's qualified environmental professional. These emergency and general contact lists must be maintained in an easily accessible location at the site.

Table 14: Emergency Contact Numbers

Medical, Fire, and Police	911
One Call Center	(800) 272-4480 (3 day notice required for utility markout)
Poison Control Center	(800) 222-1222

Table 14: Emergency Contact Numbers	
Pollution Toxic Chemical Oil Spills	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362

Contact Numbers	
Charlie McGuckin, Roux Associates, Inc. (Owner's Qualified Environmental Professional)	(631) 232-2600
Wayne St. Clair (Site Manager)	(518) 465-6534
Region 4 Hazardous Waste Engineer	(518) 357-2045
Region 4 Project Manager	(518) 357-2393

* Note: Contact numbers subject to change and should be updated as necessary.

2.5.2 Map and Directions to Nearest Health Facility

- Site Location: BASF Rensselaer Facility (OU1), Rensselaer, New York
- Nearest Hospital Name: Albany Medical Center
- Hospital Location: 43 New Scotland Avenue, Albany, New York
- Hospital Telephone: (518) 262-3125
- Directions to the Hospital:
  1. Start out going **NORTH** on RIVERSIDE AVENUE toward BELMORE PLACE
  2. RIVERSIDE AVENUE becomes BROADWAY
  3. Turn **LEFT** onto US-20 West / US-9 North Continue to follow US-20 West
  4. Take the South PEARL STREET / US-20 West / ROUTE 32 ramp
  5. Turn **LEFT** onto US-20 / NY-32 / South PEARL STREET
  6. Turn **RIGHT** onto MADISON AVENUE / US-20
  7. Turn **LEFT** onto NEW SCOTLAND AVENUE
  8. 43 NEW SCOTLAND AVENUE is on the **RIGHT**

  Total Distance: *Approximately 3.3 miles*

  Total Estimated Time: *Approximately 10 minutes*

Map Showing Route from the site to the Hospital: See Figure 10.

2.5.3 Response Procedures

As appropriate, the fire department and other emergency response group will be notified immediately by telephone of the emergency. The emergency telephone number list is found at the beginning of this

Contingency Plan. The list will also be posted prominently at the site and made readily available to all personnel at all times.

A general Contingency Plan is provided as Appendix G that outlines required response procedures. The Site-specific Contingency Plan should be updated as warranted.

3. Site Monitoring Plan

3.1 Introduction

3.1.1 General

The Monitoring Plan describes the measures for evaluating the performance and effectiveness of the remedy to reduce or mitigate contamination at the site, the composite cover system, and all affected site media identified below. Monitoring of other Engineering Controls is described in Chapter 4, Operation, Monitoring and Maintenance Plan. This Monitoring Plan may only be revised with the approval of the NYSDEC.

3.1.2 Purpose and Schedule

This Monitoring Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards and Part 375 SCOs for soil;
- Assessing achievement of the remedial performance criteria;
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring activities.

To adequately address these issues, this Monitoring Plan provides information on:

- Sampling locations, protocol, and frequency;
- Information on all designed monitoring systems (e.g., well logs);
- Analytical sampling program requirements;
- Reporting requirements;
- Quality Assurance/Quality Control (QA/QC) requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Annual monitoring of the performance of the remedy and overall reduction in contamination on-site will be conducted for the first three to five years, applicable, as discussed herein. The frequency thereafter will be determined by NYSDEC. Trends in contaminant levels in air, soil, and/or groundwater in the affected areas, will be evaluated to determine if the remedy continues to be effective in achieving remedial goals. Monitoring programs are summarized in Table 15 and outlined in detail in Sections 3.2 and 3.3 below.

Table 15: Monitoring/Inspection Schedule

Monitoring Program	Inspection/Monitoring Frequency*	Matrix	Analytes	Reporting Frequency
Composite Cover System – Existing surface cap (asphalt, gravel, pavement and vegetation areas) – Excavation Areas- Gravel surface (Areas 2 and 4B) – Clay cap over buildings with basements – Concrete building foundations (buildings without basements) – Epoxy cover – Lagoon Cap – Main plant vegetative cap (swales and stormwater detention areas)	annually	Multi	None	annually
Perimeter Soil Vapor Program	dictated by development	Vapor	VOCs	annually
GW Performance (5 active monitoring wells)	every fifth quarter	Groundwater	VOCs, SVOCs, metals	annually
Groundwater Treatment System, to include: – assessment of yearly operation/any problems – total groundwater treated – influent and effluent	annual summary	Groundwater	VOCs	annually

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC and NYSDOH.

3.2 Composite Cover System Monitoring

The composite cover system (Figure 8, Plates 13 and 14) as discussed in Section 1.4.9 consists of the following components:

- Existing Surface Cap
  - Existing Natural & Landscaped Area Cap
  - Existing Asphalt, Concrete, Gravel & Railroad Track Areas
- Main Plant Excavation Areas 2 and 4B - Gravel Cap
- Former Buildings Foundation Cap
  - Former Buildings without Basements - Concrete Cap
  - Former Buildings with Basements - Low Permeability Soil Cap
- Former Building 67 Elastocoat Cap
- Constructed Lagoon Area Vegetative Cap
  - Lagoon Stormwater Detention Area Cap
  - Lagoon Vegetative Soil Cap
- Constructed Main Plant Vegetative Cap
  - Gravel Vegetated Swales
- Grassed Stormwater Detention Areas

OM&M requirements for the composite cover system are discussed in the following subsections of this SMP.

Based upon the findings of periodic inspections, the maintenance needs of the composite cap will be evaluated and corrective actions will be taken when necessary. A brief summary of the key maintenance concerns and the respective corrective actions is provided below for each component of the composite cover system.

3.2.1 Existing Surface Cap

Based upon the findings of periodic inspections, the maintenance needs of the existing surface cap will be evaluated and corrective actions will be taken when necessary. A brief summary of the key maintenance concerns and the respective corrective actions for these caps are provided below:

- Woody Vegetation Observed in Asphalt Areas: Woody species greater than one-inch in diameter will be removed.
- Other Vegetation: Signs of stressed vegetation and insect infestation will be noted during inspections and measures will be implemented as appropriate to ensure the vegetation is healthy to provide a continuous vegetative cap.
- Site maintenance: Existing surface cap does not need to be repaired unless being disturbed for Site maintenance or developed and it should be replaced-in-kind or with an approved alternative surface cap.

3.2.2 Main Plant Excavation Areas Cap

Based upon the findings of periodic inspections, the maintenance needs of the excavation areas will be evaluated and corrective actions will be taken when necessary.

- Woody Vegetation Observed in Gravel Areas: Woody species greater than one-inch in diameter will be removed.
- Site maintenance: Gravel area does not need to be repaired unless being disturbed for Site maintenance or developed and it should be replaced-in-kind or with an approved alternative surface cap.

3.2.3 Former Buildings Foundation Cap

The former buildings foundation cap consists of the following, depending on location:

- concrete building foundation (buildings without basements);
- compacted impermeable clay and topsoil (buildings with basements); and
- non-woven geotextile and spray elastomer system or elastocoat (building 67).

A brief summary of the key maintenance concerns and the respective corrective actions for these caps are provided below.

Concrete Building Foundation

- Woody Vegetation Observed: Woody species greater than one-inch in diameter will be removed.
- Site maintenance: Concrete does not need to be repaired unless being disturbed for Site maintenance or developed and it should be replaced-in-kind or with an approved alternative surface cap.

Compacted Impermeable Clay and Topsoil

- Evidence of Erosion: Areas where signs of settlement or erosion problems (i.e., rills or gullies, orange demarcation layer exposed) are observed will be repaired by re-grading the localized area, adding the required fill material and/or topsoil, and reseeding as necessary.
- Woody Vegetation Observed: Woody species greater than one-inch in diameter will be removed.

Non-woven Geotextile and Elastocoat

- Evidence of Cracks, Bubbles or Flaking of the Elastocoat: Areas where signs of cracking, bubbling or flaking of the elastocoat will be repaired by a certified installer (Line-X or similar).
- Evidence of Separation of the Elastocoat from the Geotextile: Areas where signs of separation of the elastocoat from the geotextile will be repaired by a certified installer (Line-X or similar).
- Woody Vegetation Observed: Woody species greater than one-inch in diameter will be removed.

3.2.4 Lagoon Area Vegetative Cap

The principal objective of the vegetative cap is to eliminate human health and wildlife exposure to constituents in the soil underlying unpaved areas. Also the combination of grading improvements, stormwater management, evapotranspiration mechanisms, and water storage in the soil will eliminate the vast majority of recharge/infiltration in the Lagoon Area.

The following will be monitored during the performance of each inspection.

- Evidence of Erosion: Areas where signs of settlement or erosion problems (i.e., rills or gullies, biota barrier/recycled concrete aggregate (RCA) demarcation layer exposed) are observed will be repaired by re-grading the localized area, adding the required fill material and/or topsoil, and reseeding as necessary.

- Vegetation: Signs of stressed vegetation and insect infestation, will be noted during inspections and measures will be implemented as appropriate to ensure the vegetation is healthy to provide a continuous vegetative cap.

3.2.5 Main Plant Vegetative Cap

The principal objective of the vegetative cap is to eliminate human health and wildlife exposure to constituents in the soil underlying unpaved areas. Also the combination of grading improvements, stormwater management, evapotranspiration mechanisms, and water storage in the soil will eliminate the vast majority of recharge/infiltration in the Main Plant Area.

The following will be monitored during the performance of each inspection.

- Evidence of Erosion: Areas where signs of settlement or erosion problems (i.e., rills or gullies, bottom of 6 to 12-inch topsoil demarcation layer exposed) are observed will be repaired by re-grading the localized area, adding the required fill material and/or topsoil, and reseeding as necessary.
- Woody Vegetation Observed: Woody species greater than one-inch in diameter will be removed.
- Other Vegetation: Signs of stressed vegetation, invasive plants, and insect infestation, will be noted during inspections and measures will be implemented as appropriate to ensure the vegetation is healthy to provide a continuous vegetative cap.

3.3 Media Monitoring Program

3.3.1 Soil Vapor Monitoring

A soil vapor monitoring program will be performed upon Site development annually for three years following the effective date of this SMP to confirm that there is no off-site migration of VOCs in soil vapor. All work will be completed in accordance with the New York State Department of Health ("NYSDOH") final document entitled "Guidance for Evaluating Soil Vapor Intrusion in the State of New York," dated October 2006 (NYSDOH, 2006).

An initial round of soil vapor monitoring was performed as discussed in Section 2.3.2.

Soil Vapor Collection

Prior to collecting soil vapor samples, approximately three volumes of air will be purged from the Teflon™ sampling tube at a rate of less than 200 milliliters per minute ("ml/m"), to ensure a representative vapor sample is collected. During purging activities, a tracer gas (i.e., helium) will be used to verify that the ambient air above the land surface slab is not being drawn into the sample. To accomplish this, an enclosure, such as a clean, empty five-gallon bucket, will be inverted over the sampling point. Helium will be introduced into the bucket, creating a helium-enriched environment immediately surrounding the sample point. A tedlar sampling bag will be attached to the low-flow air pump and filled with vapors purged from the sampling tube as the helium is added to the enclosure over the top of the location. The purge volume in the tedlar bag will then be screened for the tracer gas (helium) using a direct read field meter. The atmosphere in the enclosure will also be monitored for helium using a direct read field meter. The helium concentration in the tedlar bag will be compared to the concentration in the enclosure. If the helium concentration in the tedlar bag is greater than 10 percent of the helium concentration in the enclosure, the seals of the sampling equipment will be verified and the tubing will be purged again until the helium concentration in the tedlar bag is less than 10 percent of the concentration in the enclosure. If necessary, additional concrete will be used to ensure

that a proper seal has been achieved. This tracer testing will serve as a quality assurance/quality control measure to ensure that a true, representative soil vapor sample will be collected.

Following purging activities, a laboratory cleaned and evacuated six-liter SUMMA canister will then be attached to the top of the Teflon™ tubing. The SUMMA canister will be equipped with a laboratory provided flow regulator that has been pre-calibrated to collect samples over a continuous 8-hour time period. The valve on the SUMMA canister will then be opened, allowing for the collection of a vapor sample.

Soil vapor samples will be submitted under chain-of-custody procedures to an ELAP certified laboratory for analysis. Samples will be analyzed for VOCs using United States Environmental Protection Agency ("USEPA") Method TO-15.

Collection of Ambient Outdoor Air Samples

Ambient outdoor air samples will be collected during the soil vapor monitoring concurrently with the soil vapor samples described above. The ambient outdoor air samples will be collected at a height approximately one foot above the land surface. The outdoor ambient air samples will be collected from a representative, upwind location at a distance of approximately five feet from their respective sampling location. The ambient outdoor air samples will be collected to better define the background atmospheric conditions within the area of the soil vapor investigation. The ambient outdoor air samples will be collected using a 6-liter SUMMA canister equipped with a pre-calibrated flow regulator set to collect samples over an 8-hour period.

During the collection of all vapor samples, the field sampling team will maintain a log of the samples collected throughout the monitoring period. The log will contain specific information about each sample including, but not limited to, the following:

- sample identification;
- date and time of sample collection;
- sampling depth interval;
- identity of samplers;
- sampling methods and devices;
- purge volumes;
- volume of soil vapor extracted;
- the canister vacuum before and after samples collected;
- apparent moisture content (dry, moist, saturated, etc.) of the sampling zone;
- chain of custody protocols and records used to track samples from sampling point to analysis; and
- weather conditions (i.e., precipitation, outdoor temperature, wind direction, and barometric pressure).

Outdoor air samples will be submitted under chain-of-custody procedures to TestAmerica Laboratories of Burlington, Vermont (an ELAP certified laboratory) for analysis. Samples will be analyzed for VOCs using USEPA Method TO-15.

Soil Vapor Point Repairs, Replacement and Decommissioning

Upon installation of replacement soil vapor monitoring points, repairs and/or replacement of soil vapor points or other related components (i.e., j-plugs or locks) in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring points for the purpose of replacement and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Decommissioning without replacement will be done only with the prior approval of NYSDEC. Abandonment will be performed in accordance with NYSDEC's "CP-43: Groundwater Monitoring Well Decommissioning Policy" issued on November 3, 2009 (NYSDEC, 2009). Soil Vapor Points that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.3.2 Groundwater Monitoring

Groundwater monitoring will be performed on a periodic basis to assess the performance of the remedy. The monitoring wells that make up the Performance Monitoring Network are provided below along with the rationale for being included in the network and shown in Plate 15:

Monitoring Well	Justification	Status
LF-MW-46R	Located Downgradient of GCS Area 6	Decommissioned February 6, 2017
LF-MW-47R	Located Downgradient of GCS Area 6	Decommissioned February 6, 2017
LG-MW-2R	Located downgradient of GCS Area 3 and for Lagoon Area Arsenic in Groundwater Remediation Monitoring	Not currently being sampled
LG-MW-4R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Decommissioned February 6, 2017
LG-MW-5R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Not currently being sampled
LG-MW-6R	**Lagoon Area Arsenic in Groundwater Remediation Monitoring**	**Active - Converted from a stick-up to a flush-mount**
LG-PZ-10R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Decommissioned July 6, 2018
LG-PZ-14R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Not currently being sampled
LG-PZ-15R	Downgradient of GCS Area 5	Not currently being sampled
LG-PZ-24R	**Downgradient of GCS Area 1 (Western Portion)**	**Active**
LG-PZ-6R	**Lagoon Area Arsenic in Groundwater Remediation Monitoring**	**Active - Converted from a stick-up to a flush-mount**

Monitoring Well	Justification	Status
MP-MW-105R	**Downgradient of AOC-1 and Re-injection Gallery**	**Active**
MP-MW-108R	Downgradient of AOC-2 and Re-injection Gallery	Decommissioned February 6, 2017
MP-MW-119R	Requested by the NYSDEC	Decommissioned February 6, 2017
MP-MW-120	Requested by the NYSDEC	Decommissioned February 6, 2017
ST-MW-12	**Downgradient of GCS Area 1 (Eastern portion)**	**Active**

Monitoring well construction logs are included as Appendix H along with the decommissioning forms. Groundwater monitoring wells LG-MW-25 and LG-MW-26 are not part of the groundwater Performance Monitoring Network; however, they have been sampled in the past. In the letter dated June 23, 2016, the NYSDEC indicated sampling of these wells could be discontinued but should be protected for potential future sampling. These two wells were decommissioned on July 6, 2018, the corresponding decommissioning forms are provided in Appendix H.

Groundwater monitoring at the 5 active locations listed above will continue be performed every fifth quarter and compared to New York State Ambient Water-Quality Standards and Guidance Values ("AWQSGVs"). The AWQSGVs are identified in the NYSDEC's Division of Water Technical and Operational Guidance Series No.1.1.1 (NYSDEC, 1998b) and subsequently amended, where applicable, by the April 2000 (NYSDEC, 2000a) and June 2000 (NYSDEC, 2000b) NYSDEC addendums. The data generated in June 2008 prior to start-up of the GCS will be referenced, for comparison purposes, as the baseline groundwater sampling event. These results are summarized in Table 16.

Prior to sample collection, the monitoring wells will be gauged and then purged via low-flow means using a submersible or peristaltic pump. Unless otherwise approved by NYSDEC, the USEPA *Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures* will be employed. Samples and parameter readings will be collected using a flow-through cell to prevent sample contact with atmospheric air. All well sampling activities will be recorded in a field book and a groundwater-sampling log (Appendix I) will be prepared. Other observations (e.g., well integrity, etc.) will be noted on the well sampling log. The well sampling log will serve as the inspection form for the groundwater monitoring well network. Groundwater samples will be analyzed for VOCs using USEPA Method 624.1, base/neutral/acid extractable semivolatile compounds ("SVOCs") using USEPA Method 625.1, and TAL metals using USEPA Method 200.7 / 245.1. Both filtered and unfiltered samples will also be submitted for metals analysis. The filtered samples will be obtained in the field during sampling using a 0.45-micron disposable filter.

The sampling frequency may be modified with the approval NYSDEC. The SMP will be modified to reflect changes in sampling plans approved by NYSDEC. It should be noted that in a letter dated September 1, 2017, the NYSDEC requested the inclusion of perfluorinated organic compounds (perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS)) and 1,4-dioxane in the next annual groundwater monitoring analysis that was completed in 2017. In a follow-up letter dated May 14, 2019, the NYSDEC requested as

part of the 2019 groundwater monitoring, that 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS) are to be added to the sampling analysis for monitoring wells LG-PZ-24R, MP-MW-105R and ST-MW-12. The required analytical methods to be used by the Laboratory for PFAS are modified EPA Method 537 and Method 8270 selective ion monitoring (SIM) for 1,4-dioxane.

Monitoring Well Repairs, Replacement and Decommissioning

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced (as per the Monitoring Plan), if an event renders the wells unusable.

Repairs and/or replacement of wells or other related components (i.e., j-plugs or locks) in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. Well abandonment will be performed in accordance with NYSDEC's "CP-43: Groundwater Monitoring Well Decommissioning Policy" issued on November 3, 2009 (NYSDEC, 2009). Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

It should be noted that the 16 monitoring locations were installed between November 8th and November 30, 2010; replacing wells previously installed either during or before the RI of the Main Plant. Wherever possible, these replacement wells were installed within five feet of the old wells. All other Site monitoring wells and piezometers were abandoned in place. In a letter dated June 23, 2016, the NYSDEC approved a reduction in the 16 monitoring locations comprising the monitoring well network and further specified the following wells were required to be sampled every fifth quarter: LG-MW-6R, LG-PZ-6R, LG-PZ-10R, LG-PZ-24R, MP-MW-105R and ST-MW-12. On February 6, 2017 the following monitoring wells were decommissioned: LG-MW-4R, LF-MW-46R, LF-MW-47R, MP-MW-108R, MP-MW-119R, MP-MW-120R, ST-MW-2 and ST-MW-15. Monitoring well decommissioning forms are included in Appendix H. During the 2019 ongoing sediment remediation work in the Hudson River, monitoring wells LG-MW-6R, LG-PZ-6R, and LG-PZ-10R were destroyed. The following three wells remain in the monitoring well network: LG-PZ-24R, MP-MW-105R and ST-MW-12. Monitoring well ST-MW-12 is located offsite and is sampled by Albany Molecular.

3.4 Site-Wide Inspection

Site-wide inspections will be performed on a regular schedule at a minimum of once a year. Site-wide inspections will also be performed after all severe weather conditions that may affect Engineering Controls or monitoring devices. During these inspections, an inspection form will be completed (Appendix J). The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;

- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection;
- Compliance with permits and schedules included in the Operation and Maintenance Plan; and
- Confirm that site records are up to date.

3.5 Monitoring Quality Assurance/Quality Control

All sampling and analyses will be performed in accordance with the requirements of the Quality Assurance Project Plan (QAPP) prepared for the site (Appendix K). Main Components of the QAPP include:

- QA/QC Objectives for Data Measurement.
- Sampling Program:
  - Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.
  - Sample holding times will be in accordance with the NYSDEC ASP requirements.
  - Field QC samples (e.g., trip blanks, coded field duplicates, and matrix spike/matrix spike duplicates) will be collected as necessary.
- Sample Tracking and Custody.
- Calibration Procedures:
  - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
  - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.
- Analytical Procedures.
- Preparation of a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.
- Internal QC and Checks.
- QA Performance and System Audits.
- Preventative Maintenance Procedures and Schedules.
- Corrective Action Measures.

3.6 Monitoring Reporting Requirements

Forms and any other information generated during regular monitoring events and inspections will be kept on file on-site. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be (1) subject to approval by NYSDEC and (2) submitted at the time of the Periodic Review Report, as specified in the Reporting Plan of this SMP.

All monitoring results will be reported to NYSDEC on a periodic basis in the Periodic Review Report. The report (or letter) will include, at a minimum:

- Date of event;
- Personnel conducting sampling;
- Description of the activities performed;
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc.);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether groundwater conditions have changed since the last reporting event.

Data will be reported in hard copy or digital format as determined by NYSDEC. A summary of the monitoring program deliverables are summarized in Table 17 below.

Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Preparation and Submission of PRR and Certification	Every Three Years
Completion of Cap Inspection Form	Annually
Groundwater Sampling	Every 5th Quarter
Preparation and Submission of Corrective Measures Plan	As needed
Preparation and Submission of Revisions to NYSDEC-approved SMP and referenced EWP, HASP, CAMP, QAPP and CCP	As-needed
Preparation and Submission of Project-Specific SWPPP	As-needed

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC.

4. Operation and Maintenance Plan

4.1 Introduction

The O&M Plan describes the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site.

This O&M Plan:

- Includes the steps necessary to allow individuals unfamiliar with the site to operate and maintain the groundwater treatment system;
- Includes an operation and maintenance contingency plan; and
- Will be updated periodically to reflect changes in site conditions or the manner in which the groundwater treatment system is operated and maintained.

Information on non-mechanical Engineering Controls (i.e., composite cover system) is provided in Section 3 - Engineering and Institutional Control Plan.

4.2 Engineering Control System Operation and Maintenance

4.2.1 Groundwater Treatment System

The Groundwater Treatment System O&M Plan is provided in Appendix C. A copy of this O&M Plan, along with the complete SMP, will be kept at the site. This O&M Plan is not to be used as a stand-alone document, but as a component document of the SMP.

The system testing described in Appendix C will be conducted if, in the course of the Groundwater Treatment System lifetime, significant changes are made to the system, and the system must be restarted.

4.3 Engineering Control System Performance Monitoring

Groundwater Treatment System performance monitoring will consist of groundwater sampling as described in Section 3.3.2, and effluent monitoring in accordance with the discharge permit requirements.

The Effluent Limitations and Monitoring Requirements for the GWTS require that analyses for the following parameters be performed by a laboratory certified by the State of New York at the frequencies listed below, as further detailed in the O&M Plan.

Parameter	Frequency
Flow	Continuous
pH	Bi-Weekly
Benzene	Bi-Weekly
Chlorobenzene	Bi-Weekly
1,2, Dichloroethane	Bi-Weekly
Ethylbenzene	Bi-Weekly
Toluene	Bi-Weekly
1,2,4 Trichlorobenzene	Bi-Weekly

Parameter	Frequency
Vinyl Chloride	Bi-Weekly
Butylbenzyl phthalate	Bi-Weekly
Bis(2-ethylhexyl) phthalate	Bi-Weekly
Naphthalene	Bi-Weekly
Phenol	Bi-Weekly
Aluminum	Bi-Weekly
Arsenic	Bi-Weekly
Barium	Bi-Weekly
Chromium	Bi-Weekly
Cobalt	Bi-Weekly
Copper	Bi-Weekly
Iron	Bi-Weekly
Manganese	Bi-Weekly
Nickel	Bi-Weekly
Zinc	Bi-Weekly
Sodium	Bi-Weekly
Total Dissolved Solids	Bi-Weekly

4.3.1 Monitoring Schedule

Performance monitoring of groundwater will take place every fifth quarter. Effluent monitoring will be in accordance with the discharge permit, as discussed in Section 4.3. Inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or sampling may take place when a suspected failure of the groundwater treatment system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. Monitoring deliverables for the [type] system are specified later in this Plan.

4.3.2 General Equipment Monitoring

A visual inspection of the complete system should be completed daily and also conducted during the monitoring event. The system components to be monitored are summarized in the Daily Treatment System Operations Log, described in Section 7.2 of the O&M Plan (Appendix C), which provide operational data to help fill out monthly reports, institute new procedures, or determine causes of operational or maintenance problems. A sample form for is provided in Appendix G of the O&M Plan and copies of the daily forms are kept on file onsite. The entries to be made on the log are listed below:

1. Date.
2. Operator on duty.
3. Flowrate from the wells.
4. Total Groundwater volume processed.
5. Flowrate and Volume through Treatment System Components.
6. System Status.

7. Pump Pressures.
8. Blower Pressures.
9. LGAC Pressures.
10. Chemicals added to the system.
11. Unusual situations.
12. General comments

If any equipment readings are not within their typical range, any equipment is observed to be malfunctioning, or the system is not performing within specifications, maintenance and repair as per the Operation and Maintenance Plan are required immediately, and the groundwater treatment system restarted. General equipment maintenance procedures can be found in Section 5.0 of the O&M Plan. Examples of maintenance logs can be found in Tables 1 – 13 of the O&M Plan.

4.3.3 System Monitoring Devices and Alarms

The groundwater treatment system has warning devices that trigger alarms to indicate that the system is not operating properly. The devices include, but are not limited to, liquid level switches, UV lamp sensitivity devices, pressure switches, power/VFD faults switches, and temperature switches. The alarms result in a notification via the telemetry system (Sierra Wireless Gateway) to the operators via email. The values generated from each sensor are available within the HMI for real-time viewing (locally and remotely). Equipment specific alarms are detailed in Section 3.0 and listed in Appendix D of the O&M Plan. In the event that the warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the system restarted. Operational problems will be noted in the subsequent Periodic Review Report.

4.3.4 Sampling Event Protocol

Sampling event protocol is described in the O&M plan in Appendix C.

4.4 Maintenance and Performance Monitoring Reporting Requirements

The equipment comprising the GWTS requires regular service and maintenance in accordance with the instructions provided with each piece of equipment. Preventive maintenance is performed on the emergency generator and the effluent pump P-301. All the other equipment operates until the equipment fails and requires replacement. Adequate records of service are maintained for each item of equipment when replaced. Maintenance reports and any other information generated during regular operations at the site will be kept on-file on-site. All reports, forms, and other relevant information generated will be available upon request to the NYSDEC and submitted as part of the Periodic Review Report, as specified in the Section 5 of this SMP.

4.4.1 Routine Maintenance Reports

Checklists or forms (see Appendices I) will be completed during each routine maintenance event. Checklists/forms will include, but not be limited to the following information:

- Date;
- Name, company, and position of person(s) conducting maintenance activities;

- Maintenance activities conducted;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

4.4.2 Non-Routine Maintenance Reports

During each non-routine maintenance event, a form will be completed which will include, but not be limited to, the following information:

- Date;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Presence of leaks;
- Date of leak repair;
- Other repairs or adjustments made to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

5. Inspections, Reporting, and Certifications

5.1 Site Inspections

5.1.1 Inspection Frequency

All inspections will be conducted at the frequency specified in the schedules provided in Section 3 of this SMP and the O&M Plan (Appendix C). At a minimum, a site-wide inspection will be conducted annually (Appendix J). Inspections of remedial components will also be conducted when a breakdown of any treatment system component has occurred or whenever a severe condition has taken place, such as an erosion or flooding event that may affect the ECs.

5.1.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on the appropriate forms for their respective system which are contained in Appendices C and J. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records (as requested by the NYSDEC), generated for the site during the reporting period will be provided in electronic format in each respective periodic Review Report.

5.1.3 Evaluation of Records and Reporting

The results of the inspection and site monitoring observations/data will be evaluated as part of the EC/IC certification to confirm that the:

- EC/ICs are in place, are performing properly, and remain effective;
- The Monitoring Plan is being implemented;
- Operation and maintenance activities are being conducted properly; and based on the above items;
- Corrective actions are being performed, when applicable; and
- The site remedy continues to be protective of public health and the environment and is performing as designed in the Final Design Documents and Construction Completion Report (CCR).

5.2 Certification of Engineering and Institutional Controls

After the last inspection of the reporting period, a qualified environmental professional will prepare the following certification:

- For each institutional or engineering control identified for the site, I certify that all of the following statements are true:
  - The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;
  - The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;
  - Nothing has occurred that would impair the ability of the control to protect the public health and environment;
  - Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;

  - Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;
  - If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;
  - Use of the site is compliant with the deed restriction;
  - The engineering control systems are performing as designed and are effective;
  - To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program; and
  - The information presented in this report is accurate and complete.
- I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Designated Site Representative] for the site.

The signed certification will be completed on annual basis and, submitted during the Periodic Review Report(s) certification period, with other related documentation, if applicable, as described below.

5.3 Periodic Review Report

A Periodic Review Report will be submitted to the Department as requested, beginning eighteen months after the [Certificate of Completion or equivalent document e.g., Satisfactory Completion Letter, No Further Action Letter, etc.] is issued. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A (Metes and Bounds). The report will be prepared in accordance with NYSDEC DER-10 and submitted within 45 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment, and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable inspection forms and other records generated for the site during the reporting period in electronic format.
- A summary of any discharge monitoring data and/or information generated during the reporting period with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document.
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications.

  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring Plan for the media being monitored.
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan.
  - The overall performance and effectiveness of the remedy.
- A performance summary for all treatment systems at the site during the calendar year, including information such as:
  - The number of days the system was run for the reporting period;
  - The average, high, and low flows per day;
  - The contaminant mass removed;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;
  - A description of the resolution of performance problems;
  - A summary of the performance, effluent and/or effectiveness monitoring; and
  - Comments, conclusions, and recommendations based on data evaluation.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office and Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation.

5.4 Corrective Measures Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a corrective measures plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the corrective measures plan until it is approved by the NYSDEC.

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TABLES

1. Summary of Metals Detected in Soil during the Remedial Investigation
2. Summary of Volatile Organic Compounds Detected in Soil Detected during the Remedial Investigation
3. Summary of Semivolatile Organic Compounds Detected in Soil Detected during the Remedial Investigation
4. Summary of Pesticides Detected in Soil Detected during the Remedial Investigation
5. Summary of PCBs Detected in Soil Detected during the Remedial Investigation
6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
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12. Post-Remediation Criteria for On-site Re-use of Excavated Material/ Imported Fill Materials
13. Summary of Soil Vapor Analytical Data
14. Emergency and General Contact Number List (embedded)
15. Monitoring Inspection Schedule (embedded)
16. Baseline Groundwater Monitoring Results (June 2008)
17. Monitoring/Inspection Report Submission Schedule (embedded)

Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-FS-1 3/28/2001 0-0.5	MP-FS-2 3/28/2001 0-0.5	MP-SB-1 05/15/2000 0.0-2.0	MP-SB-2 05/15/2000 0.0-2.0	MP-SB-3 05/17/2000 2.0-6.0	MP-SB-4 05/15/2000 4.0-5.7	MP-SB-5 05/15/2000 2.0-4.0	MP-SB-6 05/12/2000 3.5-5.5
Aluminum	7572		4390	4910	**7630**	**9340**	**13500**	122	5970	7290
Antimony	ND		**1.1 B**	3 U	7.6 U	6.5 U	8.4 U	**49.5**	6.9 U	7.2 U
Arsenic	7.5		**11.1**	6.7	**19.6**	**236**	**760**	**31.1**	**167**	**13.1**
Barium	300		139	92.6	173	77.1	**779**	68 U	67.1	88
Beryllium	0.16		0.13 B	0.13 B	0.63 U	**0.63**	**0.77**	34 U	0.58 U	**0.65**
Cadmium	1		0.84 B	**1.5**	**1.5**	0.87	**1.3**	34 U	0.58 U	**6.3**
Calcium	6841		**96800**	**58000**	**23800**	**27400**	**16200**	2080	**114000**	**107000**
Chromium	10		**31.1**	**21.6**	**7280**	**4400**	**193**	**239000**	**294**	**97**
Cobalt	30		5.8 B	4.6 B	9.1	8.5	14.7	20.8	5.8 U	6.6
Copper	58		51.7	**88.2**	**644**	**866**	**655**	**1630**	**341**	**6220**
Cyanide	ND		NA	NA	**1.6**	1.1 U	1.4 U	3.4 U	1.2 U	1.2 U
Iron	16700		**30800**	**18500**	**37000**	**29800**	**82900**	**127000**	**38800**	**34000**
Lead	24.75		**112**	**45.3**	**19200**	**4880**	**3770**	34 U	**327**	**71.8**
Magnesium	3614		3240	**4000**	**3880**	**7100**	1250	1700 U	**47200**	**4320**
Manganese	229.4		**616**	132	**540**	**330**	**1360**	100 U	**503**	**393**
Mercury	0.1		0.1 U	0.1 U	**3.6**	**0.98**	**69.9**	**2.9**	**0.7**	**0.35**
Nickel	13		**18.9**	**15.3**	**34.9**	**37.2**	**58**	**35.6**	**28.6**	**15.3**
Potassium	1704		**1760**	1510	898	1420	987	1700 U	1030	1360
Selenium	2		5 U	5 U	13 U	11 U	14 U	680 U	12 U	12 U
Silver	ND		2 U	2 U	1.3 U	1.1 U	1.4 U	3.4 U	1.2 U	1.2 U
Sodium	929		**49000**	**39100**	**1190**	**1100**	700 U	1700 U	580 U	762
Thallium	ND		**2.9**	**2 B**	1.3 U	1.1 U	1.4 U	**19.4**	1.2 U	1.2 U
Vanadium	150		7.5 B	9.4 B	24.4	28.2	22.2	35.4	18.5	20.2
Zinc	87		**98.8**	**171**	**947**	**404**	**579**	7.8	**8330**	**420**

ft bls - Feet below land surface
mg/kg - Milligrams per kilogram
NYSDEC - New York State Department of Environmental Conservation
U - Not detected, detection limit is shown
B - Estimated concentration
* - Higher of NYSDEC RSCOs and Site Background
ND - Non detect
NA - Not analyzed
Bold - Data highlighted in bold represents detections that exceed the NYSDEC RSCOs
DUP - Duplicate Sample

Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-7	MP-SB-7 DUP	MP-SB-8	MP-SB-8 DUP	MP-SB-9	MP-SB-10	MP-SB-11	MP-SB-12
		Sample Date:	05/15/2000	05/15/2000	05/15/2000	05/15/2000	05/15/2000	05/16/2000	05/16/2000	05/16/2000
		Sample Depth (ft bls):	2.0-6.0	2.0-6.0	5.0-7.5	5.0-7.5	0.0-2.0	5.0-7.0	4.0-6.0	4.2-6.2
Aluminum	7572		5390	5960	6690	6650	7470	7310	2050	6210
Antimony	ND		8.6 U	9.2 U	6.4 U	6.3 U	6.6 U	6.3 U	34 U	6.3 U
Arsenic	7.5		**45.4**	**26.5**	6.3	**10.2**	**19.7**	2.6	**36.1**	3.1
Barium	300		98.6	144	56.1	83.3	54.7	47	23 U	38.3
Beryllium	0.16		0.72 U	0.77 U	0.53 U	0.53 U	0.55 U	0.53 U	0.58 U	0.53 U
Cadmium	1		0.72 U	0.77 U	0.53 U	0.53 U	1.1 U	0.53 U	1.7 U	0.53 U
Calcium	6841		**100000**	**120000**	**7810**	**13400**	**24200**	2180	1830	2930
Chromium	10		**196**	**115**	**23.7**	**22.2**	**106**	**13.5**	**126**	**12**
Cobalt	30		7.2 U	7.7 U	6	6.3	13.1	5.6	22.4	5.3
Copper	58		**130**	**93**	31.8	35.9	**419**	12	**326**	33.3
Cyanide	ND		1.4 U	1.5 U	1.1 U	1 U	1.1 U	1 U	1.2 U	1 U
Iron	16700		**26200**	**21300**	**18300**	**18200**	**104000**	15400	**259000**	**14400**
Lead	24.75		**810**	**758**	**96.5**	**213**	**197**	10.4	58 U	**43.5**
Magnesium	3614		2290	3050	**5110**	**6920**	**6960**	**3790**	858	2940
Manganese	229.4		**268**	**269**	**254**	228	**626**	**361**	**1050**	**234**
Mercury	0.1		**4.9**	**2.7**	**0.41**	**0.45**	**1.2**	0.032 U	**0.31**	0.034
Nickel	13		**21.8**	**22.6**	**15.7**	**15.5**	**61**	12.6	**240**	12.6
Potassium	1704		840	770 U	849	1210	788	1220	580 U	1110
Selenium	2		14 U	15 U	11 U	10 U	11 U	10 U	58 U	10 U
Silver	ND		1.4 U	1.5 U	1.1 U	1 U	1.1 U	1 U	1.2 U	1 U
Sodium	929		**942**	**976**	530 U	530 U	550 U	656	2900 U	530 U
Thallium	ND		1.4 U	1.5 U	1.1 U	1 U	**1.8**	1 U	**9.6**	1 U
Vanadium	150		17.2	21.8	11.6	12.9	36.9	11.2	73.2	10.4
Zinc	87		**156**	**154**	**98.3**	**96.2**	**173**	36.8	46.7	**257**

ft bls - Feet below land surface
mg/kg - Milligrams per kilogram
NYSDEC - New York State Department of Environmental Conservation
U - Not detected, detection limit is shown
B - Estimated concentration
* - Higher of NYSDEC RSCOs and Site Background
ND - Non detect
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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-13	MP-SB-14	MP-SB-15	MP-SB-16	MP-SB-17	MP-SB-18	MP-SB-19	MP-SB-20
		Sample Date:	05/16/2000	05/18/2000	05/18/2000	05/16/2000	05/18/2000	05/19/2000	05/09/2000	05/08/2000
		Sample Depth (ft bls):	5.0-7.0	5.0-7.5	8.0-9.5	6.0-8.0	4.0-6.5	4.0-5.5	0.0-2.0	0.0-2.0
Aluminum	7572		6710	6640	**14700**	6340	**7750**	**8310**	**7810**	**9760**
Antimony	ND		6.8 U	6.5 U	6.3 U	6.7 U	6.5 U	6.6 U	7.6 U	6.3 U
Arsenic	7.5		3.5	6.3	5.9	**18.2**	**12.5**	**67.7**	**8.3**	3.7
Barium	300		45.8	40.4	123	207	48.7	65.3	51.5	46.4
Beryllium	0.16		0.57 U	0.54 U	**0.82**	0.56 U	0.54 U	**1.3**	0.63 U	0.52 U
Cadmium	1		0.57 U	0.54 U	0.52 U	0.56 U	0.54 U	0.55 U	0.63 U	0.52 U
Calcium	6841		**9160**	4250	**13300**	**56300**	**8190**	**11600**	3380	1890
Chromium	10		**22.6**	**69.5**	**23.1**	**100**	**41.8**	**32.1**	**17**	**12.5**
Cobalt	30		6	6.3	10.6	11.8	10.5	7.8	7.6	7.5
Copper	58		22.7	48.4	33.2	**203**	**147**	41.7	**244**	16.1
Cyanide	ND		1.1 U	1.1 U	1 U	1.1 U	1.1 U	1.1 U	1.3 U	1 U
Iron	16700		**15800**	**25300**	**30600**	**100000**	**74100**	**24000**	**23100**	**20300**
Lead	24.75		**26.6**	**123**	13.7	**289**	**158**	**42**	**46**	13.2
Magnesium	3614		3420	2740	**7350**	**7780**	**4610**	**4480**	3510	**4420**
Manganese	229.4		**247**	**278**	**791**	**703**	**579**	**291**	**271**	**305**
Mercury	0.1		0.078	**0.43**	0.045	**0.26**	**0.28**	**0.13**	**0.21**	0.1
Nickel	13		**13.6**	**20.3**	**24.8**	**75.6**	**52.3**	**21.6**	**17**	**17**
Potassium	1704		1190	1040	**2560**	1390	1310	1430	1110	1360
Selenium	2		11 U	11 U	10 U	11 U	11 U	11 U	13 U	10 U
Silver	ND		1.1 U	1.1 U	1 U	1.1 U	1.1 U	1.1 U	1.3 U	1 U
Sodium	929		570 U	540 U	728	583	848	550 U	630 U	520 U
Thallium	ND		1.1 U	1.1 U	1 U	1.1 U	**1.1**	1.1 U	1.3 U	1 U
Vanadium	150		11.6	15.6	23.7	30.2	25.6	19.1	16.5	13.9
Zinc	87		50.5	**150**	79.8	**126**	**92.6**	**129**	67.8	**224**

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Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-21 05/09/2000 2.8-4.8	MP-SB-24 05/10/2000 3.0-5.0	MP-SB-25 05/09/2000 3.0-5.0	MP-SB-26 05/09/2000 3.0-5.0	MP-SB-27 05/09/2000 2.5-4.5	MP-SB-28 05/17/2000 0.0-2.0	MP-SB-29 05/09/2000 1.0-3.0	MP-SB-30 05/10/2000 3.0-5.0
Aluminum	7572		**7880**	**8670**	**14900**	**15800**	**14100**	2200	6160	**8420**
Antimony	ND		7 U	7.3 U	6.7 U	6.6 U	7 U	6.6 U	7.4 U	6.4 U
Arsenic	7.5		**47.8**	**19.5**	**8.5**	**20.8**	**66.2**	**8.6**	**849**	5.3
Barium	300		56.4	96	92.1	94.1	190	40.6	64.7	46.2
Beryllium	0.16		0.58 U	0.61 U	**0.75**	**0.68**	**0.64**	0.55 U	0.62 U	0.53 U
Cadmium	1		0.58 U	0.61 U	0.56 U	0.55 U	0.59 U	0.55 U	0.62 U	0.53 U
Calcium	6841		**11900**	5070	5020	**12000**	**10400**	578	**13900**	**9640**
Chromium	10		**16.8**	**15**	**18.4**	**19.4**	**19.1**	**15.7**	**10.9**	**12.5**
Cobalt	30		8	6.1 U	8.6	7.2	6.2	5.5 U	6.3	7.4
Copper	58		**84**	34.9	32.3	36.1	**105**	32	25	26.8
Cyanide	ND		1.2 U	1.2 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U
Iron	16700		**28700**	**17100**	**26800**	**29300**	**28600**	**4020**	**16900**	**18400**
Lead	24.75		**50.9**	**379**	**108**	**51.5**	**449**	**33**	**41.4**	11 U
Magnesium	3614		**4030**	**2560**	**5580**	**7090**	3300	550 U	2080	**4960**
Manganese	229.4		**268**	172	**490**	**344**	**279**	20	**283**	**384**
Mercury	0.1		**0.11**	**0.7**	**0.24**	0.052	**1**	**0.21**	0.083	**0.19**
Nickel	13		**16.8**	**16.2**	**22.1**	**22.9**	**17.3**	4.4 U	**13.8**	**15.6**
Potassium	1704		904	1090	1220	1310	1080	1200	736	1310
Selenium	2		12 U	12 U	11 U	11 U	12 U	11 U	12 U	11 U
Silver	ND		1.2 U	1.2 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U
Sodium	929		690	**1560**	748	550 U	590 U	550 U	**1120**	530 U
Thallium	ND		1.2 U	1.2 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U
Vanadium	150		22.7	16.6	23.8	27.5	24.2	7.4	18.6	14.1
Zinc	87		**214**	**185**	86.9	**95.3**	**142**	11.7	52.9	71.2

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-31 05/19/2000 0.0-4.0	MP-SB-32 05/10/2000 3.0-5.0	MP-SB-33 05/10/2000 2.5-4.5	MP-SB-34 05/11/2000 3.0-5.0	MP-SB-35 05/11/2000 3.8-5.0	MP-SB-36 05/11/2000 3.0-5.0	MP-SB-37 05/11/2000 4.5-6.5	MP-SB-38 05/17/2000 0.0-2.0
Aluminum	7572		**9710**	5110	7500	**9500**	11000	**9880**	7320	**9670**
Antimony	ND		6.4 U	7 U	7.1 U	7.4 U	7.2 U	6.6 U	6.7 U	6.4 U
Arsenic	7.5		**22.1**	**22.8**	**49.3**	7.3	**42**	**8.1**	4.2	**26.1**
Barium	300		48.1	228	94.2	181	145	199	109	122
Beryllium	0.16		**0.55**	**0.61**	0.59 U	0.62 U	0.6 U	0.55 U	0.56 U	**0.57**
Cadmium	1		0.53 U	0.59 U	0.59 U	0.62 U	0.6 U	0.55 U	**1.6**	0.54 U
Calcium	6841		**34700**	**10200**	**38700**	**22400**	**44300**	**101000**	**34600**	**41500**
Chromium	10		**17.5**	**14.4**	**13.5**	**833**	**112**	**220**	**231**	**52.7**
Cobalt	30		10.4	10	7	6.2 U	6.4	8.2	5.7	14.4
Copper	58		33.8	38	20.8	**138**	56	**65.1**	**89.8**	**186**
Cyanide	ND		1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U	1.1 U
Iron	16700		**24000**	**30200**	**21300**	**33000**	**26100**	**40200**	**26800**	**68600**
Lead	24.75		**25.7**	14.5	**38**	**276**	**171**	**1660**	**394**	**121**
Magnesium	3614		**6570**	1910	3190	2830	**4230**	**8870**	**4530**	**8460**
Manganese	229.4		**494**	192	162	**251**	**305**	**610**	**277**	**519**
Mercury	0.1		0.076	0.048	**0.1**	**0.96**	**1.8**	**1.2**	0.047	**52.5**
Nickel	13		**25.8**	**21.6**	**15.3**	**24.5**	**17.9**	**24.3**	**20.6**	**37.4**
Potassium	1704		**1890**	850	956	1060	1510	**1780**	1570	**2010**
Selenium	2		11 U	12 U	12 U	12 U	12 U	11 U	11 U	11 U
Silver	ND		1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U	1.1 U
Sodium	929		530 U	590 U	**1000**	**3500**	**1390**	**990**	560 U	737
Thallium	ND		1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U	1.1 U
Vanadium	150		23.2	26.7	24.3	21	26	20.6	13.9	43.6
Zinc	87		**103**	36.2	**109**	**175**	**137**	**166**	**409**	**146**

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-39	MP-SB-40	MP-SB-41	MP-SB-42	MP-SB-43	MP-SB-44	MP-SB-45	MP-SB-45
		Sample Date:	05/17/2000	05/17/2000	05/17/2000	05/18/2000	05/19/2000	05/10/2000	05/11/2000	05/11/2000
		Sample Depth (ft bls):	0.0-2.0	5.0-7.0	4.0-8.0	5.0-7.0	4.0-6.0	4.0-6.0	0.0-2.0	3.0-5.0
Aluminum	7572		6990	1220	2200	**12200**	6870	**10600**	7350	6930
Antimony	ND		6.3 U	7.1 U	7.2 U	6.6 U	7 U	6.6 U	6.4 U	6.3 U
Arsenic	7.5		**45.9**	4.5	**10.2**	**7.6**	**21.7**	**31**	**9.2**	2.7
Barium	300		84.5	230	46.3	104	72.6	63	66.6	48.3
Beryllium	0.16		0.52 U	0.59 U	0.6 U	**0.61**	**0.65**	0.55 U	0.53 U	0.52 U
Cadmium	1		0.52 U	0.59 U	0.6 U	0.55 U	0.58 U	0.55 U	0.53 U	0.52 U
Calcium	6841		**121000**	590 U	**11500**	**31300**	**8760**	**8540**	**7780**	1630
Chromium	10		**23.3**	**12.5**	9.4	**32.8**	**25.7**	**14.1**	**58.8**	**10.5**
Cobalt	30		6	5.9 U	6.4	10	9.4	7.1	8.8	6.7
Copper	58		51.1	28.7	31.8	50	**119**	25.5	**67.2**	14.7
Cyanide	ND		1 U	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U	1 U
Iron	16700		**19100**	**11600**	**24600**	**29600**	**36900**	**22600**	**39600**	**17800**
Lead	24.75		**45.7**	**461**	**40.7**	**50.5**	**381**	**29.2**	**86.1**	10
Magnesium	3614		**26200**	590 U	658	**11400**	3290	**4130**	**5270**	3040
Manganese	229.4		227	8.2	38.4	**369**	**434**	**472**	**348**	**365**
Mercury	0.1		**10.6**	**8.2**	**0.29**	**1**	**0.78**	0.049	**0.15**	0.031 U
Nickel	13		**16.6**	8.3	**18.8**	**49.8**	**25.1**	**15.2**	**50.7**	12.1
Potassium	1704		1620	590 U	600 U	**2180**	1190	1430	1110	1100
Selenium	2		10 U	12 U	12 U	11 U	12 U	11 U	11 U	10 U
Silver	ND		1 U	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U	1 U
Sodium	929		574	590 U	600 U	747	580 U	550 U	**983**	691
Thallium	ND		1 U	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U	1 U
Vanadium	150		15.6	8.2	15.4	33.7	24	19.1	19.4	11.3
Zinc	87		70.8	8.3	18.7	**115**	**93**	50.7	**116**	38.5

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-47 05/12/2000 2.0-3.5	MP-SB-48 05/18/2000 0.0-2.0	MP-SB-49 05/18/2000 0.0-2.0	MP-SB-50 05/08/2000 0.0-2.0	MP-SB-51 05/11/2000 4.0-6.0	MP-SB-52 05/11/2000 0.0-2.0	MP-SB-53 05/23/2000 0.0-2.0	MP-SB-54 05/23/2000 1.0-4.0
Aluminum	7572		5800	**8080**	5950	6260	**10800**	**13300**	6560	**9070**
Antimony	ND		7 U	6.4 U	6.4 U	6.3 U	6.5 U	7.3 U	6.3 U	**9.5**
Arsenic	7.5		**14.4**	3.2	2	2.3	5.1	**12**	2.6	**125**
Barium	300		60.7	55.7	27.4	34.4	52.5	137	32.8	118
Beryllium	0.16		0.58 U	0.53 U	0.54 U	0.52 U	0.54 U	**0.71**	0.52 U	0.59 U
Cadmium	1		0.58 U	0.53 U	0.54 U	0.52 U	0.54 U	0.61 U	0.52 U	0.59 U
Calcium	6841		3870	**20500**	996	**7440**	3290	2480	1780	**11600**
Chromium	10		**39.9**	**12**	8.1	**10.1**	**16**	**18.4**	9.6	**11.9**
Cobalt	30		7.8	5.9	5.4 U	5.2 U	7	6.6	5.4	5.9 U
Copper	58		**63.4**	12.8	7.9	9.6	23	53.9	10.3	28.6
Cyanide	ND		1.2 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U	1 U	1.2 U
Iron	16700		**36000**	**15400**	12300	12400	**22100**	**22100**	14000	**18000**
Lead	24.75		**377**	**36.1**	12.2	16.1	11.4	**74.2**	17.1	**174**
Magnesium	3614		2620	**4820**	2570	2750	**5330**	**3620**	2840	2010
Manganese	229.4		**327**	**262**	137	172	**478**	**520**	178	141
Mercury	0.1		**0.5**	0.032 U	0.036	0.03 U	0.033 U	**0.28**	0.051	**0.38**
Nickel	13		**77.4**	**13.2**	9.4	10.8	**15.9**	**17.3**	11.2	**13.2**
Potassium	1704		1040	1560	1140	882	1290	1590	988	1150
Selenium	2		12 U	11 U	11 U	10 U	11 U	12 U	10 U	12 U
Silver	ND		1.2 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U	1 U	1.2 U
Sodium	929		580 U	530 U	540 U	929	540 U	610 U	520 U	590 U
Thallium	ND		1.2 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U	1 U	1.2 U
Vanadium	150		16.4	12.9	9.9	10	18.1	23.8	11.4	16.6
Zinc	87		**143**	59.2	41	43	48.2	**108**	50.8	85

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-55	MP-SB-55 DUP	MP-SB-57	MP-SB-58	MP-SB-59	MP-SB-60	MP-SB-60	MP-SB-61
		Sample Date:	05/23/2000	05/23/2000	05/23/2000	05/23/2000	05/16/2000	3/6/2001	3/6/2001	3/6/2001
		Sample Depth (ft bls):	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	2.0-3.5	0-2	4-6	0-2
Aluminum	7572		1670	2100	708	2090	502	1,040.00	258.00	**13,800.00**
Antimony	ND		10 U	9.5 U	7.9 U	10 U	15 U	3 U	3 U	3 U
Arsenic	7.5		5.0	6.1	**8.2**	**12**	**23.6**	3 U	**7.6**	**107**
Barium	300		116	228	29.7	105	26 U	7.7 B	26.2 B	143
Beryllium	0.16		0.88 U	0.79 U	0.66 U	0.85 U	0.64 U	0.3 U	**1.5**	**1.5**
Cadmium	1		0.88 U	0.79 U	0.66 U	0.85 U	1.3 U	0.24 B	**61.8**	**3.7**
Calcium	6841		**22600**	**31600**	**53400**	**28000**	2590	2,480	6,280	**106,000**
Chromium	10		**24.2**	**35.9**	**18.2**	**132**	**2090**	1.9 B	**809**	**73.4**
Cobalt	30		**45.5**	**48**	6.6 U	**48**	20.3	0.71 B	21.6	5 B
Copper	58		**89.7**	**115**	**125**	**253**	**597**	2.2 B	**333**	37.1
Cyanide	ND		1.8 U	1.6 U	1.3 U	**3.4**	**1.6**	3 U	**0.76**	**0.78**
Iron	16700		**25800**	**33600**	**14500**	**54000**	**198000**	2,380	7,160	14,200
Lead	24.75		**621**	**794**	**219**	**904**	**655**	2.3	**32.6**	**42.7**
Magnesium	3614		1190	1670	660 U	1100	640 U	1,890	150 B	**27,300**
Manganese	229.4		116	140	37.8	120	**865**	72.9	**2,480**	**1,190**
Mercury	0.1		**1.9**	**1**	**0.12**	**2.9**	**0.2**	0.1 U	**0.21**	**0.17**
Nickel	13		12.8	**13.9**	5.3 U	**16.9**	**297**	2.6 B	**170**	11.5
Potassium	1704		**2040**	**2750**	**2560**	**5460**	640 U	1,030 B	86.6 B	**2,230**
Selenium	2		18 U	16 U	13 U	17 U	26 U	5 U	5 U	5 U
Silver	ND		1.8 U	1.6 U	1.3 U	1.7 U	1.3 U	2 U	2 U	2 U
Sodium	929		**13500**	**16500**	1270	2480	1300 U	69.1 B	854 B	**1,670**
Thallium	ND		1.8 U	1.6 U	1.3 U	1.7 U	**7**	3 U	3 U	3 U
Vanadium	150		8.8 U	7.9 U	6.6 U	26.4	30.4	4.4 B	94.3	29.3
Zinc	87		41.4	66.4	17.6	**105**	**1000**	3.8 B	**1,520**	65.9

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-61 3/6/2001 4-6	MP-SB-62 3/6/2001 0-2	MP-SB-62 3/6/2001 4-6	MP-SB-63 3/6/2001 0-2	MP-SB-63 3/6/2001 2-4	MP-SB-64 3/6/2001 0-2	MP-SB-65 03/12/2001 0-2	MP-SB-65 03/12/2001 6-8
Aluminum	7572		3,020.00	6,650.00	1,520.00	7,200.00	**9,030.00**	**9,090.00**	2,720.00	2,890.00
Antimony	ND		3 U	3 U	**78.6**	3 U	3 U	3 U	**1.1**	**31.00**
Arsenic	7.5		1.5 U	**51.1**	**411**	**43.8**	**51.6**	**7.8**	**29.3**	4.80
Barium	300		86.7 B	72.5	102	99.9	124	80.3	125	41.0 B
Beryllium	0.16		**4**	**0.43 B**	**1.1 B**	**0.65 B**	**0.81 B**	**0.48 B**	**0.32**	**0.32 B**
Cadmium	1		**23**	**13.1**	**35.5**	**15.8**	**11.3**	**5.2**	0.99	0.065 U
Calcium	6841		**35,500**	**43,300**	**15,900**	**29,600**	**33,100**	**36,200**	**133,000**	3,410.00
Chromium	10		**2,960**	**349**	**2,030**	**255**	**598**	**41.5**	**23.9**	**24.10**
Cobalt	30		17.3 B	11.9	9 B	13.6	13.4	9.3 B	4.8	3.4 B
Copper	58		**265**	**366**	**8,580**	**550**	**1,790**	40.9	31	**115.00**
Cyanide	ND		**3.4**	**0.36 B**	**4.2**	**0.25 B**	**0.41 B**	3 U	**0.66**	**1.10**
Iron	16700		**53,200**	**51,700**	**51,500**	**67,500**	**47,700**	**22,300**	12,700	**20,500.00**
Lead	24.75		**47.4**	**106**	**667**	**257**	**331**	22.7	**58.1**	**660.00**
Magnesium	3614		2,850	**4,960**	818 B	**4,100**	**4,560**	**7,060**	**34,300**	690 B
Manganese	229.4		**478**	**5,720**	**307**	**718**	**783**	**722**	204	26.40
Mercury	0.1		**0.19 B**	**1.4**	**4.9**	**3.3**	**3.7**	**0.11**	**0.45**	0.06
Nickel	13		**51**	**44.3**	**81.2**	**68.2**	**56.1**	**25**	**14.8**	5.7 B
Potassium	1704		397 B	750 B	226 B	844 B	809 B	1,240	487	273 B
Selenium	2		**5**	5 U	5 U	5 U	5 U	5 U	1.1	1.10
Silver	ND		2 U	2 U	**2.9 B**	2 U	2 U	2 U	**0.42**	0.45 U
Sodium	929		**3,760**	**1,810**	**10,500**	564 B	652 B	218 B	703	317 B
Thallium	ND		3 U	3 U	3 U	3 U	3 U	3 U	**0.64**	**3.40**
Vanadium	150		37.7	23.3	**495**	33.4	25.8	34.8	23.1	9.0 B
Zinc	87		**3,950**	**2,540**	**15,200**	**576**	**602**	**256**	66.5	9.90

ft bls - Feet below land surface
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NYSDEC - New York State Department of Environmental Conservation
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Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-66	MP-SB-66	MP-SB-67	MP-SB-67	MP-SB-68	MP-SB-68 DUP	MP-SB-68	MP-SB-69
		Sample Date:	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001
		Sample Depth (ft bls):	0-2	4-6	0-2	2-4	0-2	0-2	2-4	0-2
Aluminum	7572		5,040.00	4,470.00	6,480.00	6,990.00	**9,340.00**	**7,590.00**	4,080.00	**8,420.00**
Antimony	ND		0.34 U	0.41 U	0.4 U	0.41 U	0.35 U	0.44 U	0.48 U	0.39 U
Arsenic	7.5		**12.4**	**301**	**1,120**	**1,530**	**39.5**	**50.80**	**305**	**16.4**
Barium	300		22.3 B	18.2 B	67	97.1	57.5	60.70	120	41.1 B
Beryllium	0.16		**0.26 B**	**0.17 B**	**0.59 B**	**0.33 B**	**0.47 B**	**0.46B**	**0.52 B**	**0.53 B**
Cadmium	1		0.051 U	0.061 U	0.06 U	0.061 U	0.052 U	0.066 U	0.072 U	0.058 U
Calcium	6841		**61,800**	2,300	**20,600**	**8,270**	**71,500**	**72,900.00**	**17,000**	**26,500**
Chromium	10		8.4	8.5	**30.9**	9.2	**15.7**	**17.70**	**10.6**	**15.3**
Cobalt	30		5.2 B	4.2 B	22.5	8.8 B	5.7 B	5.8 B	6.8 B	8.6 B
Copper	58		10	**142**	**59.9**	15.1	25.7	26.70	33.4	27.7
Cyanide	ND		0.15 U	0.15 U	**0.65**	**0.3 B**	**0.2 B**	**0.55 B**	**0.43 B**	0.14 U
Iron	16700		13,000	12,100	**55,700**	14,200	**19,300**	**19,000.00**	15,500	**20,900**
Lead	24.75		1.6	20.7	**166**	**491**	16.7	**38.80**	**121**	19.4
Magnesium	3614		**29,700**	2,850	**5,700**	2,820	**11,400**	**16,800.00**	1,530	**5,210**
Manganese	229.4		**273**	110	**410**	**539**	**580**	**372.00**	**314**	**538**
Mercury	0.1		0.056 U	0.1 B	**0.38**	**0.16**	0.076 B	**0.11 B**	**0.13**	**0.22**
Nickel	13		11.4	10.1	**53.6**	**21.3**	**15**	**14.60**	**14.7**	**19.6**
Potassium	1704		580 B	451 B	391 B	456 B	749 B	640 B	427 B	858 B
Selenium	2		1.4	1 U	**3.1**	1 U	1.2	1.70	1.7	1.1
Silver	ND		0.38 U	0.41 U	0.45 U	0.46 U	0.41 U	0.45 U	0.48 U	0.43 U
Sodium	929		114 B	285 B	882 B	888 B	**1,140**	892 B	523 B	**978**
Thallium	ND		**3.8**	**3.1**	**14**	**2.6**	**2.8**	**4.10**	**3.5**	**4.5**
Vanadium	150		9.3 B	7.9 B	**215**	24.7	22.2	19.50	15.5	13
Zinc	87		39.1	**174**	**243**	**157**	78.8	**87.60**	75.7	78.7

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Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-69	MP-SB-70	MP-SB-70	MP-SB-71	MP-SB-71	MP-SB-72	MP-SB-72	MP-SB-73
		Sample Date:	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/14/2001	03/14/2001	03/14/2001
		Sample Depth (ft bls):	4-6	0-2	4-6	0-2	4-6	0-2	8-10	0-2
Aluminum	7572		**9,480.00**	2,360.00	**8,740.00**	6,980.00	**9,640**	2,660.00	**9,580.00**	5,950.00
Antimony	ND		0.38 U	0.43 U	0.42 U	**2 B**	0.44 U	**1.1**	**1.5**	**1.8**
Arsenic	7.5		6	**51.1**	**546**	**161**	**494**	**27.7**	**497**	**25.4**
Barium	300		20.9 B	50.6	101	66.6	135	64.9	32.1	152
Beryllium	0.16		**0.49 B**	**0.24 B**	**0.7 B**	**0.45 B**	**0.59 B**	**0.89**	**0.41**	**1.9**
Cadmium	1		0.057 U	0.065 U	0.063 U	0.071 U	0.066 U	**1.1**	0.89	**1.4**
Calcium	6841		2,720	**30,900**	6,140	**53,100**	**8,710**	**286000**	1730	**7060**
Chromium	10		**17.9**	**24.7**	**18.1**	**19.1**	**12.6**	**30.6**	**20.7**	**45.4**
Cobalt	30		12.6	3.9 B	9.7 B	5 B	5.8 B	10.2	7	12
Copper	58		45.7	18	34.8	23	15.5	**138**	26	**153**
Cyanide	ND		**0.21 B**	0.16 U	**0.29 B**	**0.33 B**	0.17 U	**0.65**	**0.34**	**0.35**
Iron	16700		**25,100**	9,780	**22,000**	**21,200**	**22,300**	13700	**22700**	**18600**
Lead	24.75		23.8	**60.4**	**261**	**49.7**	**60.9**	**175**	12.4	**261**
Magnesium	3614		**5,160**	1,710	2,960	**4,500**	**3,660**	**5150**	**4410**	2320
Manganese	229.4		**633**	115	**1,050**	**332**	**484**	184	**295**	141
Mercury	0.1		**0.21**	**0.31**	**0.42**	**0.16**	0.074 B	**0.98**	0.054	**0.13**
Nickel	13		**26.1**	11	**53.7**	11.4	**17.1**	**68**	**17.5**	**67.4**
Potassium	1704		830 B	469 B	663 B	630 B	776 B	436	738	591
Selenium	2		0.94 U	1.1 U	1.4	1.2 U	1.2	1.1	1.1	1.1
Silver	ND		0.46 U	0.42 U	0.47 U	0.46 U	0.42 U	**0.43**	**0.42**	**0.44**
Sodium	929		**1,960**	592 B	**931 B**	700 B	812 B	920	677	**1380**
Thallium	ND		**4.9**	**2.8**	**3.7**	**4.7**	**5.6**	**0.64**	**2.5**	**1.3**
Vanadium	150		15.2	12.9	17.9	15.5	20.1	5.7	13.8	11.7
Zinc	87		**106**	45.9	**118**	77.6	64.2	**381**	77.3	**601**

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-73	MP-SB-74	MP-SB-74	MP-SB-75	MP-SB-75	MP-SB-76	MP-SB-76	MP-SB-77
		Sample Date:	03/14/2001	03/14/2001	03/14/2001	03/14/2001	03/14/2001	03/14/2001	03/14/2001	3/28/2001
		Sample Depth (ft bls):	6-8	0-2	8-10	0-2	4-6	0-2	4-6	0-1
Aluminum	7572		**9,850.00**	4,860.00	**13,500.00**	6,360.00	414.00	7,410.00	**30,000.00**	4840
Antimony	ND		**3.6**	**1.8 B**	**2.1**	**0.83**	**58.5**	**4**	**1.8**	3 U
Arsenic	7.5		**563**	**129.00**	**90.2**	**11.4**	1.5	**1260**	**149**	**31.6**
Barium	300		81.5	48.00	98.6	59.9	0.5	63.9	209	**511**
Beryllium	0.16		**0.5**	**0.27 B**	**0.62**	**0.3**	0.15	**0.38**	**1.5**	0.15 B
Cadmium	1		**1.5**	0.37 B	**1.3**	**1.4**	**1.1**	**1.6**	**4.3**	**3.1**
Calcium	6841		2430	**9,240.00**	**8940**	**65900**	**98900**	**23500**	**224000**	5350
Chromium	10		**14**	9.40	**17.5**	**180**	**147000**	**101**	**46.1**	**2940**
Cobalt	30		5.7	4.3 B	9.4	6.8	0.25	7.6	20.3	**172**
Copper	58		18.2	16.50	21.5	**58.7**	**9840**	**67**	**63.3**	**2000**
Cyanide	ND		**0.36**	**0.36 B**	**0.73**	**0.43**	**1**	**0.45**	**1.8**	NA
Iron	16700		**23400**	11,400.00	**26700**	**17400**	**71700**	**23700**	**56200**	**62100**
Lead	24.75		24.4	23.00	23.1	**49.5**	**901**	**395**	**71.7**	**1140**
Magnesium	3614		**3620**	**2,280.00**	**6700**	**6980**	894	**5410**	**29700**	2650
Manganese	229.4		**579**	**252.00**	**413**	**487**	**1260**	**332**	**1120**	**1180**
Mercury	0.1		0.047	**0.31**	0.066	**0.42**	**0.74**	**0.33**	**0.55**	**5.2**
Nickel	13		**14.2**	9.31	**22.8**	**17.1**	**35.2**	**24.6**	**55.3**	**323**
Potassium	1704		585	384 B	706	631	39.7	838	**1860**	545 B
Selenium	2		1.1	0.44 U	1.3	1	**2.5**	0.92	**2.9**	5 U
Silver	ND		**0.45**	0.18 U	**0.52**	**0.41**	**2**	**0.37**	**1.1**	**2.5 B**
Sodium	929		447	540.00	548	339	**1960**	457	**4120**	**3310**
Thallium	ND		**2.7**	**1.30**	**3.2**	**1.8**	**44.3**	**3.2**	**4.9**	**7.7**
Vanadium	150		15.1	8.60	18	15.5	0.4	24.7	84.3	43.3
Zinc	87		64.7	47.40	**107**	**93.4**	**89.5**	**135**	**228**	**829**

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-77	MP-SB-77	MP-SB-78	MP-SB-78	MP-SB-79	MP-SB-79	MP-SB-80	MP-SB-80
		Sample Date:	3/28/2001	3/28/2001	3/28/2001	3/28/2001	3/28/2001	3/28/2001	3/28/2001	3/28/2001
		Sample Depth (ft bls):	1-4	4-6	0-1	1-3	0-1	1-3	0-1	1-3
Aluminum	7572		5760	**15100**	**10500**	3580	4020	6070	2900	**11100**
Antimony	ND		3 U	**1.1 B**	3 U	**1.7 B**	**64.4**	**8 B**	3 U	**1.9 B**
Arsenic	7.5		**8.3**	**8.7**	**10.3**	**35**	**73.9**	**57.6**	**40.5**	**13.7**
Barium	300		257	204	175	**348**	**730**	259	278	85
Beryllium	0.16		**0.19 B**	**0.93 B**	**0.65 B**	**0.31 B**	0.3 U	**0.39 B**	0.3 U	**0.47 B**
Cadmium	1		**1.3**	0.71 B	0.8 B	**1.6**	**4.5 B**	**40.1**	**4.1 B**	0.78 B
Calcium	6841		2900	2970	**9650**	**18600**	**14300**	**28000**	**9710**	**7390**
Chromium	10		**1590**	**48.6**	**91.7**	**990**	**27500**	**99.2**	**10100**	**46.6**
Cobalt	30		6.8 B	13.1	13.2	9.3 B	**268**	13.8	**219**	7.1 B
Copper	58		20	21.7	**134**	**228**	**4750**	**150**	**5100**	55.3
Cyanide	ND		NA	NA	NA	NA	NA	NA	NA	NA
Iron	16700		**19000**	**28200**	**26900**	**49900**	**26200**	**75000**	**46400**	**21800**
Lead	24.75		**48.3**	17.6	**91.3**	**308**	**3020**	**583**	**3280**	**1190**
Magnesium	3614		**3690**	**5240**	**4260**	1350	1720 B	3370	1370 B	2420
Manganese	229.4		**358**	**372**	**398**	**5800**	**942**	**898**	**944**	**508**
Mercury	0.1		0.064 B	0.1 U	0.1 U	**0.78**	**3.4**	**1.5**	**7**	**0.34**
Nickel	13		**17.4**	**25.5**	**27.2**	**28.4**	**323**	**51**	**297**	**16**
Potassium	1704		477 B	804 B	965 B	313 B	521 B	576 B	358 B	633 B
Selenium	2		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Silver	ND		2 U	2 U	**0.4 B**	**1.2 B**	2 U	**87.7**	2 U	2 U
Sodium	929		685 B	**1600**	**1090**	**1870**	**4860 B**	**3750**	**3830 B**	**6800**
Thallium	ND		**3**	**3.7**	**3.6**	2 U	2 U	**9**	**9.7**	**3.6**
Vanadium	150		8.2 B	19.8	17.9	31.1	97.3	8.6 B	29.7 B	10.7 B
Zinc	87		**184**	79.8	**108**	**250**	**1560**	**815**	**1200**	**130**

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Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-81 3/28/2001 0-1	MP-SB-81 3/28/2001 1-3	MP-SB-82 3/28/2001 0-1	MP-SB-82 3/28/2001 1-3	MP-SB-83 3/28/2001 0-1	MP-SB-83 3/28/2001 1-3	MP-SB-101 10/20/1999 0.0-2.0	MP-SB-102 10/19/1999 0.0-2.0
Aluminum	7572		328	623	1330	957	2040	2380	**11400**	**8960**
Antimony	ND		3 U	3 U	3 U	3 U	3 U	3 U	7.3	6.4 U
Arsenic	7.5		3 U	3 U	6.8	2.2	2.8	4.4	**31.1**	**8.4**
Barium	300		15.5 B	25.8 B	**828**	52.3	86.6	50.5	87.7	52
Beryllium	0.16		0.3 U	0.3 U	0.3 U	0.068 B	0.3 U	0.3 U	**0.67**	0.53 U
Cadmium	1		0.11 B	0.12 B	**1.4**	0.23 B	0.55 B	0.57 B	0.74	0.53 U
Calcium	6841		186 B	326 B	2290	1010 B	495 B	930 B	**11300**	**18500**
Chromium	10		**85.5**	**108**	**1400**	**341**	**282**	**649**	**15.2**	**13.9**
Cobalt	30		0.42 B	1 B	12.9	1.8 B	3 B	2.3 B	9.8	9
Copper	58		30.4	**78.9**	**386**	30.8	**110**	**71.2**	34.7	26
Cyanide	ND		NA	NA	NA	NA	NA	NA	1.1 U	1 U
Iron	16700		1300	1110	11900	2690	8490	7410	**28400**	**23300**
Lead	24.75		**39.7**	20.8	**1290**	**80.9**	**72.6**	**70.3**	**38.4**	12
Magnesium	3614		40.3 B	108 B	404 B	356 B	1090 B	1190	**5790**	**6420**
Manganese	229.4		7	8.9	87.8	24.3	49.6	49.2	**886**	**520**
Mercury	0.1		**0.35**	**0.24**	**10.6**	**0.25**	**2.3**	**0.38**	0.1	0.04 U
Nickel	13		1.4 B	2.1 B	**37.1**	3.8 B	11.8	8.8 B	**22.8**	**19.9**
Potassium	1704		420 B	377 B	283 B	247 B	315 B	326 B	1630	1300
Selenium	2		5 U	5 U	5 U	5 U	5 U	5 U	11 U	10 U
Silver	ND		2 U	2 U	2 U	2 U	2 U	2 U	1.1 U	1 U
Sodium	929		558 B	**1020**	917 B	428 B	375 B	665 B	540 U	530 U
Thallium	ND		2 U	2 U	**1.5 B**	2 U	**1 B**	2 U	1.1 U	1 U
Vanadium	150		0.39 B	1.7 B	18.1	3 B	1.8 B	5.1 B	17.3	15.8
Zinc	87		74.2	22.7	**157**	20.1	35.2	**133**	**242**	**88.2**

ft bls - Feet below land surface
mg/kg - Milligrams per kilogram
NYSDEC - New York State Department of Environmental Conservation
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B - Estimated concentration
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ND - Non detect
NA - Not analyzed
Bold - Data highlighted in bold represents detections that exceed the NYSDEC RSCOs
DUP - Duplicate Sample

Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:**	MP-SB-103	MP-SB-104	MP-SB-104 FD	MP-SB-105	MP-SB-106	MP-SB-107	MP-SB-107A
		Sample Date:	10/20/1999	10/18/1999	10/18/1999	10/18/1999	10/15/1999	10/13/1999	10/15/1999
		Sample Depth (ft bls):	0.0-2.0	0.0-4.0	0.0-4.0	0.0-2.0	0.0-2.0	2.0-4.0	4.0-6.0
Aluminum	7572		3350	6100	5880	6200	6610	**12800**	7010
Antimony	ND		7.2 U	7 U	7.2 U	6.8 U	6.9 U	6.9 U	6.7 U
Arsenic	7.5		**17**	**20.6**	**22.7**	**18.4**	3.5	6.8	**16.5**
Barium	300		64.8	127	136	54.2	109	117	64.8
Beryllium	0.16		0.6 U	0.59 U	0.6 U	0.56 U	0.58 U	**0.57**	0.56 U
Cadmium	1		0.6 U	0.59 U	0.6 U	0.56 U	0.58 U	0.57 U	0.74
Calcium	6841		3770	**33800**	**37000**	**52800**	**12100**	**55900**	**36400**
Chromium	10		**12.2**	**20.3**	**19**	**10.3**	**13.1**	**23.4**	**23.7**
Cobalt	30		6 U	6.2	6	5.6 U	5.8 U	7.5	5.8
Copper	58		**126**	**85.2**	**101**	**116**	**162**	41.9	**78**
Cyanide	ND		1.2 U	1.2 U	1.2 U	**1.1**	1.2 U	**1.2**	1.1 U
Iron	16700		**24800**	**21000**	**23500**	**17700**	10300	**23500**	**28300**
Lead	24.75		**48.8**	**145**	**152**	**143**	**81.4**	**98.1**	**93.2**
Magnesium	3614		903	2980	3390	**17200**	1520	**5780**	**7330**
Manganese	229.4		96.7	171	155	129	71.7	**391**	**617**
Mercury	0.1		**1**	**2.5**	**3.4**	0.069	0.12	0.087	**0.64**
Nickel	13		11	**14.6**	**14.2**	9.6	7.2	**20.2**	**19.1**
Potassium	1704		606	905	927	967	951	1490	956
Selenium	2		12 U	12 U	12 U	11 U	12 U	11 U	11 U
Silver	ND		1.2 U	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U
Sodium	929		600 U	590 U	600 U	560 U	580 U	**936**	**1120**
Thallium	ND		1.2 U	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U
Vanadium	150		16.1	15.4	14.9	13.9	10.4	23.7	27
Zinc	87		65.8	**89.5**	71.6	**204**	28.4	**112**	63.8

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DUP - Duplicate Sample

Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-108 10/13/1999 0.0-2.0	MP-SB-109 10/12/1999 4.0-6.0	MP-SB-110 10/15/1999 2.0-4.0	MP-SB-111 10/13/1999 4.0-6.0	MP-SB-112 10/18/1999 2.0-4.0	MP-SB-113A 10/19/1999 0.0-2.0	MP-SB-114 10/12/1999 0.0-2.0
Aluminum	7572		1290	**12000**	6280	1100	**8130**	**10600**	**9430**
Antimony	ND		6.8 U	6.3 U	6.7 U	**112**	6.6 U	6.8 U	6.7 U
Arsenic	7.5		**18.6**	5.5	5.7	**11**	**15.9**	**623**	**11.6**
Barium	300		23 U	48.9	36.5	178	49.2	114	62.1
Beryllium	0.16		0.57 U	0.52 U	0.56 U	**1.6**	0.55 U	0.57 U	0.56 U
Cadmium	1		**2.2**	0.52 U	0.56 U	**3.2**	0.55 U	0.7	0.76
Calcium	6841		**15200**	4880	5360	**35700**	6410	**29000**	**40000**
Chromium	10		**126**	**15.4**	**35.8**	**23000**	**20.6**	**15.4**	**133**
Cobalt	30		15.3	8	6.2	15.4	6.5	9.2	5.8
Copper	58		**503**	31.9	39.8	**151000**	25.3	**81.7**	**58.7**
Cyanide	ND		**3.6**	1 U	1.1 U	2.3 U	1.1 U	1.1 U	1.1 U
Iron	16700		**327000**	**22800**	**23500**	**80000**	**22800**	**28000**	**33900**
Lead	24.75		**78.8**	12.8	**34.5**	**293**	**31.2**	**32.6**	**104**
Magnesium	3614		**3810**	**6400**	2940	1200 U	**4060**	**5610**	**16000**
Manganese	229.4		**963**	**836**	191	**568**	**296**	**681**	**306**
Mercury	0.1		**0.34**	0.037 U	**0.83**	**4.4**	**0.16**	**0.33**	**1.3**
Nickel	13		**181**	**19.5**	**15**	**101**	**21.2**	**20.2**	**27.8**
Potassium	1704		570 U	1120	771	1200 U	1110	1310	1060
Selenium	2		11 U	10 U	11 U	23 U	11 U	11 U	11 U
Silver	ND		1.1 U	1 U	1.1 U	2.3 U	1.1 U	1.1 U	1.1 U
Sodium	929		570 U	896	560 U	**1970**	584	781	718
Thallium	ND		1.1 U	1 U	1.1 U	**7**	1.1 U	1.1 U	1.1 U
Vanadium	150		35	19.4	12.6	20.9	41	24.4	19.9
Zinc	87		**191**	75.9	**137**	**488**	65.5	81.8	**331**

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DUP - Duplicate Sample

Table 1. Summary of Metals Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in mg/kg)	NYSDEC Recommended Soil Cleanup Objectives* (RSCOs)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	FB 10/19 SO 10/19/1999 -	FB 10/20 SO 10/20/1999 -
Aluminum	7572		<200	<200
Antimony	ND		<5	<5
Arsenic	7.5		<5	<5
Barium	300		<200	<200
Beryllium	0.16		<5	<5
Cadmium	1		<4	<4
Calcium	6841		<5000	<5000
Chromium	10		<10	<10
Cobalt	30		<50	<50
Copper	58		<25	<25
Cyanide	ND		<0.01	<0.01
Iron	16700		<100	<100
Lead	24.75		<3	<3
Magnesium	3614		<5000	<5000
Manganese	229.4		<15	<15
Mercury	0.1		<0.2	<0.2
Nickel	13		<40	<40
Potassium	1704		<5000	<5000
Selenium	2		<5	<5
Silver	ND		<10	<10
Sodium	929		<5000	<5000
Thallium	ND		<5	<5
Vanadium	150		<50	<50
Zinc	87		22.9	29.4

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mg/kg - Milligrams per kilogram
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	LG-SB-100 02-27-01 10-12	LG-SB-101 02-27-01 6-8	LG-SB-102 02-26-01 2-4	LG-SB-103 02-26-01 10-12	LG-SB-104 02-26-01 10-12	LG-SB-106 02-26-01 10-12	LG-SB-107 02-26-01 10-12	LG-SB-108 3/5/2001 4-6
1,1,1-Trichloroethane	800		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,1,2,2-Tetrachloroethane	600		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,1,2-Trichloroethane	6000		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,1-Dichloroethane	200		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,1-Dichloroethene	400		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,2-Dichloroethane	100		5 U	5 U	3 J	5 U	5 U	6 U	6 U	36 U
1,2-Dichloroethene, cis-	300		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,2-Dichloroethene, trans-	300		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,2-Dichloropropane	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,3-Dichloropropene, cis-	300		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
1,3-Dichloropropene, trans-	300		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
2-Butanone	300		5 U	5 U	5 U	5 U	5 U	33	65	35 U
2-Hexanone	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
4-Methyl-2-pentanone	1000		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Acetone	200		6	5 J	8	4 J	6	140	200	59
Benzene	60		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Bromodichloromethane	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Bromoform	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Bromomethane	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Carbon Disulfide	2700		5 U	5 U	5 U	5 U	5 U	5 J	2 J	510
Carbon Tetrachloride	600		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Chlorobenzene	1700		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Chloroform	300		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Chloromethane	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Dibromochloromethane	100		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Methylene Chloride	100		5 U	5 U	5 U	5 U	5 U	6 U	6 U	23 J
Styrene	--		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Toluene	1500		5 U	1 J	2 J	1 J	3 J	2 J	3 J	35 U
Trichloroethene	700		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Vinyl Chloride	200		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U
Xylenes (total)	1200		5 U	5 U	5 U	5 U	5 U	6 U	6 U	35 U

µg/kg - Micrograms per kilogram
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	LG-SB-108 DUP 3/4/2001 4-6	LG-SB-109 3/5/2001 6-8	LG-SB-110 2/28/2001 6-8	LG-SB-111 02-26-01 0-2	LG-SB-111 DUP 02-26-01 0-2	LG-SB-112 3/4/2001 10-12	LG-SB-112 DUP 3/4/2001 10-12
1,1,1-Trichloroethane	800		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,1,2,2-Tetrachloroethane	600		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,1,2-Trichloroethane	6000		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,1-Dichloroethane	200		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,1-Dichloroethene	400		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,2-Dichloroethane	100		23 J	5 U	5 U	6	8	52 U	29 U
1,2-Dichloroethene, cis-	300		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,2-Dichloroethene, trans-	300		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,2-Dichloropropane	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,3-Dichloropropene, cis-	300		46 U	5 U	5 U	6 U	6 U	52 U	29 U
1,3-Dichloropropene, trans-	300		46 U	5 U	5 U	6 U	6 U	52 U	29 U
2-Butanone	300		46 U	5 U	5 U	6 U	6 U	52 U	29 U
2-Hexanone	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
4-Methyl-2-pentanone	1000		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Acetone	200		46 U	12	5 J	6 U	6 U	52 U	29 U
Benzene	60		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Bromodichloromethane	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Bromoform	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Bromomethane	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Carbon Disulfide	2700		590	82	170	6 U	6 U	620	660
Carbon Tetrachloride	600		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Chlorobenzene	1700		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Chloroform	300		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Chloromethane	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Dibromochloromethane	100		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Methylene Chloride	100		21 J	5 U	2 J	6 U	6 U	52 U	27 J
Styrene	--		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		46 U	1 J	2 J	6 U	6 U	52 U	6 J
Toluene	1500		46 U	5 U	5 U	3 J	3 J	52 U	29 U
Trichloroethene	700		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Vinyl Chloride	200		46 U	5 U	5 U	6 U	6 U	52 U	29 U
Xylenes (total)	1200		46 U	5 U	5 U	6 U	6 U	52 U	29 U

µg/kg - Micrograms per kilogram
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Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	LG-SB-113 3/2/2001 10-12	LG-SB-114 3/4/2001 8-10	LG-SB-115 3/4/2001 8-10	LG-SB-116 3/4/2001 2-4	LG-SB-117 3/1/2001 8-10	LG-SB-118 3/4/2001 10-12	LG-SB-119 3/1/2001 8-10	LG-SB-119 DUP 3/1/2001 8-10
1,1,1-Trichloroethane	800		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,1,2,2-Tetrachloroethane	600		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,1,2-Trichloroethane	6000		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,1-Dichloroethane	200		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,1-Dichloroethene	400		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,2-Dichloroethane	100		7 U	9	3 J	5 U	28 U	51 U	21 U	29
1,2-Dichloroethene, cis-	300		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,2-Dichloroethene, trans-	300		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,2-Dichloropropane	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,3-Dichloropropene, cis-	300		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
1,3-Dichloropropene, trans-	300		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
2-Butanone	300		7 U	8 U	8	5 U	28 U	51 U	21 U	29
2-Hexanone	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
4-Methyl-2-pentanone	1000		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Acetone	200		7	11	46	5 J	28 U	38 J	14 J	14J
Benzene	60		7 U	8 U	4 J	5 U	28 U	51 U	21 U	29
Bromodichloromethane	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Bromoform	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Bromomethane	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Carbon Disulfide	2700		81	300	170	180	740	1100	370	300
Carbon Tetrachloride	600		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Chlorobenzene	1700		7 U	8 U	59	5 U	28 U	51 U	21 U	29
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Chloroform	300		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Chloromethane	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Dibromochloromethane	100		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Methylene Chloride	100		6 J	14	10	7	16 J	**110**	11 J	15J
Styrene	--		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		7 U	5 J	3 J	4 J	9 J	17 J	14 J	13J
Toluene	1500		7 U	2 J	6 U	1 J	28 U	51 U	5 J	29
Trichloroethene	700		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Vinyl Chloride	200		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29
Xylenes (total)	1200		7 U	8 U	6 U	5 U	28 U	51 U	21 U	29

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B - Detected in blank
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ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	LG-SB-120 3/4/2001 6-8	LG-SB-121 3/4/2001 6-8	LG-SB-122 3/4/2001 10-12	LG-SB-123 3/5/2001 6-8	LG-SB-124 3/5/2001 8-10	LG-SB-125 3/5/2001 2-4	LG-SB-126 03-01-01 10-12
1,1,1-Trichloroethane	800		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,1,2,2-Tetrachloroethane	600		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,1,2-Trichloroethane	6000		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,1-Dichloroethane	200		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,1-Dichloroethene	400		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,2-Dichloroethane	100		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,2-Dichloroethene, cis-	300		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,2-Dichloroethene, trans-	300		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,2-Dichloropropane	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,3-Dichloropropene, cis-	300		30 U	51 U	12 U	340 U	290 U	270 U	6 U
1,3-Dichloropropene, trans-	300		30 U	51 U	12 U	340 U	290 U	270 U	6 U
2-Butanone	300		30 U	51 U	12 U	340 U	290 U	270 U	6 U
2-Hexanone	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
4-Methyl-2-pentanone	1000		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Acetone	200		24 J	51 U	9 J	340 U	290 U	270 U	12
Benzene	60		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Bromodichloromethane	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Bromoform	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Bromomethane	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Carbon Disulfide	2700		310	1000	130	2400	1400	1800	49
Carbon Tetrachloride	600		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Chlorobenzene	1700		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Chloroform	300		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Chloromethane	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Dibromochloromethane	100		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Methylene Chloride	100		19 J	47 J	7 J	**200 J**	**110 J**	**140 J**	11
Styrene	--		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		8 J	17 J	3 J	78 J	290 U	56 J	6 U
Toluene	1500		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Trichloroethene	700		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Vinyl Chloride	200		30 U	51 U	12 U	340 U	290 U	270 U	6 U
Xylenes (total)	1200		30 U	51 U	12 U	340 U	290 U	270 U	6 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
U - Not detected, detection limit is shown
J - Estimated value
B - Detected in blank
-- - No NYSDEC RSCOs available
ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	LG-SB-127 03-02-01 10-12	LG-SB-128 03-02-01 8-10	LG-SB-129 03-02-01 12-14	LG-SB-130 03-01-01 10-12	LG-SB-130 DUP 03-01-01 10-12	LG-SB-131 03-01-01 10-12	LG-SB-132 03-01-01 10-12
1,1,1-Trichloroethane	800		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,1,2,2-Tetrachloroethane	600		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,1,2-Trichloroethane	6000		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,1-Dichloroethane	200		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,1-Dichloroethene	400		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,2-Dichloroethane	100		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,2-Dichloroethene, cis-	300		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,2-Dichloroethene, trans-	300		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,2-Dichloropropane	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,3-Dichloropropene, cis-	300		6 U	5 U	6 U	7 U	28 U	5 U	5 U
1,3-Dichloropropene, trans-	300		6 U	5 U	6 U	7 U	28 U	5 U	5 U
2-Butanone	300		6 U	5 U	6 U	7 U	28 U	5 U	5 U
2-Hexanone	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
4-Methyl-2-pentanone	1000		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Acetone	200		6 J	5 U	4 J	12 B	34 B	7	5 J
Benzene	60		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Bromodichloromethane	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Bromoform	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Bromomethane	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Carbon Disulfide	2700		2 J	58	89	200	440	8	6
Carbon Tetrachloride	600		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Chlorobenzene	1700		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Chloroform	300		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Chloromethane	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Dibromochloromethane	100		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Methylene Chloride	100		6 U	4 J	4 J	16	36	5 U	5 U
Styrene	--		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		6 U	5 U	2 J	6 J	12 J	5 U	5 U
Toluene	1500		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Trichloroethene	700		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Vinyl Chloride	200		6 U	5 U	6 U	7 U	28 U	5 U	5 U
Xylenes (total)	1200		6 U	5 U	6 U	7 U	28 U	5 U	5 U

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ft bls - Feet below land surface
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Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	LG-SB-133 03-02-01 10-12	LG-SB-134 03-16-01 10-12	LG-SB-135 03-02-01 12-14	LG-SB-135 DUP 03-02-01 12-14	MP-FS-1 03-20-01 0-0.5	MP-FS-2 03-20-01 0-0.5	MP-SB-1 05/15/2000 0.0-2.0
1,1,1-Trichloroethane	800		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,1,2,2-Tetrachloroethane	600		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,1,2-Trichloroethane	6000		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,1-Dichloroethane	200		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,1-Dichloroethene	400		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,2-Dichloroethane	100		6 U	7	6 U	6 U	9 U	7 U	6.4 U
1,2-Dichloroethene, cis-	300		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,2-Dichloroethene, trans-	300		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,2-Dichloropropane	--		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,3-Dichloropropene, cis-	300		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
1,3-Dichloropropene, trans-	300		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
2-Butanone	300		10	3 J	6 U	6 U	6 J	20	6.4 U
2-Hexanone	--		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
4-Methyl-2-pentanone	1000		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Acetone	200		51	10	4 J	5 J	45	58	6.4 U
Benzene	60		6 U	6 U	6 U	6 U	9 U	7 U	2.4
Bromodichloromethane	--		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Bromoform	--		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Bromomethane	--		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Carbon Disulfide	2700		26	16	54	43	9 U	7 U	6.4 U
Carbon Tetrachloride	600		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Chlorobenzene	1700		6 U	3 J	6 U	6 U	9 U	3 J	2.9 J
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6 U	6 U	6 U	6 U	9 U	6 U	6.4 U
Chloroform	300		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Chloromethane	--		6 U	6 U	6 U	6 U	4 J	13	6.4 U
Dibromochloromethane	100		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		6 U	6 U	6 U	6 U	9 U	7 U	1.3 U
Methylene Chloride	100		2 J	5 J	5 J	3 J	9 U	6 U	6.4 U
Styrene	--		6 U	6 U	7	8	9 U	7 U	6.4 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		6 U	6 U	1 J	2 J	9 U	7 U	6.4 U
Toluene	1500		6 U	6 U	6 U	6 U	9 U	7 U	57
Trichloroethene	700		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Vinyl Chloride	200		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U
Xylenes (total)	1200		6 U	6 U	6 U	6 U	9 U	7 U	6.4 U

µg/kg - Micrograms per kilogram
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Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-1	MP-SB-2	MP-SB-2	MP-SB-3	MP-SB-4	MP-SB-4	MP-SB-5	MP-SB-5
		Sample Date:	05/15/2000	05/15/2000	05/15/2000	05/17/2000	05/15/2000	05/15/2000	05/15/2000	05/15/2000
		Sample Depth (ft bls):	4.0-6.0	0.0-2.0	2.0-4.0	2.0-6.0	0.0-2.0	4.0-5.7	0.0-2.0	2.0-4.0
1,1,1-Trichloroethane	800		8.6 U	6800 U	8100 U	7.2 U	6.1 U	23.8	69000 U	140000 U
1,1,2,2-Tetrachloroethane	600		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,1,2-Trichloroethane	6000		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,1-Dichloroethane	200		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,1-Dichloroethene	400		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,2-Dichloroethane	100		13	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,2-Dichloroethene, cis-	300		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,2-Dichloroethene, trans-	300		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,2-Dichloropropane	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,3-Dichloropropene, cis-	300		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
1,3-Dichloropropene, trans-	300		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
2-Butanone	300		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
2-Hexanone	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
4-Methyl-2-pentanone	1000		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Acetone	200		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Benzene	60		1.7 U	1400 U	1600 U	1.7	1.2 U	3.5 U	14000 U	29000 U
Bromodichloromethane	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Bromoform	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Bromomethane	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Carbon Disulfide	2700		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Carbon Tetrachloride	600		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Chlorobenzene	1700		2.9 J	**214000**	**316000**	8.7	5 J	18 U	**2700000**	**8440000**
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Chloroform	300		2.4 J	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Chloromethane	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Dibromochloromethane	100		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		2	1400 U	1600 U	5.6	1.2 U	3.5 U	14000 U	**123000**
Methylene Chloride	100		8.6 U	6800 U	8100 U	7.3	3.2 JB	18 U	69000 U	140000 U
Styrene	--		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Toluene	1500		1.7 U	1400 U	1600 U	1.4 U	1.2 U	3.5 U	14000 U	29000 U
Trichloroethene	700		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Vinyl Chloride	200		8.6 U	6800 U	8100 U	7.2 U	6.1 U	18 U	69000 U	140000 U
Xylenes (total)	1200		3.3 J	6800 U	8100 U	2.1 J	6.1 U	18 U	**56200 J**	**841000**

µg/kg - Micrograms per kilogram
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DUP - Duplicate Sample

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Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-6 05/12/2000 0.0-2.0	MP-SB-6 05/12/2000 3.5-5.5	MP-SB-7 05/15/2000 0.0-2.0	MP-SB-7 DUP 05/15/2000 0.0-2.0	MP-SB-7 05/15/2000 2.0-6.0	MP-SB-7 DUP 05/15/2000 2.0-6.0	MP-SB-8 05/15/2000 0.0-2.0	MP-SB-8 DUP 05/15/2000 0.0-2.0
1,1,1-Trichloroethane	800		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,1,2,2-Tetrachloroethane	600		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,1,2-Trichloroethane	6000		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,1-Dichloroethane	200		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,1-Dichloroethene	400		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,2-Dichloroethane	100		5.6 U	8.8	93.1	39.2	7.4 U	8 U	5.3 U	8
1,2-Dichloroethene, cis-	300		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,2-Dichloroethene, trans-	300		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,2-Dichloropropane	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,3-Dichloropropene, cis-	300		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
1,3-Dichloropropene, trans-	300		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
2-Butanone	300		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
2-Hexanone	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
4-Methyl-2-pentanone	1000		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Acetone	200		5.6 U	43.2	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Benzene	60		2.6	8.1	1.2 U	1.1 U	1.5 U	1.6 U	1.1 U	1 U
Bromodichloromethane	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Bromoform	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Bromomethane	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Carbon Disulfide	2700		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Carbon Tetrachloride	600		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Chlorobenzene	1700		1.1 J	1.7 J	74.5	48.8	7.4 U	2.9 J	9.5	28
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Chloroform	300		5.6 U	1.1 J	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Chloromethane	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Dibromochloromethane	100		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1.1 U	1.1 U	1.2 U	1.1 U	1.5 U	2.9	1.1 U	1 U
Methylene Chloride	100		5.3 J	6	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Styrene	--		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Toluene	1500		1.1 U	1.1 U	1.2 U	1.1 U	1.5 U	1.6 U	1.1 U	1 U
Trichloroethene	700		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Vinyl Chloride	200		5.6 U	5.6 U	6.1 U	5.4 U	7.4 U	8 U	5.3 U	5 U
Xylenes (total)	1200		5.6 U	1.4 J	6.1 U	5.4 U	7.4 U	3.1 J	5.3 U	5 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
U - Not detected, detection limit is shown
J - Estimated value
B - Detected in blank
-- - No NYSDEC RSCOs available
ft bls - Feet below land surface
Bold - Data highlighted in bold represents detections that exceed the NYSDEC RSCOs.
DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-8 05/15/2000 5.0-7.5	MP-SB-8 DUP 05/15/2000 5.0-7.5	MP-SB-9 05/15/2000 0.0-2.0	MP-SB-9 05/15/2000 5.0-7.0	MP-SB-10 05/16/2000 0.0-2.0	MP-SB-10 05/16/2000 5.0-7.0	MP-SB-11 05/16/2000 4.0-6.0	MP-SB-12 05/16/2000 0.0-2.0
1,1,1-Trichloroethane	800		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,1,2,2-Tetrachloroethane	600		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,1,2-Trichloroethane	6000		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,1-Dichloroethane	200		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,1-Dichloroethene	400		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,2-Dichloroethane	100		5.1 U	5.1 U	14.8	380 U	4.8 U	4.8 J	2.6 J	6.7
1,2-Dichloroethene, cis-	300		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,2-Dichloroethene, trans-	300		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,2-Dichloropropane	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,3-Dichloropropene, cis-	300		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
1,3-Dichloropropene, trans-	300		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
2-Butanone	300		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
2-Hexanone	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
4-Methyl-2-pentanone	1000		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Acetone	200		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Benzene	60		1 U	1 U	24.8	**865**	0.97 U	1.1 U	1 U	1 U
Bromodichloromethane	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Bromoform	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Bromomethane	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Carbon Disulfide	2700		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Carbon Tetrachloride	600		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Chlorobenzene	1700		5.1 U	5.1 U	422	**17900**	6	7.9	7.3	2.1 J
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Chloroform	300		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Chloromethane	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Dibromochloromethane	100		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1 U	1 U	75.9	1020	0.97 U	1.1 U	1 U	1 U
Methylene Chloride	100		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	3.6 J	5.2 U
Styrene	--		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Toluene	1500		1 U	1 U	1.1 U	75 U	0.97 U	1.1 U	1 U	1 U
Trichloroethene	700		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Vinyl Chloride	200		5.1 U	5.1 U	5.5 U	380 U	4.8 U	5.4 U	5.2 U	5.2 U
Xylenes (total)	1200		5.1 U	5.1 U	76.2	**2720**	4.8 U	5.4 U	5.2 U	5.2 U

µg/kg - Micrograms per kilogram
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-12	MP-SB-13	MP-SB-13	MP-SB-14	MP-SB-14	MP-SB-15	MP-SB-15	MP-SB-16
		Sample Date:	05/16/2000	05/16/2000	05/16/2000	05/18/2000	05/18/2000	05/18/2000	05/18/2000	05/16/2000
		Sample Depth (ft bls):	4.2-6.2	0.0-2.0	5.0-7.0	0.0-2.0	5.0-7.5	0.0-2.0	8.0-9.5	0.0-2.0
1,1,1-Trichloroethane	800		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,1,2,2-Tetrachloroethane	600		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,1,2-Trichloroethane	6000		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,1-Dichloroethane	200		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,1-Dichloroethene	400		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,2-Dichloroethane	100		2.8 J	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	9.9
1,2-Dichloroethene, cis-	300		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,2-Dichloroethene, trans-	300		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,2-Dichloropropane	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,3-Dichloropropene, cis-	300		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
1,3-Dichloropropene, trans-	300		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
2-Butanone	300		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
2-Hexanone	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
4-Methyl-2-pentanone	1000		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Acetone	200		5 U	5.5 U	5.7 U	5.4 U	34.2	5.1 U	4.8 U	4.9 U
Benzene	60		1 U	1.1 U	1.1 U	1.1 U	1.1 U	1 U	0.97 U	0.98 U
Bromodichloromethane	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Bromoform	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Bromomethane	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Carbon Disulfide	2700		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Carbon Tetrachloride	600		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Chlorobenzene	1700		5 U	1.2 J	5.7 U	6	2.8 J	5.1 U	4.8 U	4.9 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Chloroform	300		5 U	2.7 J	3.8 J	3 J	19.8	2.9 J	5.3	2.3 J
Chloromethane	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Dibromochloromethane	100		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1 U	1.1 U	1.1 U	1.1 U	1.1 U	1 U	0.97 U	0.98 U
Methylene Chloride	100		5 U	3.8 J	4 J	7.4	2.3 J	5.7	3 J	3.3 J
Styrene	--		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Toluene	1500		1 U	1.1 U	1.1 U	1.1 U	1.1 U	1 U	0.97 U	0.98 U
Trichloroethene	700		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Vinyl Chloride	200		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U
Xylenes (total)	1200		5 U	5.5 U	5.7 U	5.4 U	5.4 U	5.1 U	4.8 U	4.9 U

µg/kg - Micrograms per kilogram
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Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-16 05/16/2000 6.0-8.0	MP-SB-17 05/18/2000 0.0-2.0	MP-SB-17 05/18/2000 4.0-6.5	MP-SB-18 05/19/2000 0.0-2.0	MP-SB-18 05/19/2000 4.0-5.5	MP-SB-21 05/09/2000 0.0-2.0	MP-SB-21 05/09/2000 2.8-4.8	MP-SB-24 05/10/2000 0.0-2.0
1,1,1-Trichloroethane	800		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,1,2,2-Tetrachloroethane	600		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,1,2-Trichloroethane	6000		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,1-Dichloroethane	200		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,1-Dichloroethene	400		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,2-Dichloroethane	100		16	5.2 U	5.4 U	5.3 U	5.2 U	51.5	44.5	25.6
1,2-Dichloroethene, cis-	300		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,2-Dichloroethene, trans-	300		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,2-Dichloropropane	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,3-Dichloropropene, cis-	300		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
1,3-Dichloropropene, trans-	300		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
2-Butanone	300		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
2-Hexanone	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
4-Methyl-2-pentanone	1000		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Acetone	200		108	29.9	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Benzene	60		2.1	2.4	1.1 U	1.1 U	1 U	1.2 U	1.2 U	**108**
Bromodichloromethane	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Bromoform	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Bromomethane	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Carbon Disulfide	2700		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Carbon Tetrachloride	600		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Chlorobenzene	1700		6	8	4 J	5.3 U	5.2 U	6.1 U	5.8 U	140
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Chloroform	300		19.7	4.6 J	13.1	5.3 U	1.4 J	6.1 U	5.8 U	5.2 U
Chloromethane	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Dibromochloromethane	100		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		12.5	1 U	1.1 U	1.1 U	1 U	1.2 U	1.2 U	21.5
Methylene Chloride	100		4.6 J	7.6	7.5	10.9	7.8	4.5 B	7.6 B	12.7 B
Styrene	--		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		11.2	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Toluene	1500		1.4	1 U	1.1 U	1.1 U	1 U	1.2 U	1.2 U	1 U
Trichloroethene	700		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Vinyl Chloride	200		5.5 U	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	5.2 U
Xylenes (total)	1200		59.8	5.2 U	5.4 U	5.3 U	5.2 U	6.1 U	5.8 U	2.7 J

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
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ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-24 05/10/2000 3.0-5.0	MP-SB-25 05/09/2000 0.0-2.0	MP-SB-25 05/09/2000 3.0-5.0	MP-SB-26 05/09/2000 0.0-2.0	MP-SB-26 05/09/2000 3.0-5.0	MP-SB-27 05/09/2000 0.0-2.0	MP-SB-27 05/09/2000 2.5-4.5	MP-SB-28 05/17/2000 0.0-2.0
1,1,1-Trichloroethane	800		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,1,2,2-Tetrachloroethane	600		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,1,2-Trichloroethane	6000		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,1-Dichloroethane	200		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,1-Dichloroethene	400		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,2-Dichloroethane	100		22.2	7.4	8.6	5.1	5 U	**246**	**4820**	9.5
1,2-Dichloroethene, cis-	300		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,2-Dichloroethene, trans-	300		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,2-Dichloropropane	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,3-Dichloropropene, cis-	300		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
1,3-Dichloropropene, trans-	300		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
2-Butanone	300		35.6	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
2-Hexanone	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
4-Methyl-2-pentanone	1000		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Acetone	200		119	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Benzene	60		**253**	1.1 U	1 U	1 U	1 U	2.2	**69.6**	1.1 U
Bromodichloromethane	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Bromoform	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Bromomethane	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Carbon Disulfide	2700		2.9 J	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Carbon Tetrachloride	600		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Chlorobenzene	1700		945	5.5 U	5.2 U	5 U	1.4 J	1.6 J	**19600**	5.3 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Chloroform	300		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Chloromethane	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Dibromochloromethane	100		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		157	1.1 U	1 U	1 U	1 U	1.2 U	202	1.1 U
Methylene Chloride	100		9.5	18.9 B	27 B	11.3 B	15.1 B	8.7 B	14.3 J	6.7
Styrene	--		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Toluene	1500		2.5	1.1 U	1 U	1 U	1 U	1.2 U	372	1.1 U
Trichloroethene	700		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Vinyl Chloride	200		6 U	5.5 U	5.2 U	5 U	5 U	5.8 U	46 U	5.3 U
Xylenes (total)	1200		122	5.5 U	5.2 U	5 U	5 U	5.8 U	884	5.3 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
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J - Estimated value
B - Detected in blank
-- - No NYSDEC RSCOs available
ft bls - Feet below land surface
Bold - Data highlighted in bold represents detections that exceed the NYSDEC RSCOs.
DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-28	MP-SB-29	MP-SB-30	MP-SB-30	MP-SB-31	MP-SB-32	MP-SB-32	MP-SB-33
		Sample Date:	05/17/2000	05/09/2000	05/10/2000	05/10/2000	05/19/2000	05/10/2000	05/10/2000	05/10/2000
		Sample Depth (ft bls):	2.0-4.0	1.0-3.0	0.0-2.0	3.0-5.0	0.0-4.0	0.0-2.0	3.0-5.0	0.0-2.0
1,1,1-Trichloroethane	800		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,1,2,2-Tetrachloroethane	600		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,1,2-Trichloroethane	6000		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,1-Dichloroethane	200		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,1-Dichloroethene	400		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,2-Dichloroethane	100		7.2	3.2 J	5	7.6	5.2 U	5.2 U	59.1	5 U
1,2-Dichloroethene, cis-	300		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,2-Dichloroethene, trans-	300		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,2-Dichloropropane	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,3-Dichloropropene, cis-	300		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
1,3-Dichloropropene, trans-	300		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
2-Butanone	300		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
2-Hexanone	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
4-Methyl-2-pentanone	1000		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Acetone	200		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Benzene	60		1 U	7.9	1 U	1.1 U	1 U	1 U	1.4	1 U
Bromodichloromethane	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Bromoform	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Bromomethane	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Carbon Disulfide	2700		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Carbon Tetrachloride	600		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Chlorobenzene	1700		5.2 U	5.6 U	1.2 J	5.6 U	5.2 U	5.2 U	2.3 J	5 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Chloroform	300		5.2 U	1.6 J	5 U	1.1 J	5.2 U	5.2 U	2.6 J	5 U
Chloromethane	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Dibromochloromethane	100		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1 U	1.1 U	1 U	1.1 U	1 U	1 U	1.2 U	1 U
Methylene Chloride	100		5.5	6.7 B	3.7 JB	9.7 B	7.4	5.8 B	4.3 J	12.8 B
Styrene	--		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	2.1 J	5 U
Toluene	1500		1 U	1.1 U	1 U	1.1 U	1 U	1 U	1.2 U	1 U
Trichloroethene	700		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Vinyl Chloride	200		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U
Xylenes (total)	1200		5.2 U	5.6 U	5 U	5.6 U	5.2 U	5.2 U	5.8 U	5 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
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J - Estimated value
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ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-33	MP-SB-34	MP-SB-34	MP-SB-35	MP-SB-35	MP-SB-36	MP-SB-36	MP-SB-37
		Sample Date:	05/10/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000
		Sample Depth (ft bls):	2.5-4.5	0.0-2.0	3.0-5.0	0.0-2.0	3.8-5.0	0.0-2.0	3.0-5.0	0.0-2.0
1,1,1-Trichloroethane	800		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,1,2,2-Tetrachloroethane	600		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,1,2-Trichloroethane	6000		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,1-Dichloroethane	200		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,1-Dichloroethene	400		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,2-Dichloroethane	100		100	5.1 U	8.5	5 U	5.6 U	5 U	5.5 U	4.8 U
1,2-Dichloroethene, cis-	300		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,2-Dichloroethene, trans-	300		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,2-Dichloropropane	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,3-Dichloropropene, cis-	300		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
1,3-Dichloropropene, trans-	300		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
2-Butanone	300		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
2-Hexanone	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
4-Methyl-2-pentanone	1000		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Acetone	200		6.2 U	5.1 U	34.9	5 U	5.6 U	5 U	36	4.8 U
Benzene	60		1.2 U	1 U	6.3	1 U	1.1 U	1 U	1.1 U	0.97 U
Bromodichloromethane	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Bromoform	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Bromomethane	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Carbon Disulfide	2700		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Carbon Tetrachloride	600		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Chlorobenzene	1700		8.5	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Chloroform	300		1.5 J	0.72 J	5.7 U	5 U	0.99 J	2.1 J	1.2 J	4.8 U
Chloromethane	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Dibromochloromethane	100		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1.2 U	3.2	1.2	1 U	1.1 U	1 U	1.1 U	0.97 U
Methylene Chloride	100		3.6 JB	9 B	11.2 B	13.8 B	13.9 B	13.8 B	12.9	10.3
Styrene	--		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Toluene	1500		1.2 U	1 U	1.1 U	1 U	1.1 U	1 U	1.1 U	0.97 U
Trichloroethene	700		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Vinyl Chloride	200		6.2 U	5.1 U	5.7 U	5 U	5.6 U	5 U	5.5 U	4.8 U
Xylenes (total)	1200		6.2 U	32	3.3 J	5 U	5.6 U	5 U	5.5 U	4.8 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-37	MP-SB-38	MP-SB-38	MP-SB-39	MP-SB-39	MP-SB-40	MP-SB-40	MP-SB-41
		Sample Date:	05/11/2000	05/17/2000	05/17/2000	05/17/2000	05/17/2000	05/17/2000	05/17/2000	05/17/2000
		Sample Depth (ft bls):	4.5-6.5	0.0-2.0	4.0-7.0	0.0-2.0	5.0-8.0	0.0-2.0	5.0-7.0	0.0-2.0
1,1,1-Trichloroethane	800		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,1,2,2-Tetrachloroethane	600		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,1,2-Trichloroethane	6000		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,1-Dichloroethane	200		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,1-Dichloroethene	400		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,2-Dichloroethane	100		5.6 U	13.7	12.2	14	5.8 U	78	**204**	11.9
1,2-Dichloroethene, cis-	300		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,2-Dichloroethene, trans-	300		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,2-Dichloropropane	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,3-Dichloropropene, cis-	300		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
1,3-Dichloropropene, trans-	300		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
2-Butanone	300		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
2-Hexanone	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
4-Methyl-2-pentanone	1000		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Acetone	200		29.2	5.2 U	100	5.2 U	156	5.3 U	6.2 U	5 U
Benzene	60		3.8	1 U	5.2	1 U	1.2 U	1.1 U	1.2 U	1 U
Bromodichloromethane	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Bromoform	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Bromomethane	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Carbon Disulfide	2700		5.6 U	5.2 U	5.9	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Carbon Tetrachloride	600		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Chlorobenzene	1700		5.6 U	1.7 J	2.6 J	5.2 U	5.8 U	4.6 J	6.9	5 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Chloroform	300		3.9 J	5.2 U	5.2 U	1.1 J	1.3 J	5.3 U	1.6 J	5 U
Chloromethane	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Dibromochloromethane	100		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1.1 U	7.3	1.8	1 U	1.2 U	1.1 U	1.2 U	1 U
Methylene Chloride	100		12.6	8.3	4.3 J	5.2 U	3.2 J	4 J	8.1	6.8
Styrene	--		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	2.7 J	5 U
Toluene	1500		1.1 U	1 U	1 U	1 U	1.2 U	1.1 U	1.2 U	1 U
Trichloroethene	700		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Vinyl Chloride	200		5.6 U	5.2 U	5.2 U	5.2 U	5.8 U	5.3 U	6.2 U	5 U
Xylenes (total)	1200		5.6 U	34.3	7.8	5.2 U	5.8 U	5.3 U	6.2 U	5 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
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ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-41 05/17/2000 4.0-8.0	MP-SB-42 05/18/2000 0.0-2.0	MP-SB-42 05/18/2000 5.0-7.0	MP-SB-43 05/19/2000 0.0-2.0	MP-SB-43 05/19/2000 4.0-6.0	MP-SB-44 05/10/2000 0.0-2.0	MP-SB-44 05/10/2000 4.0-6.0	MP-SB-45 05/11/2000 0.0-2.0
1,1,1-Trichloroethane	800		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,1,2,2-Tetrachloroethane	600		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,1,2-Trichloroethane	6000		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,1-Dichloroethane	200		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,1-Dichloroethene	400		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,2-Dichloroethane	100		**456**	8.2	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,2-Dichloroethene, cis-	300		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,2-Dichloroethene, trans-	300		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,2-Dichloropropane	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,3-Dichloropropene, cis-	300		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
1,3-Dichloropropene, trans-	300		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
2-Butanone	300		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
2-Hexanone	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
4-Methyl-2-pentanone	1000		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Acetone	200		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Benzene	60		1.3 U	0.95 U	1.1 U	1.2 U	1.2 U	1.1 U	1 U	1 U
Bromodichloromethane	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Bromoform	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Bromomethane	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Carbon Disulfide	2700		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Carbon Tetrachloride	600		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Chlorobenzene	1700		10.7	4.8 U	2 J	5.9 U	5.8 U	2.9 J	1.1 J	5.2 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Chloroform	300		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Chloromethane	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Dibromochloromethane	100		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1.3 U	0.95 U	1.1 U	1.2 U	1.2 U	1.1 U	1 U	1 U
Methylene Chloride	100		3 J	1.7 J	6.3	5.9 U	1.9 J	7.9 B	4.7 B	3.6 J
Styrene	--		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		2.5 J	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Toluene	1500		1.3 U	0.95 U	1.1 U	1.2 U	1.2 U	1.1 U	1 U	1 U
Trichloroethene	700		5.4 J	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Vinyl Chloride	200		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U
Xylenes (total)	1200		6.4 U	4.8 U	5.4 U	5.9 U	5.8 U	5.7 U	5.2 U	5.2 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
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-- - No NYSDEC RSCOs available
ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-45 05/11/2000 3.0-5.0	MP-SB-46 05/11/2000 0.0-2.0	MP-SB-46 05/11/2000 3.0-5.0	MP-SB-47 05/12/2000 0.0-2.0	MP-SB-47 05/12/2000 2.0-3.5	MP-SB-51 05/11/2000 0.0-2.0	MP-SB-51 05/11/2000 4.0-6.0	MP-SB-52 05/11/2000 0.0-2.0
1,1,1-Trichloroethane	800		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,1,2,2-Tetrachloroethane	600		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,1,2-Trichloroethane	6000		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,1-Dichloroethane	200		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,1-Dichloroethene	400		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,2-Dichloroethane	100		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,2-Dichloroethene, cis-	300		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,2-Dichloroethene, trans-	300		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,2-Dichloropropane	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,3-Dichloropropene, cis-	300		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
1,3-Dichloropropene, trans-	300		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
2-Butanone	300		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
2-Hexanone	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
4-Methyl-2-pentanone	1000		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Acetone	200		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Benzene	60		1 U	0.97 U	1.1 U	1 U	1.2 U	1.2 U	1 U	1.2 U
Bromodichloromethane	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Bromoform	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Bromomethane	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Carbon Disulfide	2700		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Carbon Tetrachloride	600		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Chlorobenzene	1700		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Chloroform	300		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Chloromethane	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Dibromochloromethane	100		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1 U	0.97 U	1.1 U	1 U	1.2 U	1.2 U	1 U	1.2 U
Methylene Chloride	100		5.8	10.1	6.9	8.8	35.7	7.1	7.8	3.7 J
Styrene	--		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Toluene	1500		1 U	0.97 U	1.1 U	1 U	1.2 U	1.2 U	1 U	1.2 U
Trichloroethene	700		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Vinyl Chloride	200		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U
Xylenes (total)	1200		5 U	4.8 U	5.6 U	5.2 U	5.8 U	5.8 U	5.1 U	6 U

µg/kg - Micrograms per kilogram
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Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-52 05/11/2000 3.5-5.5	MP-SB-53 05/23/2000 0.0-2.0	MP-SB-53 DUP 05/23/2000 0.0-2.0	MP-SB-54 05/23/2000 1.0-4.0	MP-SB-55 05/23/2000 0.0-0.5	MP-SB-55 DUP 05/23/2000 0.0-0.5	MP-SB-57 05/23/2000 0.0-0.5	MP-SB-58 05/23/2000 0.0-0.5
1,1,1-Trichloroethane	800		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,1,2,2-Tetrachloroethane	600		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,1,2-Trichloroethane	6000		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,1-Dichloroethane	200		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,1-Dichloroethene	400		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,2-Dichloroethane	100		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,2-Dichloroethene, cis-	300		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,2-Dichloroethene, trans-	300		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,2-Dichloropropane	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,3-Dichloropropene, cis-	300		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
1,3-Dichloropropene, trans-	300		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
2-Butanone	300		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	47.5	11000 U
2-Hexanone	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
4-Methyl-2-pentanone	1000		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Acetone	200		5.1 U	5.2 U	5.6 U	60.4	11000 U	9900 U	**210**	11000 U
Benzene	60		1 U	1 U	1.1 U	25.1	2200 U	2000 U	6.8	2100 U
Bromodichloromethane	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Bromoform	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Bromomethane	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Carbon Disulfide	2700		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Carbon Tetrachloride	600		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Chlorobenzene	1700		5.1 U	5.2 U	5.6 U	11.7	**9840 J**	**7530 J**	320	**40100**
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Chloroform	300		5.1 U	5.2 U	5.6 U	1.2 J	11000 U	9900 U	6.7 U	11000 U
Chloromethane	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Dibromochloromethane	100		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1 U	1 U	1.1 U	1.2 U	2200 U	2000 U	4.1	2100 U
Methylene Chloride	100		2.5 J	5.9	4.9 J	6 U	11000 U	9900 U	6.9	11000 U
Styrene	--		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Toluene	1500		1 U	1 U	1.1 U	1.7	**7020**	**4530**	37.4	**11300**
Trichloroethene	700		5.1 U	5.2 U	5.6 U	6 U	11000 U	9900 U	6.7 U	11000 U
Vinyl Chloride	200		5.1 U	5.2 U	5.6 U	4.1 J	11000 U	9900 U	6.7 U	11000 U
Xylenes (total)	1200		5.1 U	5.2 U	5.6 U	6 U	**2420 J**	9900 U	19.9	11000 U

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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-59	MP-SB-59	MP-SB-60	MP-SB-60	MP-SB-60	MP-SB-61	MP-SB-61	MP-SB-61
		Sample Date:	05/16/2000	05/16/2000	02-27-01	02-27-01	02-27-01	02-27-01	02-27-01	02-27-01
		Sample Depth (ft bls):	0.0-2.0	2.0-3.5	0-2	2-4	4-6	0-2	2-4	4-6
1,1,1-Trichloroethane	800		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,1,2,2-Tetrachloroethane	600		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,1,2-Trichloroethane	6000		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,1-Dichloroethane	200		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,1-Dichloroethene	400		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,2-Dichloroethane	100		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,2-Dichloroethene, cis-	300		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,2-Dichloroethene, trans-	300		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,2-Dichloropropane	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,3-Dichloropropene, cis-	300		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
1,3-Dichloropropene, trans-	300		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
2-Butanone	300		5.3 U	5.8 U	5 U	12 U	16	5 U	5 U	60 U
2-Hexanone	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
4-Methyl-2-pentanone	1000		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Acetone	200		5.3 U	5.8 U	7	19 B	60 B	10 B	10	64 B
Benzene	60		1.1 U	1.2 U	5 U	28	1 J	5 U	5 U	60 U
Bromodichloromethane	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Bromoform	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Bromomethane	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Carbon Disulfide	2700		5.3 U	5.8 U	33	360	80	120	160	1100
Carbon Tetrachloride	600		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Chlorobenzene	1700		5.3 U	5.8 U	5 U	14	14	5 U	4 J	12 J
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Chloroform	300		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Chloromethane	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Dibromochloromethane	100		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1.1 U	1.2 U	5 U	12 U	7 U	1 J	5 U	60 U
Methylene Chloride	100		5.3 U	5.8 U	4 J	27	11	10	14	96
Styrene	--		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5.3 U	5.8 U	5 U	9 J	7 U	3 J	3 J	63
Toluene	1500		1.1 U	1.2 U	5 U	4 J	7 U	1 J	5 U	19 J
Trichloroethene	700		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Vinyl Chloride	200		5.3 U	5.8 U	5 U	12 U	7 U	5 U	5 U	60 U
Xylenes (total)	1200		5.3 U	5.8 U	5 U	12 U	7 U	4 J	5 U	20 J

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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-62 02-27-01 0-2	MP-SB-62 02-27-01 2-4	MP-SB-62 02-27-01 4-6	MP-SB-63 02-27-01 0-2	MP-SB-63 02-27-01 2-4	MP-SB-64 02-27-01 0-2	MP-SB-65 03-12-01 0-2
1,1,1-Trichloroethane	800		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,1,2,2-Tetrachloroethane	600		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,1,2-Trichloroethane	6000		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,1-Dichloroethane	200		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,1-Dichloroethene	400		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,2-Dichloroethane	100		4 J	30 U	10 U	21 U	20 U	5 U	5 U
1,2-Dichloroethene, cis-	300		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,2-Dichloroethene, trans-	300		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,2-Dichloropropane	--		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,3-Dichloropropene, cis-	300		11 U	30 U	10 U	21 U	20 U	5 U	5 U
1,3-Dichloropropene, trans-	300		11 U	30 U	10 U	21 U	20 U	5 U	5 U
2-Butanone	300		11 U	20 J	190	21 U	20 U	3 J	5 U
2-Hexanone	--		11 U	30 U	10 U	21 U	20 U	5 U	5 U
4-Methyl-2-pentanone	1000		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Acetone	200		13	160	**510 E**	21 U	17 JB	11 B	4 J
Benzene	60		7 J	**210**	**13000 D**	6 J	7 J	1 J	5 U
Bromodichloromethane	--		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Bromoform	--		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Bromomethane	--		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Carbon Disulfide	2700		260	880	240 DJ	610	620	84	130
Carbon Tetrachloride	600		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Chlorobenzene	1700		6 J	11 J	370	21 U	20 U	5 U	5 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Chloroform	300		11 U	30 U	10 U	21 U	17 J	5 U	5 U
Chloromethane	--		11 U	30 U	26	210	130	5 U	5 U
Dibromochloromethane	100		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		3 J	30 U	8 J	6 J	5 J	5 U	5 J
Methylene Chloride	100		17	51	180	41	51	8	23
Styrene	--		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5 J	11 J	25	12 J	12 J	2 J	5 U
Toluene	1500		11 U	30 U	18	14 J	7 J	5 U	4 J
Trichloroethene	700		11 U	30 U	3 J	21 U	20 U	5 U	5 U
Vinyl Chloride	200		11 U	30 U	10 U	21 U	20 U	5 U	5 U
Xylenes (total)	1200		18	30 U	120	54	38	5 U	24

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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-65 3-12-01 6-8	MP-SB-66 03-12-01 0-2	MP-SB-66 03-12-01 4-6	MP-SB-67 03-12-01 0-2	MP-SB-67 03-12-01 2-4	MP-SB-68 03-12-01 0-2	MP-SB-68 03-12-01 2-4
1,1,1-Trichloroethane	800		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,1,2,2-Tetrachloroethane	600		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,1,2-Trichloroethane	6000		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,1-Dichloroethane	200		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,1-Dichloroethene	400		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,2-Dichloroethane	100		**110**	1 J	6 U	6 U	6 U	5 U	6 U
1,2-Dichloroethene, cis-	300		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,2-Dichloroethene, trans-	300		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,2-Dichloropropane	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,3-Dichloropropene, cis-	300		6 U	6 U	6 U	6 U	6 U	5 U	6 U
1,3-Dichloropropene, trans-	300		6 U	6 U	6 U	6 U	6 U	5 U	6 U
2-Butanone	300		5 J	6 U	6 U	6 U	6 U	5 U	6 U
2-Hexanone	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
4-Methyl-2-pentanone	1000		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Acetone	200		21	5 J	8	14	6	4 J	6 U
Benzene	60		6 U	6 U	6 U	9	6 U	5 U	6 U
Bromodichloromethane	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Bromoform	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Bromomethane	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Carbon Disulfide	2700		7	6 U	6 U	6 U	6 U	5 U	6 U
Carbon Tetrachloride	600		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Chlorobenzene	1700		20	6 U	6 U	170	12	4 J	6 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Chloroform	300		3 J	6 U	6 U	6 U	6 U	5 U	5 J
Chloromethane	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Dibromochloromethane	100		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		1 J	6 U	6 U	15	6 U	5 U	6 U
Methylene Chloride	100		6 U	4 J	6 U	4 J	2 J	5 U	6 U
Styrene	--		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		4 J	6 U	2 J	4 J	6 U	1 J	2 J
Toluene	1500		1 J	6 U	6 U	18	6 U	5 U	6 U
Trichloroethene	700		3 J	6 U	2 J	6 U	6 U	1 J	1 J
Vinyl Chloride	200		6 U	6 U	6 U	6 U	6 U	5 U	6 U
Xylenes (total)	1200		6	6 U	6 U	97	6 U	5 U	6 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
U - Not detected, detection limit is shown
J - Estimated value
B - Detected in blank
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ft bls - Feet below land surface
Bold - Data highlighted in bold represents detections that exceed the NYSDEC RSCOs.
DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-69 03-12-01 0-2	MP-SB-69 DUP 3-12-01 0-2	MP-SB-69 03-12-01 4-6	MP-SB-70 03-12-01 0-2	MP-SB-70 03-12-01 4-6	MP-SB-71 03-12-01 0-2	MP-SB-71 03-12-01 4-6
1,1,1-Trichloroethane	800		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	600		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6000		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	200		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethene	400		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	100		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene, cis-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene, trans-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,3-Dichloropropene, cis-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,3-Dichloropropene, trans-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
2-Butanone	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
2-Hexanone	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
4-Methyl-2-pentanone	1000		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Acetone	200		4 J	6	6	7	4 J	19	7
Benzene	60		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Bromodichloromethane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Bromoform	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Bromomethane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Carbon Disulfide	2700		5 U	2 J	6 U	6 U	6 U	6 U	6 U
Carbon Tetrachloride	600		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Chlorobenzene	1700		2 J	5 U	6 U	6 U	6 U	6 U	4 J
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Chloroform	300		5 U	5 U	6 U	6 U	6 U	3 J	6 U
Chloromethane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Dibromochloromethane	100		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Methylene Chloride	100		5 U	2 J	2 J	3 J	6 U	6 U	2 J
Styrene	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5 U	2 J	1 J	6 U	6 U	4 J	6 U
Toluene	1500		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Trichloroethene	700		5 U	5 U	2 J	6 U	6 U	6 U	6 U
Vinyl Chloride	200		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Xylenes (total)	1200		5 U	5 U	6 U	3 J	6 U	6 U	6 U

µg/kg - Micrograms per kilogram
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-72 03-14-01 0-2	MP-SB-72 03-14-01 8-10	MP-SB-73 03-14-01 0-2	MP-SB-73 03-14-01 6-8	MP-SB-73 03-14-01 8-10	MP-SB-74 03-14-01 0-2	MP-SB-74 03-14-01 8-10
1,1,1-Trichloroethane	800		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	600		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6000		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	200		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethene	400		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	100		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene, cis-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene, trans-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,3-Dichloropropene, cis-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
1,3-Dichloropropene, trans-	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
2-Butanone	300		5 U	2 J	6 U	6 U	6 U	5 J	10
2-Hexanone	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
4-Methyl-2-pentanone	1000		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Acetone	200		4 J	6	6 U	8	88	19	48
Benzene	60		6	4 J	6 U	6 U	6 U	6 U	6 U
Bromodichloromethane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Bromoform	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Bromomethane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Carbon Disulfide	2700		28	16	98	18	75	24	32
Carbon Tetrachloride	600		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Chlorobenzene	1700		36	3 J	2 J	6 U	26	17	24
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Chloroform	300		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Chloromethane	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Dibromochloromethane	100		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		2 J	5 U	6 U	6 U	6 U	6 U	6 U
Methylene Chloride	100		11	4 J	28	6	13	8	7
Styrene	--		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		5 U	5 U	2 J	6 U	6 U	6 U	6 U
Toluene	1500		9	3 J	6 U	6 U	6 U	6 U	6 U
Trichloroethene	700		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Vinyl Chloride	200		5 U	5 U	6 U	6 U	6 U	6 U	6 U
Xylenes (total)	1200		38	5 U	1 J	6 U	6 U	6 U	6 U

µg/kg - Micrograms per kilogram
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Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-75	MP-SB-75	MP-SB-76	MP-SB-76	MP-SB-77	MP-SB-77	MP-SB-77
		Sample Date:	03-14-01	03-14-01	03-14-01	03-14-01	03-20-01	03-20-01	03-20-01
		Sample Depth (ft bls):	0-2	4-6	0-2	4-6	0-1	1-4	4-6
1,1,1-Trichloroethane	800		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,1,2,2-Tetrachloroethane	600		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,1,2-Trichloroethane	6000		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,1-Dichloroethane	200		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,1-Dichloroethene	400		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,2-Dichloroethane	100		5 U	27000 U	5 U	16 U	9 U	6 U	**140**
1,2-Dichloroethene, cis-	300		5 U	27000 U	5 U	5 J	9 U	6 U	7 U
1,2-Dichloroethene, trans-	300		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,2-Dichloropropane	--		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,3-Dichloropropene, cis-	300		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
1,3-Dichloropropene, trans-	300		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
2-Butanone	300		5 U	27000 U	5 U	190	9 U	6 U	7 U
2-Hexanone	--		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
4-Methyl-2-pentanone	1000		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Acetone	200		6	**16000 J**	3 J	**480**	20	13	52
Benzene	60		8	27000 U	5 U	**560**	8 J	6 U	7 U
Bromodichloromethane	--		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Bromoform	--		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Bromomethane	--		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Carbon Disulfide	2700		100	27000 U	5 U	60	9 U	16	7
Carbon Tetrachloride	600		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Chlorobenzene	1700		6	27000 U	5 U	**4000 E**	19	8	7 U
Chlorodibromomethane	--		NA	NA	NA	**NA**	NA	NA	NA
Chloroethane	1900		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Chloroform	300		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Chloromethane	--		5 U	80000	5 U	16 U	4 J	6 U	7 U
Dibromochloromethane	100		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		2 J	27000 U	5 U	1800 E	6 J	6 U	7 U
Methylene Chloride	100		19	27000 U	43	18	4 J	2 J	7 U
Styrene	--		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		2 J	27000 U	5 U	16 U	9 U	6 U	7 U
Toluene	1500		4 J	27000 U	5 U	10 J	10	2 J	7 U
Trichloroethene	700		5 U	27000 U	5 U	11 J	9 U	6 U	7 U
Vinyl Chloride	200		5 U	27000 U	5 U	16 U	9 U	6 U	7 U
Xylenes (total)	1200		20	27000 U	5 U	190	24	6 U	7 U

µg/kg - Micrograms per kilogram
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ft bls - Feet below land surface
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DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-78	MP-SB-78	MP-SB-79	MP-SB-79	MP-SB-80	MP-SB-80	MP-SB-81
		Sample Date:	03-20-01	03-20-01	03-21-01	03-21-01	03-21-01	03-21-01	03-21-01
		Sample Depth (ft bls):	0-1	1-3	0-1	1-3	0-1	1-3	0-1
1,1,1-Trichloroethane	800		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,1,2,2-Tetrachloroethane	600		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,1,2-Trichloroethane	6000		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,1-Dichloroethane	200		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,1-Dichloroethene	400		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,2-Dichloroethane	100		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,2-Dichloroethene, cis-	300		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,2-Dichloroethene, trans-	300		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,2-Dichloropropane	--		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,3-Dichloropropene, cis-	300		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
1,3-Dichloropropene, trans-	300		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
2-Butanone	300		6 U	360 U	1600 U	4 J	110	7 U	310 U
2-Hexanone	--		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
4-Methyl-2-pentanone	1000		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Acetone	200		9	360 U	**1300 J**	18	**530**	8	310 U
Benzene	60		6 U	360 U	**540 J**	10	**290**	6 J	**100 J**
Bromodichloromethane	--		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Bromoform	--		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Bromomethane	--		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Carbon Disulfide	2700		4 J	360 U	1600 U	4 J	52 J	7 U	310 U
Carbon Tetrachloride	600		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Chlorobenzene	1700		7	**4200**	1400 J	5 J	**2100**	17	**3100**
Chlorodibromomethane	--		NA	NA	NA	NA	NA	NA	NA
Chloroethane	1900		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Chloroform	300		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Chloromethane	--		2 J	360 U	1600 U	8 U	82 U	7 U	310 U
Dibromochloromethane	100		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Dichloromethane	100		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	5500		6 U	360 U	1600 U	8 U	35 J	7 U	310 U
Methylene Chloride	100		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Styrene	--		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1400		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Toluene	1500		6 U	360 U	1300 J	2 J	110	7 U	310 U
Trichloroethene	700		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Vinyl Chloride	200		6 U	360 U	1600 U	8 U	82 U	7 U	310 U
Xylenes (total)	1200		6 U	360 U	580 J	8 U	120	7 U	310 U

µg/kg - Micrograms per kilogram
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J - Estimated value
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ft bls - Feet below land surface
Bold - Data highlighted in bold represents detections that exceed the NYSDEC RSCOs.
DUP - Duplicate Sample

Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-81 03-21-01 1-3	MP-SB-82 03-21-01 0-1	MP-SB-82 03-21-01 1-3	MP-SB-83 03-21-01 0-1	MP-SB-83 03-21-01 1-3	MP-SB-101 10/20/1999 0.0-2.0	MP-SB-102 10/19/1999 0.0-2.0	MP-SB-103 10/20/1999 0.0-2.0
1,1,1-Trichloroethane	800		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,1,2,2-Tetrachloroethane	600		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,1,2-Trichloroethane	6000		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,1-Dichloroethane	200		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,1-Dichloroethene	400		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,2-Dichloroethane	100		5800 U	12 U	6400 U	570 U	350 U	5.4 U	56.6	5.8 U
1,2-Dichloroethene, cis-	300		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,2-Dichloroethene, trans-	300		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,2-Dichloropropane	--		5800 U	12 U	6400 U	570 U	350 U	NA	NA	NA
1,3-Dichloropropene, cis-	300		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
1,3-Dichloropropene, trans-	300		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
2-Butanone	300		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
2-Hexanone	--		5800 U	12 U	6400 U	570 U	350 U	NA	NA	NA
4-Methyl-2-pentanone	1000		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Acetone	200		5800 U	22	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Benzene	60		5800 U	5 J	6400 U	570 U	350 U	1.1 U	1.1 U	1.2 U
Bromodichloromethane	--		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Bromoform	--		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Bromomethane	--		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Carbon Disulfide	2700		5800 U	5 J	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Carbon Tetrachloride	600		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Chlorobenzene	1700		**28000**	280	**200000**	**1800**	**3000**	5.4 U	5.3 U	5.8 U
Chlorodibromomethane	--		NA	NA	NA	NA	NA	5.4 U	5.3 U	5.8 U
Chloroethane	1900		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Chloroform	300		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Chloromethane	--		5800 U	4 J	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Dibromochloromethane	100		5800 U	12 U	6400 U	570 U	350 U	NA	NA	NA
Dichloromethane	100		NA	NA	NA	NA	NA	5.4 U	5.3 U	7.5
Ethylbenzene	5500		5800 U	12 U	6400 U	570 U	350 U	1.1 U	1.1 U	1.2 U
Methylene Chloride	100		5800 U	12 U	6400 U	570 U	350 U	NA	NA	NA
Styrene	--		5800 U	12 U	6400 U	570 U	350 U	NA	NA	NA
Methyl n-butyl ketone	1000		NA	NA	NA	NA	NA	5.4 U	5.3 U	5.8 U
Tetrachloroethene	1400		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Toluene	1500		5800 U	11 J	6400 U	570 U	350 U	1.1 U	1.1 U	3.3
Trichloroethene	700		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	22.6
Vinyl Chloride	200		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	5.8 U
Xylenes (total)	1200		5800 U	12 U	6400 U	570 U	350 U	5.4 U	5.3 U	15.6

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Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-104 10/18/1999 0.0-4.0	MP-SB-104 FD 10/18/1999 0.0-4.0	MP-SB-105 10/18/1999 0.0-2.0	MP-SB-106 10/15/1999 0.0-2.0	MP-SB-107 10/13/1999 2.0-4.0	MP-SB-107A 10/15/1999 4.0-6.0	MP-SB-108 10/13/1999 0.0-2.0	MP-SB-109 10/12/1999 4.0-6.0
1,1,1-Trichloroethane	800		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,1,2,2-Tetrachloroethane	600		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,1,2-Trichloroethane	6000		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,1-Dichloroethane	200		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,1-Dichloroethene	400		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,2-Dichloroethane	100		**2070**	**1990**	5.8 U	**296000**	9.6	38.1	750 U	5.6 U
1,2-Dichloroethene, cis-	300		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,2-Dichloroethene, trans-	300		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,2-Dichloropropane	--		NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropene, cis-	300		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
1,3-Dichloropropene, trans-	300		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
2-Butanone	300		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
2-Hexanone	--		NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	1000		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Acetone	200		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Benzene	60		5.9 U	6 U	1.2 U	2800 U	21	1.4 U	150 U	0.96 J
Bromodichloromethane	--		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Bromoform	--		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Bromomethane	--		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Carbon Disulfide	2700		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Carbon Tetrachloride	600		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Chlorobenzene	1700		29 U	30 U	5.8 U	**455000**	4.4 J	6.8 U	**25400**	5.9
Chlorodibromomethane	--		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Chloroethane	1900		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Chloroform	300		29 U	30 U	5.8 U	14000 U	1.7 J	2.5 J	750 U	5.6 U
Chloromethane	--		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Dibromochloromethane	100		NA	NA	NA	NA	NA	NA	NA	NA
Dichloromethane	100		49.5	48.6	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Ethylbenzene	5500		5.9 U	6 U	1.2 U	**92800**	1.4 U	1.4 U	150 U	36.3
Methylene Chloride	100		NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--		NA	NA	NA	NA	NA	NA	NA	NA
Methyl n-butyl ketone	1000		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Tetrachloroethene	1400		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Toluene	1500		5.9 U	6 U	1.2 U	**46300**	2.7	1.4 U	150 U	1.1 U
Trichloroethene	700		29 U	30 U	5.8 U	14000 U	7.1 U	4.6 J	750 U	5.6 U
Vinyl Chloride	200		29 U	30 U	5.8 U	14000 U	7.1 U	6.8 U	750 U	5.6 U
Xylenes (total)	1200		29 U	30 U	5.8 U	**634000**	7.1 U	3.6 J	750 U	49.8

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Table 2. Summary of Volatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-110 10/15/1999 2.0-4.0	MP-SB-111 10/13/1999 4.0-6.0	MP-SB-112 10/18/1999 2.0-4.0	MP-SB-113A 10/19/1999 0.0-2.0	MP-SB-114 10/12/1999 0.0-2.0	TB 10/15 SO 10/15/1999 -	TB 10/20 SO 10/20/1999 -
1,1,1-Trichloroethane	800		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
1,1,2,2-Tetrachloroethane	600		6 U	7300 U	5.4 U	5.4 U	5.7 U	2 U	2 U
1,1,2-Trichloroethane	6000		6 U	7300 U	5.4 U	5.4 U	5.7 U	3 U	3 U
1,1-Dichloroethane	200		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
1,1-Dichloroethene	400		6 U	7300 U	5.4 U	5.4 U	5.7 U	2 U	2 U
1,2-Dichloroethane	100		8.1	7300 U	6.5	5.4 U	5.7 U	2 U	2 U
1,2-Dichloroethene, cis-	300		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
1,2-Dichloroethene, trans-	300		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
1,2-Dichloropropane	--		NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropene, cis-	300		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
1,3-Dichloropropene, trans-	300		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
2-Butanone	300		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
2-Hexanone	--		NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	1000		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Acetone	200		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Benzene	60		1.2 U	**34300**	1.1 U	1.1 U	1.1 U	1 U	1 U
Bromodichloromethane	--		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
Bromoform	--		6 U	7300 U	5.4 U	5.4 U	5.7 U	4 U	4 U
Bromomethane	--		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Carbon Disulfide	2700		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Carbon Tetrachloride	600		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
Chlorobenzene	1700		6 U	**297000**	5.4 U	5.4 U	5.7 U	2 U	2 U
Chlorodibromomethane	--		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Chloroethane	1900		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Chloroform	300		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Chloromethane	--		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Dibromochloromethane	100		NA	NA	NA	NA	NA	NA	NA
Dichloromethane	100		6 U	7300 U	5.4 U	5.4 U	5.7 U	2 U	2 U
Ethylbenzene	5500		1.6	**50700**	1.1 U	1.1 U	1.1 U	1 U	1 U
Methylene Chloride	100		NA	NA	NA	NA	NA	NA	NA
Styrene	--		NA	NA	NA	NA	NA	NA	NA
Methyl n-butyl ketone	1000		6 U	7300 U	5.4 U	5.4 U	5.7 U	5 U	5 U
Tetrachloroethene	1400		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
Toluene	1500		1.6	**2370**	1.1 U	1.1 U	1.1 U	1 U	1 U
Trichloroethene	700		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
Vinyl Chloride	200		6 U	7300 U	5.4 U	5.4 U	5.7 U	1 U	1 U
Xylenes (total)	1200		43.7	**28600**	5.4 U	5.4 U	5.7 U	1 U	1 U

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DUP - Duplicate Sample

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-FS-1 03/20/2001 0-0.5	MP-FS-2 03/20/2001 0-0.5	MP-SB-1 05/15/2000 0.0-2.0	MP-SB-2 05/15/2000 0.0-2.0	MP-SB-3 05/17/2000 2.0-6.0	MP-SB-4 05/15/2000 4.0-5.7	MP-SB-5 05/15/2000 2.0-4.0	MP-SB-6 05/12/2000 3.5-5.5
1,2,4-Trichlorobenzene	3400		5700 U	2200 U	76 J	982	1260	230 U	**17700**	94.6 J
1,2-Dichlorobenzene	7900		5700 U	2200 U	157 J	2590	2650	99.5 J	**1990000**	502
1,3-Dichlorobenzene	1600		5700 U	2200 U	63.3 J	**188000**	278 J	230 U	**22400 J**	420 U
1,4-Dichlorobenzene	8500		5700 U	2200 U	156 J	360 U	460	230 U	**74600**	147 J
1-Chloro-4-phenoxybenzene	--		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
2,4,5-Trichlorophenol	100		12000 U	4500 U	1100 U	900 U	1100 U	570 U	190 U	1000 U
2,4,6-Trichlorophenol	--		NA	NA	1100 U	900 U	1100 U	570 U	190 U	1000 U
2,4-Dichlorophenol	400		NA	NA	1100 U	900 U	1100 U	570 U	190 U	1000 U
2,4-Dimethylphenol	--		NA	NA	1100 U	900 U	1100 U	167 J	190 U	1000 U
2,4-Dinitrophenol	200		NA	NA	4300 U	3600 U	4400 U	2300 U	770 U	4200 U
2,4-Dinitrotoluene	--		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
2,6-Dinitrotoluene	1000		2400 U	940 U	430 U	360 U	440 U	230 U	77 U	420 U
2-Chloronaphthalene	--		5700 U	2200 U	430 U	135 J	440 U	230 U	44.9 J	420 U
2-Chlorophenol	800		NA	NA	1100 U	215 J	1100 U	570 U	190 U	1000 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		5700 U	2200 U	430 U	360 U	159 J	230 U	79.5	420 U
2-Methylphenol	100		NA	NA	1100 U	900 U	1100 U	570 U	190 U	1000 U
2-Nitroaniline	430		12000 U	4500 U	1100 U	900 U	1100 U	570 U	190 U	1000 U
2-Nitrophenol	330		NA	NA	1100 U	900 U	1100 U	570 U	190 U	1000 U
3&4-Methylphenol	900		NA	NA	1100 U	900 U	1100 U	570 U	190 U	1000 U
3,3'-Dichlorobenzidine	--		NA	NA	1100 U	900 U	1100 U	570 U	190 U	1000 U
3-Nitroaniline	500		12000 U	4500 U	1100 U	900 U	**4260**	570 U	320	1000 U
4,6-Dinitro-o-cresol	--		NA	NA	4300 U	3600 U	4400 U	2300 U	770 U	4200 U
4-Bromodiphenyl ether	--		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
4-Chloro-3-methyl phenol	240		NA	NA	1100 U	900 U	1100 U	570 U	190 U	**6600**
4-Chloroaniline	220		NA	NA	**2330**	**656 J**	**511 J**	570 U	190 U	1000 U
4-Nitroaniline	--		12000 U	4500 U	1100 U	900 U	1100 U	570 U	190 U	1000 U
4-Nitrophenol	100		12000 U	4500 U	4300 U	3600 U	4400 U	2300 U	770 U	4200 U
Acenaphthene	50000		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Acenaphthylene	41000		5700 U	2200 U	50.8 J	360 U	440 U	230 U	77 U	420 U
Anthracene	50000		5700 U	2200 U	430 U	158 J	440 U	230 U	42 J	420 U
Benzo[a]anthracene	224		1700 U	670 U	430 U	214 J	440 U	230 U	77 U	112 J
Benzo[a]pyrene	61		5700 U	2200 U	430 U	360 U	440 U	230 U	**65.5 J**	420 U
Benzo[b]fluoranthene	1100		5700 U	2200 U	430 U	360 U	440 U	230 U	70.5 J	420 U
Benzo[g,h,i]perylene	50000		5700 U	2200 U	430 U	360 U	440 U	230 U	56.9 J	420 U
Benzo[k]fluoranthene	1100		5700 U	2200 U	430 U	360 U	440 U	230 U	53.8 J	420 U
bis(2-Chloroethoxy)methane	--		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
bis(2-Chloroethyl)ether	--		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
bis(2-Chloroisopropyl)ether	--		NA	NA	430 U	360 U	440 U	230 U	77 U	420 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-FS-1 03/20/2001 0-0.5	MP-FS-2 03/20/2001 0-0.5	MP-SB-1 05/15/2000 0.0-2.0	MP-SB-2 05/15/2000 0.0-2.0	MP-SB-3 05/17/2000 2.0-6.0	MP-SB-4 05/15/2000 4.0-5.7	MP-SB-5 05/15/2000 2.0-4.0	MP-SB-6 05/12/2000 3.5-5.5
bis(2-Ethylhexyl)phthalate	--		1800 JB	1900 JB	430 U	225 J	440 U	230 U	77 U	420 U
Butylbenzyl phthalate	50000		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Carbazole	--		NA	NA	430 U	360 U	440 U	230 U	77 U	420 U
Chrysene	400		5700 U	2200 U	121 J	318 J	271 J	230 U	106	122 J
Dibenzo[a,h]anthracene	14		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Dibenzofuran	6200		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Diethyl phthalate	7100		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Dimethyl phthalate	2000		**7200**	**7100**	430 U	360 U	440 U	230 U	77 U	420 U
Di-n-butyl phthalate	8100		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Di-n-octyl phthalate	50000		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Di-n-propylnitrosamine	--		5700 U	2200 U	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		5700 U	2200 U	97.6 J	361	243 J	230 U	167	197 J
Fluorene	50000		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Hexachlorobenzene	410		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Hexachlorobutadiene	--		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Hexachlorocyclopentadiene	--		5700 U	2200 U	4300 U	3600 U	4400 U	2300 U	770 U	4200 U
Hexachloroethane	--		5700 U	2200 U	1100 U	900 U	1100 U	570 U	190 U	1000 U
Indeno[1,2,3-cd]pyrene	3200		5700 U	2200 U	430 U	360 U	440 U	230 U	43.4 J	420 U
Isophorone	4400		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
Naphthalene	13000		5700 U	2200 U	430 U	116 J	416 J	230 U	145	420 U
Nitrobenzene	200		5700 U	2200 U	430 U	360 U	440 U	230 U	77 U	420 U
N-Nitroso-di-n-propylamine	--		NA	NA	430 U	360 U	440 U	230 U	77 U	420 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		5700 U	2200 U	1080 J	3370	14800	570 U	186 J	102 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		12000 U	4500 U	4300 U	3600 U	4400 U	2300 U	770 U	4200 U
Phenanthrene	50000		5700 U	2200 U	430 U	150 J	282 J	230 U	206	229 J
Phenol	30		1700 U	670 U	1100 U	900 U	1100 U	570 U	190 U	**216 J**
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		5700 U	2200 U	66.3 J	353 J	232 J	230 U	144	258 J

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U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-7 05/15/2000 2.0-6.0	MP-SB-7 DUP 05/15/2000 2.0-6.0	MP-SB-8 05/15/2000 5.0-7.5	MP-SB-8 DUP 05/15/2000 5.0-7.5	MP-SB-9 05/15/2000 0.0-2.0	MP-SB-10 05/16/2000 5.0-7.0	MP-SB-11 05/16/2000 4.0-6.0
1,2,4-Trichlorobenzene	3400		742	402	72 U	21.5 J	47.8 J	71 U	77 U
1,2-Dichlorobenzene	7900		92.3 J	27.4 J	72 U	71 U	29.3 J	71 U	77 U
1,3-Dichlorobenzene	1600		156 J	92.5 J	72 U	71 U	71 U	71 U	77 U
1,4-Dichlorobenzene	8500		391 J	202	72 U	71 U	235	71 U	77 U
1-Chloro-4-phenoxybenzene	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
2,4,5-Trichlorophenol	100		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
2,4,6-Trichlorophenol	--		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
2,4-Dichlorophenol	400		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
2,4-Dimethylphenol	--		155 J	260 U	180 U	180 U	180 U	180 U	190 U
2,4-Dinitrophenol	200		4900 U	1000 U	720 U	710 U	710 U	710 U	770 U
2,4-Dinitrotoluene	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
2,6-Dinitrotoluene	1000		490 U	100 U	72 U	71 U	71 U	71 U	77 U
2-Chloronaphthalene	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
2-Chlorophenol	800		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		490 U	100 U	33 J	71 U	44.4 J	71 U	77 U
2-Methylphenol	100		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
2-Nitroaniline	430		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
2-Nitrophenol	330		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
3&4-Methylphenol	900		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
3,3'-Dichlorobenzidine	--		1200 U	260 U	120 J	279	180 U	180 U	190 U
3-Nitroaniline	500		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
4,6-Dinitro-o-cresol	--		4900 U	1000 U	720 U	710 U	710 U	710 U	770 U
4-Bromodiphenyl ether	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
4-Chloro-3-methyl phenol	240		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
4-Chloroaniline	220		1200 U	260 U	180 U	180 U	83.1 J	180 U	190 U
4-Nitroaniline	--		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
4-Nitrophenol	100		4900 U	1000 U	720 U	710 U	710 U	710 U	770 U
Acenaphthene	50000		490 U	100 U	218	96.3	71 U	71 U	77 U
Acenaphthylene	41000		490 U	101 U	106 J	117 J	71 U	71 U	77 U
Anthracene	50000		490 U	100 U	550	302	37.9 J	71 U	20.5 J
Benzo[a]anthracene	224		132 J	100 U	**1460**	**889**	145	57.7 J	61.4 J
Benzo[a]pyrene	61		490 U	100 U	**1440**	**909**	**170**	**66.9 J**	52.2 J
Benzo[b]fluoranthene	1100		490 U	100 U	**1230**	816	144	48.5 J	35.6 J
Benzo[g,h,i]perylene	50000		490 U	100 U	640	378	75.3	38.7 J	23.4 J
Benzo[k]fluoranthene	1100		490 U	100 U	953	582	112	55.8 J	48.6 J
bis(2-Chloroethoxy)methane	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
bis(2-Chloroethyl)ether	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
bis(2-Chloroisopropyl)ether	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-7 05/15/2000 2.0-6.0	MP-SB-7 DUP 05/15/2000 2.0-6.0	MP-SB-8 05/15/2000 5.0-7.5	MP-SB-8 DUP 05/15/2000 5.0-7.5	MP-SB-9 05/15/2000 0.0-2.0	MP-SB-10 05/16/2000 5.0-7.0	MP-SB-11 05/16/2000 4.0-6.0
bis(2-Ethylhexyl)phthalate	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Butylbenzyl phthalate	50000		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Carbazole	--		490 U	100 U	218	77	71 U	71 U	77 U
Chrysene	400		129 J	100 U	**1400**	**866**	169	57.5 J	61.1 J
Dibenzo[a,h]anthracene	14		490 U	100 U	**289**	**178**	**48.9 J**	71 U	77 U
Dibenzofuran	6200		490 U	100 U	83.4	44.5 J	71 U	71 U	77 U
Diethyl phthalate	7100		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Dimethyl phthalate	2000		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Di-n-butyl phthalate	8100		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Di-n-octyl phthalate	50000		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		490 U	100 U	**2690**	1480	168	75.6	98.4
Fluorene	50000		490 U	100 U	208	104	71 U	71 U	77 U
Hexachlorobenzene	410		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Hexachlorobutadiene	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Hexachlorocyclopentadiene	--		4900 U	1000 U	720 U	710 U	710 U	710 U	770 U
Hexachloroethane	--		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
Indeno[1,2,3-cd]pyrene	3200		490 U	100 U	663	440	70.1 J	36.1 J	24 J
Isophorone	4400		490 U	100 U	72 U	71 U	71 U	71 U	77 U
Naphthalene	13000		490 U	100 U	85.5	70 J	46.7 J	71 U	77 U
Nitrobenzene	200		490 U	100 U	72 U	71 U	71 U	71 U	77 U
N-Nitroso-di-n-propylamine	--		490 U	100 U	72 U	71 U	71 U	71 U	77 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		64300	9280	163 J	285	234	180 U	190 U
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		4900 U	1000 U	720 U	710 U	710 U	710 U	770 U
Phenanthrene	50000		490 U	100 U	1850	895	98.8	71 U	54.6 J
Phenol	30		1200 U	260 U	180 U	180 U	180 U	180 U	190 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		73.9 J	100 U	2440	1360	183	76.2	95.2

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-12 05/16/2000 4.2-6.2	MP-SB-13 05/16/2000 5.0-7.0	MP-SB-14 05/18/2000 5.0-7.5	MP-SB-15 05/18/2000 8.0-9.5	MP-SB-16 05/16/2000 6.0-8.0	MP-SB-17 05/18/2000 4.0-6.5	MP-SB-18 05/19/2000 4.0-5.5	MP-SB-19 05/09/2000 0.0-2.0
1,2,4-Trichlorobenzene	3400		132	76 U	72 U	69 U	895	442	30.6 J	89 U
1,2-Dichlorobenzene	7900		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
1,3-Dichlorobenzene	1600		51.7 J	76 U	72 U	69 U	370 U	70 U	75 U	89 U
1,4-Dichlorobenzene	8500		108	76 U	72 U	69 U	370 U	70 U	75 U	89 U
1-Chloro-4-phenoxybenzene	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
2,4,5-Trichlorophenol	100		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2,4,6-Trichlorophenol	--		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2,4-Dichlorophenol	400		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2,4-Dimethylphenol	--		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2,4-Dinitrophenol	200		710 U	760 U	720 U	690 U	3700 U	700 U	750 U	890 U
2,4-Dinitrotoluene	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
2,6-Dinitrotoluene	1000		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
2-Chloronaphthalene	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
2-Chlorophenol	800		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		71 U	76 U	28.3 J	69 U	313 J	70 U	75 U	70.9 J
2-Methylphenol	100		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2-Nitroaniline	430		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
2-Nitrophenol	330		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
3&4-Methylphenol	900		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
3,3'-Dichlorobenzidine	--		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
3-Nitroaniline	500		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
4,6-Dinitro-o-cresol	--		710 U	760 U	720 U	690 U	3700 U	700 U	750 U	890 U
4-Bromodiphenyl ether	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
4-Chloro-3-methyl phenol	240		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
4-Chloroaniline	220		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
4-Nitroaniline	--		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
4-Nitrophenol	100		710 U	760 U	720 U	690 U	3700 U	700 U	750 U	890 U
Acenaphthene	50000		71 U	76 U	74.6	69 U	215 J	70 U	75 U	89 U
Acenaphthylene	41000		21.4 J	77 U	151	69 U	136 J	70 U	24.7 J	56.4 J
Anthracene	50000		33.5 J	76 U	527	69 U	549	70 U	42.9 J	132
Benzo[a]anthracene	224		88.6	58.6 J	**1480**	69 U	**822**	66.7 J	148	**422**
Benzo[a]pyrene	61		**73.7**	57.2 J	**1260**	69 U	**782**	**87.1**	**190**	**422**
Benzo[b]fluoranthene	1100		66.3 J	44.2 J	976	69 U	736	72.7	165	453
Benzo[g,h,i]perylene	50000		54 J	31.2 J	637	69 U	415	93.7	184	288
Benzo[k]fluoranthene	1100		59.9 J	42.4 J	1000	69 U	722	65.1 J	152	359
bis(2-Chloroethoxy)methane	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
bis(2-Chloroethyl)ether	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
bis(2-Chloroisopropyl)ether	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-12 05/16/2000 4.2-6.2	MP-SB-13 05/16/2000 5.0-7.0	MP-SB-14 05/18/2000 5.0-7.5	MP-SB-15 05/18/2000 8.0-9.5	MP-SB-16 05/16/2000 6.0-8.0	MP-SB-17 05/18/2000 4.0-6.5	MP-SB-18 05/19/2000 4.0-5.5	MP-SB-19 05/09/2000 0.0-2.0
bis(2-Ethylhexyl)phthalate	--		71 U	76 U	72 U	69 U	407	70 U	75 U	89 U
Butylbenzyl phthalate	50000		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Carbazole	--		71 U	76 U	72 U	69 U	319 J	70 U	75 U	50.6 J
Chrysene	400		84	57.3 J	**1230**	69 U	**844**	72.2	146	**486**
Dibenzo[a,h]anthracene	14		71 U	76 U	**218**	69 U	**197 J**	70 U	75 U	**134**
Dibenzofuran	6200		71 U	76 U	72 U	69 U	280 J	70 U	75 U	36.7 J
Diethyl phthalate	7100		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Dimethyl phthalate	2000		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Di-n-butyl phthalate	8100		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Di-n-octyl phthalate	50000		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		157	79.2	2000	69 U	1880	53.8 J	184	904
Fluorene	50000		71 U	76 U	101	69 U	350 J	70 U	75 U	46.5 J
Hexachlorobenzene	410		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Hexachlorobutadiene	--		71 U	76 U	72 U	69 U	881	70 U	75 U	89 U
Hexachlorocyclopentadiene	--		710 U	760 U	720 U	690 U	3700 U	700 U	750 U	890 U
Hexachloroethane	--		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
Indeno[1,2,3-cd]pyrene	3200		46 J	26.2 J	600	69 U	416	60 J	153	262
Isophorone	4400		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
Naphthalene	13000		71 U	76 U	57.6 J	69 U	477	70 U	75 U	70 J
Nitrobenzene	200		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
N-Nitroso-di-n-propylamine	--		71 U	76 U	72 U	69 U	370 U	70 U	75 U	89 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		180 U	190 U	180 U	170 U	920 U	51.8 J	190 U	62.2 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		710 U	760 U	720 U	690 U	3700 U	700 U	750 U	890 U
Phenanthrene	50000		100	31 J	1360	69 U	1750	70 U	94.6	504
Phenol	30		180 U	190 U	180 U	170 U	920 U	180 U	190 U	220 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		139	79.7	3590	69 U	1250	105	341	706

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

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(ft bls) - Feet below land surface

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-20 05/08/2000 0.0-2.0	MP-SB-21 05/09/2000 2.8-4.8	MP-SB-24 05/10/2000 3.0-5.0	MP-SB-25 05/09/2000 3.0-5.0	MP-SB-26 05/09/2000 3.0-5.0	MP-SB-27 05/09/2000 2.5-4.5	MP-SB-28 05/17/2000 0.0-2.0	MP-SB-29 05/09/2000 1.0-3.0
1,2,4-Trichlorobenzene	3400		72 U	88.2	82.7	72 U	75 U	400 U	107	85 U
1,2-Dichlorobenzene	7900		72 U	81 U	673	97.8	75 U	852	76 U	85 U
1,3-Dichlorobenzene	1600		72 U	81 U	45.6 J	72 U	75 U	400 U	76 U	85 U
1,4-Dichlorobenzene	8500		72 U	81 U	212	72 U	75 U	554	76 U	85 U
1-Chloro-4-phenoxybenzene	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
2,4,5-Trichlorophenol	100		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2,4,6-Trichlorophenol	--		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2,4-Dichlorophenol	400		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2,4-Dimethylphenol	--		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2,4-Dinitrophenol	200		720 U	810 U	810 U	720 U	750 U	4000 U	760 U	850 U
2,4-Dinitrotoluene	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
2,6-Dinitrotoluene	1000		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
2-Chloronaphthalene	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
2-Chlorophenol	800		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		72 U	81 U	28.6 J	72 U	75 U	73.6 J	76 U	85 U
2-Methylphenol	100		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2-Nitroaniline	430		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
2-Nitrophenol	330		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
3&4-Methylphenol	900		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
3,3'-Dichlorobenzidine	--		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
3-Nitroaniline	500		180 U	200 U	200 U	180 U	190 U	1000 U	82 J	210 U
4,6-Dinitro-o-cresol	--		720 U	810 U	810 U	720 U	750 U	4000 U	760 U	850 U
4-Bromodiphenyl ether	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
4-Chloro-3-methyl phenol	240		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
4-Chloroaniline	220		180 U	200 U	200 U	180 U	190 U	1000 U	**435**	210 U
4-Nitroaniline	--		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
4-Nitrophenol	100		720 U	810 U	810 U	720 U	750 U	4000 U	760 U	850 U
Acenaphthene	50000		72 U	81 U	51.8 J	72 U	75 U	400 U	76 U	85 U
Acenaphthylene	41000		72 U	81 U	1200	72 U	75 U	400 U	64.75	85 U
Anthracene	50000		87	81 U	3670	72 U	75 U	400 U	97.2	85 U
Benzo[a]anthracene	224		196	93.4	**10800**	72 U	42.4 J	**372 J**	**264**	33.2 J
Benzo[a]pyrene	61		**194**	**123**	**8960**	72 U	46.7 J	**267 J**	**182**	85 U
Benzo[b]fluoranthene	1100		166	134	**8700**	72 U	45.8 J	541	557	85 U
Benzo[g,h,i]perylene	50000		137	131	5900	72 U	75 U	176 J	115	85 U
Benzo[k]fluoranthene	1100		144	101	**2970**	72 U	49.8 J	460	305	85 U
bis(2-Chloroethoxy)methane	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
bis(2-Chloroethyl)ether	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
bis(2-Chloroisopropyl)ether	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U

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Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-20 05/08/2000 0.0-2.0	MP-SB-21 05/09/2000 2.8-4.8	MP-SB-24 05/10/2000 3.0-5.0	MP-SB-25 05/09/2000 3.0-5.0	MP-SB-26 05/09/2000 3.0-5.0	MP-SB-27 05/09/2000 2.5-4.5	MP-SB-28 05/17/2000 0.0-2.0	MP-SB-29 05/09/2000 1.0-3.0
bis(2-Ethylhexyl)phthalate	--		72 U	81 U	81 U	72 U	75 U	400 U	103	85 U
Butylbenzyl phthalate	50000		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Carbazole	--		72 U	81 U	214	72 U	75 U	127 J	76 U	85 U
Chrysene	400		202	99.7	**9660**	72 U	57.7 J	**496**	376	50.3 J
Dibenzo[a,h]anthracene	14		**58.8 J**	81 U	**3240**	72 U	75 U	400 U	76 U	85 U
Dibenzofuran	6200		72 U	81 U	101	72 U	75 U	61.7 J	76 U	85 U
Diethyl phthalate	7100		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Dimethyl phthalate	2000		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Di-n-butyl phthalate	8100		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Di-n-octyl phthalate	50000		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		409	80.6 J	25500	72 U	61.9 J	870	414	38.1 J
Fluorene	50000		72 U	81 U	457	72 U	75 U	400 U	76 U	85 U
Hexachlorobenzene	410		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Hexachlorobutadiene	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Hexachlorocyclopentadiene	--		720 U	810 U	810 U	720 U	750 U	4000 U	760 U	850 U
Hexachloroethane	--		180 U	200 U	200 U	180 U	190 U	1000 U	190 U	210 U
Indeno[1,2,3-cd]pyrene	3200		122	113	**5840**	72 U	75 U	193 J	132	85 U
Isophorone	4400		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
Naphthalene	13000		34.4 J	81 U	69.8 J	72 U	75 U	300 J	76 U	85 U
Nitrobenzene	200		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
N-Nitroso-di-n-propylamine	--		72 U	81 U	81 U	72 U	75 U	400 U	76 U	85 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		180 U	200 U	166 J	180 U	190 U	215 J	190 U	210 U
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		720 U	810 U	810 U	720 U	750 U	4000 U	760 U	850 U
Phenanthrene	50000		302	81 U	11000	72 U	51.6 J	578	151	40.1 J
Phenol	30		180 U	200 U	200 U	180 U	190 U	**508 J**	190 U	210 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		353	76.2 J	20400	72 U	51.7 J	773	168	41.9 J

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

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B - Detected in blank

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(ft bls) - Feet below land surface

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-30 05/10/2000 3.0-5.0	MP-SB-31 05/19/2000 0.0-4.0	MP-SB-32 05/10/2000 3.0-5.0	MP-SB-33 05/10/2000 2.5-4.5	MP-SB-34 05/11/2000 3.0-5.0	MP-SB-35 05/11/2000 3.8-5.0	MP-SB-36 05/11/2000 3.0-5.0	MP-SB-37 05/11/2000 4.5-6.5
1,2,4-Trichlorobenzene	3400		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
1,2-Dichlorobenzene	7900		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
1,3-Dichlorobenzene	1600		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
1,4-Dichlorobenzene	8500		26.8 J	71 U	81 U	400 U	430 U	430 U	77 U	20.8 J
1-Chloro-4-phenoxybenzene	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
2,4,5-Trichlorophenol	100		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2,4,6-Trichlorophenol	--		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2,4-Dichlorophenol	400		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2,4-Dimethylphenol	--		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2,4-Dinitrophenol	200		750 U	710 U	810 U	4000 U	4300 U	4300 U	770 U	800 U
2,4-Dinitrotoluene	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
2,6-Dinitrotoluene	1000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
2-Chloronaphthalene	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
2-Chlorophenol	800		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
2-Methylphenol	100		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2-Nitroaniline	430		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
2-Nitrophenol	330		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
3&4-Methylphenol	900		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
3,3'-Dichlorobenzidine	--		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
3-Nitroaniline	500		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
4,6-Dinitro-o-cresol	--		750 U	710 U	810 U	4000 U	4300 U	4300 U	770 U	800 U
4-Bromodiphenyl ether	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
4-Chloro-3-methyl phenol	240		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
4-Chloroaniline	220		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
4-Nitroaniline	--		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
4-Nitrophenol	100		750 U	710 U	810 U	4000 U	4300 U	4300 U	770 U	800 U
Acenaphthene	50000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Acenaphthylene	41000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Anthracene	50000		75 U	60.2 J	41.8 J	154 J	430 U	430 U	77 U	29.3 J
Benzo[a]anthracene	224		48.3 J	220	94.4	**538**	430 U	**268 J**	77 U	91.8
Benzo[a]pyrene	61		51.7 J	**207**	**81.5**	**434**	430 U	**268 J**	77 U	80 U
Benzo[b]fluoranthene	1100		43 J	208	101	479	430 U	287 J	77 U	114
Benzo[g,h,i]perylene	50000		75 U	156	54.5 J	388 J	430 U	430 U	77 U	73.9 J
Benzo[k]fluoranthene	1100		40.1 J	177	34.4 J	420	430 U	198 J	77 U	83.6
bis(2-Chloroethoxy)methane	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
bis(2-Chloroethyl)ether	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
bis(2-Chloroisopropyl)ether	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U

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Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-30 05/10/2000 3.0-5.0	MP-SB-31 05/19/2000 0.0-4.0	MP-SB-32 05/10/2000 3.0-5.0	MP-SB-33 05/10/2000 2.5-4.5	MP-SB-34 05/11/2000 3.0-5.0	MP-SB-35 05/11/2000 3.8-5.0	MP-SB-36 05/11/2000 3.0-5.0	MP-SB-37 05/11/2000 4.5-6.5
bis(2-Ethylhexyl)phthalate	--		72.4 J	71 U	81 U	400 U	430 U	8680	83.8	80 U
Butylbenzyl phthalate	50000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Carbazole	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Chrysene	400		59 J	254	130	**672**	430 U	280 J	77 U	108
Dibenzo[a,h]anthracene	14		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Dibenzofuran	6200		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Diethyl phthalate	7100		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Dimethyl phthalate	2000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Di-n-butyl phthalate	8100		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Di-n-octyl phthalate	50000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		82.4	286	177	877	430 U	359 J	77 U	87.2
Fluorene	50000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Hexachlorobenzene	410		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Hexachlorobutadiene	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Hexachlorocyclopentadiene	--		750 U	710 U	810 U	4000 U	4300 U	4300 U	770 U	800 U
Hexachloroethane	--		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
Indeno[1,2,3-cd]pyrene	3200		75 U	130	48.9 J	354 J	430 U	430 U	77 U	79.7 J
Isophorone	4400		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Naphthalene	13000		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
Nitrobenzene	200		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
N-Nitroso-di-n-propylamine	--		75 U	71 U	81 U	400 U	430 U	430 U	77 U	80 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		190 U	180 U	200 U	1000 U	1100 U	214 J	190 U	68.2 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		750 U	710 U	810 U	4000 U	4300 U	4300 U	770 U	800 U
Phenanthrene	50000		50.8 J	269	168	662	430 U	165 J	77 U	68.7 J
Phenol	30		190 U	180 U	200 U	1000 U	1100 U	1100 U	190 U	200 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		80.8	556	177	1000	430 U	442	77 U	100

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-38 05/17/2000 0.0-2.0	MP-SB-39 05/17/2000 0.0-2.0	MP-SB-40 05/17/2000 5.0-7.0	MP-SB-41 05/17/2000 4.0-8.0	MP-SB-42 05/18/2000 5.0-7.0	MP-SB-43 05/19/2000 4.0-6.0	MP-SB-44 05/10/2000 4.0-6.0	MP-SB-45 05/11/2000 0.0-2.0
1,2,4-Trichlorobenzene	3400		355	340	**4820**	437	125	78 U	76 U	350 U
1,2-Dichlorobenzene	7900		194	161	**23000**	**9540**	48.2 J	78 U	76 U	350 U
1,3-Dichlorobenzene	1600		28.3 J	41.6 J	**2180**	**1930**	75 U	78 U	76 U	350 U
1,4-Dichlorobenzene	8500		69.6 J	41.3 J	3120	2970	75 U	78 U	76 U	350 U
1-Chloro-4-phenoxybenzene	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
2,4,5-Trichlorophenol	100		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2,4,6-Trichlorophenol	--		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2,4-Dichlorophenol	400		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2,4-Dimethylphenol	--		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2,4-Dinitrophenol	200		710 U	700 U	800 U	820 U	750 U	780 U	760 U	3500 U
2,4-Dinitrotoluene	--		71 U	352	1200	83	75 U	78 U	76 U	350 U
2,6-Dinitrotoluene	1000		71 U	88.4	931	220	75 U	78 U	76 U	350 U
2-Chloronaphthalene	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
2-Chlorophenol	800		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		29.2 J	70 U	80 U	50.8 J	75 U	1240	76 U	136 J
2-Methylphenol	100		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2-Nitroaniline	430		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
2-Nitrophenol	330		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
3&4-Methylphenol	900		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
3,3'-Dichlorobenzidine	--		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
3-Nitroaniline	500		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
4,6-Dinitro-o-cresol	--		710 U	700 U	800 U	820 U	750 U	780 U	760 U	3500 U
4-Bromodiphenyl ether	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
4-Chloro-3-methyl phenol	240		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
4-Chloroaniline	220		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
4-Nitroaniline	--		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
4-Nitrophenol	100		710 U	700 U	800 U	820 U	750 U	780 U	760 U	3500 U
Acenaphthene	50000		71 U	70 U	80 U	82 U	75 U	41.4 J	76 U	350 U
Acenaphthylene	41000		58.1 J	47.6 J	80 U	82 U	75 U	392	76 U	350 U
Anthracene	50000		41.6 J	48.9 J	80 U	82 U	75 U	333	76 U	350 U
Benzo[a]anthracene	224		183	160	80 U	82 U	39.9 J	**807**	76 U	158 J
Benzo[a]pyrene	61		**205**	**153**	80 U	82 U	75 U	**840**	76 U	**169 J**
Benzo[b]fluoranthene	1100		212	168	80 U	82 U	75 U	1060	76 U	173 J
Benzo[g,h,i]perylene	50000		218	157	80 U	82 U	75 U	1120	76 U	113 J
Benzo[k]fluoranthene	1100		191	145	80 U	82 U	75 U	674	76 U	198 J
bis(2-Chloroethoxy)methane	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
bis(2-Chloroethyl)ether	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
bis(2-Chloroisopropyl)ether	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-38 05/17/2000 0.0-2.0	MP-SB-39 05/17/2000 0.0-2.0	MP-SB-40 05/17/2000 5.0-7.0	MP-SB-41 05/17/2000 4.0-8.0	MP-SB-42 05/18/2000 5.0-7.0	MP-SB-43 05/19/2000 4.0-6.0	MP-SB-44 05/10/2000 4.0-6.0	MP-SB-45 05/11/2000 0.0-2.0
bis(2-Ethylhexyl)phthalate	--		143	70 U	80 U	82 U	56.5 J	78 U	76 U	350 U
Butylbenzyl phthalate	50000		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Carbazole	--		21.8 J	70 U	80 U	82 U	75 U	73.6 J	76 U	350 U
Chrysene	400		202	181	93.5	70.7 J	43.6 J	**958**	76 U	174 J
Dibenzo[a,h]anthracene	14		71 U	**65.9 J**	80 U	82 U	75 U	**233**	76 U	350 U
Dibenzofuran	6200		71 U	70 U	47.4 J	82 U	75 U	199	76 U	350 U
Diethyl phthalate	7100		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Dimethyl phthalate	2000		56.1 J	70 U	220	82 U	75 U	78 U	76 U	350 U
Di-n-butyl phthalate	8100		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Di-n-octyl phthalate	50000		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		192	274	61 J	82 U	26.8 J	935	76 U	231 J
Fluorene	50000		71 U	70 U	80 U	82 U	75 U	36.8 J	76 U	350 U
Hexachlorobenzene	410		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Hexachlorobutadiene	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Hexachlorocyclopentadiene	--		710 U	700 U	800 U	820 U	750 U	780 U	760 U	3500 U
Hexachloroethane	--		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
Indeno[1,2,3-cd]pyrene	3200		183	139	80 U	82 U	75 U	795	76 U	128 J
Isophorone	4400		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
Naphthalene	13000		25.6 J	70 U	80 U	82 U	75 U	500	76 U	83.1 J
Nitrobenzene	200		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
N-Nitroso-di-n-propylamine	--		71 U	70 U	80 U	82 U	75 U	78 U	76 U	350 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		408	57.4 J	45.8 J	200 U	190 U	200 U	190 U	880 U
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		710 U	700 U	800 U	820 U	750 U	780 U	760 U	3500 U
Phenanthrene	50000		104	174	107	65.5 J	75 U	709	76 U	182 J
Phenol	30		180 U	180 U	200 U	200 U	190 U	200 U	190 U	880 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		378	251	52.5 J	82 U	71 J	2230	76 U	366

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-45 05/11/2000 3.0-5.0	MP-SB-47 05/12/2000 2.0-3.5	MP-SB-48 05/18/2000 0.0-2.0	MP-SB-49 05/18/2000 0.0-2.0	MP-SB-50 05/08/2000 0.0-2.0	MP-SB-51 05/11/2000 4.0-6.0	MP-SB-52 05/11/2000 0.0-2.0	MP-SB-53 05/23/2000 0.0-2.0
1,2,4-Trichlorobenzene	3400		74 U	55.4 J	69 U	70 U	73 U	72 U	84 U	69 U
1,2-Dichlorobenzene	7900		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
1,3-Dichlorobenzene	1600		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
1,4-Dichlorobenzene	8500		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
1-Chloro-4-phenoxybenzene	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
2,4,5-Trichlorophenol	100		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2,4,6-Trichlorophenol	--		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2,4-Dichlorophenol	400		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2,4-Dimethylphenol	--		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2,4-Dinitrophenol	200		740 U	790 U	690 U	700 U	730 U	720 U	840 U	690 U
2,4-Dinitrotoluene	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
2,6-Dinitrotoluene	1000		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
2-Chloronaphthalene	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
2-Chlorophenol	800		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		74 U	34.4 J	69 U	70 U	73 U	72 U	48.7 J	69 U
2-Methylphenol	100		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2-Nitroaniline	430		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
2-Nitrophenol	330		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
3&4-Methylphenol	900		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
3,3'-Dichlorobenzidine	--		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
3-Nitroaniline	500		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
4,6-Dinitro-o-cresol	--		740 U	790 U	690 U	700 U	730 U	720 U	840 U	690 U
4-Bromodiphenyl ether	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
4-Chloro-3-methyl phenol	240		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
4-Chloroaniline	220		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
4-Nitroaniline	--		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
4-Nitrophenol	100		740 U	790 U	690 U	700 U	730 U	720 U	840 U	690 U
Acenaphthene	50000		74 U	46.1 J	69 U	70 U	73 U	72 U	84 U	69 U
Acenaphthylene	41000		74 U	79 U	34.4 J	70 U	73 U	72 U	84 U	24 J
Anthracene	50000		74 U	99.1	50.1 J	70 U	73 U	72 U	31 J	57.3 J
Benzo[a]anthracene	224		23.8 J	**242**	212	70 U	30.2 J	33.8 J	140	201
Benzo[a]pyrene	61		74 U	**254**	**202**	70 U	31.8 J	38.1 J	**150**	**163**
Benzo[b]fluoranthene	1100		74 U	271	171	70 U	37.3 J	31.5 J	192	124
Benzo[g,h,i]perylene	50000		74 U	107	142	70 U	73 U	72 U	89.5	108
Benzo[k]fluoranthene	1100		74 U	246	179	70 U	17 J	36.9 J	135	130
bis(2-Chloroethoxy)methane	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
bis(2-Chloroethyl)ether	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
bis(2-Chloroisopropyl)ether	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-45 05/11/2000 3.0-5.0	MP-SB-47 05/12/2000 2.0-3.5	MP-SB-48 05/18/2000 0.0-2.0	MP-SB-49 05/18/2000 0.0-2.0	MP-SB-50 05/08/2000 0.0-2.0	MP-SB-51 05/11/2000 4.0-6.0	MP-SB-52 05/11/2000 0.0-2.0	MP-SB-53 05/23/2000 0.0-2.0
bis(2-Ethylhexyl)phthalate	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Butylbenzyl phthalate	50000		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Carbazole	--		74 U	55.1 J	69 U	70 U	73 U	72 U	84 U	69 U
Chrysene	400		21.1 J	246	190	70 U	29.9 J	34.4 J	178	236
Dibenzo[a,h]anthracene	14		74 U	**63.3 J**	69 U	70 U	73 U	72 U	84 U	69 U
Dibenzofuran	6200		74 U	26.1 J	69 U	70 U	73 U	72 U	84 U	69 U
Diethyl phthalate	7100		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Dimethyl phthalate	2000		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Di-n-butyl phthalate	8100		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Di-n-octyl phthalate	50000		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		40.5 J	480	269	29.7 J	42.6 J	34 J	296	379
Fluorene	50000		74 U	39.6 J	69 U	70 U	73 U	72 U	84 U	69 U
Hexachlorobenzene	410		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Hexachlorobutadiene	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Hexachlorocyclopentadiene	--		740 U	790 U	690 U	700 U	730 U	720 U	840 U	690 U
Hexachloroethane	--		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
Indeno[1,2,3-cd]pyrene	3200		74 U	98.5	125	70 U	73 U	72 U	89.8	71
Isophorone	4400		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
Naphthalene	13000		74 U	39.2 J	69 U	70 U	73 U	72 U	37.6 J	93.8
Nitrobenzene	200		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
N-Nitroso-di-n-propylamine	--		74 U	79 U	69 U	70 U	73 U	72 U	84 U	69 U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		180 U	35.4 J	170 U	180 U	180 U	180 U	210 U	170 U
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		740 U	790 U	690 U	700 U	730 U	720 U	840 U	690 U
Phenanthrene	50000		42.4 J	393	158	70 U	73 U	72 U	186	386
Phenol	30		180 U	200 U	170 U	180 U	180 U	180 U	210 U	170 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		57.6 J	663	476	43.3 J	40.9 J	51.8 J	367	609

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-54 05/23/2000 1.0-4.0	MP-SB-55 05/23/2000 0.0-0.5	MP-SB-55 DUP 05/23/2000 0.0-0.5	MP-SB-57 05/23/2000 0.0-0.5	MP-SB-58 05/23/2000 0.0-0.5	MP-SB-59 05/16/2000 2.0-3.5	MP-SB-60 2/27/2001 0-2
1,2,4-Trichlorobenzene	3400		69.7 J	**6160**	3220	**5450**	**514000**	430 U	86 J
1,2-Dichlorobenzene	7900		112	2060	1350	809 J	**48500**	430 U	350 U
1,3-Dichlorobenzene	1600		84 U	**5250**	**3040**	2300 U	1210 J	430 U	350 U
1,4-Dichlorobenzene	8500		23.9 J	382 J	193 J	2300 U	2160 J	430 U	350 U
1-Chloro-4-phenoxybenzene	--		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
2,4,5-Trichlorophenol	100		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	720 U
2,4,6-Trichlorophenol	--		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
2,4-Dichlorophenol	400		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
2,4-Dimethylphenol	--		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
2,4-Dinitrophenol	200		840 U	5900 U	5500 U	23000 U	34000 U	4300 U	NA
2,4-Dinitrotoluene	--		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
2,6-Dinitrotoluene	1000		84 U	590 U	550 U	2300 U	3400 U	430 U	140 U
2-Chloronaphthalene	--		84 U	2320	1200	2300 U	3400 U	430 U	41 J
2-Chlorophenol	800		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		27.3 J	3030	1580	2300 U	3400 U	430 U	350 U
2-Methylphenol	100		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
2-Nitroaniline	430		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	720 U
2-Nitrophenol	330		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
3&4-Methylphenol	900		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
3,3'-Dichlorobenzidine	--		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
3-Nitroaniline	500		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	720 U
4,6-Dinitro-o-cresol	--		840 U	5900 U	5500 U	23000 U	34000 U	4300 U	NA
4-Bromodiphenyl ether	--		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
4-Chloro-3-methyl phenol	240		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
4-Chloroaniline	220		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	NA
4-Nitroaniline	--		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	720 U
4-Nitrophenol	100		840 U	5900 U	5500 U	23000 U	34000 U	4300 U	720 U
Acenaphthene	50000		84 U	7350	4520	2300 U	3400 U	430 U	350 U
Acenaphthylene	41000		27.9 J	590 U	223 J	2300 U	3400 U	430 U	350 U
Anthracene	50000		84 U	21800	14000	2300 U	3400 U	430 U	42 J
Benzo[a]anthracene	224		51.1 J	**41700**	**26100**	2300 U	**1890 J**	430 U	190 J
Benzo[a]pyrene	61		**70.9 J**	**26600**	**17900**	2300 U	3400 U	430 U	**92 J**
Benzo[b]fluoranthene	1100		170	**33000**	**19600**	2300 U	**1390 J**	430 U	220 J
Benzo[g,h,i]perylene	50000		106	9870	5660	2300 U	3400 U	430 U	350 U
Benzo[k]fluoranthene	1100		140	**28600**	**20000**	2300 U	**1400 J**	430 U	96 J
bis(2-Chloroethoxy)methane	--		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
bis(2-Chloroethyl)ether	--		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
bis(2-Chloroisopropyl)ether	--		84 U	590 U	550 U	2300 U	3400 U	430 U	NA

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Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-54 05/23/2000 1.0-4.0	MP-SB-55 05/23/2000 0.0-0.5	MP-SB-55 DUP 05/23/2000 0.0-0.5	MP-SB-57 05/23/2000 0.0-0.5	MP-SB-58 05/23/2000 0.0-0.5	MP-SB-59 05/16/2000 2.0-3.5	MP-SB-60 2/27/2001 0-2
bis(2-Ethylhexyl)phthalate	--		84 U	4380	7900	2370	12000	430 U	96 JB
Butylbenzyl phthalate	50000		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
Carbazole	--		84 U	590 U	550 U	2300 U	3400 U	430 U	NA
Chrysene	400		129	**39000**	**24600**	2300 U	**2440 J**	430 U	300 J
Dibenzo[a,h]anthracene	14		84 U	**6580**	**4080**	2300 U	3400 U	430 U	350 U
Dibenzofuran	6200		84 U	**8750**	4840	2300 U	3400 U	474	350 U
Diethyl phthalate	7100		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
Dimethyl phthalate	2000		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
Di-n-butyl phthalate	8100		84 U	590 U	550 U	2300 U	842 J	664	350 U
Di-n-octyl phthalate	50000		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	160 J
Fluoranthene	50000		97.7	**82100**	48200	698 J	4070	430 U	620
Fluorene	50000		84 U	11200	6730	2300 U	3400 U	430 U	350 U
Hexachlorobenzene	410		84 U	**518 J**	265 J	2300 U	3400 U	430 U	350 U
Hexachlorobutadiene	--		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
Hexachlorocyclopentadiene	--		840 U	5900 U	5500 U	23000 U	34000 U	4300 U	350 U
Hexachloroethane	--		210 U	1500 U	1400 U	5800 U	8400 U	1100 U	350 U
Indeno[1,2,3-cd]pyrene	3200		94.2	**10900**	**6660**	2300 U	3400 U	430 U	46 J
Isophorone	4400		84 U	590 U	550 U	2300 U	3400 U	430 U	350 U
Naphthalene	13000		23.1 J	6120	3280	2300 U	1050 J	430 U	350 U
Nitrobenzene	200		84 U	590 U	550 U	2300 U	3400 U	430 U	**960**
N-Nitroso-di-n-propylamine	--		84 U	590 U	550 U	2300 U	3400 U	430 U	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		210 U	1500 U	1400 U	5800 U	8400 U	213 J	160 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		840 U	5900 U	5500 U	23000 U	34000 U	4300 U	720 U
Phenanthrene	50000		45.7 J	**84200**	**50100**	2300 U	2260 J	430 U	340 J
Phenol	30		210 U	**2440**	**1570**	**2610 J**	**11200**	1100 U	**92 J**
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		75.1 J	**50300**	30700	581 J	3450	430 U	500

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-60 2/27/2001 4-6	MP-SB-61 2/27/2001 0-2	MP-SB-61 2/27/2001 4-6	MP-SB-62 2/27/2001 0-2	MP-SB-62 2/27/2001 4-6	MP-SB-63 2/27/2001 0-2	MP-SB-63 2/27/2001 2-4	MP-SB-64 02/27/01 0-2
1,2,4-Trichlorobenzene	3400		96 J	200 J	23000 U	160 J	12000 U	80 J	77 J	380 U
1,2-Dichlorobenzene	7900		380 U	450	23000 U	620	6900 J	120 J	57 J	380 U
1,3-Dichlorobenzene	1600		380 U	350 U	23000 U	67 J	12000 U	410 U	430 U	380 U
1,4-Dichlorobenzene	8500		380 U	82 J	23000 U	250 J	1700 J	410 U	430 U	380 U
1-Chloro-4-phenoxybenzene	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
2,4,5-Trichlorophenol	100		770 U	710 U	46000 U	730 U	25000 U	840 U	880 U	780 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--		380 U	350 U	23000 U	360 U	12000 U	93 J	98 J	380 U
2,6-Dinitrotoluene	1000		140 U	140 U	23000 U	140 U	12000 U	140 U	140 U	140 U
2-Chloronaphthalene	--		63 J	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		380 U	220 J	23000 U	76 J	1600 J	95 J	51 J	380 U
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	430		770 U	710 U	46000 U	730 U	25000 U	**910**	**1400**	780 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	500		770 U	710 U	46000 U	730 U	25000 U	**600 J**	**790 J**	780 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		770 U	710 U	46000 U	370 J	25000 U	840 U	63 J	780 U
4-Nitrophenol	100		770 U	710 U	46000 U	730 U	25000 U	840 U	880 U	780 U
Acenaphthene	50000		380 U	350 U	23000 U	51 J	12000 U	410 U	430 U	380 U
Acenaphthylene	41000		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Anthracene	50000		49 J	350 U	23000 U	150 J	3900 J	410 U	430 U	380 U
Benzo[a]anthracene	224		**230 J**	200 J	23000 U	220 J	12000 U	170 J	100 J	**230 J**
Benzo[a]pyrene	61		**94 J**	**180 J**	23000 U	**68 J**	12000 U	**120 J**	100 J	170 J
Benzo[b]fluoranthene	1100		240 J	230 J	23000 U	180 J	12000 U	220 J	180 J	250 J
Benzo[g,h,i]perylene	50000		86 J	160 J	23000 U	360 U	12000 U	120 J	150 J	380 U
Benzo[k]fluoranthene	1100		65 J	120 J	23000 U	56 J	12000 U	87 J	55 J	110 J
bis(2-Chloroethoxy)methane	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
bis(2-Chloroethyl)ether	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-60 2/27/2001 4-6	MP-SB-61 2/27/2001 0-2	MP-SB-61 2/27/2001 4-6	MP-SB-62 2/27/2001 0-2	MP-SB-62 2/27/2001 4-6	MP-SB-63 2/27/2001 0-2	MP-SB-63 2/27/2001 2-4	MP-SB-64 02/27/01 0-2
bis(2-Ethylhexyl)phthalate	--		110 JB	97 JB	23000 U	120 JB	12000 U	120 JB	130 JB	130 JB
Butylbenzyl phthalate	50000		380 U	350 U	23000 U	360 U	12000 U	77 J	430 U	380 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	400		330 J	190 J	23000 U	170 J	12000 U	200 J	130 J	320 J
Dibenzo[a,h]anthracene	14		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Dibenzofuran	6200		380 U	350 U	23000 U	56 J	12000 U	410 U	430 U	380 U
Diethyl phthalate	7100		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Dimethyl phthalate	2000		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Di-n-butyl phthalate	8100		380 U	350 U	23000 U	360 U	6200 J	410 U	430 U	380 U
Di-n-octyl phthalate	50000		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Di-n-propylnitrosamine	--		160 J	170 J	23000 U	1000	12000 U	170 J	140 J	380 U
Fluoranthene	50000		500	210 J	23000 U	270 J	12000 U	160 J	110 J	210 J
Fluorene	50000		380 U	350 U	23000 U	88 J	12000 U	410 U	430 U	380 U
Hexachlorobenzene	410		380 U	350 U	23000 U	260 J	12000 U	410 U	430 U	380 U
Hexachlorobutadiene	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Hexachlorocyclopentadiene	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Hexachloroethane	--		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Indeno[1,2,3-cd]pyrene	3200		73 J	130 J	23000 U	360 U	12000 U	110 J	120 J	160 J
Isophorone	4400		380 U	350 U	23000 U	360 U	12000 U	410 U	430 U	380 U
Naphthalene	13000		380 U	57 J	23000 U	110 J	1900 J	61 J	430 U	380 U
Nitrobenzene	200		**1100**	350 U	23000 U	94 J	12000 U	**970**	650	380 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		160 J	170 J	23000 U	1000	12000 U	170 J	140 J	380 U
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		770 U	710 U	46000 U	730 U	25000 U	840 U	880 U	780 U
Phenanthrene	50000		380	170 J	23000 U	420	6000 J	130 J	100 J	180 J
Phenol	30		**110 J**	100 U	23000 U	**110 J**	12000 U	**49 J**	100 U	100 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		690	310 J	23000 U	380	12000 U	220 J	170 J	440

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-65	MP-SB-65	MP-SB-66	MP-SB-66	MP-SB-67	MP-SB-67 DUP	MP-SB-67
		Sample Date:	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001
		Sample Depth (ft bls):	0-2	6-8	0-2	4-6	0-2	0-2	2-4
1,2,4-Trichlorobenzene	3400		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
1,2-Dichlorobenzene	7900		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
1,3-Dichlorobenzene	1600		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
1,4-Dichlorobenzene	8500		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
1-Chloro-4-phenoxybenzene	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
2,4,5-Trichlorophenol	100		6900 U	750 U	7300 U	750 U	7800 U	7700 U	780 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	47 J
2,6-Dinitrotoluene	1000		1400 U	160 U	1500 U	160 U	1600 U	1600 U	160 U
2-Chloronaphthalene	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		3400 U	97 J	3600 U	370 U	3800 U	3800 U	380 U
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	430		6900 U	750 U	7300 U	750 U	7800 U	7700 U	780 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	500		6900 U	750 U	7300 U	750 U	7800 U	7700 U	780 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		6900 U	370 U	7300 U	54 J	7800 U	7700 U	780 U
4-Nitrophenol	100		6900 U	370 U	7300 U	750 U	7800 U	7700 U	780 U
Acenaphthene	50000		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Acenaphthylene	41000		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Anthracene	50000		3400 U	370 U	3600 U	370 U	620 J	3800 U	380 U
Benzo[a]anthracene	224		1000 U	110 U	1100 U	62 J	**3900**	**1200**	110 J
Benzo[a]pyrene	61		3400 U	370 U	3600 U	61 J	**4100**	**1200 J**	**130 J**
Benzo[b]fluoranthene	1100		3400 U	370 U	3600 U	72 J	**4900**	**1700 J**	190 J
Benzo[g,h,i]perylene	50000		3400 U	370 U	3600 U	370 U	2500 J	3800 U	170 J
Benzo[k]fluoranthene	1100		3400 U	370 U	3600 U	370 U	**1600 J**	510 J	65 J
bis(2-Chloroethoxy)methane	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
bis(2-Chloroethyl)ether	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-65	MP-SB-65	MP-SB-66	MP-SB-66	MP-SB-67	MP-SB-67 DUP	MP-SB-67
		Sample Date:	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001
		Sample Depth (ft bls):	0-2	6-8	0-2	4-6	0-2	0-2	2-4
bis(2-Ethylhexyl)phthalate	--		440 J	44 J	3600 U	370 U	3800 U	3800 U	380 U
Butylbenzyl phthalate	50000		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA
Chrysene	400		3400 U	370 U	3600 U	53 J	**3700 J**	**1500 J**	150 J
Dibenzo[a,h]anthracene	14		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Dibenzofuran	6200		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Diethyl phthalate	7100		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Dimethyl phthalate	2000		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Di-n-butyl phthalate	8100		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Di-n-octyl phthalate	50000		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Di-n-propylnitrosamine	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Fluoranthene	50000		3400 U	370 U	3600 U	84 J	5200	1900 J	160 J
Fluorene	50000		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Hexachlorobenzene	410		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Hexachlorobutadiene	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Hexachlorocyclopentadiene	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Hexachloroethane	--		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Indeno[1,2,3-cd]pyrene	3200		3400 U	370 U	3600 U	370 U	2300 J	3800 U	130 J
Isophorone	4400		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
Naphthalene	13000		3400 U	42 J	3600 U	370 U	3800 U	3800 U	380 U
Nitrobenzene	200		3400 U	370 U	3600 U	370 U	3800 U	3800 U	380 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		3400 U	370 U	3600 U	370 U	1600 J	1700 J	72 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		6900 U	750 U	7300 U	750 U	7800 U	7700 U	780 U
Phenanthrene	50000		3400 U	100 J	3600 U	370 U	1900 J	1000 J	130 J
Phenol	30		1000 U	110 U	1100 U	110 U	1200 U	1100 U	120 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		3400 U	370 U	3600 U	75 J	5200	1800 J	150 J

µg/kg - Micrograms per kilogram

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(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-68 03/12/2001 0-2	MP-SB-68 03/12/2001 2-4	MP-SB-69 03/12/2001 0-2	MP-SB-69 03/12/2001 4-6	MP-SB-70 03/12/2001 0-2	MP-SB-70 03/12/2001 4-6	MP-SB-71 03/12/2001 0-2
1,2,4-Trichlorobenzene	3400		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
1,2-Dichlorobenzene	7900		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
1,3-Dichlorobenzene	1600		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
1,4-Dichlorobenzene	8500		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
1-Chloro-4-phenoxybenzene	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
2,4,5-Trichlorophenol	100		7100 U	790 U	720 U	760 U	15000 U	800 U	16000 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
2,6-Dinitrotoluene	1000		1500 U	160 U	150 U	160 U	3100 U	170 U	3300 U
2-Chloronaphthalene	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		3500 U	52 J	350 U	370 U	7300 U	400 U	7700 U
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	430		7100 U	790 U	720 U	760 U	15000 U	800 U	16000 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	500		7100 U	790 U	720 U	760 U	15000 U	800 U	16000 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		7100 U	790 U	720 U	760 U	15000 U	800 U	16000 U
4-Nitrophenol	100		7100 U	790 U	720 U	760 U	15000 U	800 U	16000 U
Acenaphthene	50000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Acenaphthylene	41000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Anthracene	50000		3500 U	390 U	350 U	370 U	7300 U	45 J	7700 U
Benzo[a]anthracene	224		1000 U	**240**	37 J	110 U	**940 J**	120 U	2300 U
Benzo[a]pyrene	61		3500 U	**280 J**	40 J	370 U	**780 J**	400 U	7700 U
Benzo[b]fluoranthene	1100		3500 U	440	60 J	370 U	1000 J	400 U	7700 U
Benzo[g,h,i]perylene	50000		3500 U	260 J	350 U	370 U	7300 U	400 U	7700 U
Benzo[k]fluoranthene	1100		3500 U	150 J	350 U	370 U	7300 U	400 U	7700 U
bis(2-Chloroethoxy)methane	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
bis(2-Chloroethyl)ether	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-68	MP-SB-68	MP-SB-69	MP-SB-69	MP-SB-70	MP-SB-70	MP-SB-71
		Sample Date:	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001
		Sample Depth (ft bls):	0-2	2-4	0-2	4-6	0-2	4-6	0-2
bis(2-Ethylhexyl)phthalate	--		3500 U	390 U	350 U	370 U	7300 U	68 J	7700 U
Butylbenzyl phthalate	50000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA
Chrysene	400		3500 U	400	59 J	370 U	**1000 J**	400 U	7700 U
Dibenzo[a,h]anthracene	14		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Dibenzofuran	6200		3500 U	41 J	350 U	370 U	7300 U	400 U	7700 U
Diethyl phthalate	7100		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Dimethyl phthalate	2000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Di-n-butyl phthalate	8100		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Di-n-octyl phthalate	50000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Di-n-propylnitrosamine	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Fluoranthene	50000		3500 U	270 J	54 J	370 U	1500 J	40 J	7700 U
Fluorene	50000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Hexachlorobenzene	410		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Hexachlorobutadiene	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Hexachlorocyclopentadiene	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Hexachloroethane	--		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Indeno[1,2,3-cd]pyrene	3200		3500 U	240 J	350 U	370 U	7300 U	400 U	7700 U
Isophorone	4400		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Naphthalene	13000		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
Nitrobenzene	200		3500 U	390 U	350 U	370 U	7300 U	400 U	7700 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		3500 U	66 J	41 J	370 U	7300 U	400 U	1200 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		7100 U	790 U	720 U	760 U	15000 U	800 U	16000 U
Phenanthrene	50000		3500 U	220 J	39 J	370 U	1400 J	44 J	810 J
Phenol	30		1000 U	120 U	110 U	110 U	2200 U	120 U	2300 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		3500 U	270 J	52 J	370 U	1500 J	45 J	7700 U

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-71 03/12/2001 4-6	MP-SB-72 03/14/2001 0-2	MP-SB-72 03/14/2001 8-10	MP-SB-73 03/14/2001 0-2	MP-SB-73 DUP 3/14/2001 0-2	MP-SB-73 03/14/2001 6-8	MP-SB-74 03/14/2001 0-2
1,2,4-Trichlorobenzene	3400		400 U	1800 U	350 U	2000 U	2000 U	370 U	400
1,2-Dichlorobenzene	7900		400 U	510 J	350 U	2000 U	2000 U	370 U	370 U
1,3-Dichlorobenzene	1600		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
1,4-Dichlorobenzene	8500		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
1-Chloro-4-phenoxybenzene	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
2,4,5-Trichlorophenol	100		820 U	3600 U	710 U	4000 U	4000 U	750 U	750 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
2,6-Dinitrotoluene	1000		170 U	760 U	150 U	830 U	830 U	160 U	160 U
2-Chloronaphthalene	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		400 U	390 J	350 U	2000 U	2000 U	370 U	80 J
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	430		820 U	3600 U	710 U	4000 U	4000 U	750 U	750 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	500		820 U	3600 U	710 U	4000 U	4000 U	750 U	750 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		820 U	3600 U	710 U	4000 U	4000 U	750 U	750 U
4-Nitrophenol	100		820 U	3600 U	710 U	4000 U	4000 U	750 U	750 U
Acenaphthene	50000		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Acenaphthylene	41000		250 J	300 J	350 U	2000 U	2000 U	370 U	370 U
Anthracene	50000		430	300 J	350 U	280 J	270 J	370 U	370 U
Benzo[a]anthracene	224		**2600**	**1100**	100 U	**1300**	**1100**	110 U	140
Benzo[a]pyrene	61		**2500**	**1300 J**	350 U	**1200 J**	1100 J	370 U	**160 J**
Benzo[b]fluoranthene	1100		**2800**	**3400**	350 U	**1700 J**	**1400 J**	370 U	340 J
Benzo[g,h,i]perylene	50000		1400	840 J	350 U	510 J	460 J	370 U	81 J
Benzo[k]fluoranthene	1100		1100	1100 J	350 U	590 J	540 J	370 U	100 J
bis(2-Chloroethoxy)methane	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
bis(2-Chloroethyl)ether	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-71 03/12/2001 4-6	MP-SB-72 03/14/2001 0-2	MP-SB-72 03/14/2001 8-10	MP-SB-73 03/14/2001 0-2	MP-SB-73 DUP 3/14/2001 0-2	MP-SB-73 03/14/2001 6-8	MP-SB-74 03/14/2001 0-2
bis(2-Ethylhexyl)phthalate	--		400 U	290 J	87 J	280 J	400 J	95 J	130 J
Butylbenzyl phthalate	50000		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA
Chrysene	400		**2400**	**1900**	350 U	**1400 J**	**1200 J**	370 U	200 J
Dibenzo[a,h]anthracene	14		**410**	**250 J**	350 U	2000 U	2000 U	370 U	370 U
Dibenzofuran	6200		400 U	360 J	350 U	2000 U	2000 U	370 U	370 U
Diethyl phthalate	7100		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Dimethyl phthalate	2000		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Di-n-butyl phthalate	8100		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Di-n-octyl phthalate	50000		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Di-n-propylnitrosamine	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Fluoranthene	50000		4400	2800	350 U	2100	2000	370 U	210 J
Fluorene	50000		42 J	1800 U	350 U	2000 U	2000 U	370 U	370 U
Hexachlorobenzene	410		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Hexachlorobutadiene	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Hexachlorocyclopentadiene	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Hexachloroethane	--		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Indeno[1,2,3-cd]pyrene	3200		1500	1000 J	350 U	550 J	460 J	370 U	93 J
Isophorone	4400		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
Naphthalene	13000		66 J	1200 J	350 U	2000 U	2000 U	370 U	52 J
Nitrobenzene	200		400 U	1800 U	350 U	2000 U	2000 U	370 U	370 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		290 J	340 J	350 U	2000 U	2000 U	370 U	63 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		820 U	3600 U	710 U	4000 U	4000 U	750 U	750 U
Phenanthrene	50000		650	1300 J	350 U	1400 J	1400 J	370 U	110 J
Phenol	30		120 U	540 U	100 U	600 U	590 U	110 U	110 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		4000	2500	350 U	2600	2300	370 U	260 J

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-74 03/14/2001 8-10	MP-SB-75 03/14/2001 0-2	MP-SB-75 03/14/2001 4-6	MP-SB-76 03/14/2001 0-2	MP-SB-76 03/14/2001 4-6	MP-SB-77 03/20/2001 0-1	MP-SB-77 03/20/2001 1-4
1,2,4-Trichlorobenzene	3400		420 U	1700 U	**630000**	1800 U	10000 U	**4800 DJ**	1900 U
1,2-Dichlorobenzene	7900		420 U	1700 U	86000 U	1800 U	10000 U	3900 DJ	1900 U
1,3-Dichlorobenzene	1600		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
1,4-Dichlorobenzene	8500		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
1-Chloro-4-phenoxybenzene	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
2,4,5-Trichlorophenol	100		860 U	3500 U	170000 U	3600 U	21000 U	27000 U	3900 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
2,6-Dinitrotoluene	1000		180 U	740 U	36000 U	760 U	4300 U	5600 U	820 U
2-Chloronaphthalene	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	430		860 U	3500 U	170000 U	3600 U	21000 U	27000 U	3900 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	500		860 U	3500 U	170000 U	3600 U	21000 U	**22000**	3900 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		860 U	3500 U	170000 U	3600 U	21000 U	140000 E	1300 J
4-Nitrophenol	100		860 U	3500 U	170000 U	3600 U	21000 U	27000 U	3900 U
Acenaphthene	50000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Acenaphthylene	41000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Anthracene	50000		420 U	1700 U	86000 U	1800 U	10000 U	1400 DJ	1900 U
Benzo[a]anthracene	224		130 U	**710**	26000 U	540 U	3100 U	**2600 DJ**	590 U
Benzo[a]pyrene	61		420 U	**660 J**	86000 U	**190 J**	10000 U	13000 U	1900 U
Benzo[b]fluoranthene	1100		420 U	1000 J	86000 U	1800 U	10000 U	13000 U	1900 U
Benzo[g,h,i]perylene	50000		420 U	410 J	86000 U	1800 U	10000 U	13000 U	1900 U
Benzo[k]fluoranthene	1100		420 U	400 J	86000 U	1800 U	10000 U	13000 U	1900 U
bis(2-Chloroethoxy)methane	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
bis(2-Chloroethyl)ether	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-74	MP-SB-75	MP-SB-75	MP-SB-76	MP-SB-76	MP-SB-77	MP-SB-77
		Sample Date:	03/14/2001	03/14/2001	03/14/2001	03/14/2001	03/14/2001	03/20/2001	03/20/2001
		Sample Depth (ft bls):	8-10	0-2	4-6	0-2	4-6	0-1	1-4
bis(2-Ethylhexyl)phthalate	--		130 J	200 J	86000 U	250 J	10000 U	3000 DJB	1900 U
Butylbenzyl phthalate	50000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA
Chrysene	400		420 U	**930 J**	86000 U	220 J	10000 U	**2300 DJ**	1900 U
Dibenzo[a,h]anthracene	14		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Dibenzofuran	6200		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Diethyl phthalate	7100		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Dimethyl phthalate	2000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Di-n-butyl phthalate	8100		420 U	1700 U	86000 U	1800 U	10000 U	2100 DJ	1900 U
Di-n-octyl phthalate	50000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Di-n-propylnitrosamine	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Fluoranthene	50000		420 U	1400 J	86000 U	1800 U	10000 U	3800	360 J
Fluorene	50000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Hexachlorobenzene	410		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Hexachlorobutadiene	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Hexachlorocyclopentadiene	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Hexachloroethane	--		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Indeno[1,2,3-cd]pyrene	3200		420 U	470 J	86000 U	1800 U	10000 U	13000 U	1900 U
Isophorone	4400		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Naphthalene	13000		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
Nitrobenzene	200		420 U	1700 U	86000 U	1800 U	10000 U	13000 U	1900 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		420 U	350 J	100000	1800 U	10000 U	21000 D	1200 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		860 U	3500 U	170000 U	3600 U	21000 U	27000 U	3900 U
Phenanthrene	50000		420 U	1000 J	86000 U	1800 U	10000 U	2900 DJ	210 J
Phenol	30		130 U	530 U	26000 U	**1400**	3100 U	4000 U	590 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		420 U	2100	86000 U	230 J	10000 U	5800 DJ	350 J

µg/kg - Micrograms per kilogram

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(ft bls) - Feet below land surface

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-77 03/20/2001 4-6	MP-SB-78 03/20/2001 0-1	MP-SB-78 03/20/2001 1-3	MP-SB-79 03/21/2001 0-1	MP-SB-79 03/21/2001 1-3	MP-SB-80 03/21/2001 0-1	MP-SB-80 03/21/2001 1-3
1,2,4-Trichlorobenzene	3400		2200 U	2000 U	2400 U	**14000 J**	2600 U	19000 U	2200 U
1,2-Dichlorobenzene	7900		2200 U	2000 U	260 J	23000 U	370 J	19000 U	240 J
1,3-Dichlorobenzene	1600		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
1,4-Dichlorobenzene	8500		2200 U	2000 U	2400 U	4800 J	2600 U	19000 U	2200 U
1-Chloro-4-phenoxybenzene	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
2,4,5-Trichlorophenol	100		4500 U	4100 U	4800 U	47000 U	5200 U	39000 U	4500 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
2,6-Dinitrotoluene	1000		930 U	870 U	1000 U	9900 U	1100 U	8200 U	930 U
2-Chloronaphthalene	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	36400		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	430		4500 U	4100 U	4800 U	47000 U	5200 U	39000 U	4500 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	500		4500 U	4100 U	4800 U	47000 U	5200 U	**18000 J**	4500 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		4500 U	5200	4800 U	180000	5200 U	40000	4500 U
4-Nitrophenol	100		4500 U	4100 U	4800 U	47000 U	5200 U	39000 U	4500 U
Acenaphthene	50000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Acenaphthylene	41000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Anthracene	50000		2200 U	2000 U	2400 U	5300 J	2600 U	3200 J	2200 U
Benzo[a]anthracene	224		670 U	220 J	720 U	**8700**	**320 J**	5900 U	670 U
Benzo[a]pyrene	61		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Benzo[b]fluoranthene	1100		2200 U	2000 U	2400 U	23000 U	310 J	19000 U	2200 U
Benzo[g,h,i]perylene	50000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Benzo[k]fluoranthene	1100		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
bis(2-Chloroethoxy)methane	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
bis(2-Chloroethyl)ether	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-77 03/20/2001 4-6	MP-SB-78 03/20/2001 0-1	MP-SB-78 03/20/2001 1-3	MP-SB-79 03/21/2001 0-1	MP-SB-79 03/21/2001 1-3	MP-SB-80 03/21/2001 0-1	MP-SB-80 03/21/2001 1-3
bis(2-Ethylhexyl)phthalate	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Butylbenzyl phthalate	50000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA
Chrysene	400		2200 U	220 J	2400 U	**9200 J**	330 J	**4300 J**	2200 U
Dibenzo[a,h]anthracene	14		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Dibenzofuran	6200		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Diethyl phthalate	7100		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Dimethyl phthalate	2000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Di-n-butyl phthalate	8100		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Di-n-octyl phthalate	50000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Di-n-propylnitrosamine	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Fluoranthene	50000		2200 U	370 J	320 J	8800 J	440 J	5700 J	280 J
Fluorene	50000		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Hexachlorobenzene	410		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Hexachlorobutadiene	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Hexachlorocyclopentadiene	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Hexachloroethane	--		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Indeno[1,2,3-cd]pyrene	3200		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Isophorone	4400		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
Naphthalene	13000		2200 U	700 J	2400 U	5600 J	280 J	2300 J	2200 U
Nitrobenzene	200		2200 U	2000 U	2400 U	23000 U	2600 U	19000 U	2200 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	--		2200 U	2000 U	1600 J	23000 U	21000	19000 U	1700 J
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1000		4500 U	4100 U	4800 U	47000 U	5200 U	39000 U	4500 U
Phenanthrene	50000		2200 U	270 J	260 J	9900 J	390 J	4300 J	2200 U
Phenol	30		670 U	620 U	**760**	7000 U	780 U	5900 U	670 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
Pyrene	50000		2200 U	360 J	280 J	7900 J	420 J	5900 J	260 J

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-81	MP-SB-81	MP-SB-82	MP-SB-82	MP-SB-83	MP-SB-83	MP-SB-101
		Sample Date:	03/21/2001	03/21/2001	03/21/2001	03/21/2001	03/21/2001	03/21/2001	10/20/1999
		Sample Depth (ft bls):	0-1	1-3	0-1	1-3	0-1	1-3	0.0-2.0
1,2,4-Trichlorobenzene	3400		2200 U	5800 U	8500 U	6400 U	1900 U	2300 U	72 U
1,2-Dichlorobenzene	7900		3300	**120000**	8500 U	**33000**	310 J	2500	72 U
1,3-Dichlorobenzene	1600		360 J	4000 U	8500 U	6400 U	1600	610	72 U
1,4-Dichlorobenzene	8500		340	**10000**	8500 U	3100 J	1900 U	550 J	72 U
1-Chloro-4-phenoxybenzene	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
2,4,5-Trichlorophenol	100		4400 U	8100 U	17000 U	4300 U	3900 U	4600 U	180 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	180 U
2,4-Dichlorophenol	400		NA	NA	NA	NA	NA	NA	180 U
2,4-Dimethylphenol	--		NA	NA	NA	NA	NA	NA	180 U
2,4-Dinitrophenol	200		NA	NA	NA	NA	NA	NA	720 U
2,4-Dinitrotoluene	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
2,6-Dinitrotoluene	1000		930 U	1700 U	3600 U	900 U	810 U	960 U	72 U
2-Chloronaphthalene	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
2-Chlorophenol	800		NA	NA	NA	NA	NA	NA	180 U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	720 U
2-Methylnaphthalene	36400		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	69.3 J
2-Methylphenol	100		NA	NA	NA	NA	NA	NA	180 U
2-Nitroaniline	430		4400 U	8100 U	17000 U	4300 U	3900 U	4600 U	180 U
2-Nitrophenol	330		NA	NA	NA	NA	NA	NA	180 U
3&4-Methylphenol	900		NA	NA	NA	NA	NA	NA	180 U
3,3'-Dichlorobenzidine	--		NA	NA	NA	NA	NA	NA	180 U
3-Nitroaniline	500		4400 U	8100 U	**1400 J**	4300 U	**6000**	4600 U	180 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
4-Chloro-3-methyl phenol	240		NA	NA	NA	NA	NA	NA	180 U
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		34000	1500 J	51000	13000	17000	2300 J	NA
4-Nitrophenol	100		4400 U	8100 U	17000 U	4300 U	3900 U	4600 U	720 U
Acenaphthene	50000		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Acenaphthylene	41000		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Anthracene	50000		2200 U	1400 J	8500 U	2100 U	1900 U	2300 U	72 U
Benzo[a]anthracene	224		660 U	**2200**	2600 U	640 U	220 J	690 U	57.5 J
Benzo[a]pyrene	61		2200 U	**1500 J**	8500 U	2100 U	1900 U	2300 U	46.9 J
Benzo[b]fluoranthene	1100		2200 U	**2000 J**	8500 U	2100 U	1900 U	2300 U	42.6 J
Benzo[g,h,i]perylene	50000		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	28.7J
Benzo[k]fluoranthene	1100		2200 U	750 J	8500 U	2100 U	1900 U	2300 U	42.6 J
bis(2-Chloroethoxy)methane	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
bis(2-Chloroethyl)ether	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	72 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-81	MP-SB-81	MP-SB-82	MP-SB-82	MP-SB-83	MP-SB-83	MP-SB-101
		Sample Date:	03/21/2001	03/21/2001	03/21/2001	03/21/2001	03/21/2001	03/21/2001	10/20/1999
		Sample Depth (ft bls):	0-1	1-3	0-1	1-3	0-1	1-3	0.0-2.0
bis(2-Ethylhexyl)phthalate	--		5400 B	700 JB	26000 B	5000 B	2800 B	630 JB	72 U
Butylbenzyl phthalate	50000		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Carbazole	--		NA	NA	NA	NA	NA	NA	72 U
Chrysene	400		2200 U	**1800 J**	8500 U	2100 U	230 J	2300 U	67.8 J
Dibenzo[a,h]anthracene	14		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	180 U
Dibenzofuran	6200		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Diethyl phthalate	7100		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Dimethyl phthalate	2000		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Di-n-butyl phthalate	8100		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Di-n-octyl phthalate	50000		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Di-n-propylnitrosamine	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	NA
Fluoranthene	50000		2200 U	5200	1100 J	300 J	250 J	290 J	80.3
Fluorene	50000		2200 U	630 J	8500 U	2100 U	1900 U	2300 U	72 U
Hexachlorobenzene	410		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Hexachlorobutadiene	--		2200 U	5800 U	8500 U	6400 U	1900 U	2300 U	180 U
Hexachlorocyclopentadiene	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	720 U
Hexachloroethane	--		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	180 U
Indeno[1,2,3-cd]pyrene	3200		2200 U	880 J	8500 U	2100 U	1900 U	2300 U	27.6 J
Isophorone	4400		2200 U	4000 U	8500 U	2100 U	1900 U	2300 U	72 U
Naphthalene	13000		2200 U	5800 U	8500 U	6400 U	1900 U	2300 U	59.6 J
Nitrobenzene	200		2200 U	4000 U	8500 U	2100 U	**290 J**	2300 U	72 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	180 U
N-Nitrosodiphenylamine	--		2200 U	4000 U	8500 U	2100 U	1900 U	6300	630
P-Chloroaniline	220		NA	NA	NA	NA	NA	NA	180 U
Pentachlorophenol	1000		4400 U	8100 U	17000 U	4300 U	3900 U	4600 U	720 U
Phenanthrene	50000		2200 U	2900 J	8500 U	2100 U	1900 U	300 J	75.1
Phenol	30		660 U	1200 U	2600 U	640 U	580 U	690 U	180 U
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	180 U
Pyrene	50000		390 J	3700 J	**120000**	17000	1000 J	340 J	102

µg/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Not detected, detection limit is shown

J - Indicates an estimated value

B - Detected in blank

-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-102 10/19/1999 0.0-2.0	MP-SB-103 10/20/1999 0.0-2.0	MP-SB-104 10/18/1999 0.0-4.0	MP-SB-104 FD 10/18/1999 0.0-4.0	MP-SB-105 10/18/1999 0.0-2.0	MP-SB-106 10/15/1999 0.0-2.0	MP-SB-107 10/13/1999 2.0-4.0
1,2,4-Trichlorobenzene	3400		69 U	111	**18100**	**10600**	72 U	222	78 U
1,2-Dichlorobenzene	7900		69 U	315	**43600**	**30400**	72 U	**3790**	78 U
1,3-Dichlorobenzene	1600		69 U	22.4 J	5900	4290	72 U	95	78 U
1,4-Dichlorobenzene	8500		69 U	44.3 J	7300	4950	72 U	975	78 U
1-Chloro-4-phenoxybenzene	--		69 U	79 U	79 U	80 U	72 U	79 U	78 U
2,4,5-Trichlorophenol	100		170 U	200 U	200 U	200 U	180 U	200 U	200 U
2,4,6-Trichlorophenol	--		170 U	200 U	200 U	200 U	180 U	200 U	200 U
2,4-Dichlorophenol	400		170 U	200 U	200 U	42.6 J	180 U	200 U	200 U
2,4-Dimethylphenol	--		170 U	200 U	200 U	200 U	180 U	598	200 U
2,4-Dinitrophenol	200		690 U	790 U	790 U	800 U	720 U	790 U	780 U
2,4-Dinitrotoluene	--		69 U	79 U	12100	7670	72 U	79 U	78 U
2,6-Dinitrotoluene	1000		69 U	79 U	**4640**	**2890**	72 U	79 U	78 U
2-Chloronaphthalene	--		69 U	79 U	79 U	80 U	72 U	112	78 U
2-Chlorophenol	800		170 U	200 U	200 U	200 U	180 U	**2300**	200 U
2-Methyl-4,6-Dinitrophenol	--		690 U	790 U	790 U	800 U	720 U	790 U	780 U
2-Methylnaphthalene	36400		20.5 J	171	54.6 J	33.5 J	59 J	208	78 U
2-Methylphenol	100		170 U	200 U	200 U	200 U	180 U	**1070**	200 U
2-Nitroaniline	430		170 U	200 U	380	309	180 U	200 U	200 U
2-Nitrophenol	330		170 U	200 U	200 U	200 U	180 U	200 U	200 U
3&4-Methylphenol	900		170 U	200 U	200 U	200 U	180 U	498	200 U
3,3'-Dichlorobenzidine	--		170 U	200 U	200 U	200 U	180 U	200 U	200 U
3-Nitroaniline	500		170 U	200 U	200 U	244	180 U	200 U	200 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		69 U	79 U	79 U	80 U	72 U	79 U	78 U
4-Chloro-3-methyl phenol	240		170 U	200 U	200 U	200 U	180 U	200 U	200 U
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	100		690 U	790 U	790 U	800 U	720 U	790 U	780 U
Acenaphthene	50000		69 U	79 U	79 U	80 U	72 U	79 U	78 U
Acenaphthylene	41000		69 U	29 J	671	549	72 U	95.4	78 U
Anthracene	50000		69 U	33.3 J	143	115	61.5 J	98.7	78 U
Benzo[a]anthracene	224		19.8 J	142	**1130**	**751**	21.9 J	**834**	78 U
Benzo[a]pyrene	61		69 U	**140**	**2040**	**1640**	72 U	**454**	27.8 J
Benzo[b]fluoranthene	1100		14.6	193	**2440**	**1880**	72 U	949	20.5 J
Benzo[g,h,i]perylene	50000		170U	101 J	**1390**	**1140**	180U	240	200U
Benzo[k]fluoranthene	1100		16.1 J	108	**1130**	891	72 U	**1390**	21.8 J
bis(2-Chloroethoxy)methane	--		69 U	79 U	79 U	80 U	72 U	79 U	78 U
bis(2-Chloroethyl)ether	--		69 U	79 U	79 U	80 U	72 U	79 U	78 U
bis(2-Chloroisopropyl)ether	--		69 U	79 U	79 U	80 U	72 U	79 U	78 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-102 10/19/1999 0.0-2.0	MP-SB-103 10/20/1999 0.0-2.0	MP-SB-104 10/18/1999 0.0-4.0	MP-SB-104 FD 10/18/1999 0.0-4.0	MP-SB-105 10/18/1999 0.0-2.0	MP-SB-106 10/15/1999 0.0-2.0	MP-SB-107 10/13/1999 2.0-4.0
bis(2-Ethylhexyl)phthalate	--		69 U	79 U	79 U	80 U	72 U	3920	584
Butylbenzyl phthalate	50000		69 U	79 U	79 U	80 U	72 U	79 U	78 U
Carbazole	--		69 U	79 U	48.9 J	42.6 J	30.8 J	79 U	78 U
Chrysene	400		22 J	259	1280	885	40.2 J	1080	78 U
Dibenzo[a,h]anthracene	14		170 U	**47.2 J**	**494**	**423**	180 U	**132 J**	200 U
Dibenzofuran	6200		69 U	48.3 J	79 U	80 U	20 J	152	78 U
Diethyl phthalate	7100		69 U	79 U	36.8 J	27.6 J	72 U	79 U	78 U
Dimethyl phthalate	2000		69 U	79 U	558	277	72 U	79 U	78 U
Di-n-butyl phthalate	8100		69 U	79 U	79 U	80 U	72 U	69.8 J	78 U
Di-n-octyl phthalate	50000		78.4	157	79 U	80 U	72 U	79 U	78 U
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		29.8 J	222	855	492	30 J	79 U	37.1 J
Fluorene	50000		69 U	79 U	79 U	80 U	72 U	79 U	78 U
Hexachlorobenzene	410		69 U	79 U	79 U	80 U	72 U	79 U	78 U
Hexachlorobutadiene	--		170 U	200 U	200 U	200 U	180 U	200 U	200 U
Hexachlorocyclopentadiene	--		690 U	790 U	790 U	800 U	720 U	790 U	780 U
Hexachloroethane	--		170 U	200 U	200 U	200 U	180 U	200 U	200 U
Indeno[1,2,3-cd]pyrene	3200		170 U	87 J	1490	1190	180 U	253	200 U
Isophorone	4400		69 U	79 U	79 U	80 U	72 U	79 U	78 U
Naphthalene	13000		69 U	130	28.7 J	80 U	39 J	2720	78 U
Nitrobenzene	200		69 U	79 U	**503**	**275**	72 U	79 U	78 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		170 U	200 U	200 U	200 U	180 U	200 U	200 U
N-Nitrosodiphenylamine	--		170 U	200 U	200 U	200 U	180 U	200 U	200 U
P-Chloroaniline	220		170 U	200 U	200 U	200 U	180 U	**332**	200 U
Pentachlorophenol	1000		690 U	790 U	790 U	800 U	720 U	790 U	780 U
Phenanthrene	50000		22.3 J	179	123	81	62.1 J	1150	78 U
Phenol	30		170 U	200 U	**1600**	**911**	180 U	**472**	200 U
P-Nitroaniline	--		170 U	200 U	68.6 J	65 J	180 U	200 U	200 U
Pyrene	50000		29.8 J	231	646	370	37.7 J	750	35 J

µg/kg - Micrograms per kilogram

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-- - No NYSDEC RSCOs Standard or Guidance value available

(ft bls) - Feet below land surface

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Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-107A 10/15/1999 4.0-6.0	MP-SB-108 10/13/1999 0.0-2.0	MP-SB-109 10/12/1999 4.0-6.0	MP-SB-110 10/15/1999 2.0-4.0	MP-SB-111 10/13/1999 4.0-6.0	MP-SB-112 10/18/1999 2.0-4.0	MP-SB-113A 10/19/1999 0.0-2.0
1,2,4-Trichlorobenzene	3400		74 U	380 U	350 U	1800	23000 U	74 U	75 U
1,2-Dichlorobenzene	7900		74 U	380 U	350 U	352	23000 U	74 U	22 J
1,3-Dichlorobenzene	1600		74 U	380 U	350 U	25.3 J	23000 U	74 U	75 U
1,4-Dichlorobenzene	8500		74 U	380 U	350 U	93.5	23000 U	74 U	75 U
1-Chloro-4-phenoxybenzene	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
2,4,5-Trichlorophenol	100		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
2,4,6-Trichlorophenol	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
2,4-Dichlorophenol	400		180 U	940 U	870 U	180 U	**59300**	190 U	190 U
2,4-Dimethylphenol	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
2,4-Dinitrophenol	200		740 U	3800 U	3500 U	740 U	230000 U	740 U	750 U
2,4-Dinitrotoluene	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
2,6-Dinitrotoluene	1000		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
2-Chloronaphthalene	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
2-Chlorophenol	800		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
2-Methyl-4,6-Dinitrophenol	--		740 U	3800 U	3500 U	740 U	230000 U	740 U	750 U
2-Methylnaphthalene	36400		116	380 U	350 U	74 U	23000 U	43.9 J	75 U
2-Methylphenol	100		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
2-Nitroaniline	430		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
2-Nitrophenol	330		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
3&4-Methylphenol	900		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
3,3'-Dichlorobenzidine	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
3-Nitroaniline	500		180 U	940 U	870 U	274	58000 U	190 U	190 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
4-Chloro-3-methyl phenol	240		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
4-Chloroaniline	220		NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	--		NA	NA	NA	NA	NA	NA	190 U
4-Nitrophenol	100		740 U	3800 U	3500 U	740 U	230000 U	740 U	750 U
Acenaphthene	50000		246	380 U	350 U	74 U	23000 U	74 U	75 U
Acenaphthylene	41000		74 U	380 U	350 U	63.7 J	23000 U	74 U	45.3 J
Anthracene	50000		474	380 U	350 U	287	23000 U	27.2 J	134
Benzo[a]anthracene	224		**645**	380 U	350 U	**735**	23000 U	91.7	**621**
Benzo[a]pyrene	61		**637**	380 U	350 U	**684**	23000 U	**87.5**	**585**
Benzo[b]fluoranthene	1100		557	380 U	350 U	580	23000 U	74.6	580
Benzo[g,h,i]perylene	50000		310	940U	870U	325	58000U	57.9J	297
Benzo[k]fluoranthene	1100		426	380 U	350 U	418	23000 U	71.8 J	336
bis(2-Chloroethoxy)methane	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
bis(2-Chloroethyl)ether	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
bis(2-Chloroisopropyl)ether	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** / **Sample Date:** / **Sample Depth (ft bls):**	MP-SB-107A 10/15/1999 4.0-6.0	MP-SB-108 10/13/1999 0.0-2.0	MP-SB-109 10/12/1999 4.0-6.0	MP-SB-110 10/15/1999 2.0-4.0	MP-SB-111 10/13/1999 4.0-6.0	MP-SB-112 10/18/1999 2.0-4.0	MP-SB-113A 10/19/1999 0.0-2.0
bis(2-Ethylhexyl)phthalate	--		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
Butylbenzyl phthalate	50000		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
Carbazole	--		214	380	350 U	74 U	23000 U	74 U	25.2 J
Chrysene	400		605	380 U	350 U	698	23000 U	93.5	**596**
Dibenzo[a,h]anthracene	14		**111 J**	940 U	870 U	**106 J**	58000 U	190 U	**122 J**
Dibenzofuran	6200		163	380 U	350 U	74 U	23000 U	74 U	75 U
Diethyl phthalate	7100		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
Dimethyl phthalate	2000		74 U	380 U	350 U	382	23000 U	74 U	75 U
Di-n-butyl phthalate	8100		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
Di-n-octyl phthalate	50000		66.9 J	380 U	350 U	38.2 J	23000 U	239	60 J
Di-n-propylnitrosamine	--		NA	NA	NA	NA	NA	NA	NA
Fluoranthene	50000		1450	380 U	350 U	1220	23000 U	156	1080
Fluorene	50000		262	380 U	350 U	74 U	23000 U	74 U	75 U
Hexachlorobenzene	410		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
Hexachlorobutadiene	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
Hexachlorocyclopentadiene	--		740 U	3800 U	3500 U	740 U	230000 U	740 U	750 U
Hexachloroethane	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
Indeno[1,2,3-cd]pyrene	3200		363	940 U	870 U	333	58000 U	52.8 J	306
Isophorone	4400		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
Naphthalene	13000		401	380 U	350 U	45.5 J	7190 J	28.2 J	75 U
Nitrobenzene	200		74 U	380 U	350 U	74 U	23000 U	74 U	75 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
N-Nitrosodiphenylamine	--		156 J	940 U	870 U	64.7 J	105000	190 U	319
P-Chloroaniline	220		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
Pentachlorophenol	1000		740 U	3800 U	3500 U	740 U	230000 U	740 U	750 U
Phenanthrene	50000		1530	380 U	350 U	414	23000 U	96	457
Phenol	30		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
P-Nitroaniline	--		180 U	940 U	870 U	180 U	58000 U	190 U	190 U
Pyrene	50000		1220	131 J	350 U	1210	23000 U	153	1090

µg/kg - Micrograms per kilogram

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(ft bls) - Feet below land surface

Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:**	MP-SB-114	MP-SOIL-FB
		Sample Date:	10/12/1999	05/12/2000
		Sample Depth (ft bls):	0.0-2.0	-
1,2,4-Trichlorobenzene	3400		74 U	2.1 U
1,2-Dichlorobenzene	7900		84.2	2.1 U
1,3-Dichlorobenzene	1600		74 U	2.1 U
1,4-Dichlorobenzene	8500		74 U	2.1 U
1-Chloro-4-phenoxybenzene	--		74 U	2.1 U
2,4,5-Trichlorophenol	100		180 U	5.3 U
2,4,6-Trichlorophenol	--		180 U	5.3 U
2,4-Dichlorophenol	400		180 U	5.3 U
2,4-Dimethylphenol	--		180 U	5.3 U
2,4-Dinitrophenol	200		740 U	21 U
2,4-Dinitrotoluene	--		74 U	2.1 U
2,6-Dinitrotoluene	1000		74 U	2.1 U
2-Chloronaphthalene	--		74 U	5.3 U
2-Chlorophenol	800		180 U	5.3 U
2-Methyl-4,6-Dinitrophenol	--		740 U	NA
2-Methylnaphthalene	36400		74 U	2.1 U
2-Methylphenol	100		180 U	5.3 U
2-Nitroaniline	430		180 U	5.3 U
2-Nitrophenol	330		180 U	5.3 U
3&4-Methylphenol	900		180 U	5.3 U
3,3'-Dichlorobenzidine	--		180 U	5.3 U
3-Nitroaniline	500		180 U	5.3 U
4,6-Dinitro-o-cresol	--		NA	21 U
4-Bromodiphenyl ether	--		74 U	2.1 U
4-Chloro-3-methyl phenol	240		180 U	5.3 U
4-Chloroaniline	220		NA	5.3 U
4-Nitroaniline	--		180 U	5.3 U
4-Nitrophenol	100		740 U	21 U
Acenaphthene	50000		74 U	2.1 U
Acenaphthylene	41000		74 U	NA
Anthracene	50000		43.9 J	2.1 U
Benzo[a]anthracene	224		179	2.1 U
Benzo[a]pyrene	61		**144**	2.1 U
Benzo[b]fluoranthene	1100		136	2.1 U
Benzo[g,h,i]perylene	50000		68.4J	2.1 U
Benzo[k]fluoranthene	1100		122	2.1 U
bis(2-Chloroethoxy)methane	--		74 U	2.1 U
bis(2-Chloroethyl)ether	--		74 U	2.1 U
bis(2-Chloroisopropyl)ether	--		74 U	2.1 U

Table 3. Summary of Semivolatile Organic Compounds Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/kg)	NYSDEC Soil Cleanup Objectives (RSCOs)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-114 10/12/1999 0.0-2.0	MP-SOIL-FB 05/12/2000 -
bis(2-Ethylhexyl)phthalate	--		58.3 J	2.1 U
Butylbenzyl phthalate	50000		74 U	2.1 U
Carbazole	--		74 U	2.1 U
Chrysene	400		168	2.1 U
Dibenzo[a,h]anthracene	14		180 U	2.1 U
Dibenzofuran	6200		74 U	5.3 U
Diethyl phthalate	7100		74 U	2.1 U
Dimethyl phthalate	2000		74 U	2.1 U
Di-n-butyl phthalate	8100		74 U	2.1 U
Di-n-octyl phthalate	50000		74 U	2.1 U
Di-n-propylnitrosamine	--		NA	NA
Fluoranthene	50000		263	2.1 U
Fluorene	50000		74 U	2.1 U
Hexachlorobenzene	410		74 U	2.1 U
Hexachlorobutadiene	--		180 U	2.1 U
Hexachlorocyclopentadiene	--		740 U	21 U
Hexachloroethane	--		180 U	5.3 U
Indeno[1,2,3-cd]pyrene	3200		76.8 J	2.1 U
Isophorone	4400		74 U	2.1 U
Naphthalene	13000		74 U	2.1 U
Nitrobenzene	200		74 U	2.1 U
N-Nitroso-di-n-propylamine	--		NA	2.1 U
N-Nitrosodimethylamine	--		180 U	NA
N-Nitrosodiphenylamine	--		180 U	5.3 U
P-Chloroaniline	220		180 U	NA
Pentachlorophenol	1000		740 U	21 U
Phenanthrene	50000		169	2.1 U
Phenol	30		180 U	5.3 U
P-Nitroaniline	--		180 U	NA
Pyrene	50000		228	2.1 U

µg/kg - Micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
U - Not detected, detection limit is shown
J - Indicates an estimated value
B - Detected in blank
-- - No NYSDEC RSCOs Standard or Guidance value available
(ft bls) - Feet below land surface
Bold - Data highlighted in bold represents detections that exceed NYSDEC RSCOs

Table 4. Summary of Pesticides Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs) (ug/Kg)	**Sample Designation:**	MP-SB-101	MP-SB-102	MP-SB-103	MP-SB-104	MP-SB-104 FD	MP-SB-105	MP-SB-106
		Sample Date:	10/20/1999	10/19/1999	10/20/1999	10/18/1999	10/18/1999	10/18/1999	10/15/1999
		Sample Depth (ft bls):	0.0-2.0	0.0-2.0	0.0-2.0	0.0-4.0	0.0-4.0	0.0-2.0	0.0-2.0
4,4'-DDT	2100		1.4 U	0.72 U	3.5	0.79 U	0.78 U	0.75 U	7.6 U
4-4'-DDD	2900		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
4-4'-DDE	2100		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Aldrin	41		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Alpha Chlordane	--		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Alpha-BHC	110		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Beta-BHC	200		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Delta-BHC	300		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Dieldrin	44		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Endosulfan I	900		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Endosulfan II	900		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Endosulfan Sulfate	1000		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Endrin	100		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Endrin Aldehyde	--		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Endrin Ketone	--		3.4 U	1.8 U	2 U	2 U	2 U	1.9 U	19 U
Gamma Chlordane	540		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Gamma-BHC (Lindane)	60		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Heptachlor	100		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Heptachlor Epoxide	2.2		1.4 U	0.72 U	0.8 U	0.79 U	0.78 U	0.75 U	7.6 U
Methoxychlor	--		3.4 U	1.8 U	2 U	2 U	2 U	1.9 U	19 U
Toxaphene	--		140 U	72 U	80 U	79 U	78 U	75 U	760 U

Notes:

ug/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC RSCOs

ft bls - Feet below land surface

Table 4. Summary of Pesticides Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs) (ug/Kg)	**Sample Designation:**	MP-SB-107	MP-SB-107A	MP-SB-108	MP-SB-109	MP-SB-110	MP-SB-111	MP-SB-112
		Sample Date:	10/13/1999	10/15/1999	10/13/1999	10/12/1999	10/15/1999	10/13/1999	10/18/1999
		Sample Depth (ft bls):	2.0-4.0	4.0-6.0	0.0-2.0	4.0-6.0	2.0-4.0	4.0-6.0	2.0-4.0
4,4'-DDT	2100		0.74 U	0.72 U	3.7 U	1.4 U	94.3	42 U	0.74 U
4-4'-DDD	2900		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
4-4'-DDE	2100		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Aldrin	41		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Alpha Chlordane	--		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Alpha-BHC	110		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Beta-BHC	200		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Delta-BHC	300		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Dieldrin	44		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Endosulfan I	900		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Endosulfan II	900		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Endosulfan Sulfate	1000		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Endrin	100		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Endrin Aldehyde	--		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Endrin Ketone	--		1.8 U	1.8 U	9.4 U	3.6 U	18 U	100 U	1.8 U
Gamma Chlordane	540		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Gamma-BHC (Lindane)	60		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Heptachlor	100		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Heptachlor Epoxide	2.2		0.74 U	0.72 U	3.7 U	1.4 U	7.2 U	42 U	0.74 U
Methoxychlor	--		1.8 U	1.8 U	9.4 U	3.6 U	18 U	100 U	1.8 U
Toxaphene	--		74 U	72 U	370 U	140 U	720 U	4200 U	74 U

Notes:

ug/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC RSCOs

ft bls - Feet below land surface

Table 4. Summary of Pesticides Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs) (ug/Kg)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-113A 10/19/1999 0.0-2.0	MP-SB-114 10/12/1999 0.0-2.0
4,4'-DDT	2100		1.5 U	0.75 U
4-4'-DDD	2900		1.5 U	0.75 U
4-4'-DDE	2100		1.5 U	0.75 U
Aldrin	41		1.5 U	0.75 U
Alpha Chlordane	--		1.5 U	0.75 U
Alpha-BHC	110		1.5 U	0.75 U
Beta-BHC	200		1.5 U	0.75 U
Delta-BHC	300		1.5 U	0.75 U
Dieldrin	44		1.5 U	0.75 U
Endosulfan I	900		1.5 U	0.75 U
Endosulfan II	900		1.5 U	0.75 U
Endosulfan Sulfate	1000		1.5 U	0.75 U
Endrin	100		1.5 U	0.75 U
Endrin Aldehyde	--		1.5 U	0.75 U
Endrin Ketone	--		3.6 U	1.9 U
Gamma Chlordane	540		1.5 U	0.75 U
Gamma-BHC (Lindane)	60		1.5 U	0.75 U
Heptachlor	100		1.5 U	0.75 U
Heptachlor Epoxide	2.2		1.5 U	0.75 U
Methoxychlor	--		3.6 U	1.9 U
Toxaphene	--		150 U	75 U

Notes:

ug/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC RSCOs

ft bls - Feet below land surface

Table 5. Summary of Polychlorinated Biphenyls Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Parameter (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs) (ug/Kg)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-101 10/20/1999 0-2	MP-SB-102 10/19/1999 0-2	MP-SB-103 10/20/1999 0-2	MP-SB-104 10/18/1999 0-4	MP-SB-104 FD 10/18/1999 0-4	MP-SB-105 10/18/1999 0-2
Aroclor-1016	10000		17 U	18 U	20 U	20 U	20 U	19 U
Aroclor-1221	10000		17 U	18 U	20 U	20 U	20 U	19 U
Aroclor-1232	10000		17 U	18 U	20 U	20 U	20 U	19 U
Aroclor-1242	10000		17 U	18 U	20 U	20 U	20 U	19 U
Aroclor-1248	10000		17 U	18 U	20 U	20 U	20 U	19 U
Aroclor-1254	10000		17 U	18 U	20 U	20 U	20 U	19 U
Aroclor-1260	10000		17 U	18 U	20 U	20 U	20 U	19 U

Notes:

ug/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Indicates compound was analyzed for but not detected

ft bls - Feet below land surface

Table 5. Summary of Polychlorinated Biphenyls Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Parameter (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs) (ug/Kg)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-101 10/20/1999 0-2	MP-SB-106 10/15/1999 0-2	MP-SB-107 10/13/1999 2-4	MP-SB-107A 10/15/1999 4-6	MP-SB-108 10/13/1999 0-2	MP-SB-109 10/12/1999 4-6
Aroclor-1016	10000		17 U	19 U	18 U	18 U	19 U	18 U
Aroclor-1221	10000		17 U	19 U	18 U	18 U	19 U	18 U
Aroclor-1232	10000		17 U	19 U	18 U	18 U	19 U	18 U
Aroclor-1242	10000		17 U	19 U	18 U	18 U	19 U	18 U
Aroclor-1248	10000		17 U	19 U	18 U	18 U	19 U	18 U
Aroclor-1254	10000		17 U	19 U	3190	203	180	18 U
Aroclor-1260	10000		17 U	19 U	18 U	18 U	19 U	18 U

Notes:

ug/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Indicates compound was analyzed for but not detected

ft bls - Feet below land surface

Table 5. Summary of Polychlorinated Biphenyls Detected in Soil during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Parameter (Concentrations in µg/kg)	NYSDEC Recommended Soil Cleanup Objectives (RSCOs) (ug/Kg)	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	MP-SB-101 10/20/1999 0-2	MP-SB-110 10/15/1999 2-4	MP-SB-111 10/13/1999 4-6	MP-SB-112 10/18/1999 2-4	MP-SB-113A 10/19/1999 0-2	MP-SB-114 10/12/1999 0-2
Aroclor-1016	10000		17 U	18 U	1000 U	18 U	18 U	19 U
Aroclor-1221	10000		17 U	18 U	1000 U	18 U	18 U	19 U
Aroclor-1232	10000		17 U	18 U	1000 U	18 U	18 U	19 U
Aroclor-1242	10000		17 U	18 U	1000 U	18 U	18 U	19 U
Aroclor-1248	10000		17 U	18 U	1000 U	18 U	18 U	19 U
Aroclor-1254	10000		17 U	18 U	1000 U	18 U	18 U	140
Aroclor-1260	10000		17 U	18 U	1000 U	18 U	18 U	19 U

Notes:

ug/kg - Micrograms per kilogram

NYSDEC - New York State Department of Environmental Conservation

U - Indicates compound was analyzed for but not detected

ft bls - Feet below land surface

Table 6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
BASF Corporation, Rensselaer, New York

Field ID	Sample Interval (ft bls)	Sample ID	Date Collected	Analyte	Result (mg/kg)
LG-SB-100	0 - 2	B3-50-02	2/27/2001	Arsenic	**10.7**
LG-SB-100 DUP	0 - 2	B3-50-10	2/27/2001	Arsenic	**11.7**
LG-SB-100	2 - 4	B3-50-03	2/27/2001	Arsenic	**14.8**
LG-SB-100	4 - 6	B3-50-04	2/27/2001	Arsenic	**21.4**
LG-SB-100	6 - 8	B3-50-05	2/27/2001	Arsenic	**22.0**
LG-SB-100	8 - 10	B3-50-06	2/27/2001	Arsenic	**18.2**
LG-SB-100	10 - 12	B3-50-07	2/27/2001	Arsenic	**12.1**
LG-SB-101	0 - 2	B3-48-22	2/27/2001	Arsenic	**43.0**
LG-SB-101	2 - 4	B3-48-23	2/27/2001	Arsenic	**29.4**
LG-SB-101	4 - 6	B3-48-24	2/27/2001	Arsenic	5.9
LG-SB-101	6 - 8	B3-48-25	2/27/2001	Arsenic	2.5
LG-SB-101	8 - 10	B3-49-02	2/27/2001	Arsenic	5.1
LG-SB-101	10 - 12	B3-49-03	2/27/2001	Arsenic	2.5
LG-SB-102	0 - 2	B3-45-22	2/26/2001	Arsenic	**29.6**
LG-SB-102	2 - 4	B3-45-23	2/26/2001	Arsenic	**138**
LG-SB-102	4 - 6	B3-45-24	2/26/2001	Arsenic	**236**
LG-SB-102	6 - 8	B3-45-25	2/26/2001	Arsenic	**154**
LG-SB-102	8 - 10	B3-46-02	2/26/2001	Arsenic	**80.1**
LG-SB-102	10 - 12	B3-46-03	2/26/2001	Arsenic	**44.0**
LG-SB-103	0 - 2	B3-44-16	2/26/2001	Arsenic	**91.8**
LG-SB-103	2 - 4	B3-44-17	2/26/2001	Arsenic	**45.2**
LG-SB-103	4 - 6	B3-44-18	2/26/2001	Arsenic	**79.2**
LG-SB-103	6 - 8	B3-44-19	2/26/2001	Arsenic	5.2
LG-SB-103	8 - 10	B3-44-20	2/26/2001	Arsenic	3.0
LG-SB-103	10 - 12	B3-44-21	2/26/2001	Arsenic	**97.9**
LG-SB-104	0 - 2	B3-43-02	2/26/2001	Arsenic	**14.6**
LG-SB-104	2 - 4	B3-43-03	2/26/2001	Arsenic	**21.3**
LG-SB-104	4 - 6	B3-43-04	2/26/2001	Arsenic	**165**
LG-SB-104	6 - 8	B3-43-05	2/26/2001	Arsenic	**47.8**
LG-SB-104	8 - 10	B3-43-06	2/26/2001	Arsenic	**21.6**
LG-SB-104	10 - 12	B3-43-07	2/26/2001	Arsenic	**79.2**
LG-SB-105	0 - 2	B3-41-12	2/26/2001	Arsenic	**35.1**
LG-SB-105	2 - 4	B3-41-13	2/26/2001	Arsenic	**33.8**
LG-SB-105	4 - 6	B3-41-14	2/26/2001	Arsenic	**32.7**
LG-SB-105	6 - 8	B3-41-15	2/26/2001	Arsenic	**37.2**
LG-SB-105	6 - 8	B3-41-18	2/26/2001	Arsenic	**48.6**
LG-SB-106	0 - 2	B3-40-03	2/26/2001	Arsenic	**9.3**
LG-SB-106	2 - 4	B3-40-04	2/26/2001	Arsenic	4.0
LG-SB-106	4 - 6	B3-40-05	2/26/2001	Arsenic	**97.4**
LG-SB-106	6 - 8	B3-40-06	2/26/2001	Arsenic	**79.7**
LG-SB-106	8 - 10	B3-40-07	2/26/2001	Arsenic	**28.0**
LG-SB-106	10 - 12	B3-40-08	2/26/2001	Arsenic	**53.3**

Table 6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
BASF Corporation, Rensselaer, New York

Field ID	Sample Interval (ft bls)	Sample ID	Date Collected	Analyte	Result (mg/kg)
LG-SB-107	0 - 2	B3-38-15	2/26/2001	Arsenic	**57.7**
LG-SB-107	2 - 4	B3-38-16	2/26/2001	Arsenic	**55.2**
LG-SB-107	4 - 6	B3-38-17	2/26/2001	Arsenic	**168**
LG-SB-107	6 - 8	B3-38-18	2/26/2001	Arsenic	**25.1**
LG-SB-107	8 - 10	B3-38-19	2/26/2001	Arsenic	**42.7**
LG-SB-107	10 - 12	B3-38-20	2/26/2001	Arsenic	**17.5**
LG-SB-108	0 - 2	B3-05-11	2/28/2001	Arsenic	**15.7**
LG-SB-108	2 - 4	B3-05-12	2/28/2001	Arsenic	**576**
LG-SB-108	4 - 6	B3-05-13	2/28/2001	Arsenic	**441**
LG-SB-108 DUP	4 - 6	B3-06-02	2/28/2001	Arsenic	**524**
LG-SB-108	6 - 8	B3-05-14	2/28/2001	Arsenic	**45.0**
LG-SB-108	8 - 10	B3-05-15	3/1/2001	Arsenic	**36.5**
LG-SB-108	10 - 12	B3-05-16	3/1/2001	Arsenic	**31.1**
LG-SB-109	0 - 2	B3-03-21	2/28/2001	Arsenic	**150**
LG-SB-109	2 - 4	B3-03-22	2/28/2001	Arsenic	**482**
LG-SB-109	4 - 6	B3-03-23	2/28/2001	Arsenic	**18.4**
LG-SB-109	6 - 8	B3-03-24	2/28/2001	Arsenic	2.1
LG-SB-109	8 - 10	B3-03-25	2/28/2001	Arsenic	4.1
LG-SB-109	10 - 12	B3-04-02	2/28/2001	Arsenic	2.5
LG-SB-109	12 - 14	B3-04-03	2/28/2001	Arsenic	2.9
LG-SB-110	0 - 2	B3-02-16	2/28/2001	Arsenic	**22.4**
LG-SB-110	2 - 4	B3-02-17	2/28/2001	Arsenic	**34.6**
LG-SB-110	4 - 6	B3-02-18	2/28/2001	Arsenic	2.5
LG-SB-110	6 - 8	B3-02-19	2/28/2001	Arsenic	2.6
LG-SB-110	8 - 10	B3-02-20	2/28/2001	Arsenic	2.3
LG-SB-110	10 - 12	B3-02-21	2/28/2001	Arsenic	1.9
LG-SB-110	12 - 14	B3-02-22	2/28/2001	Arsenic	1.8
LG-SB-111	0 - 2	B3-36-22	2/26/2001	Arsenic	**26.5**
LG-SB-111	2 - 4	B3-36-23	2/26/2001	Arsenic	**42.5**
LG-SB-111	4 - 6	B3-36-24	2/26/2001	Arsenic	**48.4**
LG-SB-111	6 - 8	B3-36-25	2/26/2001	Arsenic	5.5
LG-SB-111	8 - 10	B3-37-02	2/26/2001	Arsenic	**9.2**
LG-SB-111	10 - 12	B3-37-03	2/26/2001	Arsenic	**12.9**
LG-SB-112	0 - 2	B3-33-13	3/1/2001	Arsenic	**15.3**
LG-SB-112	2 - 4	B3-33-14	3/1/2001	Arsenic	**45.1**
LG-SB-112 DUP	2 - 4	B3-33-24	3/1/2001	Arsenic	**48.7**
LG-SB-112	4 - 6	B3-33-15	3/1/2001	Arsenic	**60.6**
LG-SB-112	6 - 8	B3-33-16	3/1/2001	Arsenic	**246**
LG-SB-112	8 - 10	B3-33-17	3/1/2001	Arsenic	**26.4**
LG-SB-112	10 - 12	B3-33-18	3/1/2001	Arsenic	6.8

Table 6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
BASF Corporation, Rensselaer, New York

Field ID	Sample Interval (ft bls)	Sample ID	Date Collected	Analyte	Result (mg/kg)
LG-SB-113	0 - 2	B3-32-09	3/1/2001	Arsenic	**827**
LG-SB-113	2 - 4	B3-32-10	3/1/2001	Arsenic	**59.8**
LG-SB-113	4 - 6	B3-32-11	3/1/2001	Arsenic	**11.0**
LG-SB-113	6 - 8	B3-32-12	3/1/2001	Arsenic	6.2
LG-SB-113	8 - 10	B3-32-13	3/1/2001	Arsenic	**8.0**
LG-SB-113	10 - 12	B3-32-14	3/1/2001	Arsenic	6.8
LG-SB-114	0 - 2	B3-30-07	3/1/2001	Arsenic	**11.0**
LG-SB-114	2 - 4	B3-30-08	3/1/2001	Arsenic	**9.4**
LG-SB-114	4 - 6	B3-30-09	3/1/2001	Arsenic	7.2
LG-SB-114	6 - 8	B3-30-10	3/1/2001	Arsenic	**9.1**
LG-SB-114	8 - 10	B3-30-11	3/1/2001	Arsenic	**8.0**
LG-SB-115	0 - 2	B3-26-21	3/1/2001	Arsenic	**19.5**
LG-SB-115 DUP	0 - 2	B3-29-05	3/1/2001	Arsenic	**14.7**
LG-SB-115	2 - 4	B3-26-22	3/1/2001	Arsenic	**9.4**
LG-SB-115	4 - 6	B3-26-23	3/1/2001	Arsenic	7.3
LG-SB-115	6 - 8	B3-26-24	3/1/2001	Arsenic	**10.0**
LG-SB-115	8 - 10	B3-26-25	3/1/2001	Arsenic	**46.9**
LG-SB-116	0 - 2	B3-24-21	2/28/2001	Arsenic	**1.9 E**
LG-SB-116	2 - 4	B3-24-22	2/28/2001	Arsenic	**12.3 E**
LG-SB-116	4 - 6	B3-24-23	3/1/2001	Arsenic	**16.8**
LG-SB-116	6 - 8	B3-24-24	3/1/2001	Arsenic	**46.0**
LG-SB-116	8 - 10	B3-24-25	3/1/2001	Arsenic	**37.6**
LG-SB-117	0 - 2	B3-23-03	2/28/2001	Arsenic	**50.4 E**
LG-SB-117	2 - 4	B3-23-04	2/28/2001	Arsenic	**10.2 E**
LG-SB-117	4 - 6	B3-23-05	2/28/2001	Arsenic	**7.2 E**
LG-SB-117	6 - 8	B3-23-06	2/28/2001	Arsenic	**4.6 E**
LG-SB-117	8 - 10	B3-23-07	2/28/2001	Arsenic	**7.2 E**
LG-SB-117	10 - 12	B3-23-08	2/28/2001	Arsenic	**20.8 E**
LG-SB-117	12 - 14	B3-23-09	2/28/2001	Arsenic	**59.7 E**
LG-SB-118	0 - 2	B3-21-04	2/28/2001	Arsenic	**24.8 E**
LG-SB-118	2 - 4	B3-21-05	2/28/2001	Arsenic	**13.3 E**
LG-SB-118	4 - 6	B3-21-06	2/28/2001	Arsenic	**7.0 E**
LG-SB-118 DUP	4 - 6	B3-21-16	2/28/2001	Arsenic	**12.6 E**
LG-SB-118	6 - 8	B3-21-07	2/28/2001	Arsenic	**14.9 E**
LG-SB-118	8 - 10	B3-21-08	2/28/2001	Arsenic	**6.8 E**
LG-SB-118	10 - 12	B3-21-09	2/28/2001	Arsenic	**4.5 E**
LG-SB-119	0 - 2	B3-19-04	2/28/2001	Arsenic	**17.2**
LG-SB-119	2 - 4	B3-19-05	2/28/2001	Arsenic	7.2
LG-SB-119	4 - 6	B3-19-06	2/28/2001	Arsenic	**7.7**
LG-SB-119	6 - 8	B3-19-07	2/28/2001	Arsenic	**6.6 E**
LG-SB-119	8 - 10	B3-19-08	2/28/2001	Arsenic	**23.2 E**
LG-SB-119	10 - 12	B3-19-09	2/28/2001	Arsenic	**328**
LG-SB-119	12 - 14	B3-19-10	2/28/2001	Arsenic	**596 E**
LG-SB-119 DUP	12 - 14	B3-19-21	2/28/2001	Arsenic	**611 E**

Table 6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
BASF Corporation, Rensselaer, New York

Field ID	Sample Interval (ft bls)	Sample ID	Date Collected	Analyte	Result (mg/kg)
LG-SB-120	0 - 2	B3-17-16	2/28/2001	Arsenic	**16.4**
LG-SB-120	2 - 4	B3-17-17	2/28/2001	Arsenic	**119**
LG-SB-120	4 - 6	B3-17-18	2/28/2001	Arsenic	7.0
LG-SB-120	6 - 8	B3-17-19	2/28/2001	Arsenic	**12.6**
LG-SB-120	8 - 10	B3-17-20	2/28/2001	Arsenic	**527**
LG-SB-120	10 - 12	B3-17-21	2/28/2001	Arsenic	**80.6**
LG-SB-120	12 - 14	B3-17-22	3/1/2001	Arsenic	**773**
LG-SB-121	0 - 2	B3-15-20	2/28/2001	Arsenic	**44.0**
LG-SB-121	2 - 4	B3-15-21	2/28/2001	Arsenic	**205**
LG-SB-121	4 - 6	B3-15-22	2/28/2001	Arsenic	**147**
LG-SB-121	6 - 8	B3-15-23	2/28/2001	Arsenic	**86.1**
LG-SB-121	8 - 10	B3-15-24	2/28/2001	Arsenic	**39.1**
LG-SB-121	10 - 12	B3-15-25	2/28/2001	Arsenic	**43.8**
LG-SB-122	0 - 2	B3-14-13	3/1/2001	Arsenic	**146**
LG-SB-122	2 - 4	B3-14-14	3/1/2001	Arsenic	**85.6**
LG-SB-122	4 - 6	B3-14-15	2/28/2001	Arsenic	**79.4**
LG-SB-122	6 - 8	B3-14-16	2/28/2001	Arsenic	**90.9**
LG-SB-122	8 - 10	B3-14-17	2/28/2001	Arsenic	**70.7**
LG-SB-122	10 - 12	B3-14-18	3/1/2001	Arsenic	**20.0**
LG-SB-123	0 - 2	B3-10-15	3/1/2001	Arsenic	**230**
LG-SB-123	2 - 4	B3-10-16	3/1/2001	Arsenic	**17.7**
LG-SB-123	4 - 6	B3-10-17	2/28/2001	Arsenic	**3,050**
LG-SB-123	6 - 8	B3-10-18	2/28/2001	Arsenic	**52,600**
LG-SB-123	8 - 10	B3-10-19	2/28/2001	Arsenic	**79,400**
LG-SB-123	10 - 12	B3-10-20	2/28/2001	Arsenic	**16,000**
LG-SB-124	0 - 2	B3-09-13	2/28/2001	Arsenic	**4,160**
LG-SB-124	2 - 4	B3-09-14	2/28/2001	Arsenic	**14,400**
LG-SB-124	4 - 6	B3-09-15	2/28/2001	Arsenic	**9,520**
LG-SB-124	6 - 8	B3-09-16	2/28/2001	Arsenic	**29,200**
LG-SB-124	8 - 10	B3-09-17	2/28/2001	Arsenic	**51,900**
LG-SB-124	10 - 12	B3-09-18	2/28/2001	Arsenic	**32,500**
LG-SB-125	0 - 2	B3-07-11	3/1/2001	Arsenic	**1,070**
LG-SB-125	2 - 4	B3-07-12	3/1/2001	Arsenic	**2,290**
LG-SB-125	4 - 6	B3-07-13	3/1/2001	Arsenic	**167**
LG-SB-125	6 - 8	B3-07-14	3/1/2001	Arsenic	**13,700**
LG-SB-125	12 - 14	B3-07-15	3/1/2001	Arsenic	**2,300**
LG-SB-126	0 - 2	B3-68-03	3/7/2001	Arsenic	**73.2**
LG-SB-126	2 - 4	B3-68-04	3/7/2001	Arsenic	**690**
LG-SB-126	4 - 6	B3-68-05	3/7/2001	Arsenic	**1,780**
LG-SB-126	6 - 8	B3-68-06	3/7/2001	Arsenic	**1,820**
LG-SB-126	8 - 10	B3-68-07	3/7/2001	Arsenic	**1,880**
LG-SB-126	10 - 12	B3-68-08	3/7/2001	Arsenic	**1,150**

Table 6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
BASF Corporation, Rensselaer, New York

Field ID	Sample Interval (ft bls)	Sample ID	Date Collected	Analyte	Result (mg/kg)
LG-SB-127	0 - 2	B3-79-04	3/7/2001	Arsenic	**170**
LG-SB-127	2 - 4	B3-79-05	3/7/2001	Arsenic	**18.7**
LG-SB-127	4 - 6	B3-79-06	3/7/2001	Arsenic	3.3
LG-SB-127	6 - 8	B3-79-07	3/7/2001	Arsenic	**449**
LG-SB-127	8 - 10	B3-79-08	3/7/2001	Arsenic	**1,760**
LG-SB-127	10 - 12	B3-79-09	3/7/2001	Arsenic	**344**
LG-SB-127	12 - 14	B3-79-10	3/7/2001	Arsenic	**15.8**
LG-SB-128	0 - 2	B3-76-02	3/7/2001	Arsenic	**112**
LG-SB-128	2 - 4	B3-76-03	3/7/2001	Arsenic	7.1
LG-SB-128	4 - 6	B3-76-04	3/7/2001	Arsenic	**9.5**
LG-SB-128	6 - 8	B3-76-05	3/7/2001	Arsenic	**30.1**
LG-SB-128	8 - 10	B3-76-06	3/7/2001	Arsenic	**15.3**
LG-SB-128	10 - 12	B3-76-07	3/7/2001	Arsenic	5.9
LG-SB-129	0 - 2	B3-74-08	3/7/2001	Arsenic	**16.6**
LG-SB-129	2 - 4	B3-74-09	3/7/2001	Arsenic	2.3
LG-SB-129	4 - 6	B3-74-10	3/7/2001	Arsenic	2.4
LG-SB-129	6 - 8	B3-74-11	3/7/2001	Arsenic	2.2
LG-SB-129 DUP	6 - 8	B3-74-15	3/7/2001	Arsenic	2.0
LG-SB-129	8 - 10	B3-74-12	3/7/2001	Arsenic	3.2
LG-SB-129	10 - 12	B3-74-13	3/7/2001	Arsenic	2.2
LG-SB-129	12 - 14	B3-74-14	3/7/2001	Arsenic	4.6
LG-SB-130	0 - 2	B3-69-11	3/7/2001	Arsenic	**74.9**
LG-SB-130 DUP	0 - 2	B3-69-20	3/7/2001	Arsenic	**134**
LG-SB-130	2 - 4	B3-69-12	3/7/2001	Arsenic	**641**
LG-SB-130	4 - 6	B3-69-13	3/7/2001	Arsenic	**319**
LG-SB-130	6 - 8	B3-69-14	3/7/2001	Arsenic	**602**
LG-SB-130	8 - 10	B3-69-15	3/7/2001	Arsenic	**171**
LG-SB-130	10 - 12	B3-69-16	3/7/2001	Arsenic	**58.2**
LG-SB-131	0 - 2	B3-71-03	3/7/2001	Arsenic	**44.4**
LG-SB-131	2 - 4	B3-71-04	3/7/2001	Arsenic	**45.8**
LG-SB-131	4 - 6	B3-71-05	3/7/2001	Arsenic	**77.4**
LG-SB-131	6 - 8	B3-71-06	3/7/2001	Arsenic	**294**
LG-SB-131	8 - 10	B3-71-07	3/7/2001	Arsenic	**25.3**
LG-SB-131	10 - 12	B3-71-08	3/7/2001	Arsenic	**10.1**
LG-SB-132	0 - 2	B3-72-03	3/7/2001	Arsenic	**177**
LG-SB-132	2 - 4	B3-72-04	3/7/2001	Arsenic	**42.9**
LG-SB-132	4 - 6	B3-72-05	3/7/2001	Arsenic	**8.9**
LG-SB-132	6 - 8	B3-72-06	3/7/2001	Arsenic	4.3
LG-SB-132 DUP	6 - 8	B3-72-11	3/7/2001	Arsenic	3.2
LG-SB-132	8 - 10	B3-72-07	3/7/2001	Arsenic	**13.8**
LG-SB-132	10 - 12	B3-72-08	3/7/2001	Arsenic	**90.0**

Table 6. Summary of Arsenic Detected in Lagoon Area Soil during Remedial Investigation
BASF Corporation, Rensselaer, New York

Field ID	Sample Interval (ft bls)	Sample ID	Date Collected	Analyte	Result (mg/kg)
LG-SB-133	0 - 2	B3-80-12	3/7/2001	Arsenic	**177**
LG-SB-133	2 - 4	B3-80-13	3/7/2001	Arsenic	**49.3**
LG-SB-133	4 - 6	B3-80-14	3/7/2001	Arsenic	**181**
LG-SB-133	6 - 8	B3-80-15	3/7/2001	Arsenic	**88.7**
LG-SB-133	8 - 10	B3-80-16	3/7/2001	Arsenic	**98.4**
LG-SB-133	10 - 12	B3-80-17	3/7/2001	Arsenic	**53.0**
LG-SB-134	0 - 2	B3-120-09	3/16/2001	Arsenic	**267**
LG-SB-134	2 - 4	B3-120-10	3/16/2001	Arsenic	**71.7**
LG-SB-134	4 - 6	B3-120-11	3/16/2001	Arsenic	**118**
LG-SB-134	6 - 8	B3-120-12	3/16/2001	Arsenic	**45.0**
LG-SB-134	8 - 10	B3-120-13	3/16/2001	Arsenic	**146**
LG-SB-134	10 - 12	B3-120-14	3/16/2001	Arsenic	**404**
LG-SB-135	0 - 2	B3-77-11	3/7/2001	Arsenic	**160**
LG-SB-135	2 - 4	B3-77-12	3/7/2001	Arsenic	**159**
LG-SB-135	4 - 6	B3-77-13	3/7/2001	Arsenic	**58.6**
LG-SB-135	6 - 8	B3-77-14	3/7/2001	Arsenic	**10.1**
LG-SB-135	8 - 10	B3-77-15	3/7/2001	Arsenic	**9.1**
LG-SB-135	10 - 12	B3-77-16	3/7/2001	Arsenic	**209**
LG-SB-135 DUP	10 - 12	B3-77-23	3/7/2001	Arsenic	**187**
LG-SB-135	12 - 14	B3-77-17	3/7/2001	Arsenic	**290**

ft bls - Feet below land surface
mg/kg - Milligrams per kilogram
Bold - Data highlighted in bold represents detections that exceeded the New York State Department of Environmental Conservation Recommended Soil Cleanup Objective of 7.5 mg/kg for arsenic
Dup - Duplicate sample
E - Estimated concentration

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	L-MW-43r 04/27/2000 Filtered	L-MW-43r 04/27/2000 Unfiltered	L-MW-45 11/11/1999 Filtered	L-MW-45 11/11/1999 Unfiltered	LF-MW-43R 4/23/2001 Filtered	LF-MW-43R 4/23/2001 Unfiltered	LF-MW-45 4/25/2001 Filtered
Aluminum	--		200U	200U	200 U	3200	7 U	415	9.6 B
Antimony	3		5U	5U	5 U	5 U	**6.7 B**	3 U	3 U
Arsenic	25		15.8	**25.2**	5 U	18.2	3 U	**171**	4.4 B
Barium	1000		200U	200U	924	**1240**	1 U	**1410**	324
Beryllium	3		5U	5U	5 U	5 U	0.73 B	0.3 U	0.1 U
Cadmium	5		4U	4U	4 U	4 U	0.3 U	4.8 B	0.4 U
Calcium	--		61300	64700	185000	189000	188 B	101000	109000
Chromium (+6)	50		NA	NA	NA	NA	NA	500 U	0.2 U
Chromium (Total)	50		10U	11	10 U	10 U	0.5 U	37.9	2.6 B
Cobalt	--		50U	50U	50 U	50 U	0.5 U	0.62 B	0.6 U
Copper	200		25U	25U	25 U	25 U	2 U	135	2 U
Cyanide	200		NS	NS	NS	NS	12.4	3 U	2 U
Iron	300		218	**4710**	**30600**	**46800**	66.7 B	**165000**	**33200**
Lead	25		3U	3U	3 U	3.4	3 U	23.6	**35**
Magnesium	35000		7880	7960	25000	26900	992 B	9510	21400
Manganese	300		**1680**	**1840**	**3060**	**3480**	224	**11700**	**3740**
Mercury	0.7		0.2U	0.2U	0.2 U	0.2	0.1 U	0.1 U	0.1 U
Nickel	100		40U	40U	40 U	40 U	3 U	13.4 B	3.5 BE
Potassium	--		17800	18200	7940	9710	15400	15900	3240 B
Selenium	10		5U	5U	5 U	5 U	5 U	5 U	4 U
Silver	50		10U	10U	10 U	10 U	2 U	6.3 B	4 U
Sodium	20000		**636000**	**611000**	**420000**	**437000**	**62700**	**487000**	**248000 E**
Thallium	0.5		5U	5U	5 U	5 U	3 U	**14.1**	**20.6**
Vanadium	--		50U	50U	50 U	50 U	2.1 B	0.8 U	30.5 BE
Zinc	2000		21	20U	32.3	34	6 U	123	36.6

Notes:

µg/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not detected, detection limit shown

B - Indicates an estimated value

E - Exceeds Calibration Limit

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** / **Sample Date:** / **Filtered/Unfiltered:**	LF-MW-45 4/25/2001 Unfiltered	LF-PZ-115 4/11/2001 Filtered	LF-PZ-115 4/11/2001 Unfiltered	LF-PZ-116 4/11/2001 Filtered	LF-PZ-116 4/11/2001 Unfiltered	LF-PZ-117 4/11/2001 Filtered	LF-PZ-117 4/11/2001 Unfiltered	LF-PZ-118 4/11/2001 Filtered
Aluminum	--		163 B	22.4 B	2040	66.5 B	1010	33 B	83.4 B	15.6 B
Antimony	3		3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Arsenic	25		7.3 B	13.7	16.2	6.1 B	7.2 B	3 U	3 U	3 U
Barium	1000		426	48.9 B	88.5 B	102 B	124 B	94.9 B	105 B	57.4 B
Beryllium	3		0.1 U	0.3 U	0.31 B	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Cadmium	5		0.4 U	0.41 B	1.6 B	0.51 B	0.91 B	0.3 U	0.33 B	1.2 B
Calcium	--		138000	237000	268000	207000	235000	179000	200000	105000
Chromium (+6)	50		0.1 U	20 U	40 U	20 U	40 U	20 U	40 U	20 U
Chromium (Total)	50		3.7 B	1.3 B	18.6	2 B	6.8 B	1.5 B	2.4 B	12.5
Cobalt	--		0.6 U	6 B	12 B	2.2 B	4.1 B	1.5 B	1.9 B	6.5 B
Copper	200		2 U	1 U	104	1 U	1 U	1 U	1 U	1 U
Cyanide	200		2 U	7.8 B	9.8 B	6.9 B	6.2 B	4.9 B	3 U	7.1 B
Iron	300		**42600**	**9520**	**19200**	**11500**	**14700**	**7420**	**8400**	**17900**
Lead	25		**41.5**	2 U	**126**	2 U	11.9	2 U	2 U	16.3
Magnesium	35000		25300	**43700**	**49100**	27200	30700	**36200**	**40600**	27600
Manganese	300		**4380**	**2310**	**2960**	**1060**	**1260**	**1500**	**1710**	**1570**
Mercury	0.7		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	100		0.7 UE	19.8 B	41.9	7.9 B	12.2 B	6.3 B	6.6 B	73.5
Potassium	--		3310 B	28400	28500	16700	18900	4170 B	4730 B	4570 B
Selenium	10		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Silver	50		4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Sodium	20000		**307000 E**	**249000**	**261000**	**180000**	**203000**	**87300**	**97000**	**46400**
Thallium	0.5		**18.3**	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vanadium	--		41.5 BE	0.5 U	4.8 B	0.5 U	1.7 B	0.5 U	0.5 U	0.5 U
Zinc	2000		46.7	30.7	247	48.7	105	11.8 B	24.8	1430

Notes:

µg/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not detected, detection limit shown

B - Indicates an estimated value

E - Exceeds Calibration Limit

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	LF-PZ-118	LG-MH-5	LG-MH-5	LG-MH-5	LG-MH-5	LG-MH-5	LG-MH-6	LG-MH-6
		Sample Date:	4/11/2001	11/11/1999	05/01/2000	05/01/2000	4/26/2001	4/26/2001	11/11/1999	04/27/2000
		Filtered/Unfiltered:	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Unfiltered	Filtered
Aluminum	--		58 B	200 U	200U	200U	25 U	31.2 B	200 U	200U
Antimony	3		3 U	5 U	5U	5U	3 U	3 U	5 U	5U
Arsenic	25		3 U	11.2	8.3	9	4.8 B	4.9 B	5 U	5U
Barium	1000		66.9 B	200 U	246	241	155 B	153 B	200 U	384
Beryllium	3		0.44 B	5 U	5U	5U	0.1 U	0.1 U	5 U	5U
Cadmium	5		1.8 B	4 U	4U	4U	0.93 B	0.99 B	4 U	4U
Calcium	--		110000	61300	311000	299000	217000	219000	31000	167000
Chromium (+6)	50		200 U	NA	NA	NA	NA	0.04 U	NA	NA
Chromium (Total)	50		15.9	10 U	10U	10U	0.77 B	0.74 B	10 U	10U
Cobalt	--		9 B	50 U	50U	50U	0.3 B	0.37 B	50 U	50U
Copper	200		46.4	25 U	25U	25U	2 U	2 U	25 U	25U
Cyanide	200		3 U	NS	0.01U	10U	2.8 B	2 U	NS	0.01U
Iron	300		**18400**	**2610**	**12400**	**12300**	**15100**	**15300**	**693**	**9500**
Lead	25		**43.8**	3 U	3U	3U	1 U	1 U	3 U	3U
Magnesium	35000		28400	7210	**36800**	**36300**	26300	26100	5000 U	19300
Manganese	300		**1650**	318	**2080**	**2000**	**2040**	**2020**	**740**	**4260**
Mercury	0.7		0.1 U	0.2 U	0.2U	0.2U	0.1 UN	0.1 UN	0.2 U	0.2U
Nickel	100		80.5	40 U	40U	40U	2.1 B	2.1 B	40 U	40U
Potassium	--		4720 B	6720	14800	13900	13900	14100	5000 U	12000
Selenium	10		4 U	5 U	5U	5U	2 U	2 U	5 U	5U
Silver	50		2 U	10 U	10U	10U	1 U	1 U	10 U	10U
Sodium	20000		**48000**	**468000**	**1000000**	**964000**	**1280000 E**	**1320000 E**	**59800**	**860000**
Thallium	0.5		2 U	5 U	5U	5U	2 U	2 U	5 U	5U
Vanadium	--		3.5 B	50 U	50U	50U	0.2 U	0.2 U	50 U	50U
Zinc	2000		1560	20 U	20U	20U	5.8 B	20.4	20 U	20U

Notes:

µg/L - Micrograms per liter

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NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	LG-MH-6 DUP 04/27/2000 Filtered	LG-MH-6 04/27/2000 Unfiltered	LG-MH-6 DUP 04/27/2000 Unfiltered	LG-MH-6 4/26/2001 Filtered	LG-MH-6 4/26/2001 Unfiltered	LG-MH-7 11/11/1999 Unfiltered	LG-MH-7 05/01/2000 Filtered
Aluminum	--		200U	200U	200U	39.6 B	25 U	200 U	200U
Antimony	3		5U	5U	5U	3 U	3 U	5 U	5U
Arsenic	25		5U	5U	5U	3 U	3 U	5 U	5U
Barium	1000		373	375	349	230	230	302	200U
Beryllium	3		5U	5U	5U	0.1 U	0.1 U	5 U	5U
Cadmium	5		4U	4U	4U	0.79 B	0.79 B	4 U	4U
Calcium	--		161000	163000	154000	151000	155000	218000	188000
Chromium (+6)	50		NA	NA	NA	NA	0.02 U	NA	NA
Chromium (Total)	50		10U	10U	10U	1.6 B	1.6 B	10 U	10U
Cobalt	--		50U	50U	50U	0.8 B	0.61 B	50 U	50U
Copper	200		25U	25U	25U	2 U	2 U	25 U	25U
Cyanide	200		0.01U	10U	10U	8 B	2 U	NS	0.01U
Iron	300		**9130**	9550	9080	12800	12700	**62500**	**54300**
Lead	25		3U	3U	3U	1 U	1 U	3 U	3U
Magnesium	35000		18700	18500	17900	22200	22800	31700	29500
Manganese	300		**4090**	4160	3890	5160	5090	**14000**	**14300**
Mercury	0.7		0.2U	0.2U	0.2U	0.1 UN	0.1 UN	0.2 U	0.2U
Nickel	100		40U	40U	40U	3.4 B	3.3 B	40 U	40U
Potassium	--		11600	11400	10900	12700	13300	17300	11400
Selenium	10		5U	5U	5U	2 U	2 U	5 U	5U
Silver	50		10U	10U	10U	1 U	1 U	10 U	10U
Sodium	20000		**831000**	833000	798000	1010000 E	1180000 E	**854000**	**878000**
Thallium	0.5		5U	5U	5U	2 U	2 U	5 U	5U
Vanadium	--		50U	50U	50U	0.2 U	0.2 U	50 U	50U
Zinc	2000		20U	20U	20U	4.1 B	7.2 B	20 U	20U

Notes:

µg/L - Micrograms per liter

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	LG-MH-7	LG-MH-7	LG-MH-7	LG-MW-1	LG-MW-1	LG-MW-1	LG-MW-1	LG-MW-1
		Sample Date:	05/01/2000	4/26/2001	4/26/2001	11/11/1999	04/27/2000	04/27/2000	03/13/2001	03/13/2001
		Filtered/Unfiltered:	Unfiltered	Filtered	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Aluminum	--		200U	25 U	25 U	200 U	200U	12600	15.5 BE	1790 E
Antimony	3		5U	3 U	3 U	**5.9**	5U	5.7	**4.3 B**	**4.3 B**
Arsenic	25		5U	5.7 B	6.8 B	**37300**	**14200**	17200	**24000**	**24300**
Barium	1000		200U	149 B	149 B	200 U	200U	200U	46.9 B	75 B
Beryllium	3		5U	0.1 U	0.1 U	5 U	5U	5U	0.2 U	0 .2 U
Cadmium	5		4U	3.5 B	3.9 B	4 U	4U	4U	0.3 U	0 .3 U
Calcium	--		180000	157000	158000	155000	144000	147000	130000	137000
Chromium (+6)	50		NA	NA	0.1 U	NA	NA	NA	NA	20U
Chromium (Total)	50		10U	2.6 B	2.9 B	10 U	10U	18.8	3.5 B	8.3 B
Cobalt	--		50U	0.22 B	0.25 B	50 U	50U	50U	1.1 B	3.9 B
Copper	200		25U	2 U	2 U	25 U	25U	25U	2 U	10.4 B
Cyanide	200		10U	4.5 B	2 U	NS	0.01U	10U	7 U	13.4
Iron	300		52100	55400	55900	183	100U	19200	130	**4230**
Lead	25		3U	1 U	1 U	3 U	5.7	**29.6**	3 U	3 U
Magnesium	35000		28400	26100	26300	29600	20900	23600	23900	25100
Manganese	300		13800	13000	13200	**1070**	46.2	963	**508**	**917**
Mercury	0.7		0.2U	0.1 UN	0.1 UN	0.2 U	0.2U	0.2U	0.13 U	0.13 U
Nickel	100		40U	9.5 B	9.9 B	40 U	40U	40U	3.9 B	6.5 B
Potassium	--		11000	10200	10700	7340	6220	10500	4210 BE	4710 BE
Selenium	10		5U	2 U	2 U	5 U	9.2	5U	5.9	6.4
Silver	50		10U	1 U	1 U	10 U	10U	10U	0.7 U	0.7 U
Sodium	20000		853000	866000 E	922000 E	**456000**	**404000**	379000	**308000 E**	**321000 E**
Thallium	0.5		5U	2 U	2 U	5 U	5U	5U	**6.3 B**	**7.6 B**
Vanadium	--		50U	0.2 U	0.2 U	50 U	50U	50U	50.7 E	59.4 E
Zinc	2000		26.6	4 U	35.3	20 U	20U	181	15.3 BE	76.5 E

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** / **Sample Date:** / **Filtered/Unfiltered:**	LG-MW-2 11/11/1999 Filtered	LG-MW-2 11/11/1999 Unfiltered	LG-MW-2 4/24/2001 Filtered	LG-MW-2 4/24/2001 Unfiltered	LG-MW-3 11/12/1999 Filtered	LG-MW-3 11/12/1999 Unfiltered	LG-MW-3 04/27/2000 Filtered	LG-MW-3 04/27/2000 Unfiltered
Aluminum	--		200 U	75300	25 U	13200	200 U	22600	200U	111000
Antimony	3		5 U	5 U	1.5 B	1 U	5 U	5 U	5U	5U
Arsenic	25		5 U	**213**	11.8 E	**35.1 E**	5 U	12.3	5U	49.2
Barium	1000		200 U	528	20.7 B	87.9 B	200 U	278	200U	866
Beryllium	3		5 U	5 U	0.1 U	0.49 B	5 U	5 U	5U	5.1
Cadmium	5		4 U	4 U	0.4 U	0.83 B	4 U	4 U	4U	4U
Calcium	--		398000	433000	352000 E	405000 E	169000	211000	153000	266000
Chromium (+6)	50		NA	NA	20 U	40	NA	NA	NA	NA
Chromium (Total)	50		10 U	**86.6**	0.62 B	14.5	10 U	25.1	10U	134
Cobalt	--		50 U	50 U	2.3 B	8.5 B	50 U	50 U	50U	55.4
Copper	200		25 U	90.6	2 U	2 U	25 U	89.7	25U	252
Cyanide	200		NS	NS	2 UN	2 UN	NS	NS	0.01U	10U
Iron	300		100 U	**103000**	**366 E**	**11400 E**	100 U	**30400**	100U	159000
Lead	25		4.6	**49.7**	1 U	6	3 U	24.1	3U	**75.4**
Magnesium	35000		**263000**	**296000**	**175000 E**	**221000 E**	**43700**	51300	31500	73600
Manganese	300		**788**	**2410**	**718 E**	**1110 E**	15 U	**711**	15U	2410
Mercury	0.7		0.2 U	0.27	0.1 U	0.1 U	0.2 U	0.22	0.2U	0.2U
Nickel	100		40 U	93.3	0.2 U	9 B	40 U	40 U	40U	140
Potassium	--		5380	25000	5520	9480	5000 U	7930	5000U	29700
Selenium	10		5 U	5 U	2 U	2 U	5 U	5 U	7.2	5U
Silver	50		10 U	10 U	2.9 B	2.4 B	10 U	10 U	10U	10U
Sodium	20000		**205000**	**170000**	**331000 E**	**242000 E**	**123000**	**120000**	**83600**	78400
Thallium	0.5		5 U	5 U	2 U	2 U	5 U	5 U	5U	5U
Vanadium	--		50 U	118	0.2 U	14.9 B	50 U	50 U	50U	193
Zinc	2000		20 U	316	4.8 B	32.5	20 U	101	20U	398

Notes:

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	LG-MW-3 4/24/2001 Filtered	LG-MW-3 4/24/2001 Unfiltered	LG-MW-4 11/12/1999 Filtered	LG-MW-4 11/12/1999 Unfiltered	LG-MW-4 4/16/2001 Filtered	LG-MW-4 4/16/2001 Unfiltered	LG-MW-5 11/12/1999 Filtered	LG-MW-5 11/12/1999 Unfiltered
Aluminum	--		53.5 B	953	200 U	14300	7.9 B	605	200 U	2170
Antimony	3		1 U	1 U	5 U	5 U	**4.7 B**	**5.3 B**	5 U	5 U
Arsenic	25		3 UE	3 UE	**394**	**4090**	**5680**	**7220**	**1820**	**2450**
Barium	1000		72 B	89 B	283	841	68.4 B	233	200 U	216
Beryllium	3		0.1 U	0.1 U	5 U	5 U	0.1 U	0.19 B	5 U	5 U
Cadmium	5		0.4 U	0.4 U	4 U	4 U	0.22 B	1 B	4 U	4 U
Calcium	--		136000 E	138000 E	191000	198000	136000	158000	208000	195000
Chromium (+6)	50		20 U	**60**	NA	NA	NA	40 U	NA	NA
Chromium (Total)	50		1 B	1.8 B	10 U	23	0.32 B	2 B	10 U	10 U
Cobalt	--		0.27 B	1.3 B	50 U	50 U	3.5 B	1 B	50 U	50 U
Copper	200		6.6 B	25.9	25 U	159	3.1 B	13 B	25 U	25 U
Cyanide	200		2 UN	2 UN	NS	NS	4.8 B	3.4 B	NS	NS
Iron	300		47 BE	**891 E**	**21900**	**77500**	**517**	**7920**	**4810**	**11800**
Lead	25		1 U	2.7 B	3 U	**36.7**	2 U	2 U	3 U	18
Magnesium	35000		31400 E	28700 E	**46600**	**52200**	14300	16900	**42000**	**39900**
Manganese	300		2.8 BE	124 E	**2950**	**3800**	140	274	**1410**	**1450**
Mercury	0.7		0.1 U	0.1 U	0.2 U	0.27	0.1 U	0.1 U	0.2 U	0.2 U
Nickel	100		1.2 B	2.2 B	40 U	40 U	2 B	3.2 B	40 U	40 U
Potassium	--		1870 B	2080 B	5000 U	7190	3180 B	3540 B	5460	5640
Selenium	10		2 U	2 U	5 U	5 U	4 U	5.4	5 U	5 U
Silver	50		1.1 B	1.2 B	10 U	10 U	7.4 B	4 U	10 U	10 U
Sodium	20000		**66500 E**	**61400 E**	**29000**	**27000**	1750 B	2240 B	**220000**	**262000**
Thallium	0.5		2 U	2 U	5 U	5 U	**8.1 B**	**8.6 B**	5 U	5 U
Vanadium	--		0.64 B	2 B	50 U	50 U	17.4 B	23.3 B	50 U	50 U
Zinc	2000		3.8 B	11.9 B	20 U	91.1	45.3	21.7	20 U	32.6

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	LG-MW-5 D 11/12/1999 Filtered	LG-MW-5 D 11/12/1999 Unfiltered	LG-MW-5 4/24/2001 Filtered	LG-MW-5 4/24/2001 Unfiltered	LG-MW-6 11/11/1999 Unfiltered	LG-MW-6 04/27/2000 Filtered	LG-MW-6 04/27/2000 Unfiltered	LG-MW-6 4/24/2001 Filtered
Aluminum	--		200 U	778	25 U	198 B	200 U	200U	412	25 U
Antimony	3		5 U	5 U	1 U	1.8 B	5 U	5U	5U	**3.7 B**
Arsenic	25		**1840**	**2280**	**985 E**	**1570 E**	**5570**	**15600**	**15200**	**10600 E**
Barium	1000		200 U	227	128 B	162 B	200 U	200U	200U	114 B
Beryllium	3		5 U	5 U	0.1 U	0.1 U	5 U	5U	5U	0.1 U
Cadmium	5		4 U	4 U	0.4 U	0.71 B	4 U	4U	4U	0.4 U
Calcium	--		212000	208000	191000 E	188000 E	78500	178000	166000	156000 E
Chromium (+6)	50		NA	NA	20 U	40 U	NA	NA	NA	NA
Chromium (Total)	50		10 U	10 U	1.9 B	3 B	10 U	10U	10U	0.98 B
Cobalt	--		50 U	50 U	0.2 U	0.35 B	50 U	50U	50U	0.2 U
Copper	200		25 U	25 U	2 U	2 U	25 U	25U	25U	2 U
Cyanide	200		NS	NS	2 UN	2 UN	NS	0.01U	10U	2 UN
Iron	300		**5310**	**9310**	**5910 E**	**10800 E**	100 U	100U	**549**	11.3 BE
Lead	25		3 U	6.7	1 U	6.4	3 U	3U	3.8	1 U
Magnesium	35000		**42800**	**42500**	**43200 E**	**42500 E**	12500	31100	28200	26300 E
Manganese	300		**1430**	**1540**	**919 E**	**913 E**	**626**	**1280**	**1940**	**466 E**
Mercury	0.7		0.2 U	0.2 U	0.1 U	0.1 U	0.2 U	0.2U	0.2U	0.1 U
Nickel	100		40 U	40 U	1.5 B	2.3 B	40 U	40U	40U	1.7 B
Potassium	--		5290	5630	2560 B	2610 B	5000 U	5760	5360	4520 B
Selenium	10		5 U	5 U	2 U	2 U	5 U	8.1	5U	2 U
Silver	50		10 U	10 U	1.2 B	1 U	10 U	10U	10U	1.4 B
Sodium	20000		**222000**	**280000**	**102000 E**	**98700 E**	**64900**	**322000**	**289000**	**253000 E**
Thallium	0.5		5 U	5 U	2 U	2 U	5 U	5U	5U	2 U
Vanadium	--		50 U	50 U	0.2 U	0.41 B	50 U	50U	50U	1.4 B
Zinc	2000		20 U	25.1	6 B	24.3	70.8	30.2	20U	7 B

Notes:

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	LG-MW-6	LG-PZ-1	LG-PZ-1	LG-PZ-2	LG-PZ-2	LG-PZ-101	LG-PZ-101
		Sample Date:	4/24/2001	4/16/2001	4/16/2001	4/16/2001	4/16/2001	4/18/2001	4/18/2001
		Filtered/Unfiltered:	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Aluminum	--		239	7 U	125 B	8.9 B	152 B	7 U	417
Antimony	3		**4.8 B**	**3.2 B**	**4.6 B**	**3.8 B**	**4.1 B**	2 U	2 U
Arsenic	25		**11300 E**	**98.7**	**125**	**112**	**115**	3 U	3 U
Barium	1000		184 B	111 B	111 B	255	245	586	590
Beryllium	3		0.1 U	0.1 U	0.15 B	0.1 U	0.15 B	0.2 U	0.2 U
Cadmium	5		0.4 U	1.2 B	1.3 B	0.95 B	0.98 B	0.32 B	0.57 B
Calcium	--		160000 E	171000	163000	188000	172000	251000	243000
Chromium (+6)	50		20 U	NA	20 U	NA	40 U	NA	20 U
Chromium (Total)	50		2 B	0.83 B	1 B	0.55 B	1 B	0.44 B	1.6 B
Cobalt	--		0.45 B	1.2 B	1.6 B	0.99 B	1.5 B	0.64 B	1.4 B
Copper	200		9.4 B	2 U	2 U	2 U	3.4 B	2 U	5.6 B
Cyanide	200		2 UN	4 B	3.7 B	3.2 B	2.2 B	4.6 B	4.7 B
Iron	300		**975 E**	**7340**	**9790**	**5380**	**6060**	**598**	**1390**
Lead	25		8.1	2 U	2 U	2 U	2 U	3 U	18.6
Magnesium	35000		27400 E	26200	24900	33500	30700	28500	28500
Manganese	300		**1060 E**	**535**	**666**	**1190**	**1100**	**345**	266
Mercury	0.7		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	100		3 B	2 B	2.5 B	0.7 U	0.7 U	1.3 B	1.9 B
Potassium	--		4810 B	2600 B	2850 B	4770 B	4180 B	5800	6180
Selenium	10		2 U	5.6	5.3	4 U	4 U	5 U	5 U
Silver	50		1.6 B	4 U	4 U	4 U	6.4 B	1.8 B	2.8 B
Sodium	20000		**265000 E**	11300	9950	12200	10900	**1620000**	**1710000**
Thallium	0.5		2 U	**9.7 B**	**9.8 B**	**5.8 B**	**11.8**	3 U	3 U
Vanadium	--		2.1 B	29.1 B	28.2 B	33.8 B	33.2 B	27.8 B	28.2 B
Zinc	2000		21	10.5 B	15.6 B	14.2 B	18.3 B	1 U	1 U

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	LG-PZ-101 DUP 4/18/2001 Filtered	LG-PZ-101 DUP 4/18/2001 Unfiltered	LG-PZ-102 4/17/2001 Filtered	LG-PZ-102 4/17/2001 Unfiltered	LG-PZ-103 4/17/2001 Filtered	LG-PZ-103 4/17/2001 Unfiltered	LG-PZ-2 4/16/2001 Filtered
Aluminum	--		7 U	274	7 U	32000	54 B	208000	8.9 B
Antimony	3		2 U	2 U	**6.1 B**	**14.3 B**	3 B	**13.8 B**	**3.8 B**
Arsenic	25		3 U	3 U	**308**	**3480**	**378**	**9830**	**112**
Barium	1000		488	475	181 B	440	81.5 B	**1580**	255
Beryllium	3		0.2 U	0.2 U	0.2 U	1.7 B	0.2 U	**10.8**	0.1 U
Cadmium	5		0.37 B	0.64 B	0.3 U	0.3 U	0.3 U	0.3 U	0.95 B
Calcium	--		202000	196000	201000	207000	115000	256000	188000
Chromium (+6)	50		NA	20 U	NA	40 U	NA	20 U	NA
Chromium (Total)	50		0.53 B	1.1 B	21.5	**58.4**	**90.5**	**376**	0.55 B
Cobalt	--		1.2 B	1.4 B	1.5 BE	29.6 BE	0.75 BE	233 E	0.99 B
Copper	200		2 U	4.6 B	79	71.8	**244**	**578**	2 U
Cyanide	200		6.5 B	5.4 B	3 U	3.8 B	5.6 B	4.6 B	3.2 B
Iron	300		**546**	**874**	198	**67900**	**393**	**483000**	**5380**
Lead	25		3 U	10.1	3 UE	**231 E**	12.4 E	**1540 E**	2 U
Magnesium	35000		24300	23000	20800	34300	14700	**116000**	33500
Manganese	300		293	199	289	**1250**	14 B	**8740**	**1190**
Mercury	0.7		0.1 U	0.1 U	0.1 U	**1**	0.1 U	**4.7**	0.1 U
Nickel	100		1.8 B	2 B	1.4 B	61.7	1.2 B	**426**	0.7 U
Potassium	--		4790 B	4600 B	3190 B	8080	5050	26700	4770 B
Selenium	10		5 U	7.7	6.4	5 U	5 U	5 U	4 U
Silver	50		2.1 B	2.1 B	0.7 U	0.7 U	0.7 U	0.7 U	4 U
Sodium	20000		**1350000**	**1340000**	**199000 E**	**185000 E**	**166000 E**	**177000 E**	12200
Thallium	0.5		3 U	**3.7 B**	3 U	**11.7**	3 U	**77**	**5.8 B**
Vanadium	--		23.2 B	23.6 B	17.9 BE	108 E	13.1 BE	609 E	33.8 B
Zinc	2000		14.7 B	16.2 B	21.5 E	312 E	32.7 E	**2900 E**	14.2 B

Notes:

µg/L - Micrograms per liter

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** / **Sample Date:** / **Filtered/Unfiltered:**	LG-PZ-2 4/16/2001 Unfiltered	MP-GS-1 05/22/2000 Filtered	MP-GS-1 05/22/2000 Unfiltered	MP-GS-2 05/22/2000 Unfiltered	MP-GS-3 05/22/2000 Filtered	MP-GS-3 DUP 05/22/2000 Filtered	MP-GS-3 05/22/2000 Unfiltered
Aluminum	--		152 B	1370	202000	10400	200U	200U	400
Antimony	3		**4.1 B**	5U	5U	5U	5U	5U	5U
Arsenic	25		**115**	5U	**127**	15.6	**244**	**244**	**239**
Barium	1000		245	200U	**1950**	425	200U	200U	201
Beryllium	3		0.15 B	5U	**10**	5U	5U	5U	5U
Cadmium	5		0.98 B	4U	4.9	4U	4U	4U	4U
Calcium	--		172000	248000	824000	328000	271000	276000	274000
Chromium (+6)	50		40 U	NA	NA	NA	NA	NA	NA
Chromium (Total)	50		1 B	16.9	**596**	**474**	**410**	**403**	**447**
Cobalt	--		1.5 B	50U	229	50U	50U	50U	50U
Copper	200		3.4 B	25U	**651**	**1870**	25U	25U	25U
Cyanide	200		2.2 B	NS	NS	NS	NS	NS	NS
Iron	300		**6060**	100U	**489000**	**34100**	**5150**	**5280**	**7220**
Lead	25		2 U	5	**532**	**7160**	3U	3U	**102**
Magnesium	35000		30700	5000U	**136000**	**98300**	**35200**	**35400**	35000
Manganese	300		**1100**	15U	**8550**	**24400**	**2080**	**2080**	**2080**
Mercury	0.7		0.1 U	0.2U	**3**	**1.1**	0.2U	0.2U	0.41
Nickel	100		0.7 U	40U	**436**	47.8	40U	40U	40U
Potassium	--		4180 B	75900	86500	5000U	61000	62100	60100
Selenium	10		4 U	5U	**11.8**	5U	5U	5U	5U
Silver	50		6.4 B	10U	10U	10U	10U	10U	10U
Sodium	20000		10900	**144000**	**110000**	**163000**	**2010000**	**2120000**	**1980000**
Thallium	0.5		**11.8**	5U	**7.2**	5U	5U	5U	5U
Vanadium	--		33.2 B	50U	320	50U	84.2	82.9	81.7
Zinc	2000		18.3 B	20U	1780	667	27.6	56.4	60.9

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** / **Sample Date:** / **Filtered/Unfiltered:**	MP-GS-3 DUP 05/22/2000 Unfiltered	MP-GS-4 05/22/2000 Filtered	MP-GS-4 05/22/2000 Unfiltered	MP-MW-1 11/10/1999 Unfiltered	MP-MW-1 4/24/2001 Filtered	MP-MW-1 4/24/2001 Unfiltered	MP-MW-2 11/10/1999 Filtered
Aluminum	--		867	200U	9920	364	216	356	200 U
Antimony	3		5U	5U	5U	5 U	1.9 B	**3.3 B**	5 U
Arsenic	25		**223**	**8680**	**11600**	17.7	3 UE	5.8 BE	5 U
Barium	1000		215	200U	200U	200 U	95.3 B	71.5 B	200 U
Beryllium	3		5U	5U	5U	5 U	0.11 B	0.12 B	5 U
Cadmium	5		4U	4U	4U	4 U	1.4 B	0.78 B	4 U
Calcium	--		277000	144000	150000	97600	148000 E	105000 E	992000
Chromium (+6)	50		NA	NA	NA	NA	NA	20 U	NA
Chromium (Total)	50		**464**	10U	15.8	41.5	21	26.8	10 U
Cobalt	--		50U	50U	50U	50 U	3.7 B	2.8 B	50 U
Copper	200		36.4	25U	32.3	25 U	2 U	2 U	25 U
Cyanide	200		NS	0.01U	NS	NS	2 UN	2 UN	NS
Iron	300		**10100**	**122000**	**149000**	**6930**	**20500 E**	**12100 E**	**30900**
Lead	25		**175**	3U	18.9	3 U	1 U	1 U	6 U
Magnesium	35000		**34500**	27000	29300	12800	27400 E	15500 E	**345000**
Manganese	300		**2040**	**7560**	**9210**	330	**2840 E**	**1030 E**	**32000**
Mercury	0.7		0.25	0.2U	0.2U	0.2 U	0.1 U	0.1 U	0.2 U
Nickel	100		40U	40U	40U	40 U	11.6 B	12.5 B	40 U
Potassium	--		58400	18100	19800	5000 U	6170	5890	7340
Selenium	10		5U	5U	5U	5 U	2 U	2 U	10 U
Silver	50		10U	10U	10U	10 U	1 U	1 U	10 U
Sodium	20000		**1940000**	**1740000**	**1770000**	**193000**	**1210000 E**	**967000 E**	**3860000**
Thallium	0.5		5U	5U	5U	5 U	2 U	2 U	5 U
Vanadium	--		75.6	50U	50U	50 U	0.2 U	0.56 B	50 U
Zinc	2000		135	29.8	262	926	754	812	247

Notes:

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	MP-MW-2	MP-MW-2	MP-MW-2	MP-MW-3	MP-MW-3	MP-MW-3	MP-MW-3
		Sample Date:	11/10/1999	03/13/2001	03/14/2001	11/10/1999	11/10/1999	4/24/2001	4/24/2001
		Filtered/Unfiltered:	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Aluminum	--		92200	8.2 BE	442 E	200 U	1090	108 B	2130
Antimony	3		**11.2**	2 U	2 U	5 U	5 U	1.1 B	1.9 B
Arsenic	25		**91.2**	**62.5**	9.7 B	5 U	7.9	3 UE	3 UE
Barium	1000		590	63.5 B	66.7 B	200 U	200 U	17.3 B	27.7 B
Beryllium	3		5 U	0.2 U	0.2 U	5 U	5 U	0.1 U	0.13 B
Cadmium	5		**12.6**	0.6 B	0.95 B	4 U	4 U	0.49 B	2.6 B
Calcium	--		1090000	120000	122000	260000	233000	184000 E	280000 E
Chromium (+6)	50		NA	NA	20U	NA	NA	20 U	500 U
Chromium (Total)	50		**1070**	3 B	8.3 B	**96.2**	**220**	12.5	**59.9**
Cobalt	--		50 U	0.95 B	1 B	50 U	50 U	6.8 B	13.6 B
Copper	200		**768**	8.8 B	19.2 B	25 U	25 U	2 U	12.1 B
Cyanide	200		**NS**	7 U	16.6	NS	NS	2 UN	7.7B
Iron	300		**198000**	79.9 B	**2660**	**6130**	**9750**	**4960 E**	**18300 E**
Lead	25		**323**	3 U	3 U	3 U	12	1 U	**47.2**
Magnesium	35000		**368000**	19200	19500	**53000**	**45500**	**40800 E**	**73300 E**
Manganese	300		**33600**	**1760**	**1810**	**13400**	**12000**	**10500 E**	**21200 E**
Mercury	0.7		0.2 U	0.13 U	0.31	0.2 U	0.2 U	0.1 U	0.1 U
Nickel	100		**116**	3.4 B	2.6 B	40 U	40 U	3.6 B	6.8 B
Potassium	--		33200	4060 BE	3630 BE	14900	15300	6460	6140
Selenium	10		5 U	9.8	9.5	5 U	5 U	2 U	2 U
Silver	50		10 U	1.9 B	0.7 U	10 U	10 U	1.4 B	1.7 B
Sodium	20000		**2860000**	**1820000 E**	**1820000 E**	**826000**	**941000**	**879000 E**	**1000000 E**
Thallium	0.5		5 U	**5.7 B**	**7.1 B**	10 U	5 U	**3.3 B**	2 U
Vanadium	--		205	49.3 BE	53.3 E	50 U	50 U	0.2 U	4.9 B
Zinc	2000		**3440**	64.4 E	88.8 E	90.3	115	31	160

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-101 11/8/1999 Filtered	MP-MW-101 11/8/1999 Unfiltered	MP-MW-101 4/25/2001 Filtered	MP-MW-101 4/25/2001 Unfiltered	MP-MW-102 11/10/1999 Filtered	MP-MW-102 11/10/1999 Unfiltered
Aluminum	--		200 U	62700	7 U	14200	2060	51900
Antimony	3		**6.4**	**58**	3 U	5.6 B	5 U	5 U
Arsenic	25		**2610**	**3590**	1200	1410	**85.7**	**216**
Barium	1000		200 U	555	128 B	159 B	200 U	473
Beryllium	3		5 U	**6.7**	0.1 U	0.93 B	5 U	**5.9**
Cadmium	5		4 U	4 U	0.4 U	2 B	4 U	4 U
Calcium	--		106000	104000	168000	191000	101000	99200
Chromium (+6)	50		NA	NA	0.2 U	0.1 U	NA	NA
Chromium (Total)	50		10 U	**67.8**	1.1 B	11.4	10 U	**53.3**
Cobalt	--		50 U	50 U	0.68 B	1.4 B	50 U	55.1
Copper	200		25 U	62.3	2 U	2 U	25 U	110
Cyanide	200		NS	NS	2 U	2.6 B	NS	NS
Iron	300		**8630**	**71500**	12900	16200	**91300**	**162000**
Lead	25		3 U	**43.7**	10.5	10.5	5.3	**183**
Magnesium	35000		13600	17600	32200	33700	13700	23300
Manganese	300		**2400**	**3390**	4680	4750	**1520**	
Mercury	0.7		0.2 U	**1.2**	0.1 U	0.1 U	0.2 U	0.58
Nickel	100		40 U	48.2	0.7 UE	4.2 BE	40 U	98.1
Potassium	--		11700	14500	6180	6440	5530	11700
Selenium	10		5 U	5 U	4 U	5.3	5 U	5 U
Silver	50		10 U	10 U	4 U	4 U	10 U	10 U
Sodium	20000		**1500000**	**1230000**	654000 E	779000 E	**166000**	**156000**
Thallium	0.5		5 U	5 U	20	17.6	5 U	5 U
Vanadium	--		50 U	121	32.7 BE	57 E	50 U	112
Zinc	2000		34.9	967	13.8 B	113	129	419

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-102 4/25/2001 Filtered	MP-MW-102 4/25/2001 Unfiltered	MP-MW-103 11/10/1999 Filtered	MP-MW-103 11/10/1999 Unfiltered	MP-MW-104 11/9/1999 Filtered	MP-MW-104 11/9/1999 Unfiltered
Aluminum	--		36.3 B	3090	200 U	71200	200 U	533
Antimony	3		3 U	3 U	5 U	5 U	5 U	5 U
Arsenic	25		28.5	46.3	11.8	**108**	5 U	5 U
Barium	1000		33.4 B	47.3 B	200 U	951	200 U	200 U
Beryllium	3		0.1 U	0.62 B	5 U	5 U	5 U	5 U
Cadmium	5		3.5 B	0.4 U	4 U	4 U	4 U	4 U
Calcium	--		95200	103000	152000	156000	266000	254000
Chromium (+6)	50		0.2 U	0.1 U	NA	NA	NA	NA
Chromium (Total)	50		1.8 B	3.8 B	10 U	**90.6**	10 U	10 U
Cobalt	--		29.2 B	33.5 B	50 U	55.2	50 U	50 U
Copper	200		2 U	53.4	25 U	**462**	25 U	25 U
Cyanide	200		2 U	2 U	NS	**NS**	NS	NS
Iron	300		21900	32000	100 U	**81400**	**3700**	**13100**
Lead	25		25.6	51.3	3 U	**128**	3 U	5.7
Magnesium	35000		14800	15600	17900	30600	32200	30700
Manganese	300		1030	889	**544**	**1750**	**7010**	**6900**
Mercury	0.7		0.1 U	0.47	0.2 U	**2.1**	0.2 U	0.2 U
Nickel	100		10 BE	52.7 E	40 U	94.3	40 U	40 U
Potassium	--		4490 B	4650 B	6140	17400	9010	9340
Selenium	10		4 U	6.9	5 U	5 U	5 U	5 U
Silver	50		4 U	4 U	10 U	10 U	10 U	10 U
Sodium	20000		95600 E	98600 E	**222000**	**215000**	**180000**	**209000**
Thallium	0.5		7.6 B	3 U	5 U	5 U	5 U	5 U
Vanadium	--		19.8 BE	28.7 BE	50 U	102	50 U	50 U
Zinc	2000		101	155	29.3	355	78.8	48.9

Notes:

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-104 4/18/2001 Filtered	MP-MW-104 4/18/2001 Unfiltered	MP-MW-105 11/8/1999 Filtered	MP-MW-105 11/8/1999 Unfiltered	MP-MW-105 4/23/2001 Filtered	MP-MW-105 4/23/2001 Unfiltered
Aluminum	--		7 U	698	5720	56600	7 U	63800
Antimony	3		**3.1 B**	**3.4 B**	5 U	5 U	**6.2 B**	**3.8 B**
Arsenic	25		3.4 B	6.4 B	**38.9**	**286**	3 U	**123**
Barium	1000		131 B	94.2 B	200 U	**1480**	1 U	581
Beryllium	3		0.2 U	0.2 U	5 U	5 U	1.3 B	**3.6 B**
Cadmium	5		0.77 B	0.59 B	4 U	4.1	0.3 U	3.2 B
Calcium	--		195000	131000	106000	132000	140 U	122000
Chromium (+6)	50		NA	400 U	NA	NA	NA	40 U
Chromium (Total)	50		0.91 B	3.5 B	10 U	**73.6**	0.5 U	34.1
Cobalt	--		2.7 B	2.2 B	50 U	50 U	0.5 U	95.3
Copper	200		3.5 B	12.2 B	25 U	136	2 U	77.9
Cyanide	200		3.1 B	5.3 B	NS	NS	3 U	3 U
Iron	300		**977**	**1020**	**73700**	**170000**	7 U	**102000**
Lead	25		3 U	9.4	**587**	**5500**	3 U	**1770**
Magnesium	35000		25600	17600	13900	24000	7 U	**36300**
Manganese	300		**957**	181	**2740**	**3990**	2 U	**6320**
Mercury	0.7		0.1 U	0.1 U	0.2 U	**0.79**	0.1 U	0.2 B
Nickel	100		4.1 B	4.3 B	40 U	75.8	3 U	**146**
Potassium	--		10000	6890	8020	17100	5540	15600
Selenium	10		5 U	5 U	5 U	5 U	5 U	5 U
Silver	50		1.8 B	2.3 B	10 U	10 U	2 U	2 U
Sodium	20000		**133000**	**85900**	**86900**	**90500**	939 B	**76100**
Thallium	0.5		**4.7 B**	3 U	5 U	5 U	3 U	**8.4 B**
Vanadium	--		21.4 B	17.8 B	50 U	106	0.8 U	43.5 B
Zinc	2000		119	100	551	**7070**	6 U	**10100**

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-106 11/8/1999 Filtered	MP-MW-106 11/8/1999 Unfiltered	MP-MW-106 03/13/2001 Filtered	MP-MW-106 03/13/2001 Unfiltered	MP-MW-106 4/14/2001 Filtered	MP-MW-106 4/14/2001 Unfiltered
Aluminum	--		200 U	87500	42.3 BE	24200 E	33.4 B	6310
Antimony	3		5 U	5 U	2 U	2 U	**3.5 B**	3 U
Arsenic	25		**124**	**263**	**70.8**	**136**	**81.3**	**88.6**
Barium	1000		200 U	728	10.7 B	253	18.7 B	29.9 B
Beryllium	3		5 U	5 U	0.2 U	0.28 B	0.3 U	0.3 U
Cadmium	5		4 U	4.4	0.3 U	0.3 U	**6.9**	3.3 B
Calcium	--		291000	311000	242000	241000	284000	300000
Chromium (+6)	50		NA	NA	NA	20U	NA	20 U
Chromium (Total)	50		10 U	**99**	7.7 B	36.7	0.5 U	0.67 B
Cobalt	--		50 U	50 U	13.4 B	17.4 B	9.8 B	10.4 B
Copper	200		25 U	185	2 U	330	1 U	5.3 B
Cyanide	200		NS	NS	7 U	16.9	11.3	8.4 B
Iron	300		**141000**	**195000**	**90500**	**100000**	**94000**	**100000**
Lead	25		3 U	**341**	3 U	**158**	5.4	12.5
Magnesium	35000		28000	29700	23900	26100	28800	30500
Manganese	300		**3770**	**4530**	**3090**	**3240**	**2950**	**3130**
Mercury	0.7		0.25	0.68	0.14 U	0.25 B	0.1 U	0.1 U
Nickel	100		40 U	40.3	18.9 B	24.8 B	25.3 B	25.6 B
Potassium	--		21400	26100	13100 E	19600 E	15000	15100
Selenium	10		5.8	5.9	8.3	**11.1**	4 U	4 U
Silver	50		10 U	10 U	0.7 U	0.7 U	2 U	2 U
Sodium	20000		**727000**	**722000**	**592000 E**	**554000 E**	**622000**	**630000**
Thallium	0.5		5 U	5 U	**19.6**	**22.6**	2 U	2 U
Vanadium	--		50 U	81.3	0.8 U	0.8 U	0.5 U	0.5 U
Zinc	2000		98.2	966	519 E	877 E	435 E	514 E

Notes:

µg/L - Micrograms per liter

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NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-107 11/9/1999 Filtered	MP-MW-107 11/9/1999 Unfiltered	MP-MW-107 03/13/2001 Filtered	MP-MW-107 03/14/2001 Unfiltered	MP-MW-108 11/9/1999 Filtered	MP-MW-108 11/9/1999 Unfiltered
Aluminum	--		200 U	33200	17.4 BE	12900 E	1480	18500
Antimony	3		5 U	**28.9**	2 U	2 U	5 U	5 U
Arsenic	25		5 U	**58.8**	3 U	40.8	12.8	**40.8**
Barium	1000		200 U	566	68.7 B	352	200 U	200 U
Beryllium	3		5 U	5 U	.2 U	.88 B	5 U	5 U
Cadmium	5		4 U	**9.4**	.3 U	.3 U	4 U	**6.7**
Calcium	--		186000	211000	139000	140000	648000	506000
Chromium (+6)	50		NA	NA	NA	NA	NA	NA
Chromium (Total)	50		10 U	**4210**	9 B	2650	14.3	**144**
Cobalt	--		50 U	113	7.4 B	30.5 B	50 U	50 U
Copper	200		25 U	**1180**	2 U	1250	25 U	171
Cyanide	200		NS	**NS**	7 U	129	NS	NS
Iron	300		**96400**	**311000**	**69300**	**116000**	**51700**	**196000**
Lead	25		3 U	**857**	3 U	721	3 U	**73.1**
Magnesium	35000		27700	35000	20900	22300	**124000**	**112000**
Manganese	300		**6630**	**7950**	**2000**	2140	**4480**	**5350**
Mercury	0.7		0.31	**3.1**	.14 U	1.5	0.4	**0.84**
Nickel	100		46.8	**528**	17.3 B	163	40 U	**147**
Potassium	--		23700	24500	20200 E	20100 E	31400	26300
Selenium	10		5 U	8.1	**11**	10.5	5 U	6.8
Silver	50		10 U	10 U	.76 B	.7 U	10 U	10 U
Sodium	20000		**1880000**	**2340000**	**2300000 E**	2170000 E	**1160000**	**935000**
Thallium	0.5		5 U	5 U	**24.5**	35.3	5 U	5 U
Vanadium	--		50 U	132	.8 UE	3.2 BE	50 U	126
Zinc	2000		32.9	**2660**	35.3 E	1410 E	70.9	338

Notes:

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NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-108 4/25/2001 Filtered	MP-MW-108 4/25/2001 Unfiltered	MP-MW-109 11/9/1999 Filtered	MP-MW-109 11/9/1999 Unfiltered	MP-MW-109 DUP 11/9/1999 Filtered	MP-MW-109 DUP 11/9/1999 Unfiltered
Aluminum	--		7 U	893	200 U	60400	200 U	101000
Antimony	3		3 U	3 U	5 U	5 U	5 U	5 U
Arsenic	25		3.8 B	2 U	5 U	**80.5**	5 U	**149**
Barium	1000		84.5 B	101 B	200 U	769	200 U	1000
Beryllium	3		0.1 U	0.1 U	5 U	**6.2**	5 U	**8.2**
Cadmium	5		0.4 U	0.4 U	4 U	4 U	4 U	4.9
Calcium	--		559000	648000	23400	33800	25400	36400
Chromium (+6)	50		0.2 U	0.2 U	NA	NA	NA	NA
Chromium (Total)	50		2.5 B	14.8	10 U	**70.7**	10 U	**120**
Cobalt	--		1.2 B	2.4 B	50 U	50 U	50 U	50 U
Copper	200		2 U	2 U	25 U	**237**	25 U	**450**
Cyanide	200		2 U	2 U	NS	**NS**	NS	**NS**
Iron	300		14100	40100	**12100**	**114000**	**13500**	**171000**
Lead	25		2 U	27.4	3 U	**162**	3 U	**310**
Magnesium	35000		41100	51200	5000 U	14100	5000 U	22800
Manganese	300		2690	3430	**1750**	**2870**	**1860**	**3320**
Mercury	0.7		0.1 U	0.1 U	0.31	0.62	0.32	**2.4**
Nickel	100		1.2 BE	11.1 BE	40 U	81.9	40 U	**131**
Potassium	--		15800	16400	5000 U	11400	5000 U	17200
Selenium	10		4 U	5.5	5 U	5 U	5 U	5 U
Silver	50		4 U	4 U	10 U	10 U	10 U	10 U
Sodium	20000		1150000 E	1100000 E	**237000**	**259000**	**249000**	**250000**
Thallium	0.5		3 U	3 U	5 U	**6.3**	5 U	5 U
Vanadium	--		39.3 BE	66.7 E	50 U	138	50 U	210
Zinc	2000		4 U	151	113	**25000**	55.3	**37100**

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-109 4/23/2001 Filtered	MP-MW-109 4/23/2001 Unfiltered	MP-MW-110 11/9/1999 Filtered	MP-MW-110 11/9/1999 Unfiltered	MP-MW-110 4/25/2001 Filtered	MP-MW-110 4/25/2001 Unfiltered
Aluminum	--		7 U	10900	802	32800	47.9 B	1300
Antimony	3		**6.2 B**	3 U	5 U	5 U	3 U	3 U
Arsenic	25		3 U	**32.3**	6.7	**26.8**	3.7 B	6.2 B
Barium	1000		1 U	567	422	872	91.7 B	124 B
Beryllium	3		1.3 B	0.69 B	5 U	5 U	0.1 U	0.1 U
Cadmium	5		0.3 U	**5.8**	4 U	4.5	0.4 U	0.68 B
Calcium	--		140 U	114000	90900	132000	56900	88100
Chromium (+6)	50		NA	40 U	NA	NA	0.4 U	0.2 U
Chromium (Total)	50		0.5 U	17	10 U	**135**	9.3 B	14.6
Cobalt	--		0.5 U	11.6 B	50 U	50 U	0.91 B	2.1 B
Copper	200		2 U	2 U	25 U	**233**	2 U	2 U
Cyanide	200		3 U	3 U	NS	**NS**	5.4 B	2 U
Iron	300		7 U	**78500**	**5600**	**146000**	664	4280
Lead	25		3 U	**37.5**	5.8	**248**	2 U	17.4
Magnesium	35000		7 U	15500	8920	25300	5280	7790
Manganese	300		2 U	**10800**	**883**	**3200**	728	1170
Mercury	0.7		0.1 U	0.1 U	0.29	**1.9**	0.1 U	0.25 B
Nickel	100		3 U	22 B	40 U	58	1.3 BE	3.6 BE
Potassium	--		10600	15300	6720	11600	3480 B	3780 B
Selenium	10		5 U	5 U	5 U	5.6	4 U	4 U
Silver	50		2 U	2 U	10 U	10 U	4 U	4 U
Sodium	20000		963 B	**922000**	**926000**	**909000**	522000 E	471000 E
Thallium	0.5		3 U	**6.9 B**	5 U	5 U	7.8 B	7.3 B
Vanadium	--		0.8 U	15.8 B	50 U	86.3	10.5 BE	19.7 BE
Zinc	2000		6 U	**4810**	43.8	641	4.3 B	125

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-111 11/9/1999 Filtered	MP-MW-111 11/9/1999 Unfiltered	MP-MW-111 4/17/2001 Filtered	MP-MW-111 4/17/2001 Unfiltered	MP-MW-112 11/9/1999 Filtered	MP-MW-112 11/9/1999 Unfiltered
Aluminum	--		200 U	6730	7 U	215000	291	17000
Antimony	3		5 U	**22.2**	**3.3 B**	**276**	5 U	5 U
Arsenic	25		5 U	13.4	3 U	**404**	**45.6**	**140**
Barium	1000		200 U	200 U	17.5 B	**1760**	200 U	413
Beryllium	3		5 U	5 U	0.2 U	**11.4**	5 U	5 U
Cadmium	5		4 U	4.5	0.3 U	**50.6**	4 U	4 U
Calcium	--		304000	364000	260000	900000	26200	31600
Chromium (+6)	50		NA	NA	NA	100 U	NA	NA
Chromium (Total)	50		11.2	**4610**	16.7	**164000**	10 U	45.6
Cobalt	--		50 U	50 U	3.3 BE	339 E	50 U	50 U
Copper	200		25 U	**3570**	45.6	**189000**	26.3	137
Cyanide	200		NS	**NS**	6 B	6.9 B	NS	NS
Iron	300		**21100**	**108000**	**38200**	**1740000**	**2170**	**42600**
Lead	25		3 U	**1440**	**38.7 E**	**19600 E**	**43.4**	**536**
Magnesium	35000		12000	19900	10300	**126000**	5000 U	6420
Manganese	300		**996**	**3000**	**1110**	**19900**	**599**	**1260**
Mercury	0.7		0.38	**1**	0.1 U	**86.1**	0.54	**1.2**
Nickel	100		40 U	46.8	16 B	**1250**	**103**	**111**
Potassium	--		7130	7500	5240	23400	7880	9810
Selenium	10		5 U	5 U	5 U	5 U	5 U	5 U
Silver	50		10 U	10 U	0.7 U	0.7 U	10 U	10 U
Sodium	20000		**880000**	**1150000**	**612000 E**	**538000 E**	**245000**	**274000**
Thallium	0.5		5 U	5 U	**5.2 B**	**120**	5 U	5 U
Vanadium	--		50 U	50 U	28.2 BE	1220 E	146	252
Zinc	2000		20 U	779	51.2 E	**11800 E**	162	324

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-MW-113 5/2/2001 Filtered	MP-MW-113 5/2/2001 Unfiltered	MP-MW-113 DUP 4/26/2001 Filtered	MP-MW-113 DUP 4/26/2001 Unfiltered	MP-MW-114 5/2/2001 Filtered
Aluminum	--		33.7	984	35.6 B	1060	139
Antimony	3		**3.5**	**19.4**	**3.2 B***	3 U*	1 U
Arsenic	25		3 U	4.1	5.4 B*	3 U*	3 U
Barium	1000		64.2	82	64.8 B	81.3 B	225
Beryllium	3		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Cadmium	5		0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Calcium	--		35800	59200	35900	55400	133000
Chromium (+6)	50		NA	20U	NA	20U	NA
Chromium (Total)	50		4.8	11.4	5 B	12.3	2.6
Cobalt	--		0.48	2.3	0.9 B*	2.4 B*	0.7
Copper	200		5.4	20.9	4.6 B*	10.1 B*	2.1
Cyanide	200		3.8	7.6	2.3 B*	4.1 B*	3.7
Iron	300		18.5	**2140**	36 B*	**2020 ***	252
Lead	25		1 U	5.5	1 U	3.3	1 U
Magnesium	35000		13300	20300	13400	18700	**81400**
Manganese	300		26.6	90.4	27.3	82.2	53.3
Mercury	0.7		0.14 U	0.13 U	0.1 UN	0.1 UN	0.13 U
Nickel	100		1	3.9	1.5 B*	4.2 B*	3.3
Potassium	--		5940	7070	5690	6620	20300
Selenium	10		2 U	2	2 U	2 U	2 U
Silver	50		1 U	2.4	1 U*	1 U*	1 U
Sodium	20000		**57100**	**84100**	**57100 E**	**77600 E**	**266000**
Thallium	0.5		2 U	2 U	**4.4 B**	2 U	2 U
Vanadium	--		3.8	7.3	4.2 B	6.6 B	0.64
Zinc	2000		5.2	46.5	5.4 B	38.9	7.5

Notes:

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** / **Sample Date:** / **Filtered/Unfiltered:**	MP-MW-114 5/2/2001 Unfiltered	MP-PP-1 04/26/2000 Filtered	MP-PP-1 04/26/2000 Unfiltered	MP-PP-2 04/26/2000 Filtered	MP-PP-2 04/26/2000 Unfiltered	MP-PP-2 4/14/2001 Filtered	MP-PP-2 4/14/2001 Unfiltered	MP-PP-3 04/27/2000 Filtered
Aluminum	--		6820	200U	200U	200U	200U	15.2 B	13.4 B	200U
Antimony	3		1 U	**31.6**	**35.4**	**36.3**	**37**	**20.5 B**	**19.6 B**	5U
Arsenic	25		3 U	**1450**	**1600**	**1600**	**1700**	**799**	**747**	**1100**
Barium	1000		271	200U	200U	200U	200U	80.4 B	80.1 B	200U
Beryllium	3		0.19	5U	5U	5U	5U	0.3 U	0.3 U	5U
Cadmium	5		0.98	4U	4U	4U	4U	0.3 U	0.3 U	4U
Calcium	--		172000	108000	115000	110000	115000	145000	136000	126000
Chromium (+6)	50		20U	NA	NA	NA	NA	NA	20 U	NA
Chromium (Total)	50		14	10U	10U	10U	10U	0.89 B	0.9 B	10U
Cobalt	--		9.4	50U	50U	50U	50U	0.37 B	0.46 B	50U
Copper	200		16.1	25U	25U	25U	25U	4.2 B	4.1 B	25U
Cyanide	200		2 U	0.01U	10U	0.01U	10U	8.3 B	3 U	0.01U
Iron	300		**14500**	100U	100U	100U	100U	43.7 B	19.5 B	**4050**
Lead	25		6.5	3U	3U	3U	3U	2 U	2 U	3U
Magnesium	35000		**87200**	13400	13700	13600	13700	19200	18400	12200
Manganese	300		**463**	410	435	403	451	84.9	81.4	**2670**
Mercury	0.7		0.13 U	0.2U	0.2U	0.2U	0.2U	0.1 U	0.1 U	0.2U
Nickel	100		19.4	40U	40U	40U	40U	3.1 B	3 U	40U
Potassium	--		21600	5000U	5000U	5000U	5000U	5780	5990	10900
Selenium	10		2 U	6	5U	8.2	5.4	4 U	4 U	5U
Silver	50		1 U	10U	10U	10U	10U	2 U	2 U	10U
Sodium	20000		**268000**	**478000**	**469000**	**484000**	**467000**	**313000**	**294000**	**895000**
Thallium	0.5		2 U	5U	5U	5U	5U	2 U	2 U	5U
Vanadium	--		11.2	50U	50U	50U	50U	1.5 B	1.4 B	50U
Zinc	2000		54.2	63.6	41.6	20U	20U	8.4 BE	7 BE	20.2

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	MP-PP-3	MP-PP-4	MP-PP-4	MP-PP-5	MP-PP-5	MP-PZ-106	MP-PZ-106	MP-PZ-107
		Sample Date:	04/27/2000	04/27/2000	04/27/2000	04/27/2000	04/27/2000	4/10/2001	4/10/2001	4/12/2001
		Filtered/Unfiltered:	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
Aluminum	--		200U	200U	200U	200U	200U	274	2450	7 U
Antimony	3		5U	5U	5U	5U	5U	**99.2**	**94.4**	2 U
Arsenic	25		**1470**	5U	5U	**148**	**148**	**1620**	**2160**	3 U
Barium	1000		204	200U	200U	200U	200U	5.2 B	56 B	288
Beryllium	3		5U	5U	5U	5U	5U	0.2 U	0.2 U	0.2 U
Cadmium	5		4U	4U	4U	4U	4U	0.3 U	0.42 B	0.36 B
Calcium	--		128000	141000	146000	148000	153000	2740	7130	78800
Chromium (+6)	50		NA	NA	NA	NA	NA	10 U	10 U	50 U
Chromium (Total)	50		10U	11.9	13.5	10U	10U	1.2 B	6.3 B	0.6 B
Cobalt	--		50U	50U	50U	50U	50U	1.6 B	3.2 B	1.8 B
Copper	200		25U	25U	25U	25U	25U	7.6 B	17.8 B	5.5 B
Cyanide	200		19	0.01U	10U	0.01U	10U	3.0 U	7.0 B	10.8
Iron	300		**10100**	100U	115	**5340**	**12700**	289	**3780**	**1900**
Lead	25		3U	4.8	3U	3U	3U	5.4	14.2	3 U
Magnesium	35000		12100	16800	16800	16000	16100	290 B	905 B	9260
Manganese	300		**2720**	**479**	**490**	**1020**	**1070**	7.2 B	154	**2350**
Mercury	0.7		0.2U	0.2U	0.2U	0.2U	0.2U	0.13 U	0.14 U	0.1 U
Nickel	100		40U	40U	40U	40U	40U	2 B	2.5 B	2.2 B
Potassium	--		10700	10100	10100	11800	11800	1090 B	1780	7260
Selenium	10		5U	7.8	5U	6.1	5U	5 U	5 U	6.2
Silver	50		10U	10U	10U	10U	10U	1.2 B	1.1 B	1.2 B
Sodium	20000		**875000**	**563000**	**542000**	**1130000**	**1020000**	**97500**	**122000**	**1010000 E**
Thallium	0.5		5U	5U	5U	5U	5U	3 U	3 U	**5.8 B**
Vanadium	--		50U	50U	50U	50U	50U	7.9 B	13.2 B	15.3 B
Zinc	2000		23.3	113	113	25.7	35.1	4.7 B	27.6	20.5 E

Notes:

µg/L - Micrograms per liter

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NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-PZ-107 4/12/2001 Unfiltered	MP-PZ-108 4/12/2001 Filtered	MP-PZ-108 4/12/2001 Unfiltered	MP-PZ-109 4/23/2001 Filtered	MP-PZ-109 4/23/2001 Unfiltered	MP-PZ-110 4/23/2001 Filtered	MP-PZ-110 4/23/2001 Unfiltered
Aluminum	--		2690	7 U	8360	7 U	24500	7 U	7620
Antimony	3		2.8 B	2 U	2 U	**5.2 B**	3 U	**4.5 B**	3 U
Arsenic	25		3 U	3 U	4.3 B	3 U	19.2	3 U	8 B
Barium	1000		310	69.9 B	149 B	1 U	309	74.2 B	305
Beryllium	3		0.2 U	0.2 U	0.47 B	1.1 B	1.2 B	0.3 B	0.4 B
Cadmium	5		0.97 B	0.3 U	2.5 B	0.3 U	3.2 B	0.3 U	1.5 B
Calcium	--		79000	126000	118000	140 U	86100	18000	90900
Chromium (+6)	50		20 U	70 U	20 U	NA	20 U	NA	40 U
Chromium (Total)	50		3.8 B	0.3 U	17.5	0.5 U	47.7	0.52 B	**97.2**
Cobalt	--		3.1 B	0.5 U	7.9 B	0.5 U	19.2 B	0.5 U	7.5 B
Copper	200		11 B	2 U	28.3	2 U	51.2	2 U	40.1
Cyanide	200		11.7	6.9 B	6.1 B	3 U	3 U	3 U	3 U
Iron	300		**5710**	2 U	**18700**	7 U	**39200**	**1400**	**18100**
Lead	25		3 U	3 U	3 U	3 U	**78.6**	3 U	**80.8**
Magnesium	35000		9710	17200	17900	7 U	19800	3870 B	11300
Manganese	300		**2600**	64	**1550**	2 U	**2930**	**649**	**1570**
Mercury	0.7		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.51
Nickel	100		3.1 B	1.3 B	17.6 B	3 U	37 B	3 U	25.6 B
Potassium	--		8160	3430 B	4830 B	3790 B	12700	3410 B	6480
Selenium	10		6.7	8.5	5 U	5 U	5 U	5 U	5 U
Silver	50		0.7 U	0.7 U	0.7 U	2 U	2 U	2 U	2 U
Sodium	20000		**1030000 E**	**417000 E**	**353000 E**	861 B	**49500**	**50500**	**104000**
Thallium	0.5		**5.4 B**	3 U	**11.8**	3 U	3 U	3 U	3 U
Vanadium	--		20.4 B	20.2 B	30.3 B	0.8 U	41.9 B	5.1 B	17 B
Zinc	2000		32.2 E	36.9 E	156 E	6 U	245	6 U	150

Notes:

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NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	MP-PZ-111	MP-PZ-111	MP-PZ-112	MP-PZ-112	MP-PZ-113	MP-PZ-113	MP-PZ-114
		Sample Date:	4/23/2001	4/23/2001	4/11/2001	4/11/2001	4/12/2001	4/12/2001	4/12/2001
		Filtered/Unfiltered:	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
Aluminum	--		20.4 B	8790	16.2 B	82.1 B	7 U	231	21 B
Antimony	3		**3.7 B**	3 U	3 U	3 U	2 U	2 U	2 U
Arsenic	25		3 U	14.6	3 U	3 U	4.4 B	10.9	3 U
Barium	1000		6.9 B	211	191 B	200 B	55.1 B	61.6 B	22 B
Beryllium	3		0.56 B	0.49 B	0.3 U	0.3 U	0.2 U	0.2 U	0.2 B
Cadmium	5		0.3 U	1.7 B	0.3 U	0.3 U	0.31 B	1.1 B	0.95 B
Calcium	--		5020	90000	113000	121000	58600	65000	116000
Chromium (+6)	50		NA	100 U	NA	20 U	550000 U	3000 U	4000 U
Chromium (Total)	50		0.5 U	**363**	0.65 B	0.94 B	0.37 B	12.5	1.4 B
Cobalt	--		0.5 U	7.3 B	1.7 B	1.3 B	0.97 B	1.3 B	18.1 B
Copper	200		2 U	61.6	2.5 B	3.9 B	2 U	48.1	**516**
Cyanide	200		3 U	3 U	3 U	3 U	5.3 B	5.6 B	5.6 B
Iron	300		**1550**	**22700**	**441**	**621**	**2520**	**8250**	**4950**
Lead	25		3 U	**147**	2 U	2.2 B	3 U	18.5	3 U
Magnesium	35000		2830 B	9230	9740	10300	7490	8170	14800
Manganese	300		**601**	**1520**	**844**	**871**	**460**	**551**	**11600**
Mercury	0.7		0.1 U	0.24 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	100		3 U	32.6 B	3.3 B	3.2 B	3.3 B	10.9 B	89.1
Potassium	--		2460 B	6930	4040 B	4270 B	12500	13800	15600
Selenium	10		5 U	5 U	4 U	4 U	6.6	**10.7**	6.1
Silver	50		2 U	2 U	2 U	2 U	0.7 U	0.7 U	2.2 B
Sodium	20000		**37100**	**62900**	**30600**	**32700**	**69200 E**	**76800 E**	**395000 E**
Thallium	0.5		3 U	3 U	2 U	2 U	**6.9 B**	3 U	3 U
Vanadium	--		5.4 B	19.5 B	3.1 B	1.3 B	12 B	15 B	18.5 B
Zinc	2000		6 U	155	14.2 B	18.9 B	62.2 E	208 E	108 E

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	MP-PZ-114 4/12/2001 Unfiltered	MP-PZ-120 5/2/2001 Filtered	MP-PZ-120 5/2/2001 Unfiltered	MP-PZ-121 5/2/2001 Filtered	MP-PZ-121 5/2/2001 Unfiltered	MP-SB-19 05/09/2000 Filtered	MP-SB-19 05/09/2000 Unfiltered
Aluminum	--		177 B	5930	7320	25 U	2470	200U	28300
Antimony	3		**4.5 B**	1 U	1 U	1 U	1	5U	5U
Arsenic	25		3 U	7.1	6.9	3 U	3 U	5U	18.7
Barium	1000		19 B	32.4	48.3	84.6	357	200U	311
Beryllium	3		0.2 U	0.21	0.24	0.1 U	0.1 U	5U	5U
Cadmium	5		0.3 U	4.2	4.5	0.4 U	0.67	4U	4U
Calcium	--		106000	538000	561000	38900	157000	129000	152000
Chromium (+6)	50		240000 U	NA	20 U	NA	20 U	NA	NA
Chromium (Total)	50		**841**	26.7	47.7	0.2 U	14.5	10U	38.7
Cobalt	--		18 B	2.5	3.6	0.75	7.4	50U	50U
Copper	200		**831**	2 U	2 U	2 U	159	25U	123
Cyanide	200		3 U	7.7	11.3	9.8	9.6	NS	NS
Iron	300		**71200**	**70000**	**66400**	153	**7410**	100U	**48300**
Lead	25		3.8	2	**26.2**	1 U	**81.2**	3U	**45.6**
Magnesium	35000		13300	**132000**	**132000**	3900	14800	25200	34700
Manganese	300		**11500**	**11200**	**11300**	**330**	**1490**	**620**	**2210**
Mercury	0.7		0.1 U	0.12 U	0.13 U	0.13 U	**1**	0.2U	0.2U
Nickel	100		**135**	0.64	4.3	1.5	10.8	40U	59.2
Potassium	--		14100	27300	28200	4720	30600	5000U	8650
Selenium	10		**13.9**	2 U	2 U	2 U	2 U	5U	5U
Silver	50		0.7 U	1 U	1 U	1 U	1.7	10U	10U
Sodium	20000		**340000 E**	**464000**	**468000**	**443000**	**1640000**	**119000**	**113000**
Thallium	0.5		**13.3**	2 U	2 U	2 U	2 U	5U	5U
Vanadium	--		13.3 B	0.2 U	2.4	0.2 U	5.8	50U	50U
Zinc	2000		173 E	7.6	206	2 U	65.2	20U	248

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	MP-SB-20	MP-SB-20	MP-SB-46	MP-SB-46	MP-SB-49	MP-SB-49	MP-SB-50	MP-SB-50
		Sample Date:	05/08/2000	05/08/2000	05/17/2000	05/17/2000	05/18/2000	05/18/2000	05/08/2000	05/08/2000
		Filtered/Unfiltered:	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Aluminum	--		200U	8670	200U	5480	200U	19800	200U	84000
Antimony	3		5U	5U	5U	5U	5U	5U	5U	5U
Arsenic	25		5U	5U	8	13	5U	**27.6**	5U	**76.6**
Barium	1000		200U	200U	397	318	200U	305	200U	**1550**
Beryllium	3		5U	5U	5U	5U	5U	5U	5U	**6.9**
Cadmium	5		4U	4U	4U	4U	4U	4U	4U	4U
Calcium	--		96700	97500	170000	192000	93900	124000	113000	168000
Chromium (+6)	50		NA	NA	NA	NA	NA	NA	NA	NA
Chromium (Total)	50		10U	10U	10U	19.2	10U	34.2	10U	**188**
Cobalt	--		50U	50U	50U	50U	50U	50U	50U	123
Copper	200		25U	25U	25U	29.1	25U	61.1	25U	**340**
Cyanide	200		NS	NS	NS	NS	NS	NS	NS	NS
Iron	300		162	**11800**	**6100**	**19400**	**5530**	**39400**	100U	**225000**
Lead	25		3U	8.2	3U	**50.4**	3U	**119**	3U	**222**
Magnesium	35000		18200	20000	26000	31600	17200	22800	19700	**48200**
Manganese	300		35.7	**342**	**1510**	**1750**	**3260**	**3760**	**3410**	**16200**
Mercury	0.7		0.2U	0.2U	0.2U	0.2U	0.2U	1.6	0.2U	0.2U
Nickel	100		40U	40U	40U	40U	40U	40U	40U	**178**
Potassium	--		5000U	5950	8550	9770	6230	9290	8300	25000
Selenium	10		5U	5U	5U	5U	5U	5U	5U	**10.6**
Silver	50		10U	10U	10U	10U	10U	10U	10U	10U
Sodium	20000		**24800**	**25100**	**1130000**	**1150000**	**572000**	**539000**	**1180000**	**1140000**
Thallium	0.5		5U	5U	5U	5U	5U	5U	5U	5U
Vanadium	--		50U	50U	50U	50U	50U	50U	50U	163
Zinc	2000		29.9	66.5	374	215	20U	186	50.9	**2500**

Notes:

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Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:** **Sample Date:** **Filtered/Unfiltered:**	ST-MW-2 11/10/1999 Unfiltered	ST-MW-6A 04/25/2000 Filtered	ST-MW-6A 04/25/2000 Unfiltered	ST-MW-6A 4/10/2001 Unfiltered	ST-MW-6A 4/10/2001 Filtered	ST-MW-7A 04/25/2000 Filtered	ST-MW-7A 04/25/2000 Unfiltered
Aluminum	--		200 U	200U	1770	272	94.7 B	200U	1660
Antimony	3		5 U	5U	5U	**6.4 B**	**7 B**	5U	5U
Arsenic	25		5 U	**35.2**	**57.4**	**31.2**	**27.5**	5U	5U
Barium	1000		409	200U	200U	65.8 B	59.8 B	200U	200U
Beryllium	3		5 U	5U	5U	0.2 U	0.2 U	5U	5U
Cadmium	5		4 U	4U	4U	0.3 U	0.3 U	4U	4U
Calcium	--		159000	40900	35800	57200	54000	35600	36400
Chromium (+6)	50		NA	NA	NA	20 U	20 U	NA	NA
Chromium (Total)	50		10 U	10U	10U	0.67 B	0.55 B	10U	10U
Cobalt	--		50 U	50U	50U	1.8 B	2.6 B	50U	50U
Copper	200		25 U	30.8	68	18.2 B	21.1 B	25U	25U
Cyanide	200		NS	NS	NS	102	101	NS	NS
Iron	300		**2850**	167	**4630**	**481**	163	137	**3140**
Lead	25		3 U	5.6	22.3	3 U	3 U	3U	3.3
Magnesium	35000		**37600**	5000U	5000U	2110 B	1980 B	5000U	5000U
Manganese	300		**996**	93.1	225	170	159	151	487
Mercury	0.7		0.2 U	0.2U	0.2U	0.14 U	0.14 U	0.2U	0.2U
Nickel	100		40 U	40U	40U	8.1 B	8.7 B	40U	40U
Potassium	--		5000 U	20500	18400	28700	27200	10300	11100
Selenium	10		5 U	5U	5U	5 U	5 U	5.4	5U
Silver	50		10 U	10U	10U	0.82 U	1.6 B	10U	10U
Sodium	20000		**140000**	**196000**	**213000**	**115000**	**107000**	**29000**	**27600**
Thallium	0.5		5 U	5U	5U	**7.9 B**	**6.3 B**	5U	5U
Vanadium	--		50 U	50U	50U	9.1 B	7.9 B	50U	50U
Zinc	2000		20 U	28.5	32.8	10.8 B	10.4 B	42.7	20U

Notes:

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NA - Not analyzed

Table 7. Summary of Metals Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York.

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water-Quality Standards [1]	**Field Designation:**	ST-MW-9	ST-MW-9	B 11/11 WG	B 11/11 WG	MP-W-B	MP-W-B
		Sample Date:	04/25/2000	04/25/2000	11/11/1999	11/11/1999	04/27/2000	05/12/2000
		Filtered/Unfiltered:	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Filtered
Aluminum	--		200U	5130	200 U	200 U	200U	200U
Antimony	3		5U	5U	5 U	5 U	5U	5U
Arsenic	25		5U	5U	5 U	5 U	5U	5U
Barium	1000		200U	200U	200 U	200 U	200U	200U
Beryllium	3		5U	5U	5 U	5 U	5U	5U
Cadmium	5		4U	4U	4 U	4 U	4U	4U
Calcium	--		114000	120000	5000 U	5000 U	5000U	5000U
Chromium (+6)	50		NA	NA	NA	NA	NA	NA
Chromium (Total)	50		10U	10U	10 U	10 U	10U	10U
Cobalt	--		50U	50U	50 U	50 U	50U	50U
Copper	200		25U	25U	25 U	25 U	25U	25U
Cyanide	200		NS	NS	NS	NS	0.01U	NS
Iron	300		100U	**6500**	100 U	149	100U	100U
Lead	25		3U	9.1	3 U	3 U	3U	3U
Magnesium	35000		10300	11300	5000 U	5000 U	5000U	5000U
Manganese	300		15U	391	15 U	15 U	15U	15U
Mercury	0.7		0.2U	0.2U	0.2 U	0.2 U	0.2U	0.2U
Nickel	100		40U	40U	40 U	40 U	40U	40U
Potassium	--		5110	6590	5000 U	5000 U	5000U	5000U
Selenium	10		**11.8**	7.5	5 U	5 U	5U	5U
Silver	50		10U	10U	10 U	10 U	10U	10U
Sodium	20000		**36200**	37800	5000 U	5000 U	5000U	5000U
Thallium	0.5		5U	5U	5 U	5 U	5U	5U
Vanadium	--		50U	50U	50 U	50 U	50U	50U
Zinc	2000		20U	48.1	20 U	47.1	20U	49.6

Notes:

µg/L - Micrograms per liter

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NA - Not analyzed

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LF-MW-43r 04/27/2000	LF-MW-43R 4/23/2001	LF-MW-45 11/11/1999	LF-MW-45 4/25/2001	LF-PZ-115 4/11/2001	LF-PZ-116 4/11/2001	LF-PZ-117 4/11/2001
1,1,1-Trichloroethane	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
1,1,2,2-Tetrachloroethane	5		200 U	500 U	2 U	5 U	5 U	25 U	50 U
1,1,2-Trichloroethane	1		300 U	500 U	3 U	5 U	5 U	25 U	50 U
1,1-Dichloroethane	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
1,1-Dichloroethene	5		200 U	500 U	2 U	5 U	5 U	25 U	50 U
1,2-Dichloroethane	0.6		200 U	500 U	2 U	5 U	5 U	25 U	50 U
1,2-Dichloroethene, cis-	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
1,2-Dichloroethene, trans-	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
1,2-Dichloropropane	1		100 U	500 U	1 U	5 U	5 U	25 U	50 U
1,3,5-Trimethylbenzene	5		NA	500 U	NA	5 U	5 U	25 U	50 U
1,3-Dichloropropane	5		NA	500 U	NA	5 U	5 U	25 U	50 U
1,3-Dichloropropene, cis-	0.4 *		100 U	500 U	1 U	5 U	5 U	25 U	50 U
1,3-Dichloropropene, trans-	0.4 *		100 U	500 U	1 U	5 U	5 U	25 U	50 U
2-Butanone	--		500 U	500 U	5 U	5 U	5 U	25 U	50 U
2-Hexanone	50		500 U	500 U	5 U	1 J	5 U	25 U	50 U
4-Methyl-2-pentanone	--		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Acetone	50		500 U	500 U	5 U	4 J	5 U	25 U	50 U
Benzene	1		**18500**	**15000**	1 U	0.7 U	**10**	**11**	7 U
Bromodichloromethane	50		100 U	500 U	1 U	5 U	5 U	25 U	50 U
Bromoform	50		400 U	500 U	4 U	5 U	5 U	25 U	50 U
Bromomethane	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Carbon Disulfide	--		500 U	500 U	5 U	5	5 U	25 U	50 U
Carbon Tetrachloride	5		100 U	500 U	1 U	5 U	5 U	25 U	50 U
Chlorobenzene	5		**83.2 J**	500 U	**7**	2 J	**420**	**640**	**1100**
Chloroethane	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Chloroform	7		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Chloromethane	--		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Dibromochloromethane	50		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Ethylbenzene	5		100 U	500 U	1 U	5 U	5 U	25 U	50 U
Methylene Chloride	5		200 U	500 U	2 U	5 U	5 U	25 U	50 U
Styrene	5		500 U	500 U	5 U	5 U	5 U	25 U	50 U
Tetrachloroethene	5		100 U	500 U	1 U	5 U	5 U	25 U	50 U

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LF-MW-43r 04/27/2000	LF-MW-43R 4/23/2001	LF-MW-45 11/11/1999	LF-MW-45 4/25/2001	LF-PZ-115 4/11/2001	LF-PZ-116 4/11/2001	LF-PZ-117 4/11/2001
Toluene	5		100 U	500 U	1 U	5 U	5 U	25 U	50 U
Trichloroethene	5		100 U	500 U	1 U	5 U	5 U	25 U	50 U
Vinyl acetate	--		NA	500 U	NA	5 U	5 U	25 U	50 U
Vinyl Chloride	2		100 U	200 U	1 U	2 U	2	10 U	20 U
Xylenes (total)	5		100 U	500 U	1 U	5 U	5 U	25 U	50 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not Detected; Detected Limit Shown

J - Estimated value

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DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LF-PZ-118 4/11/2001	LG-MH-5 11/11/1999	LG-MH-5 05/01/2000	LG-MH-5 4/26/2001	LG-MH-6 11/11/1999	LG-MH-6 04/27/2000	LG-MH-6 DUP 04/27/2000
1,1,1-Trichloroethane	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		25 U	2 U	2 U	5 U	2 U	2 U	2 U
1,1,2-Trichloroethane	1		25 U	3 U	3 U	5 U	3 U	3 U	3 U
1,1-Dichloroethane	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		25 U	2 U	2 U	5 U	2 U	2 U	2 U
1,2-Dichloroethane	0.6		25 U	**1.7 J**	2 U	**2 J**	2 U	2 U	2 U
1,2-Dichloroethene, cis-	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		25 U	1 U	1 U	5 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5		25 U	NA	NA	5 U	NA	NA	NA
1,3-Dichloropropane	5		25 U	NA	NA	5 U	NA	NA	NA
1,3-Dichloropropene, cis-	0.4 *		25 U	1 U	1 U	5 U	1 U	1 U	1 U
1,3-Dichloropropene, trans-	0.4 *		25 U	1 U	1 U	5 U	1 U	1 U	1 U
2-Butanone	--		25 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	50		25 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		25 U	5 U	5 U	15	5 U	5 U	5 U
Benzene	1		**110**	**1.7**	**41.3**	**7**	**9.2**	**19.2**	**20.7**
Bromodichloromethane	50		25 U	1 U	1 U	5 U	1 U	1 U	1 U
Bromoform	50		25 U	4 U	4 U	5 U	4 U	4 U	4 U
Bromomethane	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		25 U	1 U	1 U	5 U	1 U	1 U	1 U
Chlorobenzene	5		**640**	**222**	**149**	**100**	**20.1**	**37.6**	**41.1**
Chloroethane	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	--		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		**11 J**	1 U	1 U	5 U	1 U	**5.9**	**6.2**
Methylene Chloride	5		25 U	2 U	2 U	5 U	2 U	2 U	2 U
Styrene	5		25 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		25 U	1 U	1 U	5 U	1 U	1 U	1 U

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LF-PZ-118 4/11/2001	LG-MH-5 11/11/1999	LG-MH-5 05/01/2000	LG-MH-5 4/26/2001	LG-MH-6 11/11/1999	LG-MH-6 04/27/2000	LG-MH-6 DUP 04/27/2000
Toluene	5		25 U	1 U	0.49 J	5 U	0.41 J	0.32 J	1 U
Trichloroethene	5		25 U	1 U	1 U	5 U	1 U	1 U	1 U
Vinyl acetate	--		25 U	NA	NA	5 U	NA	NA	NA
Vinyl Chloride	2		10 U	1 U	1 U	2 U	1 U	1 U	1 U
Xylenes (total)	5		**15 J**	1 U	1 U	5 U	1 U	1 U	1 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MH-6 4/26/2001	LG-MH-7 11/11/1999	LG-MH-7 05/01/2000	LG-MH-7 4/26/2001	LG-MW-1 11/11/1999	LG-MW-1 3/13/2001	LG-MW-2 11/11/1999
1,1,1-Trichloroethane	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		5 U	20 U	10 U	120 U	2 U	5 U	2 U
1,1,2-Trichloroethane	1		5 U	30 U	15 U	120 U	3 U	5 U	3 U
1,1-Dichloroethane	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
1,1-Dichloroethene	5		5 U	20 U	10 U	120 U	2 U	5 U	2 U
1,2-Dichloroethane	0.6		**8**	20 U	10 U	120 U	**19.7**	10	2 U
1,2-Dichloroethene, cis-	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
1,2-Dichloropropane	1		5 U	10 U	5 U	120 U	1 U	5 U	1 U
1,3,5-Trimethylbenzene	5		5 U	NA	NA	120 U	NA	5 U	NA
1,3-Dichloropropane	5		5 U	NA	NA	120 U	NA	5 U	NA
1,3-Dichloropropene, cis-	0.4 *		5 U	10 U	5 U	120 U	1 U	5 U	1 U
1,3-Dichloropropene, trans-	0.4 *		5 U	10 U	5 U	120 U	1 U	5 U	1 U
2-Butanone	--		5 U	50 U	25 U	120 U	5 U	5 U	5 U
2-Hexanone	50		5 U	50 U	25 U	120 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Acetone	50		8	50 U	25 U	120 U	5 U	5 U	5 U
Benzene	1		**22**	**25.4**	**265**	**130**	1 U	0.7 U	1 U
Bromodichloromethane	50		5 U	10 U	5 U	120 U	1 U	5 U	1 U
Bromoform	50		5 U	40 U	20 U	120 U	4 U	5 U	4 U
Bromomethane	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Carbon Disulfide	--		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Carbon Tetrachloride	5		5 U	10 U	5 U	120 U	1 U	5 U	1 U
Chlorobenzene	5		**48**	**3220**	**1650**	**2600**	2 U	2 J	2 U
Chloroethane	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Chloroform	7		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Chloromethane	--		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Dibromochloromethane	50		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Ethylbenzene	5		**12**	10 U	5 U	120 U	1 U	5 U	1 U
Methylene Chloride	5		5 U	20 U	10 U	120 U	2 U	5 U	2 U
Styrene	5		5 U	50 U	25 U	120 U	5 U	5 U	5 U
Tetrachloroethene	5		5 U	10 U	5 U	120 U	1 U	5 U	1 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MH-6 4/26/2001	LG-MH-7 11/11/1999	LG-MH-7 05/01/2000	LG-MH-7 4/26/2001	LG-MW-1 11/11/1999	LG-MW-1 3/13/2001	LG-MW-2 11/11/1999
Toluene	5		5 U	10 U	5 U	120 U	1 U	5 U	1 U
Trichloroethene	5		5 U	10 U	5 U	120 U	1 U	5 U	1 U
Vinyl acetate	--		5 U	NA	NA	120 U	NA	5 U	NA
Vinyl Chloride	2		2 U	10 U	5 U	50 U	1 U	2 U	1 U
Xylenes (total)	5		5 U	10 U	5 U	120 U	1 U	5 U	1 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MW-2 4/24/2001	LG-MW-3 11/12/1999	LG-MW-3 4/24/2001	LG-MW-4 11/12/1999	LG-MW-4 4/16/2001	LG-MW-5 11/12/1999	LG-MW-5 DUP 11/12/1999
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		5 U	2 U	5 U	2 U	5 U	2 U	2 U
1,1,2-Trichloroethane	1		5 U	3 U	5 U	3 U	5 U	3 U	3 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		5 U	2 U	5 U	2 U	5 U	2 U	2 U
1,2-Dichloroethane	0.6		**1 J**	**89.8**	5 U	2 U	5 U	2 U	2 U
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		5 U	1 U	5 U	1 U	5 U	1 U	1 U
1,3,5-Trimethylbenzene	5		5 U	NA	5 U	NA	5 U	NA	NA
1,3-Dichloropropane	5		5 U	NA	5 U	NA	5 U	NA	NA
1,3-Dichloropropene, cis-	0.4 *		5 U	1 U	5 U	1 U	5 U	1 U	1 U
1,3-Dichloropropene, trans-	0.4 *		5 U	1 U	5 U	1 U	5 U	1 U	1 U
2-Butanone	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	50		5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		2 J	5 U	2 J	5 U	5 U	5 U	5 U
Benzene	1		0.7 U	1 U	0.7 U	1 U	0.7 U	1 U	1 U
Bromodichloromethane	50		5 U	1 U	5 U	1 U	5 U	1 U	1 U
Bromoform	50		5 U	4 U	5 U	4 U	5 U	4 U	4 U
Bromomethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		5 U	1 U	5 U	1 U	5 U	1 U	1 U
Chlorobenzene	5		5 U	0.7 J	5 U	2 U	5 U	2.4	2.4
Chloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		5 U	1 U	5 U	1 U	5 U	1 U	1 U
Methylene Chloride	5		5 U	2 U	5 U	2 U	5 U	2 U	2 U
Styrene	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		5 U	1 U	5 U	1 U	5 U	1 U	1 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LG-MW-2	LG-MW-3	LG-MW-3	LG-MW-4	LG-MW-4	LG-MW-5	LG-MW-5 DUP
		Sample Date:	4/24/2001	11/12/1999	4/24/2001	11/12/1999	4/16/2001	11/12/1999	11/12/1999
Toluene	5		5 U	1 U	5 U	1 U	5 U	1 U	1 U
Trichloroethene	5		5 U	1 U	5 U	1 U	5 U	1 U	1 U
Vinyl acetate	--		5 U	NA	5 U	NA	5 U	NA	NA
Vinyl Chloride	2		2 U	1 U	2 U	1 U	2 U	1 U	1 U
Xylenes (total)	5		5 U	1 U	5 U	1 U	5 U	1 U	1 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MW-5 4/24/2001	LG-MW-6 11/11/1999	LG-MW-6 4/24/2001	LG-PZ-1 4/16/2001	LG-PZ-101 4/18/2001	LG-PZ-101 DUP 4/18/2001	LG-PZ-102 4/17/2001
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		5 U	2 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1		5 U	3 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		5 U	2 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	0.6		5 U	**7.3**	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		5 U	1 U	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	5		5 U	NA	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	5		5 U	NA	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropene, cis-	0.4 *		5 U	1 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropene, trans-	0.4 *		5 U	1 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	50		5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		2 J	5 U	5	5 U	7	6	5
Benzene	1		0.7 U	1 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Bromodichloromethane	50		5 U	1 U	5 U	5 U	5 U	5 U	5 U
Bromoform	50		5 U	4 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		5 U	1 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5		2 J	2 U	5 U	5 U	5 U	1 J	5 U
Chloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		5 U	1 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	5		5 U	2 U	5 U	5 U	5 U	5 U	5 U
Styrene	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		5 U	1 U	5 U	5 U	5 U	5 U	5 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MW-5 4/24/2001	LG-MW-6 11/11/1999	LG-MW-6 4/24/2001	LG-PZ-1 4/16/2001	LG-PZ-101 4/18/2001	LG-PZ-101 DUP 4/18/2001	LG-PZ-102 4/17/2001
Toluene	5		5 U	1 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5		5 U	1 U	5 U	5 U	5 U	5 U	5 U
Vinyl acetate	--		5 U	NA	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	2		2 U	1 U	2 U	2 U	2 U	2 U	2 U
Xylenes (total)	5		5 U	1 U	5 U	5 U	5 U	5 U	5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-PZ-103 4/17/2001	LG-PZ-2 4/16/2001	MP-GS-1 05/22/2000	MP-GS-2 05/22/2000	MP-GS-3 05/22/2000	MP-GS-3 DUP 05/22/2000	MP-GS-4 05/22/2000
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
1,1,2,2-Tetrachloroethane	5		5 U	5 U	2 U	2 U	2 U	2 U	100 U
1,1,2-Trichloroethane	1		5 U	5 U	3 U	3 U	3 U	3 U	150 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
1,1-Dichloroethene	5		5 U	5 U	2 U	2 U	2 U	2 U	100 U
1,2-Dichloroethane	0.6		5 U	5 U	2 U	2 U	2 U	2 U	**10400**
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
1,2-Dichloropropane	1		5 U	5 U	1 U	1 U	1 U	1 U	50 U
1,3,5-Trimethylbenzene	5		5 U	5 U	NA	NA	NA	NA	NA
1,3-Dichloropropane	5		5 U	5 U	NA	NA	NA	NA	NA
1,3-Dichloropropene, cis-	0.4 *		5 U	5 U	1 U	1 U	1 U	1 U	50 U
1,3-Dichloropropene, trans-	0.4 *		5 U	5 U	1 U	1 U	1 U	1 U	50 U
2-Butanone	--		5 U	5 U	5 U	5 U	5 U	5 U	250 U
2-Hexanone	50		5 U	5 U	5 U	5 U	5 U	5 U	250 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U	5 U	5 U	250 U
Acetone	50		5	5 U	5 U	5 U	5 U	5 U	250 U
Benzene	1		0.7 U	0.7 U	**2.7**	1 U	**37**	**59.3**	**7080**
Bromodichloromethane	50		5 U	5 U	1 U	1 U	1 U	1 U	50 U
Bromoform	50		5 U	5 U	4 U	4 U	4 U	4 U	200 U
Bromomethane	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
Carbon Disulfide	--		5 U	5 U	5 U	5 U	5 U	5 U	250 U
Carbon Tetrachloride	5		5 U	5 U	1 U	1 U	1 U	1 U	50 U
Chlorobenzene	5		5 U	5 U	**4.2**	2 U	**13**	**15.7**	**9210**
Chloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
Chloroform	7		5 U	5 U	5 U	5 U	1.5 J	1.6 J	250 U
Chloromethane	--		1 J	5 U	5 U	5 U	5 U	5 U	250 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U	5 U	5 U	250 U
Ethylbenzene	5		5 U	5 U	0.73 J	1 U	0.3 J	0.34 J	**54.1**
Methylene Chloride	5		5 U	5 U	2 U	2 U	2 U	2 U	100 U
Styrene	5		5 U	5 U	5 U	5 U	5 U	5 U	250 U
Tetrachloroethene	5		5 U	5 U	1 U	1 U	1 U	1 U	50 U

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-PZ-103 4/17/2001	LG-PZ-2 4/16/2001	MP-GS-1 05/22/2000	MP-GS-2 05/22/2000	MP-GS-3 05/22/2000	MP-GS-3 DUP 05/22/2000	MP-GS-4 05/22/2000
Toluene	5		5 U	5 U	1.4	1 U	1.1	1.2	**76.6**
Trichloroethene	5		5 U	5 U	1 U	1 U	1 U	1 U	**45 J**
Vinyl acetate	--		5 U	5 U	NA	NA	NA	NA	NA
Vinyl Chloride	2		2 U	2 U	1 U	1 U	1 U	1 U	50 U
Xylenes (total)	5		5 U	5 U	3.3	1 U	1.3	1.5	**122**

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not Detected; Detected Limit Shown

J - Estimated value

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Bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-1 11/10/1999	MP-MW-1 4/24/2001	MP-MW-2 11/10/1999	MP-MW-2 3/13/2001	MP-MW-3 11/10/1999	MP-MW-3 4/24/2001	MP-MW-101 11/8/1999
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U	50 U	**110**	250 U
1,1,2,2-Tetrachloroethane	5		2 U	5 U	2 U	5 U	20 U	100 U	100 U
1,1,2-Trichloroethane	1		3 U	5 U	3 U	5 U	30 U	100 U	150 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U	50 U	**28 J**	250 U
1,1-Dichloroethene	5		2 U	5 U	2 U	5 U	20 U	**26 J**	100 U
1,2-Dichloroethane	0.6		**787**	**170**	**2160**	**68**	**12300**	**3500**	**326**
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U	50 U	100 U	250 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U	50 U	100 U	250 U
1,2-Dichloropropane	1		1 U	5 U	1 U	5 U	10 U	100 U	50 U
1,3,5-Trimethylbenzene	5		NA	5 U	NA	5 U	NA	100 U	NA
1,3-Dichloropropane	5		NA	5 U	NA	5 U	NA	100 U	NA
1,3-Dichloropropene, cis-	0.4 *		1 U	5 U	1 U	5 U	10 U	100 U	50 U
1,3-Dichloropropene, trans-	0.4 *		1 U	5 U	1 U	5 U	10 U	100 U	50 U
2-Butanone	--		5 U	5 U	5 U	5 U	50 U	100 U	250 U
2-Hexanone	50		5 U	5 U	5 U	5 U	50 U	100 U	250 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Acetone	50		5 U	8	5 U	5 U	50 U	33 J	250 U
Benzene	1		**3.8**	1	1 U	0.7 U	**78.2**	**60**	**1920**
Bromodichloromethane	50		1 U	5 U	1 U	5 U	10 U	100 U	50 U
Bromoform	50		4 U	5 U	4 U	5 U	40 U	100 U	200 U
Bromomethane	5		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Carbon Disulfide	--		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Carbon Tetrachloride	5		1 U	5 U	1 U	5 U	10 U	100 U	50 U
Chlorobenzene	5		**252**	**86**	4.3	2 J	**4700**	**3100**	**38300**
Chloroethane	5		5 U	5 U	5 U	5 U	**30.2 J**	100 U	250 U
Chloroform	7		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Chloromethane	--		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Ethylbenzene	5		1.0	5 U	1 U	5 U	**5.7 J**	100 U	**131**
Methylene Chloride	5		2 U	5 U	2 U	5 U	20 U	100 U	100 U
Styrene	5		5 U	5 U	5 U	5 U	50 U	100 U	250 U
Tetrachloroethene	5		0.5 J	5 U	1 U	5 U	10 U	100 U	50 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-1 11/10/1999	MP-MW-1 4/24/2001	MP-MW-2 11/10/1999	MP-MW-2 3/13/2001	MP-MW-3 11/10/1999	MP-MW-3 4/24/2001	MP-MW-101 11/8/1999
Toluene	5		1.7	5 U	1 U	5 U	2.3 J	100 U	**236**
Trichloroethene	5		3.7	1 J	1 U	5 U	**5.2 J**	**51 J**	50 U
Vinyl acetate	--		NA	5 U	NA	5 U	NA	100 U	NA
Vinyl Chloride	2		1 U	2 U	1 U	2 U	10 U	40 U	50 U
Xylenes (total)	5		1.2	5 U	1 U	5 U	10 U	100 U	**357**

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

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DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-101 4/25/2001	MP-MW-102 11/10/1999	MP-MW-102 4/25/2001	MP-MW-103 11/10/1999	MP-MW-104 11/9/1999	MP-MW-104 4/18/2001
1,1,1-Trichloroethane	5		1000 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		1000 U	2 U	5 U	3	2 U	5 U
1,1,2-Trichloroethane	1		1000 U	3 U	5 U	3 U	3 U	5 U
1,1-Dichloroethane	5		1000 U	5 U	5 U	5 U	1.1 J	5 U
1,1-Dichloroethene	5		1000 U	2 U	5 U	2 U	2 U	5 U
1,2-Dichloroethane	0.6		**210 J**	**1820**	**70**	2 U	**346**	**200**
1,2-Dichloroethene, cis-	5		1000 U	1.3 J	5 U	5 U	2.3 J	5 U
1,2-Dichloroethene, trans-	5		1000 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		1000 U	1 U	5 U	1 U	1 U	5 U
1,3,5-Trimethylbenzene	5		1000 U	NA	5 U	NA	NA	5 U
1,3-Dichloropropane	5		1000 U	NA	5 U	NA	NA	5 U
1,3-Dichloropropene, cis-	0.4 *		1000 U	1 U	5 U	1 U	1 U	5 U
1,3-Dichloropropene, trans-	0.4 *		1000 U	1 U	5 U	1 U	1 U	5 U
2-Butanone	--		1000 U	5 U	1 J	5 U	5 U	5 U
2-Hexanone	50		1000 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		1000 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		**450 J**	5 U	4 J	5 U	5 U	6
Benzene	1		**1000**	**8.2**	0.7 U	1 U	**36.7**	**7**
Bromodichloromethane	50		1000 U	1 U	5 U	1 U	1 U	5 U
Bromoform	50		1000 U	4 U	5 U	4 U	4 U	5 U
Bromomethane	5		1000 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		1000 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		1000 U	1 U	5 U	1 U	1 U	5 U
Chlorobenzene	5		**27000**	**11.2**	**13**	2 U	**411**	**22**
Chloroethane	5		1000 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		1000 U	5 U	5 U	0.43 J	3.4 J	1 J
Chloromethane	--		1000 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		1000 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		1000 U	0.87 J	5 U	1 U	1.4	5 U
Methylene Chloride	5		1000 U	2 U	5 U	2 U	2 J	5 U
Styrene	5		1000 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		1000 U	1.2	5 U	0.4 J	0.63 J	5 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-101 4/25/2001	MP-MW-102 11/10/1999	MP-MW-102 4/25/2001	MP-MW-103 11/10/1999	MP-MW-104 11/9/1999	MP-MW-104 4/18/2001
Toluene	5		1000 U	0.82 J	5 U	1 U	**12.2**	1 J
Trichloroethene	5		1000 U	0.8 J	5 U	**14.4**	4.8	5 U
Vinyl acetate	--		1000 U	NA	5 U	NA	NA	5 U
Vinyl Chloride	2		400 U	**17.4**	2 U	1 U	**30.1**	**4**
Xylenes (total)	5		**220 J**	1.4	5 U	1 U	**5.7**	5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

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DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-105 11/8/1999	MP-MW-105 4/23/2001	MP-MW-106 11/8/1999	MP-MW-106 3/13/2001	MP-MW-106 4/14/2001	MP-MW-107 11/9/1999
1,1,1-Trichloroethane	5		120 U	500 U	500 U	400 U	1000 U	25 U
1,1,2,2-Tetrachloroethane	5		50 U	500 U	200 U	400 U	1000 U	10 U
1,1,2-Trichloroethane	1		75 U	500 U	300 U	400 U	1000 U	15 U
1,1-Dichloroethane	5		120 U	500 U	500 U	400 U	1000 U	25 U
1,1-Dichloroethene	5		50 U	500 U	200 U	400 U	1000 U	10 U
1,2-Dichloroethane	0.6		**12900**	**16000**	**20800**	**8900**	**20000**	10 U
1,2-Dichloroethene, cis-	5		120 U	500 U	500 U	400 U	1000 U	25 U
1,2-Dichloroethene, trans-	5		120 U	500 U	500 U	400 U	1000 U	25 U
1,2-Dichloropropane	1		25 U	500 U	100 U	400 U	1000 U	5 U
1,3,5-Trimethylbenzene	5		NA	500 U	NA	400 U	1000 U	NA
1,3-Dichloropropane	5		NA	500 U	NA	400 U	1000 U	NA
1,3-Dichloropropene, cis-	0.4 *		25 U	500 U	100 U	400 U	1000 U	5 U
1,3-Dichloropropene, trans-	0.4 *		25 U	500 U	100 U	400 U	1000 U	5 U
2-Butanone	--		120 U	500 U	500 U	400 U	1000 U	25 U
2-Hexanone	50		120 U	500 U	500 U	400 U	1000 U	25 U
4-Methyl-2-pentanone	--		120 U	500 U	500 U	400 U	1000 U	25 U
Acetone	50		120 U	**120 J**	500 U	400 U	**310 J**	25 U
Benzene	1		**877**	**800**	**2930**	**660**	**2900**	**7.7**
Bromodichloromethane	50		25 U	500 U	100 U	400 U	1000 U	5 U
Bromoform	50		100 U	500 U	400 U	400 U	1000 U	20 U
Bromomethane	5		120 U	500 U	500 U	400 U	1000 U	25 U
Carbon Disulfide	--		120 U	500 U	500 U	400 U	1000 U	25 U
Carbon Tetrachloride	5		25 U	500 U	100 U	400 U	1000 U	5 U
Chlorobenzene	5		**1260**	**970**	**17000**	**3200**	**9400**	**583**
Chloroethane	5		120 U	500 U	500 U	400 U	1000 U	25 U
Chloroform	7		120 U	500 U	500 U	400 U	1000 U	25 U
Chloromethane	--		120 U	500 U	500 U	400 U	1000 U	25 U
Dibromochloromethane	50		120 U	500 U	500 U	400 U	1000 U	25 U
Ethylbenzene	5		25 U	500 U	**118**	400 U	1000 U	5 U
Methylene Chloride	5		50 U	500 U	200 U	400 U	1000 U	10 U
Styrene	5		120 U	500 U	500 U	400 U	1000 U	25 U
Tetrachloroethene	5		25 U	500 U	100 U	400 U	1000 U	5 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-105 11/8/1999	MP-MW-105 4/23/2001	MP-MW-106 11/8/1999	MP-MW-106 3/13/2001	MP-MW-106 4/14/2001	MP-MW-107 11/9/1999
Toluene	5		25 U	500 U	**380**	400 U	1000 U	5 U
Trichloroethene	5		25 U	500 U	100 U	400 U	1000 U	5 U
Vinyl acetate	--		NA	500 U	NA	400 U	1000 U	NA
Vinyl Chloride	2		**116**	200 U	**153**	160 U	400 U	5 U
Xylenes (total)	5		25 U	500 U	**405**	400 U	1000 U	5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

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Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-107 3/13/2001	MP-MW-108 11/9/1999	MP-MW-108 4/25/2001	MP-MW-109 11/9/1999	MP-MW-109 DUP 11/9/1999
1,1,1-Trichloroethane	5		25 U	120 U	100 U	25 U	50 U
1,1,2,2-Tetrachloroethane	5		25 U	50 U	100 U	10 U	20 U
1,1,2-Trichloroethane	1		25 U	75 U	100 U	15 U	30 U
1,1-Dichloroethane	5		25 U	120 U	100 U	25 U	50 U
1,1-Dichloroethene	5		25 U	50 U	100 U	10 U	20 U
1,2-Dichloroethane	0.6		25 U	50 U	**52 J**	10 U	20 U
1,2-Dichloroethene, cis-	5		25 U	120 U	100 U	25 U	50 U
1,2-Dichloroethene, trans-	5		25 U	120 U	100 U	25 U	50 U
1,2-Dichloropropane	1		25 U	25 U	100 U	5 U	10 U
1,3,5-Trimethylbenzene	5		25 U	NA	100 U	NA	NA
1,3-Dichloropropane	5		25 U	NA	100 U	NA	NA
1,3-Dichloropropene, cis-	0.4 *		25 U	25 U	100 U	5 U	10 U
1,3-Dichloropropene, trans-	0.4 *		25 U	25 U	100 U	5 U	10 U
2-Butanone	--		25 U	120 U	100 U	25 U	50 U
2-Hexanone	50		25 U	120 U	100 U	25 U	50 U
4-Methyl-2-pentanone	--		25 U	120 U	100 U	25 U	50 U
Acetone	50		25 U	**2190**	**480**	25 U	50 U
Benzene	1		**6**	**2240**	**1400**	**602**	**660**
Bromodichloromethane	50		25 U	25 U	100 U	5 U	10 U
Bromoform	50		25 U	100 U	100 U	20 U	40 U
Bromomethane	5		25 U	120 U	100 U	25 U	50 U
Carbon Disulfide	--		25 U	150	25 J	25 U	50 U
Carbon Tetrachloride	5		25 U	25 U	100 U	5 U	10 U
Chlorobenzene	5		**620**	**1130**	**1200**	**630**	**629**
Chloroethane	5		25 U	120 U	100 U	25 U	50 U
Chloroform	7		25 U	120 U	100 U	25 U	50 U
Chloromethane	--		25 U	120 U	100 U	25 U	50 U
Dibromochloromethane	50		25 U	120 U	100 U	25 U	50 U
Ethylbenzene	5		25 U	25 U	100 U	**737**	**1010**
Methylene Chloride	5		25 U	50 U	100 U	10 U	20 U
Styrene	5		25 U	120 U	100 U	25 U	50 U
Tetrachloroethene	5		25 U	25 U	100 U	5 U	10 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-107 3/13/2001	MP-MW-108 11/9/1999	MP-MW-108 4/25/2001	MP-MW-109 11/9/1999	MP-MW-109 DUP 11/9/1999
Toluene	5		25 U	**438**	**140**	5 U	10 U
Trichloroethene	5		25 U	25 U	100 U	5 U	10 U
Vinyl acetate	--		25 U	NA	100 U	NA	NA
Vinyl Chloride	2		10 U	25 U	40 U	**6.7**	10 U
Xylenes (total)	5		25 U	25 U	100 U	**600**	**1020**

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

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Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-109 4/23/2001	MP-MW-110 11/9/1999	MP-MW-110 4/25/2001	MP-MW-111 11/9/1999	MP-MW-111 4/17/2001	MP-MW-112 11/9/1999
1,1,1-Trichloroethane	5		75 U	5 U	5 U	50 U	100 U	5 U
1,1,2,2-Tetrachloroethane	5		75 U	2 U	5 U	20 U	100 U	2 U
1,1,2-Trichloroethane	1		75 U	3 U	5 U	30 U	100 U	3 U
1,1-Dichloroethane	5		75 U	5 U	5 U	50 U	100 U	5 U
1,1-Dichloroethene	5		75 U	2 U	5 U	20 U	100 U	2 U
1,2-Dichloroethane	0.6		**300**	2 U	**1 J**	20 U	100 U	2 U
1,2-Dichloroethene, cis-	5		75 U	5 U	5 U	50 U	100 U	5 U
1,2-Dichloroethene, trans-	5		75 U	5 U	5 U	50 U	100 U	5 U
1,2-Dichloropropane	1		75 U	1 U	5 U	10 U	100 U	1 U
1,3,5-Trimethylbenzene	5		**590**	NA	5 U	NA	100 U	NA
1,3-Dichloropropane	5		75 U	NA	5 U	NA	100 U	NA
1,3-Dichloropropene, cis-	0.4 *		75 U	1 U	5 U	10 U	100 U	1 U
1,3-Dichloropropene, trans-	0.4 *		75 U	1 U	5 U	10 U	100 U	1 U
2-Butanone	--		75 U	5 U	5 U	50 U	100 U	5 U
2-Hexanone	50		75 U	5 U	5 U	50 U	100 U	5 U
4-Methyl-2-pentanone	--		75 U	5 U	5 U	50 U	100 U	5 U
Acetone	50		**65 J**	5 U	2 J	50 U	100 U	5 U
Benzene	1		**200**	**3**	0.7 U	**1510**	**360**	1 U
Bromodichloromethane	50		75 U	1 U	5 U	10 U	100 U	1 U
Bromoform	50		75 U	4 U	5 U	40 U	100 U	4 U
Bromomethane	5		75 U	5 U	5 U	50 U	100 U	5 U
Carbon Disulfide	--		22 J	8.7	5 U	50 U	100 U	5 U
Carbon Tetrachloride	5		75 U	1 U	5 U	10 U	100 U	1 U
Chlorobenzene	5		**350**	**63.6**	**12**	**1610**	**3100**	3.1
Chloroethane	5		75 U	5 U	5 U	50 U	100 U	5 U
Chloroform	7		75 U	5 U	5 U	50 U	100 U	2 J
Chloromethane	--		75 U	5 U	5 U	50 U	23 J	5 U
Dibromochloromethane	50		75 U	5 U	5 U	50 U	100 U	5 U
Ethylbenzene	5		**1800**	1 U	5 U	**64.5**	100 U	1 U
Methylene Chloride	5		75 U	2 U	5 U	20 U	100 U	2 U
Styrene	5		75 U	5 U	5 U	50 U	100 U	5 U
Tetrachloroethene	5		75 U	1 U	5 U	10 U	100 U	1 U

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Toluene	5		75 U	1 U	5 U	**22.4**	100 U	1 U
Trichloroethene	5		75 U	1 U	5 U	10 U	100 U	1 U
Vinyl acetate	--		75 U	NA	5 U	NA	100 U	NA
Vinyl Chloride	2		30 U	1 U	2 U	10 U	40 U	1 U
Xylenes (total)	5		**3000**	1 U	5 U	**684**	100 U	1 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not Detected; Detected Limit Shown

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Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-113 4/26/2001	MP-MW-113 DUP 4/26/2001	MP-MW-114 4/26/2001	MP-PP-1 04/26/2000	MP-PP-2 04/26/2000	MP-PP-2 4/14/2001
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		5 U	5 U	5 U	2 U	2 U	5 U
1,1,2-Trichloroethane	1		5 U	5 U	5 U	3 U	3 U	5 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		5 U	5 U	5 U	2 U	2 U	5 U
1,2-Dichloroethane	0.6		5 U	**1 J**	5 U	2 U	2 U	5 U
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		5 U	5 U	5 U	1 U	1 U	5 U
1,3,5-Trimethylbenzene	5		5 U	5 U	5 U	NA	NA	5 U
1,3-Dichloropropane	5		5 U	5 U	5 U	NA	NA	5 U
1,3-Dichloropropene, cis-	0.4 *		5 U	5 U	5 U	1 U	1 U	5 U
1,3-Dichloropropene, trans-	0.4 *		5 U	5 U	5 U	1 U	1 U	5 U
2-Butanone	--		5 U	2 J	5 U	5 U	5 U	5 U
2-Hexanone	50		5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		6	6	6	5 U	5 U	2 J
Benzene	1		0.7 U	0.7 U	**2**	1 U	1 U	0.7 U
Bromodichloromethane	50		5 U	5 U	5 U	1 U	1 U	5 U
Bromoform	50		5 U	5 U	5 U	4 U	4 U	5 U
Bromomethane	5		5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		1 J	2 J	1 J	5 U	5 U	5 U
Carbon Tetrachloride	5		5 U	5 U	5 U	1 U	1 U	5 U
Chlorobenzene	5		5 U	5 U	5 U	2 U	2 U	5 U
Chloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		2 J	3 J	5 U	0.76 J	0.76 J	5 U
Chloromethane	--		5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		5 U	5 U	5 U	1 U	1 U	5 U
Methylene Chloride	5		5 U	5 U	5 U	2 U	2 U	5 U
Styrene	5		5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		5 U	5 U	5 U	1 U	1 U	5 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-113 4/26/2001	MP-MW-113 DUP 4/26/2001	MP-MW-114 4/26/2001	MP-PP-1 04/26/2000	MP-PP-2 04/26/2000	MP-PP-2 4/14/2001
Toluene	5		5 U	5 U	5 U	1 U	1 U	5 U
Trichloroethene	5		5 U	5 U	5 U	1 U	1 U	5 U
Vinyl acetate	--		5 U	5 U	5 U	NA	NA	5 U
Vinyl Chloride	2		2 U	2 U	2 U	1 U	1 U	2 U
Xylenes (total)	5		5 U	5 U	5 U	1 U	1 U	5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

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Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-PP-3 04/27/2000	MP-PP-4 04/27/2000	MP-PP-5 04/27/2000	MP-PZ-104 4/11/2001	MP-PZ-106 4/11/2001	MP-PZ-106 DUP 4/11/2001
1,1,1-Trichloroethane	5		250 U	5 U	100 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		100 U	2 U	40 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1		150 U	3 U	60 U	5 U	5 U	5 U
1,1-Dichloroethane	5		250 U	5 U	100 U	5 U	5 U	5 U
1,1-Dichloroethene	5		100 U	2 U	40 U	5 U	5 U	5 U
1,2-Dichloroethane	0.6		100 U	2 U	40 U	5 U	5 U	5 U
1,2-Dichloroethene, cis-	5		250 U	5 U	100 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		250 U	5 U	100 U	5 U	5 U	5 U
1,2-Dichloropropane	1		50 U	1 U	20 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	5		NA	NA	NA	5 U	5 U	5 U
1,3-Dichloropropane	5		NA	NA	NA	5 U	5 U	5 U
1,3-Dichloropropene, cis-	0.4 *		50 U	1 U	20 U	5 U	5 U	5 U
1,3-Dichloropropene, trans-	0.4 *		50 U	1 U	20 U	5 U	5 U	5 U
2-Butanone	--		250 U	5 U	100 U	5 U	5 U	5 U
2-Hexanone	50		250 U	5 U	100 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		250 U	5 U	100 U	5 U	5 U	5 U
Acetone	50		250 U	5 U	100 U	5 U	5 U	5 U
Benzene	1		**1340**	0.82 J	**724**	0.7 U	**3**	**3 J**
Bromodichloromethane	50		50 U	1 U	20 U	5 U	5 U	5 U
Bromoform	50		200 U	4 U	80 U	5 U	5 U	5 U
Bromomethane	5		250 U	5 U	100 U	5 U	5 U	5 U
Carbon Disulfide	--		250 U	5 U	100 U	1 J	5 U	5 U
Carbon Tetrachloride	5		50 U	1 U	20 U	5 U	5 U	5 U
Chlorobenzene	5		**10800**	4.7	**4200**	5 U	**9**	**9**
Chloroethane	5		250 U	5 U	100 U	5 U	5 U	5 U
Chloroform	7		250 U	1.8 J	100 U	5	5	5
Chloromethane	--		250 U	5 U	100 U	5 U	5 U	5 U
Dibromochloromethane	50		250 U	5 U	100 U	5 U	5 U	5 U
Ethylbenzene	5		**38.5 J**	1 U	**51.2**	5 U	5 U	5 U
Methylene Chloride	5		100 U	2 U	40 U	5 U	5 U	5 U
Styrene	5		250 U	5 U	100 U	5 U	5 U	5 U
Tetrachloroethene	5		50 U	1 U	20 U	5 U	5 U	5 U

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Toluene	5		50 U	1 U	**98.6**	5 U	5 U	5 U
Trichloroethene	5		50 U	1 U	20 U	5 U	5 U	5 U
Vinyl acetate	--		NA	NA	NA	5 U	5 U	5 U
Vinyl Chloride	2		50 U	1 U	20 U	2 U	2 U	5 U
Xylenes (total)	5		50 U	1 U	**34.4**	5 U	5 U	5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-PZ-107 4/12/2001	MP-PZ-108 4/12/2001	MP-PZ-109 4/23/2001	MP-PZ-110 4/23/2001	MP-PZ-111 4/23/2001	MP-PZ-112 4/11/2001
1,1,1-Trichloroethane	5		40 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		40 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1		40 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5		40 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		40 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	0.6		40 U	5 U	**1 J**	5 U	5 U	5 U
1,2-Dichloroethene, cis-	5		40 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		40 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		40 U	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	5		**89**	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	5		40 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropene, cis-	0.4 *		40 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropene, trans-	0.4 *		40 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	--		40 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	50		40 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		40 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		40 U	5 U	4 J	2 J	3 J	5 U
Benzene	1		**340**	0.7 U	**4**	0.7 U	0.7 U	0.7 U
Bromodichloromethane	50		40 U	5 U	5 U	5 U	5 U	5 U
Bromoform	50		40 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5		40 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		40 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		40 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5		**310**	2 J	**180**	5 U	5 U	5 U
Chloroethane	5		40 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		40 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	--		40 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		40 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		**810**	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	5		40 U	5 U	5 U	5 U	5 U	5 U
Styrene	5		40 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		40 U	5 U	5 U	5 U	5 U	5 U

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Toluene	5		40 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5		40 U	5 U	5 U	5 U	5 U	5 U
Vinyl acetate	--		40 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	2		16 U	2 U	2 U	2 U	2 U	2 U
Xylenes (total)	5		**91**	5 U	5 U	5 U	5 U	5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-PZ-113 4/12/2001	MP-PZ-114 4/12/2001	MP-PZ-120 5/2/2001	MP-PZ-121 5/2/2001	MP-SB-19 05/09/2000	MP-SB-20 05/08/2000	MP-SB-46 05/17/2000
1,1,1-Trichloroethane	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
1,1,2,2-Tetrachloroethane	5		7500 U	5 U	200 U	5 U	2 U	2 U	5 U
1,1,2-Trichloroethane	1		7500 U	5 U	200 U	5 U	3 U	3 U	7.5 U
1,1-Dichloroethane	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
1,1-Dichloroethene	5		7500 U	5 U	200 U	5 U	2 U	2 U	5 U
1,2-Dichloroethane	0.6		7500 U	5 U	**76 J**	5 U	2 U	2 U	5 U
1,2-Dichloroethene, cis-	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
1,2-Dichloroethene, trans-	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
1,2-Dichloropropane	1		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
1,3,5-Trimethylbenzene	5		7500 U	5 U	200 U	5 U	NA	NA	NA
1,3-Dichloropropane	5		7500 U	5 U	200 U	5 U	NA	NA	NA
1,3-Dichloropropene, cis-	0.4 *		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
1,3-Dichloropropene, trans-	0.4 *		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
2-Butanone	--		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
2-Hexanone	50		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
4-Methyl-2-pentanone	--		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Acetone	50		7500 U	5 U	**100 J**	4 J	5 U	5 U	**733**
Benzene	1		**3200**	**10**	**92**	**3**	1 U	1 U	**6.9**
Bromodichloromethane	50		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
Bromoform	50		7500 U	5 U	200 U	5 U	4 U	4 U	10 U
Bromomethane	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Carbon Disulfide	--		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Carbon Tetrachloride	5		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
Chlorobenzene	5		**170000**	**58**	**3700**	5 U	2 U	2 U	**398**
Chloroethane	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Chloroform	7		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Chloromethane	--		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Dibromochloromethane	50		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Ethylbenzene	5		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
Methylene Chloride	5		7500 U	5 U	200 U	5 U	2 U	2 U	5 U
Styrene	5		7500 U	5 U	200 U	5 U	5 U	5 U	12 U
Tetrachloroethene	5		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-PZ-113 4/12/2001	MP-PZ-114 4/12/2001	MP-PZ-120 5/2/2001	MP-PZ-121 5/2/2001	MP-SB-19 05/09/2000	MP-SB-20 05/08/2000	MP-SB-46 05/17/2000
Toluene	5		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
Trichloroethene	5		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U
Vinyl acetate	--		7500 U	5 U	200 U	5 U	NA	NA	NA
Vinyl Chloride	2		3000 U	2 U	80 U	2 U	1 U	1 U	2.5 U
Xylenes (total)	5		7500 U	5 U	200 U	5 U	1 U	1 U	2.5 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

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Bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-SB-48 05/18/2000	MP-SB-49 05/18/2000	MP-SB-50 05/08/2000	ST-MW-2 11/10/1999	ST-MW-6A 04/25/2000	ST-MW-6A 4/10/2001	ST-MW-7A 04/25/2000
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		2 U	2 U	2 U	2 U	2 U	5 U	2 U
1,1,2-Trichloroethane	1		3 U	3 U	3 U	3 U	3 U	5 U	3 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		2 U	2 U	2 U	2 U	2 U	5 U	2 U
1,2-Dichloroethane	0.6		2 U	**25.4**	**3.4**	2 U	2 U	**4 J**	2 U
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		1 U	1 U	1 U	1 U	1 U	5 U	1 U
1,3,5-Trimethylbenzene	5		NA	NA	NA	NA	NA	5 U	NA
1,3-Dichloropropane	5		NA	NA	NA	NA	NA	5 U	NA
1,3-Dichloropropene, cis-	0.4 *		1 U	1 U	1 U	1 U	1 U	5 U	1 U
1,3-Dichloropropene, trans-	0.4 *		1 U	1 U	1 U	1 U	1 U	5 U	1 U
2-Butanone	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	50		5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50		5 U	5 U	5 U	5 U	5 U	4 J	5 U
Benzene	1		**20.8**	**5.9**	**22.4**	1 U	**60.4**	**18**	1 U
Bromodichloromethane	50		1 U	1 U	1 U	1 U	1 U	5 U	1 U
Bromoform	50		4 U	4 U	4 U	4 U	4 U	5 U	4 U
Bromomethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		1 U	1 U	1 U	1 U	1 U	5 U	1 U
Chlorobenzene	5		**212**	**67.3**	**57.3**	2 U	**7.4**	2 J	2 U
Chloroethane	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	7		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	--		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5		1 U	1 U	0.68 J	1 U	1 U	5 U	1 U
Methylene Chloride	5		2 U	2 U	2 U	2 U	2 U	5 U	2 U
Styrene	5		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5		1 U	1 U	1 U	1 U	1 U	5 U	1 U

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-SB-48 05/18/2000	MP-SB-49 05/18/2000	MP-SB-50 05/08/2000	ST-MW-2 11/10/1999	ST-MW-6A 04/25/2000	ST-MW-6A 4/10/2001	ST-MW-7A 04/25/2000
Toluene	5		1 U	1 U	1 U	1 U	2.3	5 U	1 U
Trichloroethene	5		1 U	1 U	1 U	1 U	1 U	5 U	1 U
Vinyl acetate	--		NA	NA	NA	NA	NA	5 U	NA
Vinyl Chloride	2		1 U	**4.1**	1 U	**99.3**	**3.3**	2	1 U
Xylenes (total)	5		1 U	1 U	1 U	1 U	1 U	5 U	1 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not Detected; Detected Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

DUP - Duplicate sample

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	ST-MW-9 04/25/2000	FB 11/11 WG 11/11/1999	TB 11/12 WG 11/12/1999	MP-W-FB 04/27/2000
1,1,1-Trichloroethane	5		5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5		2 U	2 U	2 U	2 U
1,1,2-Trichloroethane	1		3 U	3 U	3 U	3 U
1,1-Dichloroethane	5		5 U	5 U	5 U	5 U
1,1-Dichloroethene	5		2 U	2 U	2 U	2 U
1,2-Dichloroethane	0.6		2 U	2 U	2 U	2 U
1,2-Dichloroethene, cis-	5		5 U	5 U	5 U	5 U
1,2-Dichloroethene, trans-	5		5 U	5 U	5 U	5 U
1,2-Dichloropropane	1		1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5		NA	NA	NA	NA
1,3-Dichloropropane	5		NA	NA	NA	NA
1,3-Dichloropropene, cis-	0.4 *		1 U	1 U	1 U	1 U
1,3-Dichloropropene, trans-	0.4 *		1 U	1 U	1 U	1 U
2-Butanone	--		5 U	5 U	5 U	5 U
2-Hexanone	50		5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	--		5 U	5 U	5 U	5 U
Acetone	50		5 U	5 U	5 U	5 U
Benzene	1		1 U	1 U	1 U	1 U
Bromodichloromethane	50		1 U	1 U	1 U	1 U
Bromoform	50		4 U	4 U	4 U	4 U
Bromomethane	5		5 U	5 U	5 U	5 U
Carbon Disulfide	--		5 U	5 U	5 U	5 U
Carbon Tetrachloride	5		1 U	1 U	1 U	1 U
Chlorobenzene	5		2 U	2 U	2 U	2 U
Chloroethane	5		5 U	5 U	5 U	5 U
Chloroform	7		5 U	5 U	5 U	5 U
Chloromethane	--		5 U	5 U	5 U	5 U
Dibromochloromethane	50		5 U	5 U	5 U	5 U
Ethylbenzene	5		1 U	1 U	1 U	1 U
Methylene Chloride	5		2 U	2 U	2 U	2 U
Styrene	5		5 U	5 U	5 U	5 U
Tetrachloroethene	5		1 U	1 U	1 U	1 U

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater Samples during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	ST-MW-9 04/25/2000	FB 11/11 WG 11/11/1999	TB 11/12 WG 11/12/1999	MP-W-FB 04/27/2000
Toluene	5		1 U	1 U	1 U	1 U
Trichloroethene	5		1 U	1 U	1 U	1 U
Vinyl acetate	--		NA	NA	NA	NA
Vinyl Chloride	2		1 U	1 U	1 U	1 U
Xylenes (total)	5		1 U	1 U	1 U	1 U

Notes:

µg/L - Micrograms per liter

* - Standard is sum of cis- and trans- 1,3-Dichloropropene

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June 1998

U - Not Detected; Detected Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

DUP - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	FB 11/11 WG 11/11/1999	LF-MW-43r 04/27/2000	LF-MW-43R 4/23/2001	LF-MW-45 11/11/1999	LF-MW-45 4/25/2001	LF-PZ-115 4/11/2001	LF-PZ-116 4/11/2001	LF-PZ-117 4/11/2001
1,2,4-Trichlorobenzene	5		2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	3		2 U	**34.7**	48	2.1 U	5 U	5 U	3 J	5 U
1,3-Dichlorobenzene	3		2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	3		2 U	1.8J	5 U	2.1 U	5 U	5 U	5 U	5 U
1-Chloro-4-phenoxybenzene	--		NA	NA	2 U	NA	2 U	2 U	2 U	2 U
2,4,5-Trichlorophenol	--		5 U	5.1U	20 U	5.2 U	20 U	20 U	20 U	20 U
2,4,6-Trichlorophenol	--		5 U	5.1U	NA	5.2 U	NA	NA	NA	NA
2,4-Dichlorophenol	5		5 U	5.1U	NA	5.2 U	NA	NA	NA	NA
2,4-Dimethylphenol	50		5 U	5.1U	NA	5.2 U	NA	NA	NA	NA
2,4-Dinitrophenol	10		20 U	20U	NA	21 U	NA	NA	NA	NA
2,4-Dinitrotoluene	5		2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
2,6-Dinitrotoluene	5		2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
2-Chloronaphthalene	10		5 U	5.1U	5 U	5.2 U	5 U	5 U	5 U	5 U
2-Chlorophenol	--		5 U	1.2J	NA	5.2 U	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		20 U	NA	NA	21 U	NA	NA	NA	NA
2-Methylnaphthalene	--		2 U	2U	10 U	2.1 U	10 U	2 J	10 U	10 U
2-Methylphenol	--		5 U	4J	NA	5.2 U	NA	NA	NA	NA
2-Nitroaniline	5		5 U	5.1U	20 U	5.2 U	20 U	20 U	20 U	20 U
2-Nitrophenol	--		5 U	5.1U	NA	5.2 U	NA	NA	NA	NA
3&4-Methylphenol	--		5 U	14.8	NA	5.2 U	NA	NA	NA	NA
3,3'-Dichlorobenzidine	5		5 U	**6.3**	NA	5.2 U	NA	NA	NA	NA
3-Nitroaniline	5		5 U	5.1U	20 U	5.2 U	20 U	20 U	20 U	20 U
4,6-Dinitro-o-cresol	--		NA	20U	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
4-Chloro-3-methyl phenol	--		5 U	5.1U	NA	5.2 U	NA	NA	NA	NA
4-Chloroaniline	5		NA	**15.4**	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		2 U	2U	NA	2.1 U	NA	NA	NA	NA
4-Nitroaniline	5		NA	5.1U	20 U	NA	20 U	20 U	20 U	20 U
4-Nitrophenol	--		20 U	20U	10 U	21 U	10 U	10 U	10 U	10 U
Acenaphthene	20		2 U	2U	10 U	2.1 U	10 U	2 J	10 U	10 U
Acenaphthylene	--		2 U	NA	10 U	2.1 U	10 U	10 U	10 U	10 U
Anthracene	50		2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Benzo[a]anthracene	0.002		2 U	2U	6 U	2.1 U	6 U	**2 J**	6 U	6 U
Benzo[a]pyrene	--		2 U	2U	2 U	2.1 U	2 U	2	2 U	2 U
Benzo[b]fluoranthene	0.002		2 U	2U	2 U	2.1 U	2 U	**2**	2 U	2 U
Benzo[g,h,i]perylene	5		NA	2U	10 U	NA	10 U	10 U	10 U	10 U
Benzo[k]fluoranthene	0.002		2 U	2U	2 U	2.1 U	2 U	2 U	2 U	2 U
bis(2-Chloroethoxy)methane	5		2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
bis(2-Chloroethyl)Ether	1		2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
bis(2-Chloroisopropyl)ether	--		2 U	2U	NA	2.1 U	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	5		2 U	2U	6 J	2.1 U	10 U	10 U	10 U	10 U
Butylbenzyl phthalate	--		2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Carbazole	--		2 U	2U	NA	2.1 U	NA	NA	NA	NA
Chrysene	0.002		2 U	2U	2 U	2.1 U	2 U	**2**	2 U	2 U
Dibenzo[a,h]anthracene	--		2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:** FB 11/11 WG 11/11/1999	LF-MW-43r 04/27/2000	LF-MW-43R 4/23/2001	LF-MW-45 11/11/1999	LF-MW-45 4/25/2001	LF-PZ-115 4/11/2001	LF-PZ-116 4/11/2001	LF-PZ-117 4/11/2001
Dibenzofuran	--	5 U	5.1U	10 U	5.2 U	10 U	10 U	10 U	10 U
Diethyl phthalate	50	2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Dimethyl phthalate	50	2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	50	2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Di-n-octyl phthalate	--	2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Di-n-propylnitrosamine	--	NA	NA	5 U	NA	5 U	5 U	5 U	5 U
Fluoranthene	50	2 U	2U	1 J	2.1 U	10 U	5 J	10 U	10 U
Fluorene	50	2 U	2U	10 U	2.1 U	10 U	3 J	10 U	10 U
Hexachlorobenzene	0.04	2 U	2U	2 U	2.1 U	2 U	2 U	2 U	2 U
Hexachlorobutadiene	0.5	5 U	2U	5 U	5.2 U	5 U	5 U	5 U	5 U
Hexachlorocyclopentadiene	5	20 U	20U	5 U	21 U	5 U	5 U	5 U	5 U
Hexachloroethane	5	5 U	5.1U	10 U	5.2 U	10 U	10 U	10 U	10 U
Indeno[1,2,3-cd]pyrene	0.002	2 U	2U	2 U	2.1 U	2 U	2 U	2 U	2 U
Isophorone	50	2 U	2U	10 U	2.1 U	10 U	10 U	10 U	10 U
Naphthalene	10	2 U	1.5J	5 U	2.1 U	5 U	**14**	5 U	5 U
Nitrobenzene	0.4	2 U	2U	5 U	2.1 U	5 U	5 U	5 U	5 U
N-Nitroso-di-n-propylamine	--	NA	2U	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--	5 U	NA	NA	5.2 U	NA	NA	NA	NA
N-Nitrosodiphenylamine	50	5 U	23.3	10 U	5.2 U	10 U	10 U	10 U	10 U
P-Chloroaniline	--	5 U	NA	NA	5.2 U	NA	NA	NA	NA
P-Nitroaniline	--	5 U	NA	NA	5.2 U	NA	NA	NA	NA
Pentachlorophenol	1	20 U	20U	20 U	21 U	20 U	20 U	20 U	20 U
Phenanthrene	50	2 U	2U	10 U	2.1 U	10 U	8 J	10 U	10 U
Phenol	1*	5 U	**49.6**	2 U	5.2 U	2 U	2 U	2 U	2 U
Pyrene	50	2 U	2U	2 J	2.1 U	10 U	4 J	10 U	10 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** LF-PZ-118 **Sample Date:** 4/11/2001	LG-MH-5 11/11/1999	LG-MH-5 05/01/2000	LG-MH-5 4/26/2001	LG-MH-6 11/11/1999	LG-MH-6 04/27/2000	LG-MH-6 DUP 04/27/2000	LG-MH-6 4/26/2001
1,2,4-Trichlorobenzene	5	**11 J**	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
1,2-Dichlorobenzene	3	25 U	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
1,3-Dichlorobenzene	3	**6 J**	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
1,4-Dichlorobenzene	3	**25**	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
1-Chloro-4-phenoxybenzene	--	10 U	NA	NA	2 U	NA	NA	NA	2 U
2,4,5-Trichlorophenol	--	100 U	5.1 U	5.2U	20 U	5.1 U	5.2U	5.1U	20 U
2,4,6-Trichlorophenol	--	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
2,4-Dichlorophenol	5	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
2,4-Dimethylphenol	50	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
2,4-Dinitrophenol	10	NA	20 U	21U	NA	20 U	21U	20U	NA
2,4-Dinitrotoluene	5	25 U	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
2,6-Dinitrotoluene	5	25 U	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
2-Chloronaphthalene	10	25 U	5.1 U	5.2U	5 U	5.1 U	5.2U	5.1U	5 U
2-Chlorophenol	--	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
2-Methyl-4,6-Dinitrophenol	--	NA	20 U	NA	NA	20 U	NA	NA	NA
2-Methylnaphthalene	--	50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
2-Methylphenol	--	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
2-Nitroaniline	5	100 U	5.1 U	5.2U	20 U	5.1 U	5.2U	5.1U	20 U
2-Nitrophenol	--	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
3&4-Methylphenol	--	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
3,3'-Dichlorobenzidine	5	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
3-Nitroaniline	5	100 U	5.1 U	5.2U	20 U	5.1 U	5.2U	5.1U	20 U
4,6-Dinitro-o-cresol	--	NA	NA	21U	NA	NA	21U	20U	NA
4-Bromodiphenyl ether	--	50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
4-Chloro-3-methyl phenol	--	NA	5.1 U	5.2U	NA	5.1 U	5.2U	5.1U	NA
4-Chloroaniline	5	NA	NA	5.2U	NA	NA	5.2U	5.1U	NA
4-Chlorophenyl phenyl ether	--	NA	2 U	2.1U	NA	2 U	2.1U	2U	NA
4-Nitroaniline	5	**16 J**	NA	5.2U	20 U	NA	5.2U	5.1U	20 U
4-Nitrophenol	--	50 U	20 U	21U	10 U	20 U	21U	20U	10 U
Acenaphthene	20	50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Acenaphthylene	--	50 U	2 U	NA	10 U	2 U	NA	NA	10 U
Anthracene	50	50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Benzo[a]anthracene	0.002	30 U	2 U	2.1U	6 U	2 U	2.1U	2U	6 U
Benzo[a]pyrene	--	10 U	2 U	2.1U	2 U	2 U	2.1U	2U	2 U
Benzo[b]fluoranthene	0.002	10 U	2 U	2.1U	2 U	2 U	2.1U	2U	2 U
Benzo[g,h,i]perylene	5	50 U	NA	2.1U	10 U	NA	2.1U	2U	10 U
Benzo[k]fluoranthene	0.002	10 U	2 U	2.1U	2 U	2 U	2.1U	2U	2 U
bis(2-Chloroethoxy)methane	5	25 U	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
bis(2-Chloroethyl)Ether	1	25 U	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
bis(2-Chloroisopropyl)ether	--	NA	2 U	2.1U	NA	2 U	2.1U	2U	NA
bis(2-Ethylhexyl)phthalate	5	50 U	1 J	4.2	10 U	1.8 J	2.1U	2U	10 U
Butylbenzyl phthalate	--	50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Carbazole	--	NA	2 U	2.1U	NA	2 U	2.1U	2U	NA
Chrysene	0.002	10 U	2 U	2.1U	2 U	2 U	2.1U	2U	2 U
Dibenzo[a,h]anthracene	--	50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LF-PZ-118	LG-MH-5	LG-MH-5	LG-MH-5	LG-MH-6	LG-MH-6	LG-MH-6 DUP	LG-MH-6
		Sample Date:	4/11/2001	11/11/1999	05/01/2000	4/26/2001	11/11/1999	04/27/2000	04/27/2000	4/26/2001
Dibenzofuran	--		50 U	5.1 U	5.2U	10 U	5.1 U	5.2U	5.1U	10 U
Diethyl phthalate	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Dimethyl phthalate	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Di-n-butyl phthalate	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Di-n-octyl phthalate	--		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Di-n-propylnitrosamine	--		25 U	NA	NA	5 U	NA	NA	NA	5 U
Fluoranthene	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Fluorene	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Hexachlorobenzene	0.04		10 U	2 U	2.1U	2 U	2 U	2.1U	2U	2 U
Hexachlorobutadiene	0.5		25 U	5.1 U	2.1U	5 U	5.1 U	2.1U	2U	5 U
Hexachlorocyclopentadiene	5		25 U	20 U	21U	5 U	20 U	21U	20U	5 U
Hexachloroethane	5		50 U	5.1 U	5.2U	10 U	5.1 U	5.2U	5.1U	10 U
Indeno[1,2,3-cd]pyrene	0.002		10 U	2 U	2.1U	2 U	2 U	2.1U	2U	2 U
Isophorone	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Naphthalene	10		**23 J**	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
Nitrobenzene	0.4		25 U	2 U	2.1U	5 U	2 U	2.1U	2U	5 U
N-Nitroso-di-n-propylamine	--		NA	NA	2.1U	NA	NA	2.1U	2U	NA
N-Nitrosodimethylamine	--		NA	5.1 U	NA	NA	5.1 U	NA	NA	NA
N-Nitrosodiphenylamine	50		50 U	5.1 U	5.2U	10 U	5.1 U	5.2U	5.1U	10 U
P-Chloroaniline	--		NA	5.1 U	NA	NA	5.1 U	NA	NA	NA
P-Nitroaniline	--		NA	5.1 U	NA	NA	5.1 U	NA	NA	NA
Pentachlorophenol	1		100 U	20 U	21U	20 U	20 U	21U	20U	20 U
Phenanthrene	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U
Phenol	1*		10 U	5.1 U	5.2U	2 U	5.1 U	5.2U	5.1U	2 U
Pyrene	50		50 U	2 U	2.1U	10 U	2 U	2.1U	2U	10 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MH-7 11/11/1999	LG-MH-7 05/01/2000	LG-MH-7 4/26/2001	LG-MW-1 11/11/1999	LG-MW-1 3/13/2001	LG-MW-2 11/11/1999	LG-MW-2 4/24/2001	LG-MW-3 11/12/1999	LG-MW-3 4/24/2001
1,2,4-Trichlorobenzene	5		2 J	2U	1 J	2 U	5 U	2.1 U	5 U	2 U	5 U
1,2-Dichlorobenzene	3		**11.6**	**6.5**	**9**	2 U	5 U	2.1 U	5 U	2 U	5 U
1,3-Dichlorobenzene	3		1.8 J	0.86J	1 J	2 U	5 U	2.1 U	5 U	2 U	5 U
1,4-Dichlorobenzene	3		**4.6**	2.6	4 J	2 U	5 U	2.1 U	5 U	2 U	5 U
1-Chloro-4-phenoxybenzene	--		NA	NA	2 U	NA	2 U	NA	2 U	NA	2 U
2,4,5-Trichlorophenol	--		5.2 U	5U	20 U	5.1 U	20 U	5.2 U	20 U	5 U	20 U
2,4,6-Trichlorophenol	--		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
2,4-Dichlorophenol	5		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
2,4-Dimethylphenol	50		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
2,4-Dinitrophenol	10		21 U	20U	NA	20 U	NA	21 U	NA	20 U	NA
2,4-Dinitrotoluene	5		2.1 U	2U	5 U	2 U	5 U	2.1 U	5 U	2 U	5 U
2,6-Dinitrotoluene	5		2.1 U	2U	5 U	2 U	5 U	2.1 U	5 U	2 U	5 U
2-Chloronaphthalene	10		5.2 U	5U	5 U	5.1 U	5 U	5.2 U	5 U	5 U	5 U
2-Chlorophenol	--		33.3	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
2-Methyl-4,6-Dinitrophenol	--		21 U	NA	NA	20 U	NA	21 U	NA	20 U	NA
2-Methylnaphthalene	--		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
2-Methylphenol	--		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
2-Nitroaniline	5		5.2 U	5U	20 U	5.1 U	20 U	5.2 U	20 U	5 U	20 U
2-Nitrophenol	--		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
3&4-Methylphenol	--		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
3,3'-Dichlorobenzidine	5		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
3-Nitroaniline	5		5.2 U	5U	20 U	5.1 U	20 U	5.2 U	20 U	5 U	20 U
4,6-Dinitro-o-cresol	--		NA	20U	NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
4-Chloro-3-methyl phenol	--		5.2 U	5U	NA	5.1 U	NA	5.2 U	NA	5 U	NA
4-Chloroaniline	5		NA	5U	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		2.1 U	2U	NA	2 U	NA	2.1 U	NA	2 U	NA
4-Nitroaniline	5		NA	5U	20 U	NA	20 U	NA	20 U	NA	20 U
4-Nitrophenol	--		21 U	20U	10 U	20 U	10 U	21 U	10 U	20 U	10 U
Acenaphthene	20		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Acenaphthylene	--		2.1 U	NA	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Anthracene	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Benzo[a]anthracene	0.002		2.1 U	2U	6 U	2 U	6 U	2.1 U	6 U	2 U	6 U
Benzo[a]pyrene	--		2.1 U	2U	2 U	2 U	2 U	2.1 U	2 U	2 U	2 U
Benzo[b]fluoranthene	0.002		2.1 U	2U	2 U	2 U	2 U	2.1 U	2 U	2 U	2 U
Benzo[g,h,i]perylene	5		NA	2U	10 U	NA	10 U	NA	10 U	NA	10 U
Benzo[k]fluoranthene	0.002		2.1 U	2U	2 U	2 U	2 U	2.1 U	2 U	2 U	2 U
bis(2-Chloroethoxy)methane	5		2.1 U	2U	5 U	2 U	5 U	2.1 U	5 U	2 U	5 U
bis(2-Chloroethyl)Ether	1		2.1 U	2U	5 U	2 U	5 U	2.1 U	5 U	2 U	5 U
bis(2-Chloroisopropyl)ether	--		2.1 U	2U	NA	2 U	NA	2.1 U	NA	2 U	NA
bis(2-Ethylhexyl)phthalate	5		2.1 U	1.7J	10 U	2 U	21 B	2.1 U	2 J	2 U	10 U
Butylbenzyl phthalate	--		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Carbazole	--		2.1 U	2U	NA	2 U	NA	2.1 U	NA	2 U	NA
Chrysene	0.002		2.1 U	2U	2 U	2 U	2 U	2.1 U	2 U	2 U	2 U
Dibenzo[a,h]anthracene	--		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LG-MH-7	LG-MH-7	LG-MH-7	LG-MW-1	LG-MW-1	LG-MW-2	LG-MW-2	LG-MW-3	LG-MW-3
		Sample Date:	11/11/1999	05/01/2000	4/26/2001	11/11/1999	3/13/2001	11/11/1999	4/24/2001	11/12/1999	4/24/2001
Dibenzofuran	--		5.2 U	5U	10 U	5.1 U	10 U	5.2 U	10 U	5 U	10 U
Diethyl phthalate	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Dimethyl phthalate	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Di-n-butyl phthalate	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Di-n-octyl phthalate	--		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Di-n-propylnitrosamine	--		NA	NA	5 U	NA	5 U	NA	5 U	NA	5 U
Fluoranthene	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Fluorene	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Hexachlorobenzene	0.04		2.1 U	2U	2 U	2 U	2 U	2.1 U	2 U	2 U	2 U
Hexachlorobutadiene	0.5		5.2 U	2U	5 U	5.1 U	5 U	5.2 U	5 U	5 U	5 U
Hexachlorocyclopentadiene	5		21 U	20U	5 U	20 U	5 U	21 U	5 U	20 U	5 U
Hexachloroethane	5		5.2 U	5U	10 U	5.1 U	10 U	5.2 U	10 U	5 U	10 U
Indeno[1,2,3-cd]pyrene	0.002		2.1 U	2U	2 U	2 U	2 U	2.1 U	2 U	2 U	2 U
Isophorone	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Naphthalene	10		**23.9**	**12.2**	5 U	2 U	5 U	2.1 U	5 U	2 U	5 U
Nitrobenzene	0.4		2.1 U	2U	5 U	2 U	5 U	2.1 U	5 U	2 U	5 U
N-Nitroso-di-n-propylamine	--		NA	2U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		5.2 U	NA	NA	5.1 U	NA	5.2 U	NA	5 U	NA
N-Nitrosodiphenylamine	50		5.2 U	5U	10 U	5.1 U	10 U	5.2 U	10 U	5 U	10 U
P-Chloroaniline	--		5.2 U	NA	NA	5.1 U	NA	5.2 U	NA	5 U	NA
P-Nitroaniline	--		5.2 U	NA	NA	5.1 U	NA	5.2 U	NA	5 U	NA
Pentachlorophenol	1		21 U	20U	20 U	20 U	20 U	21 U	20 U	20 U	20 U
Phenanthrene	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U
Phenol	1*		**1.3 J**	5U	2 U	5.1 U	2 U	5.2 U	2 U	5 U	2 U
Pyrene	50		2.1 U	2U	10 U	2 U	10 U	2.1 U	10 U	2 U	10 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LG-MW-4	LG-MW-4	LG-MW-5	LG-MW-5 FD	LG-MW-5	LG-MW-6	LG-MW-6	LG-PZ-1	LG-PZ-2
		Sample Date:	11/12/1999	4/16/2001	11/12/1999	11/12/1999	4/24/2001	11/11/1999	4/24/2001	4/16/2001	4/16/2001
1,2,4-Trichlorobenzene	5		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
1,2-Dichlorobenzene	3		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
1,3-Dichlorobenzene	3		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
1,4-Dichlorobenzene	3		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
1-Chloro-4-phenoxybenzene	--		NA	2 U	NA	NA	2 U	NA	2 U	2 U	2 U
2,4,5-Trichlorophenol	--		5 U	20 U	5.1 U	5 U	20 U	5.1 U	20 U	20 U	20 U
2,4,6-Trichlorophenol	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
2,4-Dichlorophenol	5		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
2,4-Dimethylphenol	50		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
2,4-Dinitrophenol	10		20 U	NA	20 U	20 U	NA	20 U	NA	NA	NA
2,4-Dinitrotoluene	5		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
2,6-Dinitrotoluene	5		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
2-Chloronaphthalene	10		5 U	5 U	5.1 U	5 U	5 U	5.1 U	5 U	5 U	5 U
2-Chlorophenol	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		20 U	NA	20 U	20 U	NA	20 U	NA	NA	NA
2-Methylnaphthalene	--		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
2-Methylphenol	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
2-Nitroaniline	5		5 U	20 U	5.1 U	5 U	20 U	5.1 U	20 U	20 U	20 U
2-Nitrophenol	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
3&4-Methylphenol	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
3,3'-Dichlorobenzidine	5		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
3-Nitroaniline	5		5 U	20 U	5.1 U	5 U	20 U	5.1 U	20 U	20 U	20 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
4-Chloro-3-methyl phenol	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
4-Chloroaniline	5		NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		2 U	NA	2 U	2 U	NA	2 U	NA	NA	NA
4-Nitroaniline	5		NA	20 U	NA	NA	20 U	NA	20 U	20 U	20 U
4-Nitrophenol	--		20 U	10 U	20 U	20 U	10 U	20 U	10 U	10 U	10 U
Acenaphthene	20		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Acenaphthylene	--		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Anthracene	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	1 J
Benzo[a]anthracene	0.002		2 U	6 U	2 U	2 U	6 U	2 U	6 U	6 U	**3 J**
Benzo[a]pyrene	--		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	3
Benzo[b]fluoranthene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	**3**
Benzo[g,h,i]perylene	5		NA	10 U	NA	NA	10 U	NA	10 U	10 U	10 U
Benzo[k]fluoranthene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	**1 J**
bis(2-Chloroethoxy)methane	5		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
bis(2-Chloroethyl)Ether	1		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
bis(2-Chloroisopropyl)ether	--		2 U	NA	2 U	2 U	NA	2 U	NA	NA	NA
bis(2-Ethylhexyl)phthalate	5		2 U	10 U	2 U	2 U	2 J	2 U	10 U	10 U	10 U
Butylbenzyl phthalate	--		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Carbazole	--		2 U	NA	2 U	2 U	NA	2 U	NA	NA	NA
Chrysene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	**3**
Dibenzo[a,h]anthracene	--		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LG-MW-4	LG-MW-4	LG-MW-5	LG-MW-5 FD	LG-MW-5	LG-MW-6	LG-MW-6	LG-PZ-1	LG-PZ-2
		Sample Date:	11/12/1999	4/16/2001	11/12/1999	11/12/1999	4/24/2001	11/11/1999	4/24/2001	4/16/2001	4/16/2001
Dibenzofuran	--		5 U	10 U	5.1 U	5 U	10 U	5.1 U	10 U	10 U	10 U
Diethyl phthalate	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Dimethyl phthalate	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Di-n-butyl phthalate	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Di-n-octyl phthalate	--		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Di-n-propylnitrosamine	--		NA	5 U	NA	NA	5 U	NA	5 U	5 U	5 U
Fluoranthene	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	7 J
Fluorene	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Hexachlorobenzene	0.04		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Hexachlorobutadiene	0.5		5 U	5 U	5.1 U	5 U	5 U	5.1 U	5 U	5 U	5 U
Hexachlorocyclopentadiene	5		20 U	5 U	20 U	20 U	5 U	20 U	5 U	5 U	5 U
Hexachloroethane	5		5 U	10 U	5.1 U	5 U	10 U	5.1 U	10 U	10 U	10 U
Indeno[1,2,3-cd]pyrene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	**2**
Isophorone	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	10 U
Naphthalene	10		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
Nitrobenzene	0.4		2 U	5 U	2 U	2 U	5 U	2 U	5 U	5 U	5 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
N-Nitrosodiphenylamine	50		5 U	10 U	5.1 U	5 U	10 U	5.1 U	10 U	10 U	10 U
P-Chloroaniline	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
P-Nitroaniline	--		5 U	NA	5.1 U	5 U	NA	5.1 U	NA	NA	NA
Pentachlorophenol	1		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Phenanthrene	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	5 JB
Phenol	1*		5 U	2 U	5.1 U	5 U	2 U	5.1 U	2 U	2 U	2 U
Pyrene	50		2 U	10 U	2 U	2 U	10 U	2 U	10 U	10 U	6 J

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

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NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	LG-PZ-101 4/18/2001	LG-PZ-101 DUP 4/18/2001	LG-PZ-102 4/17/2001	LG-PZ-103 4/17/2001	MP-GS-1 05/22/2000	MP-GS-2 05/22/2000	MP-GS-3 05/22/2000	MP-GS-3 DUP 05/22/2000
1,2,4-Trichlorobenzene	5		5 U	5 U	5 U	5 U	2U	1.6J	2.1U	2U
1,2-Dichlorobenzene	3		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
1,3-Dichlorobenzene	3		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
1,4-Dichlorobenzene	3		5 U	5 U	5 U	5 U	2U	**6.2**	2.1U	2U
1-Chloro-4-phenoxybenzene	--		2 U	2 U	2 U	2 U	NA	NA	NA	NA
2,4,5-Trichlorophenol	--		20 U	20 U	20 U	20 U	5.1U	5.1U	5.2U	5.1U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
2,4-Dichlorophenol	5		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
2,4-Dimethylphenol	50		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.2
2,4-Dinitrophenol	10		NA	NA	NA	NA	20U	20U	21U	20U
2,4-Dinitrotoluene	5		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
2,6-Dinitrotoluene	5		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
2-Chloronaphthalene	10		5 U	5 U	5 U	5 U	5.1U	5.1U	5.2U	5.1U
2-Chlorophenol	--		NA	NA	NA	NA	5.1U	5.1U	5.2U	1.1J
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	--		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
2-Methylphenol	--		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
2-Nitroaniline	5		20 U	20 U	20 U	20 U	5.1U	5.1U	5.2U	5.1U
2-Nitrophenol	--		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
3&4-Methylphenol	--		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
3,3'-Dichlorobenzidine	5		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
3-Nitroaniline	5		20 U	20 U	20 U	20 U	5.1U	5.1U	5.2U	5.1U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	20U	20U	21U	20U
4-Bromodiphenyl ether	--		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
4-Chloro-3-methyl phenol	--		NA	NA	NA	NA	5.1U	5.1U	5.2U	5.1U
4-Chloroaniline	5		NA	NA	NA	NA	5.1U	5.1U	2J	**13.8**
4-Chlorophenyl phenyl ether	--		NA	NA	NA	NA	2U	2U	2.1U	2U
4-Nitroaniline	5		20 U	20 U	20 U	20 U	5.1U	5.1U	5.2U	5.1U
4-Nitrophenol	--		10 U	10 U	10 U	10 U	20U	20U	21U	20U
Acenaphthene	20		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Acenaphthylene	--		10 U	10 U	10 U	10 U	NA	NA	NA	NA
Anthracene	50		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Benzo[a]anthracene	0.002		6 U	6 U	6 U	6 U	2U	2U	2.1U	2U
Benzo[a]pyrene	--		2 U	2 U	2 U	2 U	2U	2U	2.1U	2U
Benzo[b]fluoranthene	0.002		2 U	2 U	2 U	2 U	2U	2U	2.1U	2U
Benzo[g,h,i]perylene	5		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Benzo[k]fluoranthene	0.002		2 U	2 U	2 U	2 U	2U	2U	2.1U	2U
bis(2-Chloroethoxy)methane	5		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
bis(2-Chloroethyl)Ether	1		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	2U	2U	2.1U	2U
bis(2-Ethylhexyl)phthalate	5		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Butylbenzyl phthalate	--		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Carbazole	--		NA	NA	NA	NA	2U	2U	2.1U	2U
Chrysene	0.002		2 U	2 U	2 U	2 U	2U	2U	2.1U	2U
Dibenzo[a,h]anthracene	--		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LG-PZ-101	LG-PZ-101 DUP	LG-PZ-102	LG-PZ-103	MP-GS-1	MP-GS-2	MP-GS-3	MP-GS-3 DUP
		Sample Date:	4/18/2001	4/18/2001	4/17/2001	4/17/2001	05/22/2000	05/22/2000	05/22/2000	05/22/2000
Dibenzofuran	--		10 U	10 U	10 U	10 U	5.1U	5.1U	5.2U	5.1U
Diethyl phthalate	50		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Dimethyl phthalate	50		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Di-n-butyl phthalate	50		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Di-n-octyl phthalate	--		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Di-n-propylnitrosamine	--		5 U	5 U	5 U	5 U	NA	NA	NA	NA
Fluoranthene	50		10 U	10 U	10 U	10 U	2U	0.42J	2.1U	0.47J
Fluorene	50		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Hexachlorobenzene	0.04		2 U	2 U	2 U	2 U	2U	2U	2.1U	2U
Hexachlorobutadiene	0.5		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
Hexachlorocyclopentadiene	5		5 U	5 U	5 U	5 U	20U	20U	21U	20U
Hexachloroethane	5		10 U	10 U	10 U	10 U	5.1U	5.1U	5.2U	5.1U
Indeno[1,2,3-cd]pyrene	0.002		2 U	2 U	2 U	2 U	2U	2U	2.1U	2U
Isophorone	50		10 U	10 U	10 U	10 U	2U	2U	2.1U	2U
Naphthalene	10		5 U	5 U	5 U	5 U	2U	2U	2.1U	2.5
Nitrobenzene	0.4		5 U	5 U	5 U	5 U	2U	2U	2.1U	2U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	2U	2U	2.1U	2U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	50		10 U	10 U	10 U	10 U	5.1U	7.7	7.2	21.5
P-Chloroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1		20 U	20 U	20 U	20 U	20U	20U	21U	2U
Phenanthrene	50		3 JB	2 JB	2 JB	2 JB	2U	2U	2.1U	0.62J
Phenol	1*		2 U	2 U	2 U	2 U	5.1U	5.1U	**5.9**	**7.6**
Pyrene	50		10 U	10 U	10 U	10 U	2U	0.37J	2.1U	0.31J

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-GS-4	MP-MW-1	MP-MW-1	MP-MW-2	MP-MW-2	MP-MW-3	MP-MW-3	MP-MW-101
		Sample Date:	05/22/2000	11/10/1999	4/24/2001	11/10/1999	3/13/2001	11/10/1999	4/24/2001	11/8/1999
1,2,4-Trichlorobenzene	5		2U	**5.6**	3 J	2 U	5 U	2 U	5 U	**26.5**
1,2-Dichlorobenzene	3		**5.2**	**44.8**	**18**	2 U	5 U	**148**	**120**	**28.9**
1,3-Dichlorobenzene	3		2U	4	2 J	2 U	5 U	2 U	5 U	1.7 J
1,4-Dichlorobenzene	3		2U	**5.5**	2 J	2 U	5 U	**6.2**	**5**	**18**
1-Chloro-4-phenoxybenzene	--		NA	NA	2 U	NA	2 U	NA	2 U	NA
2,4,5-Trichlorophenol	--		5U	5 U	20 U	5.1 U	20 U	5 U	20 U	5.2 U
2,4,6-Trichlorophenol	--		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
2,4-Dichlorophenol	5		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
2,4-Dimethylphenol	50		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
2,4-Dinitrophenol	10		20U	20 U	NA	20 U	NA	20 U	NA	21 U
2,4-Dinitrotoluene	5		2U	2 U	5 U	2 U	5 U	2 U	5 U	2.1 U
2,6-Dinitrotoluene	5		2U	2 U	5 U	2 U	5 U	2 U	5 U	2.1 U
2-Chloronaphthalene	10		5U	2 J	1 J	5.1 U	5 U	5 U	5 U	5.2 U
2-Chlorophenol	--		4.5J	5 U	NA	5.1 U	NA	7.3	NA	32.9
2-Methyl-4,6-Dinitrophenol	--		NA	20 U	NA	20 U	NA	20 U	NA	21 U
2-Methylnaphthalene	--		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
2-Methylphenol	--		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
2-Nitroaniline	5		5U	5 U	20 U	5.1 U	20 U	5 U	20 U	5.2 U
2-Nitrophenol	--		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
3&4-Methylphenol	--		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
3,3'-Dichlorobenzidine	5		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
3-Nitroaniline	5		5U	5 U	20 U	5.1 U	20 U	5 U	20 U	5.2 U
4,6-Dinitro-o-cresol	--		20U	NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
4-Chloro-3-methyl phenol	--		5U	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
4-Chloroaniline	5		5U	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		2U	2 U	NA	2 U	NA	2 U	NA	2.1 U
4-Nitroaniline	5		5U	NA	20 U	NA	20 U	NA	20 U	NA
4-Nitrophenol	--		20U	20 U	10 U	20 U	10 U	20 U	10 U	21 U
Acenaphthene	20		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Acenaphthylene	--		NA	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Anthracene	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Benzo[a]anthracene	0.002		2U	2 U	6 U	2 U	6 U	2 U	6 U	2.1 U
Benzo[a]pyrene	--		2U	2 U	2 U	2 U	2 U	2 U	2 U	2.1 U
Benzo[b]fluoranthene	0.002		2U	2 U	2 U	2 U	2 U	2 U	2 U	2.1 U
Benzo[g,h,i]perylene	5		2U	NA	10 U	NA	10 U	NA	10 U	NA
Benzo[k]fluoranthene	0.002		2U	2 U	2 U	2 U	2 U	2 U	2 U	2.1 U
bis(2-Chloroethoxy)methane	5		2U	2 U	5 U	2 U	5 U	2 U	5 U	2.1 U
bis(2-Chloroethyl)Ether	1		2U	2 U	5 U	2 U	5 U	2 U	5 U	2.1 U
bis(2-Chloroisopropyl)ether	--		2U	2 U	NA	2 U	NA	2 U	NA	2.1 U
bis(2-Ethylhexyl)phthalate	5		2U	3.6	10 U	2.6	1 JB	2.5	**10**	0.86 J
Butylbenzyl phthalate	--		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Carbazole	--		2U	2 U	NA	2 U	NA	2 U	NA	3.4
Chrysene	0.002		2U	2 U	2 U	2 U	2 U	2 U	2 U	2.1 U
Dibenzo[a,h]anthracene	--		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-GS-4	MP-MW-1	MP-MW-1	MP-MW-2	MP-MW-2	MP-MW-3	MP-MW-3	MP-MW-101
		Sample Date:	05/22/2000	11/10/1999	4/24/2001	11/10/1999	3/13/2001	11/10/1999	4/24/2001	11/8/1999
Dibenzofuran	--		5U	5 U	10 U	5.1 U	10 U	5 U	10 U	5.2 U
Diethyl phthalate	50		2U	1.6 J	10 U	2 U	10 U	2 U	10 U	2.1 U
Dimethyl phthalate	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Di-n-butyl phthalate	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Di-n-octyl phthalate	--		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Di-n-propylnitrosamine	--		NA	NA	5 U	NA	5 U	NA	5 U	NA
Fluoranthene	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Fluorene	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	0.28 J
Hexachlorobenzene	0.04		2U	2 U	2 U	2 U	2 U	2 U	2 U	2.1 U
Hexachlorobutadiene	0.5		2U	5 U	5 U	5.1 U	5 U	5 U	5 U	5.2 U
Hexachlorocyclopentadiene	5		20U	20 U	5 U	20 U	5 U	20 U	5 U	21 U
Hexachloroethane	5		5U	5 U	10 U	5.1 U	10 U	5 U	10 U	5.2 U
Indeno[1,2,3-cd]pyrene	0.002		2U	2 U	2 U	2 U	2 U	2 U	2 U	2.1 U
Isophorone	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Naphthalene	10		2U	3	5 U	2 U	5 U	4	5 U	2.1 U
Nitrobenzene	0.4		2U	2 U	5 U	2 U	5 U	2 U	5 U	2.1 U
N-Nitroso-di-n-propylamine	--		2U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
N-Nitrosodiphenylamine	50		6.1	5 U	10 U	5.1 U	10 U	5 U	10 U	20.1
P-Chloroaniline	--		NA	5 U	NA	5.1 U	NA	5 U	NA	1.4 J
P-Nitroaniline	--		NA	5 U	NA	5.1 U	NA	5 U	NA	5.2 U
Pentachlorophenol	1		20U	20 U	20 U	20 U	20 U	20 U	20 U	21 U
Phenanthrene	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U
Phenol	1*		**11**	**1.3 J**	2 U	5.1 U	2 U	5 U	2 U	**6**
Pyrene	50		2U	2 U	10 U	2 U	10 U	2 U	10 U	2.1 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-101 4/25/2001	MP-MW-102 11/10/1999	MP-MW-102 4/25/2001	MP-MW-103 11/10/1999	MP-MW-104 11/9/1999	MP-MW-104 4/18/2001	MP-MW-105 11/8/1999
1,2,4-Trichlorobenzene	5		**80**	2 U	5 U	2 U	**17**	3 J	2 U
1,2-Dichlorobenzene	3		**73**	2 U	5 U	2 U	**633**	**50**	2.3
1,3-Dichlorobenzene	3		4 J	2 U	5 U	2 U	32.3	2 J	2 U
1,4-Dichlorobenzene	3		**45**	2 U	5 U	2 U	**236**	**9**	1.1 J
1-Chloro-4-phenoxybenzene	--		10 U	NA	2 U	NA	NA	2 U	NA
2,4,5-Trichlorophenol	--		20 U	5 U	20 U	5 U	5.2 U	20 U	5.1 U
2,4,6-Trichlorophenol	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
2,4-Dichlorophenol	5		NA	5 U	NA	5 U	**7.4**	NA	5.1 U
2,4-Dimethylphenol	50		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
2,4-Dinitrophenol	10		NA	20 U	NA	20 U	21 U	NA	20 U
2,4-Dinitrotoluene	5		10 U	2 U	5 U	2 U	2.1 U	5 U	2 U
2,6-Dinitrotoluene	5		10 U	2 U	5 U	2 U	2.1 U	5 U	2 U
2-Chloronaphthalene	10		10 U	5 U	5 U	5 U	5.2 U	5 U	5.1 U
2-Chlorophenol	--		NA	5 U	NA	5 U	14.2	NA	7.3
2-Methyl-4,6-Dinitrophenol	--		NA	20 U	NA	20 U	21 U	NA	20 U
2-Methylnaphthalene	--		10 U	1.5 J	10 U	2 U	2.1 U	10 U	2 U
2-Methylphenol	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
2-Nitroaniline	5		20 U	5 U	20 U	5 U	5.2 U	20 U	5.1 U
2-Nitrophenol	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
3&4-Methylphenol	--		NA	5 U	NA	5 U	1.1 J	NA	0.63 J
3,3'-Dichlorobenzidine	5		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
3-Nitroaniline	5		20 U	5 U	20 U	5 U	5.2 U	20 U	5.1 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
4-Chloro-3-methyl phenol	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
4-Chloroaniline	5		NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		NA	2 U	NA	2 U	2.1 U	NA	2 U
4-Nitroaniline	5		20 U	NA	20 U	NA	NA	20 U	NA
4-Nitrophenol	--		20 U	20 U	10 U	20 U	21 U	10 U	20 U
Acenaphthene	20		10 U	3.9	10 U	2 U	2.1 U	10 U	2 U
Acenaphthylene	--		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Anthracene	50		10 U	2 U	10 U	2 U	2.1 U	10 U	0.93 J
Benzo[a]anthracene	0.002		10 U	2 U	6 U	2 U	2.1 U	6 U	2 U
Benzo[a]pyrene	--		10 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Benzo[b]fluoranthene	0.002		10 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Benzo[g,h,i]perylene	5		10 U	NA	10 U	NA	NA	10 U	NA
Benzo[k]fluoranthene	0.002		10 U	2 U	2 U	2 U	2.1 U	2 U	2 U
bis(2-Chloroethoxy)methane	5		10 U	2 U	5 U	2 U	2.1 U	5 U	2 U
bis(2-Chloroethyl)Ether	1		10 U	2 U	5 U	2 U	2.1 U	5 U	2 U
bis(2-Chloroisopropyl)ether	--		NA	2 U	NA	2 U	2.1 U	NA	2 U
bis(2-Ethylhexyl)phthalate	5		10 U	2 U	10 U	2 U	2.1 U	10 U	1.2 J
Butylbenzyl phthalate	--		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Carbazole	--		NA	2 U	NA	2 U	2.1 U	NA	17.2
Chrysene	0.002		10 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Dibenzo[a,h]anthracene	--		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-MW-101	MP-MW-102	MP-MW-102	MP-MW-103	MP-MW-104	MP-MW-104	MP-MW-105
		Sample Date:	4/25/2001	11/10/1999	4/25/2001	11/10/1999	11/9/1999	4/18/2001	11/8/1999
Dibenzofuran	--		10 U	5 U	10 U	5 U	5.2 U	10 U	5.1 U
Diethyl phthalate	50		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Dimethyl phthalate	50		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Di-n-butyl phthalate	50		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Di-n-octyl phthalate	--		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Di-n-propylnitrosamine	--		10 U	NA	5 U	NA	NA	5 U	NA
Fluoranthene	50		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Fluorene	50		10 U	4.1	10 U	2 U	2.1 U	10 U	2 U
Hexachlorobenzene	0.04		10 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Hexachlorobutadiene	0.5		10 U	5 U	5 U	5 U	5.2 U	5 U	5.1 U
Hexachlorocyclopentadiene	5		10 U	20 U	5 U	20 U	21 U	5 U	20 U
Hexachloroethane	5		10 U	5 U	10 U	5 U	5.2 U	10 U	5.1 U
Indeno[1,2,3-cd]pyrene	0.002		10 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Isophorone	50		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U
Naphthalene	10		10 U	1.7 J	5 U	2 U	2.3	5 U	2 U
Nitrobenzene	0.4		10 U	2 U	5 U	2 U	2.1 U	5 U	2 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
N-Nitrosodiphenylamine	50		40	5 U	10 U	5 U	5.2 U	10 U	5.1 U
P-Chloroaniline	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
P-Nitroaniline	--		NA	5 U	NA	5 U	5.2 U	NA	5.1 U
Pentachlorophenol	1		20 U	20 U	20 U	20 U	21 U	20 U	20 U
Phenanthrene	50		10 U	1.8 J	10 U	2 U	2.1 U	2 J	2 U
Phenol	1*		10 U	5 U	2 U	5 U	**4.7 J**	2 U	**13.8**
Pyrene	50		10 U	2 U	10 U	2 U	2.1 U	10 U	2 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-105 4/23/2001	MP-MW-106 11/8/1999	MP-MW-106 3/13/2001	MP-MW-106 4/14/2001	MP-MW-107 11/9/1999	MP-MW-107 3/13/2001	MP-MW-108 11/9/1999
1,2,4-Trichlorobenzene	5		5 U	**135**	**100**	**120**	2 U	1 J	**2450**
1,2-Dichlorobenzene	3		5 U	**33.9**	**15**	**14**	2 U	5 U	**45.1**
1,3-Dichlorobenzene	3		5 U	29.8	**30**	**12**	2 U	5 U	478
1,4-Dichlorobenzene	3		5 U	**88.2**	**97**	**35**	2 U	5 U	**249**
1-Chloro-4-phenoxybenzene	--		2 U	NA	2 U	2 U	NA	2 U	NA
2,4,5-Trichlorophenol	--		20 U	5 U	20 U	20 U	5 U	20 U	5 U
2,4,6-Trichlorophenol	--		NA	5 U	NA	NA	5 U	NA	5 U
2,4-Dichlorophenol	5		NA	5 U	NA	NA	5 U	NA	5 U
2,4-Dimethylphenol	50		NA	3.8 J	NA	NA	5 U	NA	5 U
2,4-Dinitrophenol	10		NA	20 U	NA	NA	20 U	NA	20 U
2,4-Dinitrotoluene	5		5 U	2 U	5 U	5 U	2 U	5 U	2 U
2,6-Dinitrotoluene	5		5 U	2 U	5U	5 U	2 U	5 U	2 U
2-Chloronaphthalene	10		5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Chlorophenol	--		NA	28.1	NA	NA	3.2 J	NA	7.1
2-Methyl-4,6-Dinitrophenol	--		NA	20 U	NA	NA	20 U	NA	20 U
2-Methylnaphthalene	--		10 U	2 U	10 U	10 U	2 U	10 U	2 U
2-Methylphenol	--		NA	5 U	NA	NA	5 U	NA	5.9
2-Nitroaniline	5		20 U	5 U	20 U	20 U	5 U	20 U	5 U
2-Nitrophenol	--		NA	5 U	NA	NA	5 U	NA	5 U
3&4-Methylphenol	--		NA	2.8 J	NA	NA	5 U	NA	14.9
3,3'-Dichlorobenzidine	5		NA	5 U	NA	NA	5 U	NA	5 U
3-Nitroaniline	5		20 U	5 U	20 U	20 U	5 U	20 U	5 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		10 U	2 U	10 U	10 U	2 U	10 U	2 U
4-Chloro-3-methyl phenol	--		NA	5 U	NA	NA	5 U	NA	5 U
4-Chloroaniline	5		NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		NA	2 U	NA	NA	2 U	NA	2 U
4-Nitroaniline	5		20 U	NA	20 U	20 U	NA	20 U	NA
4-Nitrophenol	--		10 U	20 U	10 U	10 U	20 U	10 U	20 U
Acenaphthene	20		10 U	2 U	10 U	10 U	2 U	10 U	0.88 J
Acenaphthylene	--		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Anthracene	50		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Benzo[a]anthracene	0.002		6 U	2 U	6 U	6 U	2 U	6 U	2 U
Benzo[a]pyrene	--		2 U	2 U	2 U	2 U	2 U	2 U	2 U
Benzo[b]fluoranthene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U
Benzo[g,h,i]perylene	5		10 U	NA	10 U	10 U	NA	10 U	NA
Benzo[k]fluoranthene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U
bis(2-Chloroethoxy)methane	5		5 U	2 U	5 U	5 U	2 U	5 U	2 U
bis(2-Chloroethyl)Ether	1		5 U	2 U	5 U	5 U	2 U	5 U	2 U
bis(2-Chloroisopropyl)ether	--		NA	2 U	NA	NA	2 U	NA	2 U
bis(2-Ethylhexyl)phthalate	5		17	2.4	5 BJ	10 U	0.81J	4 JB	1 J
Butylbenzyl phthalate	--		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Carbazole	--		NA	2 U	NA	NA	1 J	NA	2 U
Chrysene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dibenzo[a,h]anthracene	--		10 U	2 U	10 U	10 U	2 U	10 U	2 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-105 4/23/2001	MP-MW-106 11/8/1999	MP-MW-106 3/13/2001	MP-MW-106 4/14/2001	MP-MW-107 11/9/1999	MP-MW-107 3/13/2001	MP-MW-108 11/9/1999
Dibenzofuran	--		10 U	5 U	10 U	10 U	5 U	10 U	5 U
Diethyl phthalate	50		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Dimethyl phthalate	50		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Di-n-butyl phthalate	50		10 U	2 U	10 U	10 U	0.55 J	10 U	2 U
Di-n-octyl phthalate	--		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Di-n-propylnitrosamine	--		5 U	NA	5 U	5 U	NA	5 U	NA
Fluoranthene	50		10 U	2 U	1 J	2 J	2 U	10 U	2 U
Fluorene	50		10 U	2 U	10 U	10 U	2 U	10 U	2 U
Hexachlorobenzene	0.04		2 U	2 U	2 U	2 U	2 U	5 U	2 U
Hexachlorobutadiene	0.5		5 U	5 U	5 U	5 U	5 U	10 U	5 U
Hexachlorocyclopentadiene	5		5 U	20 U	5 U	5 U	20 U	5 U	20 U
Hexachloroethane	5		10 U	5 U	10 U	10 U	5 U	10 U	5 U
Indeno[1,2,3-cd]pyrene	0.002		2 U	2 U	2 U	2 U	2 U	2 U	2 U
Isophorone	50		10 U	2 U	10 U	10 U	2 U	10 U	4.3
Naphthalene	10		5 U	**21.9**	2 J	**13**	1.8 J	4 JB	**10.2**
Nitrobenzene	0.4		5 U	2 U	5 U	5 U	2 U	**12**	2 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	5 U	NA	NA	5 U	NA	5 U
N-Nitrosodiphenylamine	50		10 U	5 U	10 U	10 U	1.7 J	9 J	5 U
P-Chloroaniline	--		NA	4.2 J	NA	NA	5 U	NA	3.1 J
P-Nitroaniline	--		NA	5 U	NA	NA	5 U	NA	5 U
Pentachlorophenol	1		20 U	20 U	20 U	20 U	20 U	20 U	20 U
Phenanthrene	50		10 U	1.2 J	1 J	2 J	2 U	1 J	2 U
Phenol	1*		2 U	**11.7**	**7**	**22**	5 U	2 U	**376**
Pyrene	50		10 U	2 U	10 U	3 J	2 U	10 U	2 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

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J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-108 4/25/2001	MP-MW-109 11/9/1999	MP-MW-109 FD 11/9/1999	MP-MW-109 4/23/2001	MP-MW-110 11/9/1999	MP-MW-110 4/25/2001	MP-MW-111 11/9/1999
1,2,4-Trichlorobenzene	5		**1500**	2 U	2 U	5 U	2.1 U	5 U	2 U
1,2-Dichlorobenzene	3		**40 J**	2 U	1.6 J	5 U	2.1 U	5 U	0.5 J
1,3-Dichlorobenzene	3		**640**	2 U	2 U	5 U	2.1 U	5 U	1.1 J
1,4-Dichlorobenzene	3		**210**	1.6 J	1.4 J	5 U	2.1 U	5 U	1.4 J
1-Chloro-4-phenoxybenzene	--		20 U	NA	NA	2 U	NA	2 U	NA
2,4,5-Trichlorophenol	--		200 U	5 U	5 U	20 U	5.2 U	20 U	5 U
2,4,6-Trichlorophenol	--		NA	5 U	5 U	NA	5.2 U	NA	5 U
2,4-Dichlorophenol	5		NA	5 U	5 U	NA	5.2 U	NA	5 U
2,4-Dimethylphenol	50		NA	5 U	5 U	NA	5.2 U	NA	5.9
2,4-Dinitrophenol	10		NA	20 U	20 U	NA	21 U	NA	20 U
2,4-Dinitrotoluene	5		50 U	2 U	2 U	5 U	2.1 U	5 U	2 U
2,6-Dinitrotoluene	5		50 U	2 U	2 U	5 U	2.1 U	5 U	2 U
2-Chloronaphthalene	10		50 U	5 U	5 U	5 U	5.2 U	5 U	5 U
2-Chlorophenol	--		NA	5 U	5 U	NA	1.2 J	NA	9.3
2-Methyl-4,6-Dinitrophenol	--		NA	20 U	20 U	NA	21 U	NA	20 U
2-Methylnaphthalene	--		100 U	78.7	69	18	2.1 U	10 U	2 U
2-Methylphenol	--		NA	5 U	5 U	NA	5.2 U	NA	1.5 J
2-Nitroaniline	5		200 U	5 U	5 U	20 U	5.2 U	20 U	5 U
2-Nitrophenol	--		NA	5 U	5 U	NA	5.2 U	NA	5 U
3&4-Methylphenol	--		NA	5 U	5 U	NA	5.2 U	NA	5 U
3,3'-Dichlorobenzidine	5		NA	5 U	5 U	NA	5.2 U	NA	5 U
3-Nitroaniline	5		200 U	5 U	5 U	20 U	5.2 U	20 U	5 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
4-Chloro-3-methyl phenol	--		NA	5 U	5 U	NA	5.2 U	NA	5 U
4-Chloroaniline	5		NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		NA	2 U	2 U	NA	2.1 U	NA	2 U
4-Nitroaniline	5		200 U	NA	NA	20 U	NA	20 U	NA
4-Nitrophenol	--		100 U	20 U	20 U	10 U	21 U	10 U	20 U
Acenaphthene	20		100 U	0.51 J	2 U	10 U	2.1 U	10 U	2 U
Acenaphthylene	--		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Anthracene	50		100 U	2 U	2 U	10 U	2.1 U	10 U	11.0
Benzo[a]anthracene	0.002		60 U	2 U	2 U	6 U	2.1 U	6 U	2 U
Benzo[a]pyrene	--		20 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Benzo[b]fluoranthene	0.002		20 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Benzo[g,h,i]perylene	5		100 U	NA	NA	10 U	NA	10 U	NA
Benzo[k]fluoranthene	0.002		20 U	2 U	2 U	2 U	2.1 U	2 U	2 U
bis(2-Chloroethoxy)methane	5		50 U	2 U	2 U	5 U	2.1 U	5 U	2 U
bis(2-Chloroethyl)Ether	1		50 U	2 U	2 U	5 U	2.1 U	5 U	2 U
bis(2-Chloroisopropyl)ether	--		NA	2 U	2 U	NA	2.1 U	NA	2 U
bis(2-Ethylhexyl)phthalate	5		100 U	0.83 J	0.73 J	4 J	0.79 J	2 J	1 J
Butylbenzyl phthalate	--		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Carbazole	--		NA	4	3.3	NA	39.8	NA	3.1
Chrysene	0.002		20 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Dibenzo[a,h]anthracene	--		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-MW-108	MP-MW-109	MP-MW-109 FD	MP-MW-109	MP-MW-110	MP-MW-110	MP-MW-111
		Sample Date:	4/25/2001	11/9/1999	11/9/1999	4/23/2001	11/9/1999	4/25/2001	11/9/1999
Dibenzofuran	--		100 U	5 U	5 U	10 U	5.2 U	10 U	5 U
Diethyl phthalate	50		100 U	2 U	1.4 J	10 U	2.1 U	10 U	2 U
Dimethyl phthalate	50		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Di-n-butyl phthalate	50		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Di-n-octyl phthalate	--		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Di-n-propylnitrosamine	--		50 U	NA	NA	5 U	NA	5 U	NA
Fluoranthene	50		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Fluorene	50		100 U	0.58 J	2 U	10 U	2.1 U	10 U	2 U
Hexachlorobenzene	0.04		20 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Hexachlorobutadiene	0.5		50 U	5 U	5 U	5 U	5.2 U	5 U	5 U
Hexachlorocyclopentadiene	5		50 U	20 U	20 U	5 U	21 U	5 U	20 U
Hexachloroethane	5		100 U	5 U	5 U	10 U	5.2 U	10 U	5 U
Indeno[1,2,3-cd]pyrene	0.002		20 U	2 U	2 U	2 U	2.1 U	2 U	2 U
Isophorone	50		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Naphthalene	10		50 U	**173**	**127**	80	2.1 U	5 U	2 U
Nitrobenzene	0.4		50 U	2 U	2 U	5 U	2.1 U	5 U	2 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	5 U	5 U	NA	5.2 U	NA	5 U
N-Nitrosodiphenylamine	50		100 U	5 U	5 U	10 U	0.62 J	10 U	18.5
P-Chloroaniline	--		NA	5 U	5 U	NA	5.2 U	NA	9.3
P-Nitroaniline	--		NA	5 U	5 U	NA	5.2 U	NA	5 U
Pentachlorophenol	1		200 U	20 U	20 U	20 U	21 U	20 U	20 U
Phenanthrene	50		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U
Phenol	1*		**580**	5 U	5 U	2 U	5.2 U	2 U	**13.1**
Pyrene	50		100 U	2 U	2 U	10 U	2.1 U	10 U	2 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

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Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-111 4/17/2001	MP-MW-111 DUP 4/18/2001	MP-MW-112 11/9/1999	MP-MW-113 4/26/2001	MP-MW-113 DUP 4/26/2001	MP-MW-114 4/26/2001	MP-PP-1 04/26/2000
1,2,4-Trichlorobenzene	5		10 U	1 J	2 U	5 U	5 U	5 U	2U
1,2-Dichlorobenzene	3		10 U	**35**	2 U	5 U	5 U	5 U	2U
1,3-Dichlorobenzene	3		3 J	2 J	2 U	5 U	5 U	5 U	2U
1,4-Dichlorobenzene	3		2 J	3 J	2 U	5 U	5 U	5 U	2U
1-Chloro-4-phenoxybenzene	--		10 U	2 U	NA	2 U	2 U	2 U	NA
2,4,5-Trichlorophenol	--		20 U	20 U	5 U	20 U	20 U	20 U	5U
2,4,6-Trichlorophenol	--		NA	NA	5 U	NA	NA	NA	5U
2,4-Dichlorophenol	5		NA	NA	5 U	NA	NA	NA	5U
2,4-Dimethylphenol	50		NA	NA	5 U	NA	NA	NA	5U
2,4-Dinitrophenol	10		NA	NA	20 U	NA	NA	NA	20U
2,4-Dinitrotoluene	5		10 U	5 U	2 U	5 U	5 U	5 U	2U
2,6-Dinitrotoluene	5		10 U	5 U	2 U	5 U	5 U	5 U	2U
2-Chloronaphthalene	10		10 U	5 U	5 U	5 U	5 U	5 U	5U
2-Chlorophenol	--		NA	NA	5 U	NA	NA	NA	5U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	20 U	NA	NA	NA	NA
2-Methylnaphthalene	--		10 U	10 U	2 U	10 U	10 U	10 U	2U
2-Methylphenol	--		NA	NA	5 U	NA	NA	NA	5U
2-Nitroaniline	5		20 U	20 U	5 U	20 U	20 U	20 U	5U
2-Nitrophenol	--		NA	NA	5 U	NA	NA	NA	5U
3&4-Methylphenol	--		NA	NA	5 U	NA	NA	NA	5U
3,3'-Dichlorobenzidine	5		NA	NA	5 U	NA	NA	NA	5U
3-Nitroaniline	5		20 U	20 U	5 U	20 U	20 U	20 U	5U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	20U
4-Bromodiphenyl ether	--		10 U	10 U	2 U	10 U	10 U	10 U	2U
4-Chloro-3-methyl phenol	--		NA	NA	5 U	NA	NA	NA	5U
4-Chloroaniline	5		NA	NA	NA	NA	NA	NA	5U
4-Chlorophenyl phenyl ether	--		NA	NA	2 U	NA	NA	NA	2U
4-Nitroaniline	5		20 U	20 U	NA	20 U	20 U	20 U	5U
4-Nitrophenol	--		20 U	10 U	20 U	10 U	10 U	10 U	20U
Acenaphthene	20		10 U	10 U	2 U	10 U	10 U	10 U	2U
Acenaphthylene	--		10 U	10 U	2 U	10 U	10 U	10 U	NA
Anthracene	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Benzo[a]anthracene	0.002		10 U	6 U	2 U	6 U	6 U	6 U	2U
Benzo[a]pyrene	--		10 U	2 U	2 U	2 U	2 U	2 U	2U
Benzo[b]fluoranthene	0.002		10 U	2 U	2 U	2 U	2 U	2 U	2U
Benzo[g,h,i]perylene	5		10 U	10 U	NA	10 U	10 U	10 U	2U
Benzo[k]fluoranthene	0.002		10 U	2 U	2 U	2 U	2 U	2 U	2U
bis(2-Chloroethoxy)methane	5		10 U	5 U	2 U	5 U	5 U	5 U	2U
bis(2-Chloroethyl)Ether	1		10 U	5 U	2 U	5 U	5 U	5 U	2U
bis(2-Chloroisopropyl)ether	--		NA	NA	2 U	NA	NA	NA	2U
bis(2-Ethylhexyl)phthalate	5		1 J	10 U	1.2 J	10 U	10 U	10 U	2U
Butylbenzyl phthalate	--		10 U	10 U	2 U	10 U	10 U	10 U	2U
Carbazole	--		NA	NA	2 U	NA	NA	NA	2U
Chrysene	0.002		10 U	2 U	2 U	2 U	2 U	2 U	2U
Dibenzo[a,h]anthracene	--		10 U	10 U	2 U	10 U	10 U	10 U	2U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-111 4/17/2001	MP-MW-111 DUP 4/18/2001	MP-MW-112 11/9/1999	MP-MW-113 4/26/2001	MP-MW-113 DUP 4/26/2001	MP-MW-114 4/26/2001	MP-PP-1 04/26/2000
Dibenzofuran	--		10 U	10 U	5 U	10 U	10 U	10 U	5U
Diethyl phthalate	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Dimethyl phthalate	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Di-n-butyl phthalate	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Di-n-octyl phthalate	--		10 U	10 U	2 U	10 U	10 U	10 U	2U
Di-n-propylnitrosamine	--		10 U	5 U	NA	5 U	5 U	5 U	NA
Fluoranthene	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Fluorene	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Hexachlorobenzene	0.04		10 U	2 U	2 U	2 U	2 U	2 U	2U
Hexachlorobutadiene	0.5		10 U	5 U	5 U	5 U	5 U	5 U	2U
Hexachlorocyclopentadiene	5		10 U	5 U	20 U	5 U	5 U	5 U	20U
Hexachloroethane	5		10 U	10 U	5 U	10 U	10 U	10 U	5U
Indeno[1,2,3-cd]pyrene	0.002		10 U	2 U	2 U	2 U	2 U	2 U	2U
Isophorone	50		10 U	10 U	2 U	10 U	10 U	10 U	2U
Naphthalene	10		**13**	5 U	2 U	5 U	5 U	5 U	2U
Nitrobenzene	0.4		10 U	5 U	2 U	5 U	5 U	5 U	2U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	2U
N-Nitrosodimethylamine	--		NA	NA	5 U	NA	NA	NA	NA
N-Nitrosodiphenylamine	50		25	10 U	5 U	10 U	10 U	10 U	5U
P-Chloroaniline	--		NA	NA	5 U	NA	NA	NA	NA
P-Nitroaniline	--		NA	NA	5 U	NA	NA	NA	NA
Pentachlorophenol	1		20 U	20 U	20 U	20 U	20 U	20 U	20U
Phenanthrene	50		10 U	**130 B**	2 U	10 U	10 U	10 U	2U
Phenol	1*		**21**	2 U	5 U	2 U	2 U	2 U	5U
Pyrene	50		10 U	10 U	2 U	10 U	10 U	10 U	2U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-PP-2	MP-PP-2	MP-PP-3	MP-PP-4	MP-PP-5	MP-PZ-106	MP-PZ-104	MP-PZ-106 DUP
		Sample Date:	04/26/2000	4/14/2001	04/27/2000	04/27/2000	04/27/2000	4/10/2001	--	4/10/2001
1,2,4-Trichlorobenzene	5		2U	5 U	**15.8**	**37.9**	**16.4**	5 U	NA	5 U
1,2-Dichlorobenzene	3		2U	5 U	**17**	**6.1**	**12.2**	5 U	NA	5 U
1,3-Dichlorobenzene	3		2U	5 U	1.9J	1.6J	**1.4J**	5 U	NA	5 U
1,4-Dichlorobenzene	3		2U	5 U	**8.6**	2.4	6.6	5 U	NA	5 U
1-Chloro-4-phenoxybenzene	--		NA	2 U	NA	NA	NA	2 U	NA	2 U
2,4,5-Trichlorophenol	--		5U	20 U	5U	5U	5.1U	20 U	NA	20 U
2,4,6-Trichlorophenol	--		5U	NA	5U	5U	5.1U	NA	NA	NA
2,4-Dichlorophenol	5		5U	NA	5U	5U	5.1U	NA	NA	NA
2,4-Dimethylphenol	50		5U	NA	5U	5U	5.1U	NA	NA	NA
2,4-Dinitrophenol	10		20U	NA	20U	20U	20U	NA	NA	NA
2,4-Dinitrotoluene	5		2U	5 U	2U	2U	2U	5 U	NA	5 U
2,6-Dinitrotoluene	5		2U	5 U	2U	2U	2U	5 U	NA	5 U
2-Chloronaphthalene	10		5U	5 U	5U	5U	5.1U	5 U	NA	5 U
2-Chlorophenol	--		5U	NA	20.8	5U	13	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	--		2U	10 U	2U	2U	2U	10 U	NA	10 U
2-Methylphenol	--		5U	NA	5U	5U	5.1U	NA	NA	NA
2-Nitroaniline	5		5U	20 U	5U	5U	5.1U	20 U	NA	20 U
2-Nitrophenol	--		5U	NA	5U	5U	5.1U	NA	NA	NA
3&4-Methylphenol	--		5U	NA	5U	5U	3.2J	NA	NA	NA
3,3'-Dichlorobenzidine	5		5U	NA	5U	5U	5.1U	NA	NA	NA
3-Nitroaniline	5		5U	20 U	5U	5U	5.1U	20 U	NA	20 U
4,6-Dinitro-o-cresol	--		20U	NA	20U	20U	20U	NA	NA	NA
4-Bromodiphenyl ether	--		2U	10 U	2U	2U	2U	10 U	NA	10 U
4-Chloro-3-methyl phenol	--		5U	NA	5U	5U	5.1U	NA	NA	NA
4-Chloroaniline	5		5U	NA	5U	5U	5.1U	NA	NA	NA
4-Chlorophenyl phenyl ether	--		2U	NA	2U	2U	2U	NA	NA	NA
4-Nitroaniline	5		5U	20 U	5U	5U	5.1U	20 U	NA	20 U
4-Nitrophenol	--		20U	10 U	20U	20U	20U	10 U	NA	10 U
Acenaphthene	20		2U	10 U	2U	2U	2U	10 U	NA	10 U
Acenaphthylene	--		NA	10 U	NA	NA	NA	10 U	NA	10 U
Anthracene	50		2U	2 J	2U	2U	2U	10 U	NA	10 U
Benzo[a]anthracene	0.002		2U	6 U	2U	2U	2U	6 U	NA	6 U
Benzo[a]pyrene	--		2U	2 U	2U	2U	2U	2 U	NA	2 U
Benzo[b]fluoranthene	0.002		2U	2 U	2U	2U	2U	2 U	NA	2 U
Benzo[g,h,i]perylene	5		2U	10 U	2U	2U	2U	10 U	NA	10 U
Benzo[k]fluoranthene	0.002		2U	2 U	2U	2U	2U	2 U	NA	2 U
bis(2-Chloroethoxy)methane	5		2U	5 U	2U	2U	2U	5 U	NA	5 U
bis(2-Chloroethyl)Ether	1		2U	5 U	2U	2U	2U	5 U	NA	5 U
bis(2-Chloroisopropyl)ether	--		2U	NA	2U	2U	2U	NA	NA	NA
bis(2-Ethylhexyl)phthalate	5		2U	10 U	2U	2U	2U	10 U	NA	10 U
Butylbenzyl phthalate	--		2U	10 U	2U	2U	2U	10 U	NA	10 U
Carbazole	--		2U	NA	2U	2U	2U	NA	NA	NA
Chrysene	0.002		2U	2 U	2U	2U	2U	2 U	NA	2 U
Dibenzo[a,h]anthracene	--		2U	10 U	2U	2U	2U	10 U	NA	10 U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-PP-2	MP-PP-2	MP-PP-3	MP-PP-4	MP-PP-5	MP-PZ-106	MP-PZ-104	MP-PZ-106 DUP
		Sample Date:	04/26/2000	4/14/2001	04/27/2000	04/27/2000	04/27/2000	4/10/2001	--	4/10/2001
Dibenzofuran	--		5U	10 U	5U	5U	5.1U	10 U	NA	10 U
Diethyl phthalate	50		2U	10 U	2U	2U	2U	10 U	NA	10 U
Dimethyl phthalate	50		2U	10 U	2U	2U	2U	10 U	NA	10 U
Di-n-butyl phthalate	50		2U	10 U	2U	2U	2U	10 U	NA	10 U
Di-n-octyl phthalate	--		2U	10 U	2U	2U	2U	10 U	NA	10 U
Di-n-propylnitrosamine	--		NA	5 U	NA	NA	NA	5 U	NA	5 U
Fluoranthene	50		2U	3 J	2U	2U	2U	10 U	NA	10 U
Fluorene	50		2U	10 U	2U	2U	2U	10 U	NA	10 U
Hexachlorobenzene	0.04		2U	2 U	2U	2U	2U	2 U	NA	2 U
Hexachlorobutadiene	0.5		2U	5 U	2U	2U	2U	5 U	NA	5 U
Hexachlorocyclopentadiene	5		20U	5 U	20U	20U	20U	5 U	NA	5 U
Hexachloroethane	5		5U	10 U	5U	5U	5.1U	10 U	NA	10 U
Indeno[1,2,3-cd]pyrene	0.002		2U	2 U	2U	2U	2U	2 U	NA	2 U
Isophorone	50		2U	10 U	2U	2U	2U	10 U	NA	10 U
Naphthalene	10		2U	5 U	1.1J	2U	0.83J	5 U	NA	5 U
Nitrobenzene	0.4		2U	5 U	2U	2U	2U	5 U	NA	5 U
N-Nitroso-di-n-propylamine	--		2U	NA	2U	2U	2U	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	50		5U	10 U	6.1	5U	1.3J	10 U	NA	10 U
P-Chloroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1		20U	20 U	20U	20U	20U	20 U	NA	20 U
Phenanthrene	50		2U	2 J	2U	2U	2U	10 U	NA	10 U
Phenol	1*		5U	2 U	**5**	5U	**5.7**	2 U	NA	2 U
Pyrene	50		2U	3 J	2U	2U	2U	10 U	NA	10 U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

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J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-PZ-107 4/12/2001	MP-PZ-108 4/12/2001	MP-PZ-109 4/23/2001	MP-PZ-110 4/23/2001	MP-PZ-111 4/23/2001	MP-PZ-112 4/11/2001	MP-PZ-113 4/12/2001	MP-PZ-114 4/12/2001
1,2,4-Trichlorobenzene	5		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
1,2-Dichlorobenzene	3		1 J	5 U	5 U	5 U	5 U	5 U	**130 J**	**6**
1,3-Dichlorobenzene	3		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
1,4-Dichlorobenzene	3		1 J	5 U	5 U	5 U	5 U	5 U	150 U	5 U
1-Chloro-4-phenoxybenzene	--		2 U	2 U	2 U	2 U	2 U	2 U	150 U	2 U
2,4,5-Trichlorophenol	--		20 U	20 U	20 U	20 U	20 U	20 U	300 U	20 U
2,4,6-Trichlorophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	5		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	50		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	10		NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	5		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
2,6-Dinitrotoluene	5		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
2-Chloronaphthalene	10		5 U	5 U	5 U	5 U	5 U	5 U	**1400**	5 U
2-Chlorophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	--		10 U	10 U	10 U	1 J	10 U	10 U	150 U	10 U
2-Methylphenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	5		20 U	20 U	20 U	20 U	20 U	20 U	300 U	20 U
2-Nitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol	--		NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	5		NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	5		20 U	20 U	20 U	20 U	20 U	20 U	300 U	20 U
4,6-Dinitro-o-cresol	--		NA	NA	NA	NA	NA	NA	NA	NA
4-Bromodiphenyl ether	--		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
4-Chloro-3-methyl phenol	--		NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	5		NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	--		NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	5		20 U	20 U	20 U	20 U	20 U	20 U	300 U	20 U
4-Nitrophenol	--		10 U	10 U	10 U	10 U	10 U	10 U	300 U	10 U
Acenaphthene	20		10 U	10 U	10 U	2 J	10 U	10 U	150 U	10 U
Acenaphthylene	--		10 U	10 U	10 U	2 J	10 U	10 U	150 U	10 U
Anthracene	50		10 U	10 U	10 U	8 J	10 U	10 U	150 U	10 U
Benzo[a]anthracene	0.002		6 U	6 U	6 U	23	6 U	6 U	150 U	6 U
Benzo[a]pyrene	--		2 U	2 U	2 U	21	2 U	2 U	150 U	2 U
Benzo[b]fluoranthene	0.002		2 U	2 U	2 U	27	2 U	2 U	150 U	2 U
Benzo[g,h,i]perylene	5		10 U	10 U	10 U	11	10 U	10 U	150 U	10 U
Benzo[k]fluoranthene	0.002		2 U	2 U	2 U	12	2 U	2 U	150 U	2 U
bis(2-Chloroethoxy)methane	5		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
bis(2-Chloroethyl)Ether	1		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
bis(2-Chloroisopropyl)ether	--		NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	5		10 U	10 U	10 U	4 J	10 U	10 U	150 U	10 U
Butylbenzyl phthalate	--		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Carbazole	--		NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	0.002		2 U	2 U	2 U	21	2 U	2 U	150 U	2 U
Dibenzo[a,h]anthracene	--		10 U	10 U	10 U	3 J	10 U	10 U	150 U	10 U

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Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-PZ-107 4/12/2001	MP-PZ-108 4/12/2001	MP-PZ-109 4/23/2001	MP-PZ-110 4/23/2001	MP-PZ-111 4/23/2001	MP-PZ-112 4/11/2001	MP-PZ-113 4/12/2001	MP-PZ-114 4/12/2001
Dibenzofuran	--		10 U	10 U	10 U	2 J	10 U	10 U	150 U	10 U
Diethyl phthalate	50		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Dimethyl phthalate	50		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Di-n-butyl phthalate	50		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Di-n-octyl phthalate	--		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Di-n-propylnitrosamine	--		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
Fluoranthene	50		10 U	10 U	10 U	39	10 U	10 U	150 U	10 U
Fluorene	50		10 U	10 U	10 U	5 J	10 U	10 U	150 U	10 U
Hexachlorobenzene	0.04		2 U	2 U	2 U	2 U	2 U	2 U	150 U	2 U
Hexachlorobutadiene	0.5		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
Hexachlorocyclopentadiene	5		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
Hexachloroethane	5		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Indeno[1,2,3-cd]pyrene	0.002		2 U	2 U	2 U	11	2 U	2 U	150 U	2 U
Isophorone	50		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
Naphthalene	10		**15**	5 U	5 U	2 J	5 U	5 U	**510**	5 U
Nitrobenzene	0.4		5 U	5 U	5 U	5 U	5 U	5 U	150 U	5 U
N-Nitroso-di-n-propylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	50		10 U	10 U	10 U	10 U	10 U	10 U	150 U	10 U
P-Chloroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1		20 U	20 U	20 U	20 U	20 U	20 U	300 U	20 U
Phenanthrene	50		10 U	10 U	10 U	30	10 U	2 J	150 U	10 U
Phenol	1*		2 U	2 U	2 U	2 U	2 U	2 U	**92 J**	2 U
Pyrene	50		10 U	10 U	10 U	49	10 U	10 U	150 U	10 U

Notes:

µg/L - micrograms per liter

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[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

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NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-PZ-120 5/2/2001	MP-PZ-121 5/2/2001	MP-SB-19 05/09/2000	MP-SB-20 05/08/2000	MP-SB-46 05/17/2000	MP-SB-48 05/18/2000	MP-SB-49 05/18/2000	MP-SB-50 05/08/2000
1,2,4-Trichlorobenzene	5		**660 E**	5 U	2.1U	2.1U	0.6J	2U	2U	2U
1,2-Dichlorobenzene	3		**98**	5 U	2.1U	2.1U	1.3J	1.3J	2U	2U
1,3-Dichlorobenzene	3		**100**	5 U	2.1U	2.1U	0.62J	2U	2U	2U
1,4-Dichlorobenzene	3		**18**	5 U	2.1U	2.1U	2.4	2U	2U	2U
1-Chloro-4-phenoxybenzene	--		10 U	2 U	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	--		20 U	20 U	5.2U	5.2U	5.1U	5.1U	5U	5U
2,4,6-Trichlorophenol	--		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
2,4-Dichlorophenol	5		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
2,4-Dimethylphenol	50		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
2,4-Dinitrophenol	10		NA	NA	21U	21U	20U	20U	20U	20U
2,4-Dinitrotoluene	5		10 U	5 U	2.1U	2.1U	2U	2U	2U	2U
2,6-Dinitrotoluene	5		10 U	5 U	2.1U	2.1U	2U	2U	2U	2U
2-Chloronaphthalene	10		10 U	5 U	5.2U	5.2U	5.1U	5.1U	5U	5U
2-Chlorophenol	--		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
2-Methyl-4,6-Dinitrophenol	--		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	--		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
2-Methylphenol	--		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
2-Nitroaniline	5		20 U	20 U	5.2U	5.2U	5.1U	5.1U	5U	5U
2-Nitrophenol	--		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
3&4-Methylphenol	--		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
3,3'-Dichlorobenzidine	5		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
3-Nitroaniline	5		20 U	20 U	5.2U	5.2U	5.1U	5.1U	5U	5U
4,6-Dinitro-o-cresol	--		NA	NA	21U	21U	20U	20U	20U	20U
4-Bromodiphenyl ether	--		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
4-Chloro-3-methyl phenol	--		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
4-Chloroaniline	5		NA	NA	5.2U	5.2U	5.1U	5.1U	5U	5U
4-Chlorophenyl phenyl ether	--		NA	NA	2.1U	2.1U	2U	2U	2U	2U
4-Nitroaniline	5		20 U	20 U	5.2U	5.2U	5.1U	5.1U	5U	5U
4-Nitrophenol	--		20 U	10 U	21U	21U	20U	20U	20U	20U
Acenaphthene	20		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Acenaphthylene	--		10 U	10 U	NA	NA	NA	NA	NA	NA
Anthracene	50		1 J	10 U	2.1U	2.1U	2U	2U	2U	2U
Benzo[a]anthracene	0.002		**1 J**	6 U	2.1U	2.1U	2U	2U	2U	2U
Benzo[a]pyrene	--		10 U	2 U	2.1U	2.1U	2U	2U	2U	2U
Benzo[b]fluoranthene	0.002		10 U	2 U	2.1U	2.1U	2U	2U	2U	2U
Benzo[g,h,i]perylene	5		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Benzo[k]fluoranthene	0.002		10 U	2 U	2.1U	2.1U	2U	2U	2U	2U
bis(2-Chloroethoxy)methane	5		10 U	5 U	2.1U	2.1U	2U	2U	2U	2U
bis(2-Chloroethyl)Ether	1		10 U	5 U	2.1U	2.1U	2U	2U	2U	2U
bis(2-Chloroisopropyl)ether	--		NA	NA	2.1U	2.1U	2U	2U	2U	2U
bis(2-Ethylhexyl)phthalate	5		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Butylbenzyl phthalate	--		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Carbazole	--		NA	NA	2.1U	2.1U	2U	2U	2U	2U
Chrysene	0.002		10 U	2 U	2.1U	2.1U	2U	2U	2U	2U
Dibenzo[a,h]anthracene	--		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-PZ-120	MP-PZ-121	MP-SB-19	MP-SB-20	MP-SB-46	MP-SB-48	MP-SB-49	MP-SB-50
		Sample Date:	5/2/2001	5/2/2001	05/09/2000	05/08/2000	05/17/2000	05/18/2000	05/18/2000	05/08/2000
Dibenzofuran	--		10 U	10 U	5.2U	5.2U	5.1U	5.1U	5U	5U
Diethyl phthalate	50		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Dimethyl phthalate	50		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Di-n-butyl phthalate	50		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Di-n-octyl phthalate	--		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Di-n-propylnitrosamine	--		10 U	5 U	NA	NA	NA	NA	NA	NA
Fluoranthene	50		2 J	10 U	2.1U	2.1U	2U	2U	2U	2U
Fluorene	50		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Hexachlorobenzene	0.04		10 U	2 U	2.1U	2.1U	2U	2U	2U	2U
Hexachlorobutadiene	0.5		10 U	5 U	2.1U	2.1U	2U	2U	2U	2U
Hexachlorocyclopentadiene	5		10 U	5 U	21U	21U	20U	20U	20U	20U
Hexachloroethane	5		10 U	10 U	5.2U	5.2U	5.1U	5.1U	5U	5U
Indeno[1,2,3-cd]pyrene	0.002		10 U	2 U	2.1U	2.1U	2U	2U	2U	2U
Isophorone	50		10 U	10 U	2.1U	2.1U	2U	2U	2U	2U
Naphthalene	10		**14**	5 U	2.1U	2.1U	2U	2U	2U	2U
Nitrobenzene	0.4		10 U	5 U	2.1U	2.1U	2U	2U	2U	2U
N-Nitroso-di-n-propylamine	--		NA	NA	2.1U	2.1U	2U	2U	2U	2U
N-Nitrosodimethylamine	--		NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	50		10 U	10 U	5.2U	5.2U	5.1U	5.1U	5U	5U
P-Chloroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
P-Nitroaniline	--		NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	1		20 U	20 U	21U	21U	20U	20U	20U	20U
Phenanthrene	50		8 J	10 U	2.1U	2.1U	2U	2U	2U	2U
Phenol	1*		**63**	2 U	5.2U	5.2U	5.1U	5.1U	5U	5U
Pyrene	50		2 J	10 U	2.1U	2.1U	2U	2U	2U	2U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-WATER-FB 04/27/2000	ST-MW-2 11/10/1999	ST-MW-6A 04/25/2000	ST-MW-6A 4/10/2001	ST-MW-7A 04/25/2000	ST-MW-9 04/25/2000
1,2,4-Trichlorobenzene	5		2U	2 U	2U	5 U	2U	2U
1,2-Dichlorobenzene	3		2U	2 U	2U	5 U	2U	2U
1,3-Dichlorobenzene	3		2U	2 U	2U	5 U	2U	2U
1,4-Dichlorobenzene	3		2U	2 U	2U	5 U	2U	2U
1-Chloro-4-phenoxybenzene	--		NA	NA	NA	2 U	NA	NA
2,4,5-Trichlorophenol	--		5U	5 U	5U	20 U	5.1U	5.1U
2,4,6-Trichlorophenol	--		5U	5 U	5U	NA	5.1U	5.1U
2,4-Dichlorophenol	5		5U	5 U	5U	NA	5.1U	5.1U
2,4-Dimethylphenol	50		5U	5 U	5U	NA	5.1U	5.1U
2,4-Dinitrophenol	10		20U	20 U	20U	NA	20U	20U
2,4-Dinitrotoluene	5		2U	2 U	2U	5 U	2U	2U
2,6-Dinitrotoluene	5		2U	2 U	2U	5 U	2U	2U
2-Chloronaphthalene	10		5U	5 U	5U	5 U	5.1U	5.1U
2-Chlorophenol	--		5U	5 U	5U	NA	5.1U	5.1U
2-Methyl-4,6-Dinitrophenol	--		NA	20 U	NA	NA	NA	NA
2-Methylnaphthalene	--		2U	2 U	2U	10 U	2U	2U
2-Methylphenol	--		5U	5 U	5U	NA	5.1U	5.1U
2-Nitroaniline	5		5U	5 U	5U	20 U	5.1U	5.1U
2-Nitrophenol	--		5U	5 U	5U	NA	5.1U	5.1U
3&4-Methylphenol	--		5U	5 U	5U	NA	5.1U	5.1U
3,3'-Dichlorobenzidine	5		5U	5 U	5U	NA	5.1U	5.1U
3-Nitroaniline	5		5U	5 U	5U	20 U	5.1U	5.1U
4,6-Dinitro-o-cresol	--		20U	NA	20U	NA	20U	20U
4-Bromodiphenyl ether	--		2U	2 U	2U	10 U	2U	2U
4-Chloro-3-methyl phenol	--		5U	5 U	5U	NA	5.1U	5.1U
4-Chloroaniline	5		5U	NA	5U	NA	5.1U	5.1U
4-Chlorophenyl phenyl ether	--		2U	2 U	2U	NA	2U	2U
4-Nitroaniline	5		5U	NA	5U	20 U	5.1U	5.1U
4-Nitrophenol	--		20U	20 U	20U	10 U	20U	20U
Acenaphthene	20		2U	2 U	2U	10 U	2U	2U
Acenaphthylene	--		NA	2 U	NA	10 U	NA	NA
Anthracene	50		2U	2 U	2U	10 U	2U	2U
Benzo[a]anthracene	0.002		2U	2 U	2U	6 U	2U	2U
Benzo[a]pyrene	--		2U	2 U	2U	2 U	2U	2U
Benzo[b]fluoranthene	0.002		2U	2 U	2U	2 U	2U	2U
Benzo[g,h,i]perylene	5		2U	NA	2U	10 U	2U	2U
Benzo[k]fluoranthene	0.002		2U	2 U	2U	2 U	2U	2U
bis(2-Chloroethoxy)methane	5		2U	2 U	2U	5 U	2U	2U
bis(2-Chloroethyl)Ether	1		2U	2 U	2U	5 U	2U	2U
bis(2-Chloroisopropyl)ether	--		2U	2 U	2U	NA	2U	2U
bis(2-Ethylhexyl)phthalate	5		2U	**11.5**	2U	10 U	2U	2U
Butylbenzyl phthalate	--		2U	2 U	2U	10 U	2U	2U
Carbazole	--		2U	2 U	2U	NA	2U	2U
Chrysene	0.002		2U	2 U	2U	2 U	2U	2U
Dibenzo[a,h]anthracene	--		2U	2 U	2U	10 U	2U	2U

Table 9. Summary of Semivolatile Organic Compounds Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	MP-WATER-FB	ST-MW-2	ST-MW-6A	ST-MW-6A	ST-MW-7A	ST-MW-9
		Sample Date:	04/27/2000	11/10/1999	04/25/2000	4/10/2001	04/25/2000	04/25/2000
Dibenzofuran	--		5U	5 U	5U	10 U	5.1U	5.1U
Diethyl phthalate	50		2U	2 U	2U	10 U	2U	2U
Dimethyl phthalate	50		2U	2 U	2U	10 U	2U	2U
Di-n-butyl phthalate	50		2U	2 U	2U	10 U	2U	2U
Di-n-octyl phthalate	--		2U	2 U	2U	10 U	2U	2U
Di-n-propylnitrosamine	--		NA	NA	NA	5 U	NA	NA
Fluoranthene	50		2U	2 U	2U	10 U	2U	2U
Fluorene	50		2U	2 U	2U	10 U	2U	2U
Hexachlorobenzene	0.04		2U	2 U	2U	2 U	2U	2U
Hexachlorobutadiene	0.5		2U	5 U	2U	5 U	2U	2U
Hexachlorocyclopentadiene	5		20U	20 U	20U	5	20U	20U
Hexachloroethane	5		5U	5 U	5U	10 U	5.1U	5.1U
Indeno[1,2,3-cd]pyrene	0.002		2U	2 U	2U	2 U	2U	2U
Isophorone	50		2U	2 U	2U	10 U	2U	2U
Naphthalene	10		2U	2 U	2U	5 U	2U	2U
Nitrobenzene	0.4		2U	2 U	2U	5 U	2U	2U
N-Nitroso-di-n-propylamine	--		2U	NA	2U	NA	2U	2U
N-Nitrosodimethylamine	--		NA	5 U	NA	NA	NA	NA
N-Nitrosodiphenylamine	50		5U	5 U	5U	10 U	5.1U	5.1U
P-Chloroaniline	--		NA	5 U	NA	NA	NA	NA
P-Nitroaniline	--		NA	5 U	NA	NA	NA	NA
Pentachlorophenol	1		20U	20 U	20U	3 J	20U	20U
Phenanthrene	50		2U	2 U	2U	10 U	2U	2U
Phenol	1*		5U	5 U	5U	2 U	5.1U	5.1U
Pyrene	50		2U	2 U	2U	10 U	2U	2U

Notes:

µg/L - micrograms per liter

* - Standard is for total phenols

NYSDEC - New York State Department of Environmental Conservation

[1] - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, June, 1998

U - Not Detected; Detection Limit Shown

J - Estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

NA - Not analyzed due to insufficient sample volume.

Bold - Data highlighted in bold represent detections that exceed the NYSDEC Water-Quality Standards and Guidance Values

Dup - Duplicate sample

Table 10. Summary of Pesticides Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-101 11/8/1999	MP-MW-102 11/10/1999	MP-MW-103 11/10/1999	MP-MW-104 11/9/1999	MP-MW-105 11/8/1999	MP-MW-106 11/8/1999
4,4'-DDT	0.2		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
4-4'-DDD	0.3		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
4-4'-DDE	0.2		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Aldrin	ND		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Alpha Chlordane	--		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Alpha-BHC	0.01		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Beta-BHC	0.04		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Delta-BHC	0.04		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Dieldrin	0.004		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Endosulfan I	--		0.02 U	0.29	0.021 U	0.027 U	0.02 U	0.04 U
Endosulfan II	--		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Endosulfan Sulfate	--		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Endrin	ND		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Endrin Aldehyde	5		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Endrin Ketone	5		0.051 U	0.05 U	0.052 U	0.066 U	0.05 U	0.1 U
Gamma Chlordane	--		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Gamma-BHC (Lindane)	0.05		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Heptachlor	0.04		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Heptachlor Epoxide	0.03		0.02 U	0.02 U	0.021 U	0.027 U	0.02 U	0.04 U
Methoxychlor	35		0.051 U	0.05 U	0.052 U	0.066 U	0.05 U	0.1 U
Toxaphene	0.06		2 U	2 U	2.1 U	2.7 U	2 U	4 U

Notes:

ug/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

ND - Non-detectable concentration by the approved analytical method

Table 10. Summary of Pesticides Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-107 11/9/1999	MP-MW-108 11/9/1999	MP-MW-109 11/9/1999	MP-MW-109 FD 11/9/1999	MP-MW-110 11/9/1999	MP-MW-111 11/9/1999
4,4'-DDT	0.2		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
4-4'-DDD	0.3		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
4-4'-DDE	0.2		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Aldrin	ND		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Alpha Chlordane	--		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Alpha-BHC	0.01		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Beta-BHC	0.04		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Delta-BHC	0.04		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Dieldrin	0.004		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Endosulfan I	--		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Endosulfan II	--		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Endosulfan Sulfate	--		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Endrin	ND		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Endrin Aldehyde	5		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Endrin Ketone	5		0.05 U	0.052 U	0.051 U	0.05 U	0.05 U	0.25 U
Gamma Chlordane	--		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Gamma-BHC (Lindane)	0.05		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Heptachlor	0.04		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Heptachlor Epoxide	0.03		0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.1 U
Methoxychlor	35		0.05 U	0.052 U	0.051 U	0.05 U	0.05 U	0.25 U
Toxaphene	0.06		2 U	2.1 U	2 U	2 U	2 U	10 U

Notes:

ug/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

ND - Non-detectable concentration by the approved analytical method

Table 10. Summary of Pesticides Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-112 11/9/1999	MP-MW-1 11/10/1999	MP-MW-2 11/10/1999	MP-MW-3 11/10/1999	ST-MW-2 11/10/1999	LF-MW-45 11/11/1999	LG-MH-5 11/11/1999
4,4'-DDT	0.2		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4-4'-DDD	0.3		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4-4'-DDE	0.2		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Aldrin	ND		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Alpha Chlordane	--		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Alpha-BHC	0.01		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Beta-BHC	0.04		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Delta-BHC	0.04		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Dieldrin	0.004		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan I	--		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan II	--		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan Sulfate	--		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin	ND		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Aldehyde	5		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Ketone	5		0.05 U	0.05 U	0.051 U	0.051 U	0.05 U	0.05 U	0.051 U
Gamma Chlordane	--		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Gamma-BHC (Lindane)	0.05		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor	0.04		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor Epoxide	0.03		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Methoxychlor	35		0.05 U	0.05 U	0.051 U	0.051 U	0.05 U	0.05 U	0.051 U
Toxaphene	0.06		2 U	2 U	2 U	2 U	2 U	2 U	2 U

Notes:

ug/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

ND - Non-detectable concentration by the approved analytical method

Table 10. Summary of Pesticides Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MH-6 11/11/1999	LG-MH-7 11/11/1999	LG-MW-1 11/11/1999	LG-MW-2 11/11/1999	LG-MW-3 11/12/1999	LG-MW-4 11/12/1999	LG-MW-5 11/12/1999
4,4'-DDT	0.2		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
4-4'-DDD	0.3		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
4-4'-DDE	0.2		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Aldrin	ND		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Alpha Chlordane	--		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Alpha-BHC	0.01		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Beta-BHC	0.04		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Delta-BHC	0.04		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Dieldrin	0.004		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Endosulfan I	--		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Endosulfan II	--		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Endosulfan Sulfate	--		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Endrin	ND		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Endrin Aldehyde	5		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Endrin Ketone	5		0.051 U	0.052 U	0.05 U	1.1 U	1.1 U	0.05 U	0.052 U
Gamma Chlordane	--		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Gamma-BHC (Lindane)	0.05		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Heptachlor	0.04		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Heptachlor Epoxide	0.03		0.02 U	0.021 U	0.02 U	0.43 U	0.45 U	0.02 U	0.021 U
Methoxychlor	35		0.051 U	0.052 U	0.05 U	1.1 U	1.1 U	0.05 U	0.052 U
Toxaphene	0.06		2 U	2.1 U	2 U	43 U	45 U	2 U	2.1 U

Notes:

ug/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

ND - Non-detectable concentration by the approved analytical method

Table 10. Summary of Pesticides Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	LG-MW-5 FD 11/12/1999	LG-MW-6 11/11/1999	FB 11/11 WG 11/11/1999
4,4'-DDT	0.2		0.02 U	0.02 U	0.02 U
4-4'-DDD	0.3		0.02 U	0.02 U	0.02 U
4-4'-DDE	0.2		0.02 U	0.02 U	0.02 U
Aldrin	ND		0.02 U	0.02 U	0.02 U
Alpha Chlordane	--		0.02 U	0.02 U	0.02 U
Alpha-BHC	0.01		0.02 U	0.02 U	0.02 U
Beta-BHC	0.04		0.02 U	0.02 U	0.02 U
Delta-BHC	0.04		0.02 U	0.02 U	0.02 U
Dieldrin	0.004		0.02 U	0.02 U	0.02 U
Endosulfan I	--		0.02 U	0.02 U	0.02 U
Endosulfan II	--		0.02 U	0.02 U	0.02 U
Endosulfan Sulfate	--		0.02 U	0.02 U	0.02 U
Endrin	ND		0.02 U	0.02 U	0.02 U
Endrin Aldehyde	5		0.02 U	0.02 U	0.02 U
Endrin Ketone	5		0.05 U	0.05 U	0.05 U
Gamma Chlordane	--		0.02 U	0.02 U	0.02 U
Gamma-BHC (Lindane)	0.05		0.02 U	0.02 U	0.02 U
Heptachlor	0.04		0.02 U	0.02 U	0.02 U
Heptachlor Epoxide	0.03		0.02 U	0.02 U	0.02 U
Methoxychlor	35		0.05 U	0.05 U	0.05 U
Toxaphene	0.06		2 U	2 U	2 U

Notes:

ug/L - Micrograms per liter

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

-- - No NYSDEC Ambient Water-Quality Standard or Guidance Value Available

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

ND - Non-detectable concentration by the approved analytical method

Table 11. Summary of Polychlorinated Biphenyls Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-101 11/8/1999	MP-MW-102 11/10/1999	MP-MW-103 11/10/1999	MP-MW-104 11/9/1999	MP-MW-105 11/8/1999	MP-MW-106 11/8/1999
Aroclor-1016	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U
Aroclor-1221	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U
Aroclor-1232	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U
Aroclor-1242	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U
Aroclor-1248	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U
Aroclor-1254	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U
Aroclor-1260	0.09*		0.5 U	0.5 U	0.5 U	0.65 U	0.5 U	0.5 U

Notes:

ug/L - Micrograms per liter

* - Applies to the sum of all Aroclors

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

Table 11. Summary of Polychlorinated Biphenyls Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** **Sample Date:**	MP-MW-107 11/9/1999	MP-MW-108 11/9/1999	MP-MW-109 11/9/1999	MP-MW-109 FD 11/9/1999	MP-MW-110 11/9/1999
Aroclor-1016	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U
Aroclor-1221	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U
Aroclor-1232	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U
Aroclor-1242	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U
Aroclor-1248	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U
Aroclor-1254	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U
Aroclor-1260	0.09*		0.5 U	0.55 U	0.5 U	0.5 U	0.5 U

Notes:

ug/L - Micrograms per liter

* - Applies to the sum of all Aroclors

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

Table 11. Summary of Polychlorinated Biphenyls Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	MP-MW-111 11/9/1999	MP-MW-112 11/9/1999	MP-MW-1 11/10/1999	MP-MW-2 11/10/1999	MP-MW-3 11/10/1999	ST-MW-2 11/10/1999
Aroclor-1016	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1221	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1232	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1242	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1248	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1254	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1260	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

ug/L - Micrograms per liter

* - Applies to the sum of all Aroclors

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

Table 11. Summary of Polychlorinated Biphenyls Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:**	LF-MW-45	LG-MH-5	LG-MH-6	LG-MH-7	LG-MW-1	LG-MW-2
		Sample Date:	11/11/1999	11/11/1999	11/11/1999	11/11/1999	11/11/1999	11/11/1999
Aroclor-1016	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U
Aroclor-1221	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U
Aroclor-1232	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U
Aroclor-1242	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U
Aroclor-1248	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U
Aroclor-1254	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U
Aroclor-1260	0.09*		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1 U

Notes:

ug/L - Micrograms per liter

* - Applies to the sum of all Aroclors

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

Table 11. Summary of Polychlorinated Biphenyls Detected in Groundwater during the Remedial Investigation, BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC Ambient Water Quality Standards and Guidance Standards [1] (AWQS)	**Sample Designation:** / **Sample Date:**	LG-MW-3 11/12/1999	LG-MW-4 11/12/1999	LG-MW-5 11/12/1999	LG-MW-5 FD 11/12/1999	LG-MW-6 11/11/1999	FB 11/11 WG 11/11/1999
Aroclor-1016	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1221	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1232	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1242	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1248	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1254	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1260	0.09*		1.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

ug/L - Micrograms per liter

* - Applies to the sum of all Aroclors

NYSDEC - New York State Department of Environmental Conservation

(1) - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water-Quality Standards and Guidance Values, October 22, 1993

U - Indicates compound was analyzed for but not detected

bold - Data highlighted in bold represent detections that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values

Table 12. Post-Remediation Criteria for On-site Re-use of Excavated Material/Imported Fill Materials
BASF Corporation, Rensselaer, New York

Parameter	Proposed Criteria for Post-Remediation On-site Re-use of Excavated Material/ Imported Fill Materials[1]
VOCSs (µg/kg)	
1,1,1-Trichloroethane	800
1,1,2,2-Tetrachloroethane	600
1,1,2-Trichlorotrifluoroethane	6,000
1,2,3-Trichloropropane	400
1,1-Dichloroethane	200
1,1-Dichloroethene	400
1,2-Dichloroethane	100
1,3-Dichloropropane	300
2-Butanone (MEK)	300
4-Methyl-2-pentanone (MIBK)	1,000
Acetone	200
Benzene	60
Carbon disulfide	2,700
Carbon tetrachloride	600
Chlorobenzene	1,700
Chloroethane	1,900
Chloroform	300
Dibromochloromethane	--
Ethylbenzene	5,500
Methylene chloride	100
Tetrachloroethene	1,400
Toluene	1,500
trans-1,2-Dichloroethene	300
Trichloroethene	700
Vinyl chloride	200
Xylenes (total)	1,200
SVOCSs (µg/kg)	
1,2,4-Trichlorobenzene	3,400
1,2-Dichlorobenzene	7,900
1,3-Dichlorobenzene	1,600
1,4-Dichlorobenzene	8,500
2,4,5-Trichlorophenol	100
2,4-Dichlorophenol	400
2,4-Dinitrophenol	200
2,6-Dinitrotoluene	1,000
2-Chlorophenol	800
2-Methylnaphthalene	36,400
2-Methylphenol	100
2-Nitroaniline	430
2-Nitrophenol	330
3,3'-Dichlorobenzidine	--
3-Nitroaniline	500
4-Chloro-3-methylphenol	240
4-Chloroaniline	220
4-Methylphenol	900
4-Nitrophenol	100
Acenaphthene	50,000
Acenaphthylene	50,000
Anthracene	50,000

Table 12. Post-Remediation Criteria for On-site Re-use of Excavated Material/Imported Fill Materials
BASF Corporation, Rensselaer, New York

Parameter	Proposed Criteria for Post-Remediation On-site Re-use of Excavated Material/ Imported Fill Materials[1]
SVOCSs (µg/kg)	
Aniline	100
Benzo[a]anthracene	224
Benzo[a]pyrene	61
Benzo[b]fluoranthene	220
Benzo[g,h,i]perylene	50,000
Benzo[k]fluoranthene	220
Bis(2-ethylhexyl) phthalate	50,000
Butylbenzyl phthalate	50,000
Chrysene	400
Dibenzo[a,h]anthracene	14
Dibenzofuran	6,200
Diethyl phthalate	7,100
Dimethyl phthalate	2,000
Di-n-butyl phthalate	8,100
Di-n-octyl phthalate	50,000
Fluoranthene	50,000
Fluorene	50,000
Hexachlorobenzene	410
Indeno[1,2,3-cd]pyrene	3,200
Isophorone	4,400
Naphthalene	13,000
Nitrobenzene	200
Pentachlorophenol	1,000
Phenanthrene	50,000
Phenol	30
Pyrene	50,000
Metals (mg/kg)	
Arsenic	7.5 or SB
Barium	300
Cadmium	1 or SB
Chromium (IV)	10 or SB
Chromium (III)	10 or SB
Lead	500 or SB
Mercury	0.1
Selenium	2
Silver	SB
PCBs (µg/kg)	
Aroclor-1016	--
Aroclor-1221	--
Aroclor-1232	--
Aroclor-1242	--
Aroclor-1248	--
Aroclor-1254	--
Aroclor-1260	--
Aroclor-1262	--
Total PCBs:	10,000

Table 12. Post-Remediation Criteria for On-site Re-use of Excavated Material/Imported Fill Materials
BASF Corporation, Rensselaer, New York

Parameter	Proposed Criteria for Post-Remediation On-site Re-use of Excavated Material/ Imported Fill Materials[1]
Pesticides (µg/kg)	
4,4'-DDD	2,900
4,4'-DDE	2,100
4,4'-DDT	2,100
Aldrin	41
alpha-BHC	110
Chlordane (alpha)	540
beta-BHC	200
Pesticides (µg/kg)	
delta-BHC	300
Dieldrin	44
Endosulfan I	900
Endosulfan II	900
Endosulfan sulfate	1,000
Endrin ketone	--
Endrin	100
gamma-BHC (Lindane)	60
gamma-Chlordane	540
Heptachlor epoxide	20
Heptachlor	100
Methoxychlor	--
Herbicides (µg/kg)	
2,4-D	500
2,4,5-TP (Silvex)	700
2,4,5-T	1,900

Notes:

[1] - Based on latest version of NYSDEC TAGM 4046 RSCOs.

SB - Site Background

NYSDEC - New York State Department of Environmental Conservation

RSCOs - Recommended Soil Cleanup Objectives

-- No Standard available

µg/kg - Micrograms per kilogram

mg/kg - Milligrams per kilogram

Table 13. Summary of Soil Vapor Analytical Data, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/m^3)	NYSDOH Air Guideline Values (µg/m^3)	OSHA PEL (µg/m^3)	**Sample Designation:** **Sample Date:**	101-AMBIENT 4/18/2012	102-AMBIENT 4/18/2012	103-AMBIENT 4/18/2012	104-AMBIENT 4/18/2012	105-AMBIENT 4/18/2012
1,1,1-Trichloroethane	100	1,900,000		0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
1,1,2,2-Tetrachloroethane	NA	35,000		0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
1,1,2-Trichloroethane	NA	45,000		0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
1,1-Dichloroethane	NA	400,000		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,1-Dichloroethene	NA	790,000		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,2-Dibromoethane	NA	NA		0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
1,2-Dichloroethane	NA	NA		0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
1,2-Dichloroethene (total)	NA	NA		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,2-Dichloropropane	NA	350,000		0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
1,3,5-Trimethylbenzene	NA	NA		0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
1,3-BUTADIENE	NA	NA		0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
3-Chloropropene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-ETHYLTOLUENE	NA	NA		0.20 U*	0.20 U*	0.20 U*	0.20 U*	0.20 U*
Benzene	NA	31,947		0.49	0.7	0.36	0.71	0.66
Bromodichloromethane	NA	NA		0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Bromoethene	NA	NA		0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
Bromoform	NA	NA		0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
Bromomethane	NA	NA		0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Carbon tetrachloride	5	65,000		0.41	0.44	0.47	0.44	0.49
Chloroethane	NA	NA		0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
Chloroform	NA	240,000		0.27	0.22	0.20 U	0.20 U	1
cis-1,2-Dichloroethene	NA	NA		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
cis-1,3-Dichloropropene	NA	NA		0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
CYCLOHEXANE	NA	1,050,000		0.16	1.7	0.14 U	2.9	0.27
Dibromochloromethane	NA	NA		0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
Dichlorodifluoromethane	NA	4,950,000		2.3	2.2	2.1	2.3	2.2
Ethylbenzene	NA	435,000		0.17 U	0.53	0.17 U	0.79	0.28
Freon 114	NA	7,600,000		0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Isooctane	NA	NA		0.41	0.9	0.2	0.99	0.65
m+p-Xylene	NA	435,000		0.42	1.8	0.28	1.5	0.85
Methylene chloride	60	86,840		1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
MTBE	NA	NA		0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
N-HEPTANE	NA	NA		0.27	0.99	0.2	1.6	0.16 U
N-HEXANE	NA	NA		0.84	2.2	0.49	2.4	1.2

Table 13. Summary of Soil Vapor Analytical Data, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/m^3)	NYSDOH Air Guideline Values (µg/m^3)	OSHA PEL (µg/m^3)	**Sample Designation:** **Sample Date:**	101-AMBIENT 4/18/2012	102-AMBIENT 4/18/2012	103-AMBIENT 4/18/2012	104-AMBIENT 4/18/2012	105-AMBIENT 4/18/2012
o-Xylene	NA	435,000		0.17 U	0.64	0.17 U	0.38	0.33
Tetrachloroethene	100	670,000		0.45	0.28	0.27 U	0.27 U	0.41
Toluene	NA	753,620		0.9	3.8	0.5	6	2
trans-1,2-Dichloroethene	NA	NA		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
trans-1,3-Dichloropropene	NA	NA		0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Trichloroethene	5	535,000		0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
Trichlorofluoromethane	NA	5,600,000		1.2	1.3	1.2	1.3	1.2
Vinyl chloride	NA	2,560		0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Xylenes (total)	NA	NA		0.57	2.4	0.39	1.9	1.2

J - Estimated value

U - Compound was analyzed for but not detected

µg/m^3 - Micrograms per cubic meter

Table 13. Summary of Soil Vapor Analytical Data, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/m^3)	NYSDOH Air Guideline Values (µg/m^3)	OSHA PEL (µg/m^3)	**Sample Designation:** / **Sample Date:**	106-AMBIENT 4/18/2012	107-AMBIENT 4/18/2012	108-AMBIENT 4/18/2012	109-AMBIENT 4/18/2012	SG-101 4/18/2012	SG-102 4/18/2012
1,1,1-Trichloroethane	100	1,900,000		0.22 U	0.22 U	0.22 U	0.22 U	1.1 U	2.2 U
1,1,2,2-Tetrachloroethane	NA	35,000		0.27 U	0.27 U	0.27 U	0.27 U	1.4 U	2.7 U
1,1,2-Trichloroethane	NA	45,000		0.22 U	0.22 U	0.22 U	0.22 U	1.1 U	2.2 U
1,1-Dichloroethane	NA	400,000		0.16 U	0.16 U	0.16 U	0.16 U	0.81 U	1.6 U
1,1-Dichloroethene	NA	790,000		0.16 U	0.16 U	0.16 U	0.16 U	0.79 U	1.6 U
1,2-Dibromoethane	NA	NA		0.31 U	0.31 U	0.31 U	0.31 U	1.5 U	3.1 U
1,2-Dichloroethane	NA	NA		0.32 U	0.32 U	0.32 U	0.32 U	0.81 U	1.6 U
1,2-Dichloroethene (total)	NA	NA		0.16 U	0.16 U	0.16 U	0.16 U	0.79 U	1.6 U
1,2-Dichloropropane	NA	350,000		0.37 U	0.37 U	0.37 U	0.37 U	0.92 U	1.8 U
1,3,5-Trimethylbenzene	NA	NA		0.39 U	0.39 U	0.39 U	0.39 U	0.98 U	5.5
1,3-BUTADIENE	NA	NA		0.18 U	0.18 U	0.18 U	0.18 U	0.44 U	0.88 U
3-Chloropropene	NA	NA		0.25 U	0.25 U	0.25 U	0.25 U	1.6 U	3.1 U
4-ETHYLTOLUENE	NA	NA		0.20 U*	0.20 U*	0.20 U*	0.20 U*	0.98 U	5.4
Benzene	NA	31,947		0.42	0.68	0.6	0.37	0.66	1.9
Bromodichloromethane	NA	NA		0.27 U	0.27 U	0.27 U	0.27 U	1.3 U	2.7 U
Bromoethene	NA	NA		0.35 U	0.35 U	0.35 U	0.35 U	0.87 U	1.7 U
Bromoform	NA	NA		0.41 U	0.41 U	0.41 U	0.41 U	2.1 U	4.1 U
Bromomethane	NA	NA		0.31 U	0.31 U	0.31 U	0.31 U	0.78 U	1.6 U
Carbon tetrachloride	5	65,000		0.47	0.45	0.49	0.44	1.3 U	11
Chloroethane	NA	NA		0.21 U	0.21 U	0.21 U	0.21 U	1.3 U	2.6 U
Chloroform	NA	240,000		0.21	0.45	0.20 U	0.20 U	0.98 U	12
cis-1,2-Dichloroethene	NA	NA		0.16 U	0.16 U	0.16 U	0.16 U	0.79 U	1.6 U
cis-1,3-Dichloropropene	NA	NA		0.18 U	0.18 U	0.18 U	0.18 U	0.91 U	1.8 U
CYCLOHEXANE	NA	1,050,000		1.8	0.57	1.1	0.14 U	0.69 U	5
Dibromochloromethane	NA	NA		0.34 U	0.34 U	0.34 U	0.34 U	1.7 U	3.4 U
Dichlorodifluoromethane	NA	4,950,000		2.3	2.3	2.1	2	2.5	5.8
Ethylbenzene	NA	435,000		0.48	0.31	0.5	0.17 U	0.87 U	43
Freon 114	NA	7,600,000		0.28 U	0.28 U	0.28 U	0.28 U	1.4 U	2.8 U
Isooctane	NA	NA		0.19	0.87	0.62	0.19	0.93 U	4.6
m+p-Xylene	NA	435,000		1.7	1.1	1.7	0.27	2.2 U	150
Methylene chloride	60	86,840		1.4 U	1.4 U	1.4 U	1.4 U	1.7 U	3.5 U
MTBE	NA	NA		0.14 U	0.14 U	0.14 U	0.14 U	0.72 U	1.4 U
N-HEPTANE	NA	NA		0.9	0.67	0.77	0.16	0.82 U	5.1
N-HEXANE	NA	NA		0.74	1.9	1.5	0.46	1.3	5.8

Table 13. Summary of Soil Vapor Analytical Data, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/m^3)	NYSDOH Air Guideline Values (µg/m^3)	OSHA PEL (µg/m^3)	**Sample Designation:** / **Sample Date:**	106-AMBIENT 4/18/2012	107-AMBIENT 4/18/2012	108-AMBIENT 4/18/2012	109-AMBIENT 4/18/2012	SG-101 4/18/2012	SG-102 4/18/2012
o-Xylene	NA	435,000		0.53	0.39	0.57	0.17 U	0.87 U	41
Tetrachloroethene	100	670,000		0.27 U	0.31	0.27 U	0.27 U	1.4 U	12
Toluene	NA	753,620		3.9	2.1	3.3	0.57	2.3	92
trans-1,2-Dichloroethene	NA	NA		0.16 U	0.16 U	0.16 U	0.16 U	0.79 U	1.6 U
trans-1,3-Dichloropropene	NA	NA		0.18 U	0.18 U	0.18 U	0.18 U	0.91 U	1.8 U
Trichloroethene	5	535,000		0.21 U	0.21 U	0.21 U	0.21 U	1.1 U	2.1 U
Trichlorofluoromethane	NA	5,600,000		1.1	1.3	1.3	1.1	1.4	46
Vinyl chloride	NA	2,560		0.20 U	0.20 U	0.20 U	0.20 U	0.51 U	1.0 U
Xylenes (total)	NA	NA		2.3	1.4	2.2	0.38	0.87 U	190

J - Estimated value

U - Compound was analyzed for but not detected

µg/m^3 - Micrograms per cubic meter

Table 13. Summary of Soil Vapor Analytical Data, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/m^3)	NYSDOH Air Guideline Values (µg/m^3)	OSHA PEL (µg/m^3)	**Sample Designation:** / **Sample Date:**	SG-103 4/18/2012	SG-104 4/18/2012	SG-105 4/18/2012	SG-106 4/18/2012	SG-107 4/18/2012	SG-108 4/18/2012	SG-109 4/18/2012
1,1,1-Trichloroethane	100	1,900,000		2.2 U	1.1 U	2.2 U	2.2 U	2.2 U	1.1 U	5.6
1,1,2,2-Tetrachloroethane	NA	35,000		2.7 U	1.4 U	2.7 U	2.7 U	2.7 U	1.4 U	1.4 U
1,1,2-Trichloroethane	NA	45,000		2.2 U	1.1 U	2.2 U	2.2 U	2.2 U	1.1 U	1.1 U
1,1-Dichloroethane	NA	400,000		1.6 U	0.81 U	1.6 U	1.6 U	1.6 U	0.81 U	0.81 U
1,1-Dichloroethene	NA	790,000		1.6 U	0.79 U	1.6 U	1.6 U	1.6 U	0.79 U	0.79 U
1,2-Dibromoethane	NA	NA		3.1 U	1.5 U	3.1 U	3.1 U	3.1 U	1.5 U	1.5 U
1,2-Dichloroethane	NA	NA		1.6 U	0.81 U	1.6 U	1.6 U	1.6 U	0.81 U	0.81 U
1,2-Dichloroethene (total)	NA	NA		1.6 U	0.79 U	1.6 U	1.6 U	1.6 U	0.79 U	0.79 U
1,2-Dichloropropane	NA	350,000		1.8 U	0.92 U	1.8 U	1.8 U	1.8 U	0.92 U	0.92 U
1,3,5-Trimethylbenzene	NA	NA		5.6	2.7	5	4.4	4.1	6.1	5.5
1,3-BUTADIENE	NA	NA		0.88 U	0.44 U	0.88 U	0.88 U	0.88 U	0.44 U	0.44 U
3-Chloropropene	NA	NA		3.1 U	1.6 U	3.1 U	3.1 U	3.1 U	1.6 U	1.6 U
4-ETHYLTOLUENE	NA	NA		5.4	2.5	5.2	4.6	4.3	5.4	5.2
Benzene	NA	31,947		1.7	2.2	2.4	20	2.8	1.6	2.3
Bromodichloromethane	NA	NA		2.7 U	1.3 U	2.7 U	2.7 U	2.7 U	1.3 U	1.3 U
Bromoethene	NA	NA		1.7 U	0.87 U	1.7 U	1.7 U	1.7 U	0.87 U	0.87 U
Bromoform	NA	NA		4.1 U	2.1 U	4.1 U	4.1 U	4.1 U	2.1 U	2.1 U
Bromomethane	NA	NA		1.6 U	0.78 U	1.6 U	1.6 U	1.6 U	0.78 U	0.78 U
Carbon tetrachloride	5	65,000		2.5 U	1.3 U	2.5 U	2.5 U	3	1.3 U	1.3 U
Chloroethane	NA	NA		2.6 U	1.3 U	2.6 U	2.6 U	2.6 U	1.3 U	1.3 U
Chloroform	NA	240,000		2.0 U	0.98 U	2.0 U	3.5	2.0 U	1.2	0.98 U
cis-1,2-Dichloroethene	NA	NA		1.6 U	0.79 U	1.6 U	1.6 U	1.6 U	0.79 U	0.79 U
cis-1,3-Dichloropropene	NA	NA		1.8 U	0.91 U	1.8 U	1.8 U	1.8 U	0.91 U	0.91 U
CYCLOHEXANE	NA	1,050,000		1.6	2.4	2.1	14	6.5	2.4	2.1
Dibromochloromethane	NA	NA		3.4 U	1.7 U	3.4 U	3.4 U	3.4 U	1.7 U	1.7 U
Dichlorodifluoromethane	NA	4,950,000		4.9 U	3	190	4.9 U	71	2.5 U	2.6
Ethylbenzene	NA	435,000		47	22	45	44	41	45	43
Freon 114	NA	7,600,000		2.8 U	1.4 U	2.8 U	2.8 U	2.8 U	1.4 U	1.4 U
Isooctane	NA	NA		1.9 U	3.4	1.9 U	16	2.3	1.8	4.1
m+p-Xylene	NA	435,000		160	70	150	140	130	150	140
Methylene chloride	60	86,840		3.5 U	18	3.5 U	3.5 U	3.5 U	1.7 U	1.7 U
MTBE	NA	NA		1.4 U	0.72 U	1.4 U	1.4 U	1.4 U	0.72 U	0.72 U
N-HEPTANE	NA	NA		7.9	7.4	7.9	16	9.5	6.4	6
N-HEXANE	NA	NA		6.9	19	6.4	19	9.2	5.4	5.1

Table 13. Summary of Soil Vapor Analytical Data, BASF Corporation, Rensselaer, New York

Parameter (Concentrations in µg/m^3)	NYSDOH Air Guideline Values (µg/m^3)	OSHA PEL (µg/m^3)	**Sample Designation:** / **Sample Date:**	SG-103 4/18/2012	SG-104 4/18/2012	SG-105 4/18/2012	SG-106 4/18/2012	SG-107 4/18/2012	SG-108 4/18/2012	SG-109 4/18/2012
o-Xylene	NA	435,000		44	19	41	38	34	43	40
Tetrachloroethene	100	670,000		14	6.5	14	14	13	18	18
Toluene	NA	753,620		110	70	110	120	110	100	94
trans-1,2-Dichloroethene	NA	NA		1.6 U	0.79 U	1.6 U	1.6 U	1.6 U	0.79 U	0.79 U
trans-1,3-Dichloropropene	NA	NA		1.8 U	0.91 U	1.8 U	1.8 U	1.8 U	0.91 U	0.91 U
Trichloroethene	5	535,000		2.1 U	1.1 U	2.1 U	2.1 U	2.1 U	1.1 U	1.1 U
Trichlorofluoromethane	NA	5,600,000		5.8	2.8	74	140	11	2.8	4.5
Vinyl chloride	NA	2,560		1.0 U	0.51 U	1.0 U	1.0 U	1.0 U	0.51 U	0.51 U
Xylenes (total)	NA	NA		210	89	190	180	170	190	180

J - Estimated value

U - Compound was analyzed for but not detected

µg/m^3 - Micrograms per cubic meter

Table 16. Baseline Groundwater Monitoring Results (June 2007), BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:** **Sample Date:**	FIELD BLANK 06/19/07	LF-MW-46 06/19/07	LF-MW-46 DUP 06/19/07	LG-MW-2 06/19/07	LG-PZ-15 06/19/07	MP-MW-105R 06/19/07	MP-MW-108 06/19/07	MP-MW-120 06/19/07	TRIP BLANK 06/19/07
Volatile Organic Compounds											
1,1,1-Trichloroethane	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
1,1,2-Trichloroethane	1		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
1,1-Dichloroethane	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
1,1-Dichloroethene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
1,2,4-Trichlorobenzene	5		1 U	1 U	1 U	1 U	1 U	2000 U	**960**	1 U	1 U
1,2-Dichlorobenzene	3		1 U	1 U	1 U	1 U	1 U	2000 U	**12**	1 U	1 U
1,2-Dichloroethane	0.6		1 U	**18**	**19**	1 U	1 U	**160000**	10 U	1 U	1 U
1,2-Dichloropropane	1		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
1,3-Dichlorobenzene	3		1 U	1 U	1 U	1 U	1 U	2000 U	**980**	1 U	1 U
1,4-Dichlorobenzene	3		1 U	1 U	1 U	1 U	1 U	2000 U	**390**	1 U	1 U
2-Butanone (MEK)	50		2 U	2 U	2 U	2 U	2 U	4000 U	20 U	2 U	2 U
2-Hexanone	50		2 U	2 U	2 U	2 U	2 U	4000 U	20 U	2 U	2 U
4-Methyl-2-pentanone	--		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Acetone	50		10 U	10 U	10 U	10 U	10 U	20000 U	100 U	10 U	10 U
Benzene	1		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1000 U	**890**	**2.5**	0.5 U
Bromodichloromethane	50		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Bromoform	50		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Bromomethane	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Carbon disulfide	--		1 U	1 U	1 U	1 U	1 U	2000 U	14	1 U	1 U
Carbon tetrachloride	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Chlorobenzene	5		1 U	1 U	1 U	1 U	1 U	**4200**	**950**	**41**	1 U
Chloroethane	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Chloroform	7		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Chloromethane	--		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
cis-1,2-Dichloroethene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
cis-1,3-Dichloropropene	--		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Dibromochloromethane	50		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Ethylbenzene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Methylene chloride	5		2.5 U	2.5 U	2.5 U	2.5 U	2.6	5000 U	**25**	2.5 U	2.5 U
Styrene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Tetrachloroethene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Toluene	5		1 U	1.3	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
trans-1,2-Dichloroethene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
trans-1,3-Dichloropropene	--		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Trichloroethene	5		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Vinyl chloride	2		1 U	1 U	1 U	1 U	1 U	2000 U	10 U	1 U	1 U
Xylenes (total)	5		1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	3000 U	15 U	1.5 U	1.5 U

Table 16. Baseline Groundwater Monitoring Results (June 2007), BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:** / **Sample Date:**	FIELD BLANK 06/19/07	LF-MW-46 06/19/07	LF-MW-46 DUP 06/19/07	LG-MW-2 06/19/07	LG-PZ-15 06/19/07	MP-MW-105R 06/19/07	MP-MW-108 06/19/07	MP-MW-120 06/19/07	TRIP BLANK 06/19/07
Semi-Volatile Organic Compounds											
1,2,4-Trichlorobenzene	5		1 U	1 U	1 U	1 U	1 U	1 U	**420**	1 U	NA
1,2-Dichlorobenzene	3		1 U	1 U	1 U	1 U	1 U	**4.9**	**5.1**	1 U	NA
1,3-Dichlorobenzene	3		1 U	1 U	1 U	1 U	1 U	1 U	**370**	1 U	NA
1,4-Dichlorobenzene	3		1 U	1 U	1 U	1 U	1 U	2.4	**150**	1 U	NA
2,4,5-Trichlorophenol	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
2,4,6-Trichlorophenol	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
2,4-Dichlorophenol	5		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
2,4-Dimethylphenol	50		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
2,4-Dinitrophenol	10		10 U	10 U	10 U	10 U	10 U	10 U	30 U	10 U	NA
2,4-Dinitrotoluene	5		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
2,6-Dinitrotoluene	5		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
2-Chloronaphthalene	10		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
2-Chlorophenol	--		5 U	5 U	5 U	5 U	5 U	5.1	15 U	5 U	NA
2-Methylnaphthalene	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
2-Methylphenol	--		10 U	10 U	10 U	10 U	10 U	10 U	30 U	10 U	NA
2-Nitroaniline	5		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
2-Nitrophenol	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
3&4-Methylphenol	--		10 U	10 U	10 U	10 U	10 U	10 U	30 U	10 U	NA
3,3'-Dichlorobenzidine	5		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
3-Nitroaniline	5		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
4,6-Dinitro-2-methylphenol	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
4-Bromophenyl phenyl ether	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
4-Chloro-3-methylphenol	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
4-Chloroaniline	5		5 U	5 U	5 U	5 U	5 U	5 U	**42**	5 U	NA
4-Chlorophenyl phenyl ether	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
4-Nitroaniline	5		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
4-Nitrophenol	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
Acenaphthene	20		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Acenaphthylene	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Anthracene	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Benzo[a]anthracene	0.002		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Benzo[a]pyrene	ND		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Benzo[b]fluoranthene	0.002		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Benzo[g,h,i]perylene	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Benzo[k]fluoranthene	0.002		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Bis(2-chloroethoxy)methane	5		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Bis(2-chloroethyl) ether	1		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
Bis(2-Chloroisopropyl) ether	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Bis(2-ethylhexyl) phthalate	5		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Butylbenzyl phthalate	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Carbazole	--		1 U	1 U	1 U	1 U	1 U	16	3 U	1 U	NA

Table 16. Baseline Groundwater Monitoring Results (June 2007), BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:** / **Sample Date:**	FIELD BLANK 06/19/07	LF-MW-46 06/19/07	LF-MW-46 DUP 06/19/07	LG-MW-2 06/19/07	LG-PZ-15 06/19/07	MP-MW-105R 06/19/07	MP-MW-108 06/19/07	MP-MW-120 06/19/07	TRIP BLANK 06/19/07
Semi-Volatile Organic Compounds, continued											
Chrysene	0.002		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Di-n-butyl phthalate	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Di-n-octyl phthalate	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Dibenzo[a,h]anthracene	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Dibenzofuran	--		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
Diethyl phthalate	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Dimethyl phthalate	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Fluoranthene	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Fluorene	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Hexachlorobenzene	0.04		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Hexachlorobutadiene	0.5		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Hexachlorocyclopentadiene	5		10 U	10 U	10 U	10 U	10 U	10 U	30 U	10 U	NA
Hexachloroethane	5		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Indeno[1,2,3-cd]pyrene	0.002		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Isophorone	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
n-Nitrosodi-n-propylamine	--		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
n-Nitrosodiphenylamine	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Naphthalene	10		1 U	1 U	1 U	1 U	1 U	5.5	3 U	1 U	NA
Nitrobenzene	0.4		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Pentachlorophenol	1		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
Phenanthrene	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Phenol	1		5 U	5 U	5 U	5 U	5 U	5 U	15 U	5 U	NA
Pyrene	50		1 U	1 U	1 U	1 U	1 U	1 U	3 U	1 U	NA
Unfiltered Metals											
Aluminum	--		100 U	100 U	100 U	2700	95000	110000	100 U	300	NA
Antimony	3		7.5 U	7.5 U	7.5 U	7.5 U	**8.6**	7.5 U	7.5 U	7.5 U	NA
Arsenic	25		4 U	4 U	4 U	**39**	**760**	**44**	8 U	14	NA
Barium	1000		25 U	50	49	39	**1100**	44	65	150	NA
Beryllium	3		4 U	4 U	4 U	4 U	**5.8**	**7.2**	4 U	4 U	NA
Cadmium	5		2 U	2 U	2 U	2 U	**30**	4.7	2 U	2 U	NA
Calcium	--		1000 U	140000	140000	220000	240000	120000	460000	79000	NA
Chromium	50		25 U	25 U	25 U	25 U	**180**	25 U	25 U	25 U	NA
Cobalt	--		10 U	10 U	10 U	10 U	110	150	10 U	10 U	NA
Copper	200		33	25 U	25 U	25 U	**600**	**230**	50 U	29	NA
Iron	300		150 U	150 U	150 U	**4800**	**180000**	**110000**	**1900**	**26000**	NA
Lead	25		5 U	5 U	5 U	5 U	**900**	**27**	10 U	5 U	NA
Magnesium	35000		1000 U	**37000**	**36000**	**140000**	**72000**	**63000**	11000	17000	NA
Manganese	300		25 U	**2900**	**2900**	**500**	**5200**	**9900**	**420**	**880**	NA
Mercury	0.7		0.2 U	0.2 U	0.2 U	0.2 U	**4.1**	0.2 U	0.2 U	0.2 U	NA
Nickel	100		10 U	10 U	10 U	10 U	**210**	**260**	10 U	10 U	NA

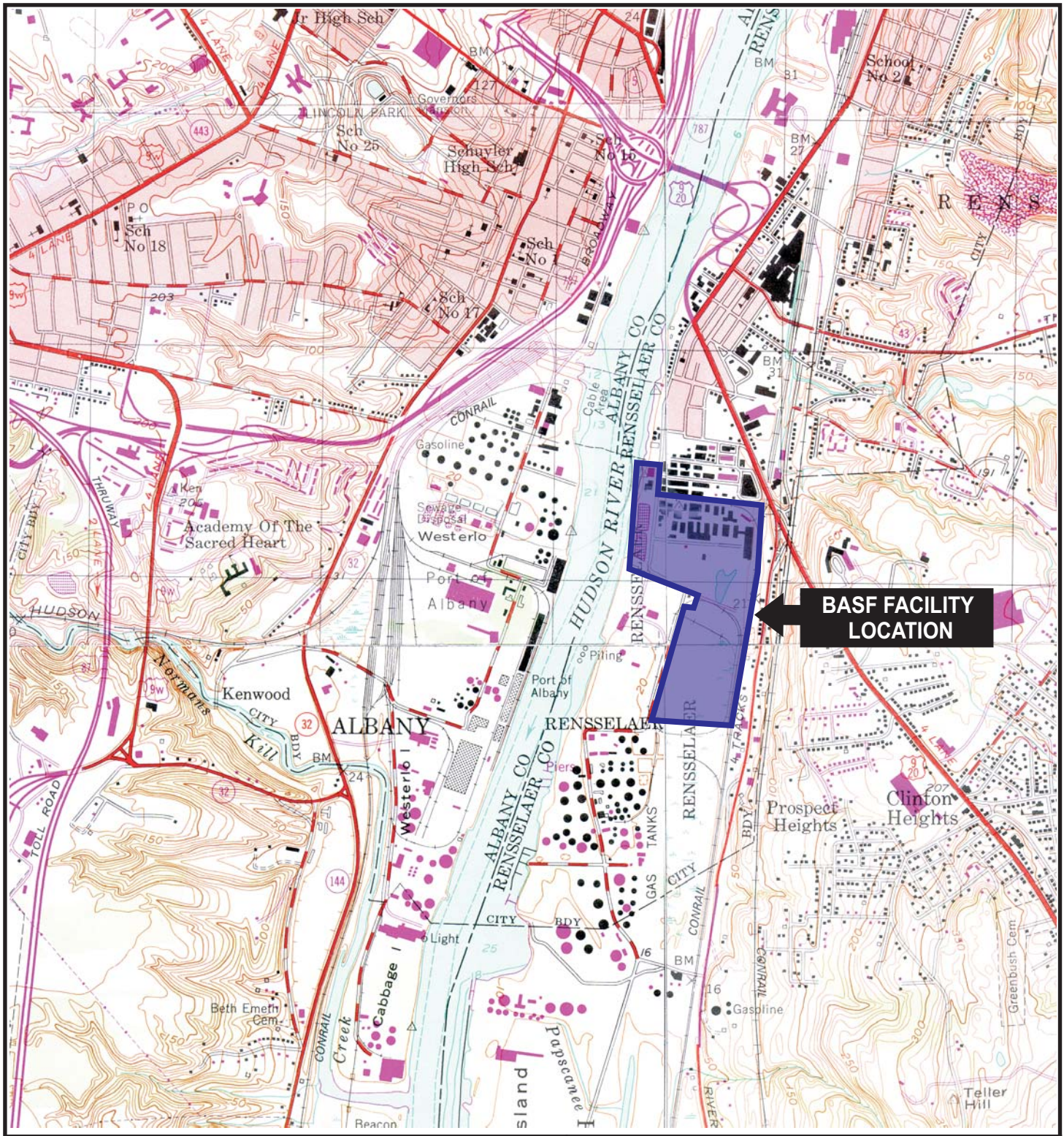
Table 16. Baseline Groundwater Monitoring Results (June 2007), BASF Corporation, Rensselaer, New York

Analyte (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:** / **Sample Date:**	FIELD BLANK 06/19/07	LF-MW-46 06/19/07	LF-MW-46 DUP 06/19/07	LG-MW-2 06/19/07	LG-PZ-15 06/19/07	MP-MW-105R 06/19/07	MP-MW-108 06/19/07	MP-MW-120 06/19/07	TRIP BLANK 06/19/07
Unfiltered Metals, continued											
Potassium	--		2500 U	2500 U	2500 U	4200	9900	5000	7000	3600	NA
Selenium	10		25 U	25 U	25 U	25 U	25 U	25 U	50 U	25 U	NA
Silver	50		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Sodium	20000		2500 U	**43000**	**42000**	**190000**	11000	**64000**	**120000**	16000	NA
Thallium	0.5		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA
Vanadium	--		25 U	25 U	25 U	25 U	140	25 U	25 U	25 U	NA
Zinc	2000		25 U	25 U	25 U	42	1100	**9700**	25 U	60	NA
Filtered Metals											
Aluminum	--		100 U	100 U	100 U	100 U	100 U	95000	100 U	210	NA
Antimony	3		7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	NA
Arsenic	25		4 U	4 U	4 U	10	7.6	**29**	8 U	4 U	NA
Barium	1000		25 U	51	52	25 U	80	33	64	160	NA
Beryllium	3		4 U	4 U	4 U	4 U	4 U	**7.7**	4 U	4 U	NA
Cadmium	5		2 U	2 U	2 U	2 U	2 U	2.2	2 U	2 U	NA
Calcium	--		1000 U	150000	150000	220000	130000	130000	510000	86000	NA
Chromium	50		25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	NA
Cobalt	--		10 U	10 U	10 U	10 U	10 U	160	10 U	10 U	NA
Copper	200		25 U	25 U	25 U	25 U	25 U	25 U	50 U	25 U	NA
Iron	300		150 U	150 U	150 U	180	150 U	**110000**	**3500**	**6000**	NA
Lead	25		5 U	5 U	5 U	5 U	5 U	10	10 U	5 U	NA
Magnesium	35000		1000 U	**39000**	**39000**	**140000**	20000	**66000**	12000	19000	NA
Manganese	300		25 U	**3100**	**3100**	**450**	25 U	**11000**	**420**	**860**	NA
Mercury	0.7		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NA
Nickel	100		10 U	10 U	10 U	10 U	10 U	**270**	10 U	10 U	NA
Potassium	--		2500 U	2500 U	2500 U	4200	3300	5800	7500	4000	NA
Selenium	10		25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	NA
Silver	50		10 U	10 U	10 U	10 U	10 U	10 U	20 U	10 U	NA
Sodium	20000		2500 U	**45000**	**45000**	**200000**	11000	**71000**	**120000**	**21000**	NA
Thallium	0.5		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA
Vanadium	--		25 U	25 U	25 U	25 U	25 U	25	25 U	25 U	NA
Zinc	2000		25 U	25 U	25 U	25 U	25 U	**9700**	25 U	**2700**	NA

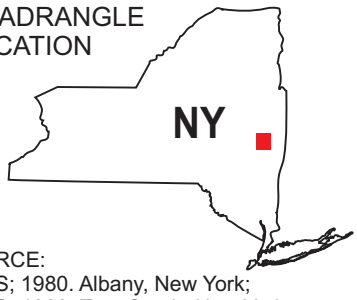
Notes:
U - Analyte was not detected at or above the reporting limit
DUP - Duplicate sample
NYSDEC - New York State Department of Environmental Conservation
AWQSGVs - Ambient Water Quality Standards and Guidance Values
µg/L - µg/L -Micrograms per liter
-- - No NYSDEC AWQSGV available
Bold - Concentration exceeds NYSDEC AWQSGVs

FIGURES

1. Site Location Map
2. BASF Site Boundaries (Site #4-42-027)
3. Former Process Building Locations
4. Summary of COCs Detected in Process Residue during Additional Remedial Investigation Activities
5. Approximate Limits of Soil Groundwater Source Areas
6. Soil IRM Excavation Areas
7. Building 81 1,2-DCA Excavation Areas
8. OU-1 Composite Cover System
9. Soil Gas Monitoring Locations
10. Hospital Route Map



QUADRANGLE LOCATION



SOURCE:
USGS; 1980. Albany, New York;
USGS; 1980. Troy South, New York
USGS; 1980. Delmar, New York
USGS; 1980. East Greenbush, New York
7.5 Minute Topographic Quadrangles

N

0 2000'

Title:

SITE LOCATION MAP

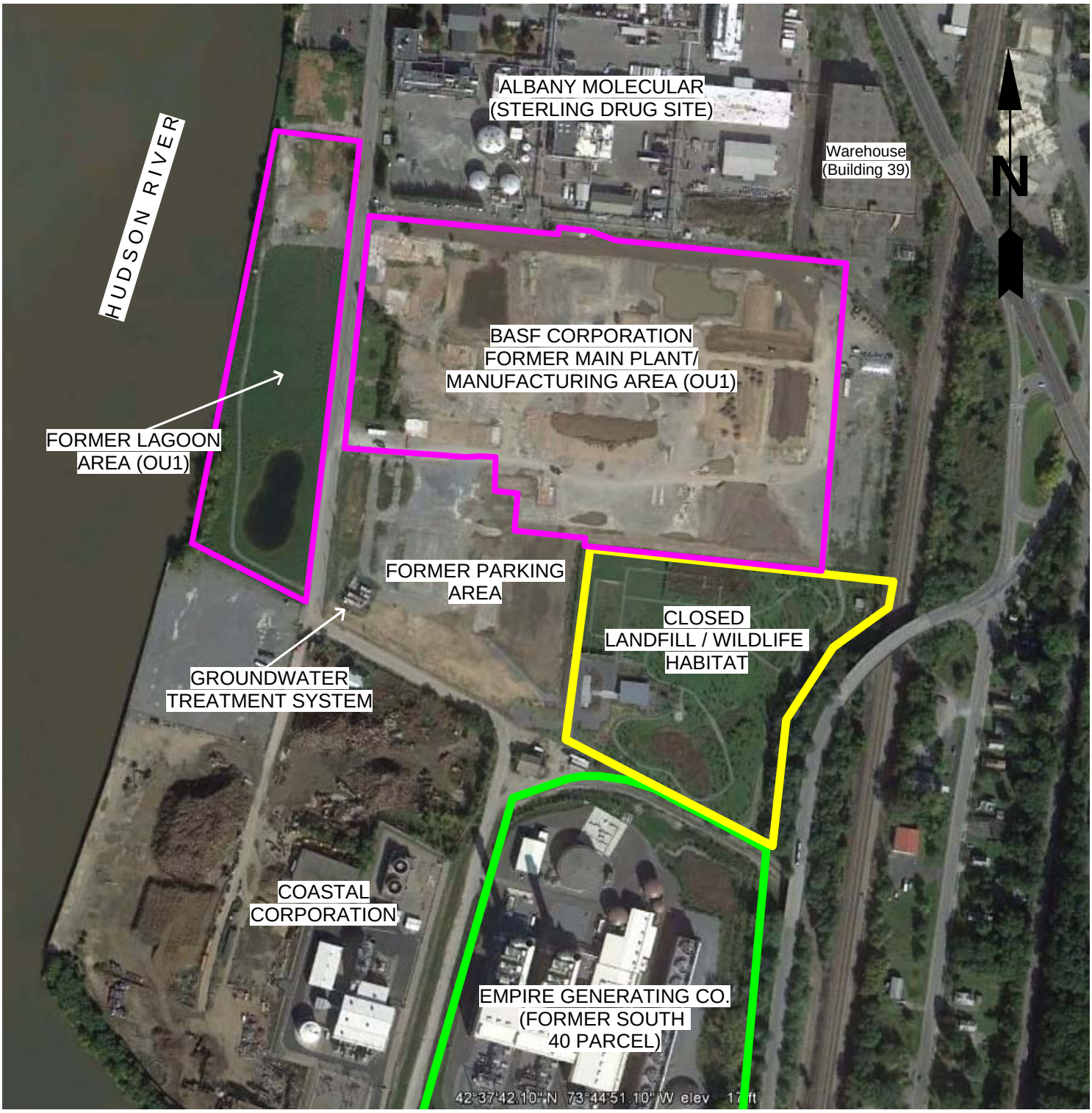
SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared for:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: D.M.H.	Date: 13DEC12	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	1
Project Mgr.: D.M.H.	Project No.: 0251.0011Y045	
File: 0251.0011Y592.07.CDR		

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AERIAL PHOTOGRAPH SOURCE: GOOGLE EARTH 2012
IMAGE DATE OCTOBER 7, 2011

Title:

BASF SITE BOUNDARIES
(SITE #4-42-027)

SITE MANAGEMENT PLAN

Prepared For:

BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: N.E.	Date: 12/13/2012	FIGURE
Prepared by: NE	NTS	2
Project Mgr: N.E.	Office: NY	
0251.0011Y592.01.WOR	0251.0011Y045	



LEGEND

- EXISTING BUILDING
- FORMER BUILDING
- FORMER, EXISTING OR ALLEGED UNDERGROUND/ABOVE GRADE TANK OR PIT
- BARBED WIRE FENCE
- CHAINLINK FENCE
- GUARDRAIL
- RAILROAD
- PROPERTY LINE
- SHRUB
- TREE

MAP REFERENCES

1. "TOPOGRAPHIC SURVEY OF LANDS NOW OR FORMERLY OF BASF WYANDOTTE, CORPORATION, PREPARED FOR BESICORP–EMPIRE DEVELOPMENT, LLC." PREPARED BY C.T. MALE ASSOCIATES, P.C., LATHAM, N.Y. BEARING DRAWING NO. 01–109, LAST REVISED FEBRUARY 9, 2001.

GENERAL NOTES

1. NORTH ORIENTATION AND COORDINATE DATUM ARE BASED ON THE EASTERN ZONE OF THE NEW YORK STATE PLANE COORDINATE SYSTEM AS ESTABLISHED BY DIFFERENTIAL G.P.S. METHODS ORIGINATING FROM MONUMENTS VAN RENSSELAER AND LANSING (NAD 27).
2. DATA SHOWN HEREON IS THE RESULT OF CONTROLLED AERIAL PHOTOGRAPHY OBTAINED BY THE FIRM OF COL–EAST, INC. FROM AERIAL PHOTOGRAPHY ACQUIRED APRIL 14, 2000, IN CONJUNCTION WITH CONTROL PROVIDED BY THE UNDERSIGNED.
3. VERTICAL DATUM FOR THIS PROJECT IS NATIONAL GEODETIC VERTICAL DATUM OF 1929 (N.G.V.D. 1929).
4. UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM DATA OBTAINED FROM PREVIOUS MAPS AND RECORD DRAWINGS. THERE MAY BE OTHER UNDERGROUND UTILITIES, THE EXISTENCES OF WHICH ARE NOT KNOWN TO THE UNDERSIGNED. SIZE AND LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES MUST BE VERIFIED BY THE APPROPRIATE AUTHORITIES. THE UNDERGROUND FACILITIES PROTECTIVE ORGANIZATION MUST BE NOTIFIED PRIOR TO CONDUCTING TEST BORINGS, EXCAVATION AND CONSTRUCTION.

200' 0 200'

Title:

FORMER PROCESS BUILDING LOCATIONS

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: O.R.	Date: 21DEC12	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	3
Project Mgr: O.R.	Project: 0251.0011Y045	
File: 0251.0011Y592.03.DWG		

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MP-SB-81	0 – 1	1 – 3
Chromium	85.5	108
Lead	39.7	--
Mercury	0.35	0.24
1,2-Dichloroethane	310 U	5800 U
Benzene	100 J	5800 U
Chlorobenzene	3100	28000
Toluene	--	5800 U
Xylenes (total)	--	5800 U
1,2,4-Trichlorobenzene	--	5800 U
1,2-Dichlorobenzene	--	120000
Benzo[a]anthracene	660 U	2200
Benzo[a]pyrene	2200 U	1500 J
Dibenzo[a,h]anthracene	2200 U	4000 U
Phenol	660 U	1200 U

MP-SB-82	0 – 1	1 – 3
Chromium	1400	341
Lead	1290	80.9
Mercury	10.6	0.25
Zinc	157	--
1,2-Dichloroethane	--	6400 U
Benzene	--	6400 U
Chlorobenzene	--	200000
Toluene	--	6400 U
Xylenes (total)	--	6400 U
1,2,4-Trichlorobenzene	8500 U	6400 U
1,2-Dichlorobenzene	8500 U	33000
Benzo[a]anthracene	2600 U	640 U
Benzo[a]pyrene	8500 U	2100 U
Dibenzo[a,h]anthracene	8500 U	2100 U
Phenol	2600 U	640 U

MP-SB-80	0 – 1	1 – 3
Arsenic	40.5	13.7
Chromium	10100	46.6
Lead	3280	1190
Mercury	7	0.34
Zinc	1200	130
Benzene	290	--
Chlorobenzene	2100	--
1,2,4-Trichlorobenzene	19000 U	--
1,2-Dichlorobenzene	19000 U	--
Benzo[a]anthracene	5900 U	670 U
Benzo[a]pyrene	19000 U	2200 U
Dibenzo[a,h]anthracene	19000 U	2200 U
Phenol	5900 U	670 U

MP-SB-79	0 – 1	1 – 3
Arsenic	73.9	57.6
Chromium	27500	99.2
Lead	3020	583
Mercury	3.4	1.5
Zinc	1560	815
1,2-Dichloroethane	1600 U	--
Benzene	540 J	--
1,2,4-Trichlorobenzene	14000 J	--
1,2-Dichlorobenzene	23000 U	--
Benzo[a]anthracene	8700	320 J
Benzo[a]pyrene	23000 U	2600 U
Dibenzo[a,h]anthracene	23000 U	2600 U
Phenol	7000 U	780 U

MP-SB-77	0 – 1	1 – 4	4 – 6
Arsenic	31.6	8.3	8.7
Chromium	2940	1590	48.6
Lead	1140	48.3	--
Mercury	5.2	--	--
Zinc	829	184	--
1,2-Dichloroethane	--	--	140
1,2,4-Trichlorobenzene	4600	--	--
Benzo[a]anthracene	2200	590 U	670 U
Benzo[a]pyrene	13000 U	1900 U	2200 U
Dibenzo[a,h]anthracene	13000 U	1900 U	2200 U
Phenol	4000 U	590 U	670 U

MP-SB-78	0 – 1	1 – 3
Arsenic	10.3	35
Chromium	91.7	990
Lead	91.3	308
Mercury	--	0.78
Zinc	108	250
1,2-Dichloroethane	--	360 U
Benzene	--	360 U
Chlorobenzene	--	4200
Benzo[a]anthracene	--	720 U
Benzo[a]pyrene	2000 U	2400 U
Dibenzo[a,h]anthracene	2000 U	2400 U
Phenol	620 U	760

MP-SB-83	0 – 1	1 – 3
Chromium	282	649
Lead	72.6	70.3
Mercury	2.3	0.38
		133
1,2-Dichloroethane	570 U	350 U
Benzene	570 U	350 U
Chlorobenzene	1800	3000
Benzo[a]anthracene		690 U
Benzo[a]pyrene	1900 U	2300 U
Dibenzo[a,h]anthracene	1900 U	2300 U
Phenol	580 U	690 U

MP-FS-1	0 – 0.5
Arsenic	11.1
Chromium	31.1
Lead	112
Zinc	98.8
1,2,4-Trichlorobenzene	5700 U
Benzo[a]anthracene	1700 U
Benzo[a]pyrene	5700 U
Dibenzo[a,h]anthracene	5700 U
Phenol	1700 U

MP-FS-2	0 – 0.5
Chromium	21.6
Lead	45.3
Zinc	171
Benzo[a]anthracene	670 U
Benzo[a]pyrene	2200 U
Dibenzo[a,h]anthracene	2200 U
Phenol	670 U



LEGEND

- MP-SB-61 ● LOCATION AND DESIGNATION OF SOIL BORING
- MP-SB-80 ● LOCATION AND DESIGNATION OF SOIL BORING IN PROCESS RESIDUE IN BUILDING BASEMENT
- MP-FS-1 ⊕ LOCATION AND DESIGNATION OF SAMPLE OF SEDIMENT COVERING CONCRETE BASEMENT FLOOR
- 93 BUILDING NUMBER

SAMPLE DESIGNATION — SAMPLE DEPTH

MP-FS-2	0 – 0.5
Chromium	21.6
Lead	45.3
Zinc	171
Benzo[a]anthracene	670 U
Benzo[a]pyrene	2200 U
Dibenzo[a,h]anthracene	2200 U
Phenol	670 U

U – NOT DETECTED; DETECTION LIMIT SHOWN

J – ESTIMATED CONCENTRATION

100' 0 100'

NOTES

1. CONSTITUENTS OF CONCERN IDENTIFIED FOR SOILS ARE SUMMARIZED IN THE REPORT TEXT.
2. ONLY DETECTIONS OF CONSTITUENTS OF CONCERN ABOVE TAGM 4046 RSCOs, OR NON-DETECTS WITH DETECTION LIMITS ABOVE TAGM 4046 RSCOs ARE SHOWN.

Title:

SUMMARY OF CONSTITUENTS OF CONCERN DETECTED IN PROCESS RESIDUE DURING ADDITIONAL RI ACTIVITIES

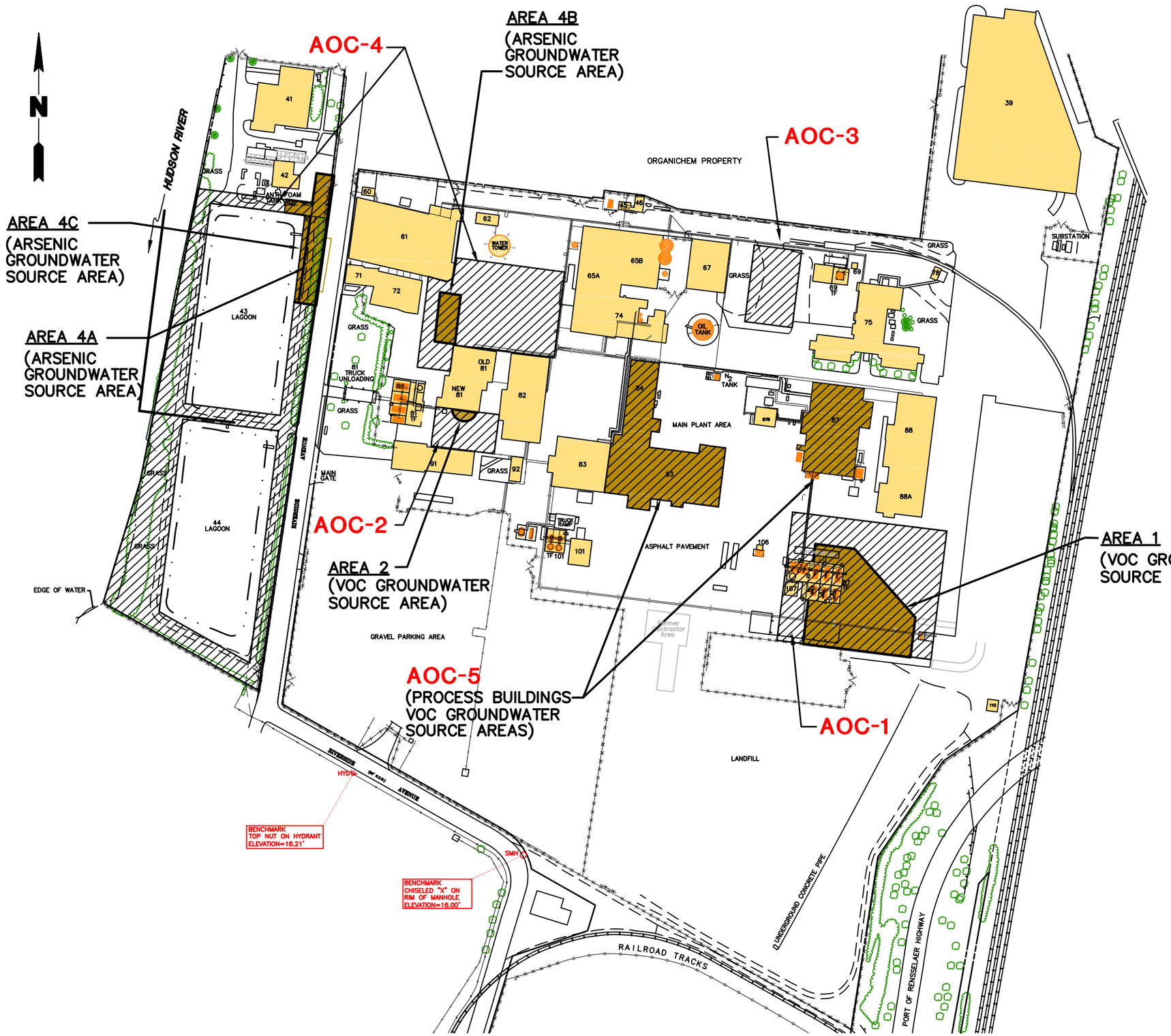
SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 21DEC12	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	4
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.12.DWG		

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MAP REFERENCES

1. "TOPOGRAPHIC SURVEY OF LANDS NOW OR FORMERLY OF BASF WYANDOTTE, CORPORATION, PREPARED FOR BESICORP–EMPIRE DEVELOPMENT, LLC." PREPARED BY C.T. MALE ASSOCIATES, P.C., LATHAM, N.Y. BEARING DRAWING NO. 01–109, LAST REVISED FEBRUARY 9, 2001.

200' 0 200'

Title:

APPROXIMATE LIMITS OF SOIL GROUNDWATER SOURCE AREAS

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: O.R.	Date: 21DEC12	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	5
Project Mgr: O.R.	Project: 0251.0011Y045	
File: 0251.0011Y592.04.DWG		

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LEGEND

- EXISTING BUILDING
- FORMER, EXISTING OR ALLEGED UNDERGROUND/ABOVE GRADE TANK OR PIT
- AREA OF REMEDIATION
- BARBED WIRE FENCE
- CHAINLINK FENCE
- GUARDRAIL
- RAILROAD
- PROPERTY LINE
- HYD HYDRANT
- SMH SEWER MANHOLE
- SHRUB
- TREE

MAP REFERENCES

1. "TOPOGRAPHIC SURVEY OF LANDS NOW OR FORMERLY OF BASF WYANDOTTE, CORPORATION, PREPARED FOR BESICORP–EMPIRE DEVELOPMENT, LLC." PREPARED BY C.T. MALE ASSOCIATES, P.C., LATHAM, N.Y. BEARING DRAWING NO. 01–109, LAST REVISED FEBRUARY 9, 2001.

200' 0 200'

Title:

SOIL IRM EXCAVATION AREAS

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: O.R.	Date: 21DEC12	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	6
Project Mgr: O.R.	Project: 0251.0011Y045	
File: 0251.0011Y592.05.DWG		

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57,000E

17.7

18.1

958692.01 N
657068.53 E

958687.19 N
657060.95 E

958691.49 N
657088.18 E

958688.24 N
657046.42 E

18.1

195 FT2

Area B

Area A

310 FT2

958681.58 N
657087.91 E

17.9

17.7

958682.1 N
657068.26 E

17.7

958666.94 N
657044.9 E

958665.89 N
657059.41 E

1

958635.74 N
657064.09 E

958634.2 N
657074.65 E

Area C

205 FT2

16.6

958616.64 N
657061.38 E

17.8

958615.1 N
657071.94 E

16.9

958607.55 N
657118.46 E

958601.55 N
657040.3 E

958601.35 N
657054.56 E

958602.01 N
657176.05 E

Area E

1,445 FT2

17.6

Area D

359 FT2

6.6

16.8

958582.65 N
657116.08 E

958576.12 N
657054.21 E

18.3

958577.1 N
657173.67 E

470 FT2

958580.91 N
657137.92 E

958564.79 N
657171.89 E

Area F

958576.31 N
657039.95 E

958567.55 N
657136.87 E

0 25 50

feet

18.2

18.4

18.4

Title:

BUILDING 81
1,2-DCA EXCAVATION AREAS

SITE MANAGEMENT PLAN

Prepared For:

BASF CORPORATION
FLORHAM PARK, NJ

ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: NE	Date: 10/15/2019
Prepared by: NE	Scale: NTS
Project Mgr: OR	Office: NY
File No: EXCAVATION AREAS	Project: 0251.0011Y054

FIGURE 7

V:\GIS\Projects\0251Y\0011Y\628\0251.0011Y628.101.mxd



Legend

- OU-1 Area

Existing Surface Cap

- Existing Natural & Landscaped Area Cap
- Existing Asphalt, Concrete, Gravel & RailRoad Track Areas

Former Building Foundations

- Former Buildings without Basements - Concrete Cap
- Former Buildings with Basements - Low Permeability Soil Cap
- Former Building 67 - Elastocoat Cap

Main Plant Excavation Areas 2 & 4B

- Main Plant Excavation Areas - Gravel Cap

Lagoon Cap

- Lagoon Stormwater Detention Area Cap
- Lagoon Vegetative Soil Cap

Main Plant Vegetative Cap

- Gravel Vegetated Swales
- Grassed Stormwater Detention Areas

Title:

OU-1
COMPOSITE COVER SYSTEM

BASF FORMER FIBERS PLANT
70 RIVERSIDE AVE, RENSSELAER, NEW YORK

Prepared For: BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: K.S.	Date: 15DEC2015	FIGURE
Prepared by: K.S.	Scale: 1 "= 300 '	8
Project Mgr: K.S.	Office: NY	
File: 0251.0011Y628.101	Project: 0251.0011Y051	



LEGEND

- FORMER BUILDING
- STORM SEWER GRATE
- MP-SG-100 — LOCATION AND DESIGNATION OF SOIL GAS MONITORING POINT
- GROUNDWATER CONTAINMENT SYSTEM TRENCH
- BARBED WIRE FENCE
- CHAINLINK FENCE

LOCATION PREFIXES

LG	LAGOON
MP	MAIN PLANT
LF	LANDFILL
ST	ALBANY MOLECULAR PROPERTY (FORMERLY ORGANICHEM)

NOTE

1. ONLY DETECTIONS OF SITE SPECIFIC COMPOUNDS ABOVE NYSDEC AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES ARE SHOWN. ONLY RESULTS FOR FILTERED METALS SAMPLES ARE SHOWN.

200' 0 200'

Title:

SOIL GAS MONITORING LOCATIONS

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared for:

BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX

Compiled by: K.S.	Date: 21OCT19	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	9
Project Mgr: K.S.	Project: 0251.0011Y045	
File: 0251.0011Y592.21.DWG		

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DIRECTIONS TO HOSPITAL

1. EXIT FACILITY AND HEAD NORTH ON RIVERSIDE AVENUE.
2. TURN LEFT ONTO ROUTE 20 AND CROSS DUNN MEMORIAL BRIDGE. STAY ON ROUTE 20.
3. TURN LEFT ONTO NEW SCOTLAND AVENUE. FOLLOW SIGNS TO EMERGENCY ROOM.

Title:

HOSPITAL ROUTE MAP

ALBANY MEDICAL CENTER
43 NEW SCOTLAND AVENUE
ALBANY, NEW YORK

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared for:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: D.M.H.	Date: 21DEC12	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	10
Project Mgr.: D.M.H.	Project No.: 0251.0011Y045	
File: 0251.0011Y592.02.CDR		

0251Y\0011Y592\0251.0011Y592.02.CDR

APPENDICES

(Provided on Flash Card in Bound Copy)

A. Metes and Bounds
B. Declaration of Covenants and Restrictions
C. Groundwater Treatment System Operation and Maintenance Plan
D. Excavation Work Plan for OU1
E. Consultant's Health and Safety Plan for OU1
F. General Community Air Monitoring Plan for OU1
G. Construction Contingency Plan for OU1
H. Monitoring Well Logs
I. Groundwater Monitoring Well Sample Log Form
J. Site Monitoring, Inspection, and Maintenance Form for OU1
K. Quality Assurance Project Plan for OU1

APPENDIX A

Metes and Bounds

APPENDIX A

ALL THAT CERTAIN TRACT, PIECE OR PARCEL OF LAND situate, lying and being in the City of Rensselaer, County of Rensselaer, State of New York, lying Northeasterly and Easterly of Riverside Avenue and Northwesterly of Port Access Highway, and being more particularly bounded and described as follows:

BEGINNING at a point at the intersection of the Northeasterly boundary of Riverside Avenue with the Easterly boundary of Riverside Avenue and runs thence from said point of beginning along the Easterly boundary of Riverside Avenue the following two (2) courses: 1) North 06 deg. 14 min. 56 sec. East 907.09 feet to a point; and 2) thence North 04 deg. 54 min. 56 sec. East 137.32 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the South and the lands now or formerly of NYCOMED, Inc. and ORGANICHEM Corp. on the North; thence along the above last mentioned division line the following seven (7) courses: 1) South 85 deg. 10 min. 34 sec. East 458.81 feet to a point; 2) thence North 05 deg. 05 min. 16 sec. East 2.60 feet to a point; 3) thence South 84 deg. 54 min. 44 sec. East 20.28 feet to a point; 4) thence North 05 deg. 05 min. 16 sec. East 15.45 feet to a point; 5) thence South 84 deg. 54 min. 44 sec. East 77.60 feet to a point; 6) thence South 69 deg. 56 min. 13 sec. East 69.85 feet to a point; and 7) thence South 84 deg. 54 min. 44 sec. East 474.13 feet to its intersection with the division line between the lands now or formerly of BASF Corporation as described in Book 1624 of Deeds at Page 320 on the East and the lands now or formerly of NYCOMED, Inc. and ORGANICHEM Corp. as described in Book 168 of Deeds at Page 168 on the West; thence along the above last mentioned division line the following four (4) courses: 1) North 04 deg. 56 min. 19 sec. East 500.97 feet to a point; 2) thence North 06 deg. 50 min. 14 sec. West 243.08 feet to a point; 3) thence North 82 deg. 03 min. 00 sec. West 20.00 feet to a point; and 4) thence North 07 deg. 57 min. 00 sec. East 70.00 feet to its intersection with the Southerly boundary of Rensselaer Avenue; thence along the Southerly boundary of Rensselaer Avenue, South 82 deg. 03 min. 00 sec. East 111.69 feet to its intersection with the Westerly boundary with U.S. Routes 9 and 20 (Columbia Turnpike); thence along the Westerly and Southwesterly boundary of U.S. Routes 9 and 20 (Columbia Turnpike) the following two (2) courses: 1) South 20 deg. 21 min. 50 sec. East 622.86 feet to a point; and 2) thence South 65 deg. 33 min. 49 sec. East 48.77 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of CSX Rail Corporation on the East; thence South 08 deg. 14 min. 10 sec. West along the above last mentioned division line 45.92 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the Northeast and the lands now or formerly of Niagara Mohawk Power Corporation on the Southwest; thence North 22 deg. 45 min. 50 sec. West along the above last mentioned division line 59.00 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the North and the lands now or formerly of Niagara Mohawk Power Corporation on the South; thence South 70 deg. 25 min. 56 sec. West along the above last mentioned division line 24.95 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of Niagara Mohawk Power Corporation on the East; thence South 05 deg. 14 min. 46 sec. West along the above last mentioned line 55.99 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the Southwest and the lands now or

formerly of Niagara Mohawk Power Corporation on the Northeast; thence South 22 deg. 47 min. 09 sec. East along the above last mentioned division line 95.00 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of CSX Rail Corporation on the East; thence South 08 deg. 05 min. 01 sec. West along the above last mentioned division line 25.18 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the North and the lands now or formerly of NYCOMED, Inc. on the South; thence North 85 deg. 13 min. 56 sec. West along the above last mentioned division line 109.70 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of NYCOMED, Inc. on the East; thence South 04 deg. 46 min. 04 sec. West along the above last mentioned division line 55.75 feet to its intersection with the division line between the lands now or formerly of NYCOMED, Inc. on the North and the lands now or formerly of BASF Wyandotte Corp. as described in Book 1300 of Deeds at Page 746 on the South; thence South 84 deg. 54 min. 44 sec. East along the above last mentioned division line 107.82 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. as described in Book 1300 of Deeds at Page 746 on the West and the lands now or formerly of CSX Rail Corporation on the East; thence South 08 deg. 04 min. 16 sec. West along the above last mentioned division line 801.44 feet to a point; thence through the lands now or formerly of BASF Wyandotte Corp. along the Northerly and Westerly boundary of proposed Lot 2 the following two (2) courses: 1) North 84 deg. 45 min. 59 sec. West 783.73 feet to a point; and 2) thence South 06 deg. 23 min. 52 sec. West 505.59 feet to its intersection with the Southwesterly boundary of proposed Lot 2; thence South 62 deg. 31 min. 02 sec. East along the proposed Southerly boundary of Lot 2 continuing through the lands now or formerly of BASF Wyandotte Corp. 591.77 feet to its intersection with the Westerly boundary of Port Access Highway (1989); thence along the Westerly boundary of said Port Access Highway, South 06 deg. 47 min. 58 sec. West 51.26 feet to its intersection with the Northeasterly boundary of proposed Lot 1; thence through the lands now or formerly of BASF Wyandotte Corp. along the proposed Northeasterly and Northerly boundary of proposed Lot 1 the following six (6) courses: 1) North 55 deg. 15 min. 35 sec. West 28.52 feet to a point; 2) thence North 60 deg. 13 min. 58 sec. West 60.02 feet to a point; 3) thence North 62 deg. 37 min. 15 sec. West 122.43 feet to a point; 4) thence South 53 deg. 41 min. 02 sec. West 40.63 feet to a point; 5) thence North 59 deg. 29 min. 04 sec. West 221.56 feet to a point; and 6) in a generally Westerly direction along a curve to the left having a radius of 345.11 feet, a chord bearing of South 71 deg. 13 min. 01 sec. West and a chord distance of 279.18 feet an arc length of 287.42 feet to its intersection with the Easterly boundary of Riverside Avenue; thence North 14 deg. 55 min. 18 sec. East along the Easterly boundary of Riverside Avenue 65.68 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the South and the lands now or formerly of the Albany Port District Commission as described in Book 462 of Deeds at Page 338 on the North; thence North 69 deg. 27 min. 19 sec. East along the above last mentioned division line 153.46 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the East and the lands now or formerly of Albany Port District Commission on the West; thence North 14 deg. 55 min. 19 sec. East along the above last mentioned division line 51.73 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the Northeast and the lands now or formerly of Albany Port District Commission on the Southwest; thence North 62 deg. 32 min. 25 sec. West along the above last mentioned division line 141.97 feet to its intersection with the Northeasterly boundary of Riverside Avenue; thence

along the Northeasterly boundary of Riverside Avenue the following two (2) courses: 1) in a generally Northwesterly direction along a curve to the left having a radius of 115.00 feet; a chord bearing of North 37 deg. 52 min. 09 sec. West and a chord distance of 95.92 feet, an arc length of 98.94 feet to a point of tangency; and 2) thence North 62 deg. 31 min. 02 sec. West 491.03 feet to the point or place of beginning and containing 37.05 acres of land, more or less.

ALL THAT CERTAIN TRACT, PIECE OR PARCEL OF LAND situate, lying and being in the City of Rensselaer, County of Rensselaer, State of New York, lying Westerly of Riverside Avenue and Easterly of the Hudson River, and being more particularly bounded and described as follows:

BEGINNING at a point at the intersection of the division line between the lands now or formerly of BASF Corporation on the Northeast and the lands now or formerly of Albany Port District Commission as described in Book 462 of Deeds at Page 338 on the Southwest with the Westerly boundary of Riverside Avenue and runs thence from said point of beginning North 62 deg. 31 min. 02 sec. West along the above mentioned division line 343.79 feet to its intersection with the Easterly pier and bulkhead line of the Hudson River; thence along said Easterly pier and bulkhead line the following six (6) courses: 1) North 14 deg. 55 min. 19 sec. East 248.65 feet to a point; 2) thence North 09 deg. 08 min. 44 sec. East 287.80 feet to a point; 3) thence North 09 deg. 35 min. 22 sec. East 33.07 feet to a point; 4) thence North 09 deg. 29 min. 57 sec. East 588.00 feet to a point; 5) thence North 80 deg. 06 min. 03 sec. West 3.87 feet to a point; and 6) thence North 09 deg. 08 min. 47 sec. East 146.50 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the South and the lands now or formerly of NYCOMED, Inc. and ORGANICHEM Corporation on the North; thence South 85 deg. 01 min. 44 sec. East along the above last mentioned division line 217.43 feet to its intersection with the above mentioned Westerly boundary of Riverside Avenue; thence along the Westerly boundary of Riverside Avenue the following three (3) courses: 1) South 04 deg. 58 min. 16 sec. West 405.54 feet to a point; 2) thence South 04 deg. 54 min. 56 sec. West 136.74 feet to a point; and 3) thence South 06 deg. 14 min. 56 sec. West 887.09 feet to the point or place of beginning and containing 8.27 acres of land, more or less.

APPENDIX B

Declaration of Covenants and Restrictions

Rensselaer County
Frank J Merola
County Clerk
Troy, New York 12180

60 2013 00446376

Volm-7000 Pg-68

Instrument Number: 2013- 00446376

As

Recorded On: November 18, 2013 **Deed Agreement**

Parties: BASF CORP

To

GAF CORP

Billable Pages: 10

Recorded By: FRONTIER ABSTRACT **Num Of Pages:** 11

Comment: DECLARATION OF COVENANT

**** Examined and Charged as Follows: ****

Deed Agreement	90 00	Coversheet	5 00
Recording Charge:	**95.00**		

**** THIS PAGE IS PART OF THE INSTRUMENT ****

I hereby certify that the within and foregoing was recorded in the Clerk's Office For: Rensselaer County, NY

File Information:

Document Number: 2013- 00446376
Receipt Number: 873730
Recorded Date/Time: November 18, 2013 11:36:41A
Book-Vol/Pg: Bk-R VI-7000 Pg-68
Cashier / Station: C O / Cashier Station 2

Record and Return To:

FRONTIER ABSTRACT
293 BROADWAY
518 339-2104
MENANDS NY 12204

RENSSELAER COUNTY • INCORPORATED 1791 •

Frank J. Merola
Rensselaer County Clerk

S5130368
Rensselaer

DECLARATION of COVENANTS and RESTRICTIONS

Doc#: 00446376
Bk: 7000 Pg: 69

THIS COVENANT is made the 4th day of September 2013, by BASF Corporation and having an office for the transaction of business at 100 Park Avenue, Florham Park, New Jersey.

WHEREAS, the BASF Manufacturing Plant Site, Operable Unit No. 1 (Site # 4-42-027) is the subject of A Consent Decree executed by the Division of Environmental Remediation as part of the New York State Department of Environmental Conservation's (the "Department's) State Superfund Program, namely that parcel of real property located on 36 Riverside Avenue in the City of Rensselaer, County of Rensselaer, State of New York, which is part of lands conveyed by GAF Corporation to BASF Corporation by deed dated March 31, 1978 and recorded in the County of Rensselaer in Liber 1300, Page 746 and being more particularly described in Appendix "A," attached to this declaration and made a part hereof, and hereinafter referred to as "the Property"; and

WHEREAS, the Department approved a remedy to eliminate or mitigate all significant threats to the environment presented by the contamination disposed at the Property and such remedy requires that the Property be subject to restrictive covenants.

NOW, THEREFORE, BASF Corporation, for itself and its successors and/or assigns, covenants that:

First, the Property subject to this Declaration of Covenants and Restrictions is as shown on a map attached to this declaration as Appendix "B" and made a part hereof.

Second, unless prior written approval by the Department or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens, hereinafter referred to as "the Relevant Agency," is first obtained, where contamination remains at the Property subject to the provisions of the Site Management Plan ("SMP"), there shall be no construction, use or occupancy of the Property that results in the disturbance or excavation of the Property which threatens the integrity of the engineering controls or which results in unacceptable human exposure to contaminated soils.

Third, the owner of the Property shall not disturb, remove, or otherwise interfere with the installation, use, operation, and maintenance of engineering controls required for the Remedy, which are described in the SMP, unless in each instance the owner first obtains a written waiver of such prohibition from the Department or Relevant Agency.

Fourth, the owner of the Property shall prohibit the Property from ever being used for purposes other than for Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv) without the express written waiver of such prohibition by the Department or Relevant Agency.

Fifth, the owner of the Property shall prohibit the use of the groundwater underlying the Property without treatment to render it safe for drinking water or for industrial purposes, as appropriate, and the user must first notify and obtain written approval to do so from the Department or Relevant Agency.

Sixth, the owner of the Property shall provide a periodic certification, prepared and submitted by a professional engineer or environmental professional acceptable to the Department or Relevant Agency, which will certify that the institutional and engineering controls put in place are unchanged from the previous certification, comply with the SMP, and have not been impaired.

Seventh, the owner of the Property shall continue in full force and effect any institutional and engineering controls required for the Remedy and maintain such controls, unless the owner first obtains permission to discontinue such controls from the Department or Relevant Agency, in compliance with the approved SMP, which is incorporated and made enforceable hereto, subject to modifications as approved by the Department or Relevant Agency.

Eighth, this Declaration is and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Property, and shall provide that the owner and its successors and assigns consent to enforcement by the Department or Relevant Agency of the prohibitions and restrictions that the Order on Consent requires to be recorded, and hereby covenant not to contest the authority of the Department or Relevant Agency to seek enforcement.

Ninth, any deed of conveyance of the Property, or any portion thereof, shall recite, unless the Department or Relevant Agency has consented to the termination of such covenants and restrictions, that said conveyance is subject to this Declaration of Covenants and Restrictions.

IN WITNESS WHEREOF, the undersigned has executed this instrument the day written below.

By: _____

Print Name: Robert N. Smith

Title: Vice President Date: 9/4/13

APPROVED BY LEGAL DEPT. CAT

Grantor's Acknowledgement

STATE OF NEW JERSEY)

) s.s.:

COUNTY OF MORRIS)

On the 4th day of Sept., in the year 2013 before me, the undersigned, personally appeared Robert N. Smith, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

_____

Notary Public State of New Jersey

JEANNE HAHN
Notary Public
New Jersey
My Commission Expires 12-06-2017

APPENDIX "A"

[METES AND BOUNDS]

APPENDIX A

ALL THAT CERTAIN TRACT, PIECE OR PARCEL OF LAND situate, lying and being in the City of Rensselaer, County of Rensselaer, State of New York, lying Northeasterly and Easterly of Riverside Avenue and Northwesterly of Port Access Highway, and being more particularly bounded and described as follows:

BEGINNING at a point at the intersection of the Northeasterly boundary of Riverside Avenue with the Easterly boundary of Riverside Avenue and runs thence from said point of beginning along the Easterly boundary of Riverside Avenue the following two (2) courses: 1) North 06 deg. 14 min. 56 sec. East 907.09 feet to a point; and 2) thence North 04 deg. 54 min. 56 sec. East 137.32 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the South and the lands now or formerly of NYCOMED, Inc. and ORGANICHEM Corp. on the North; thence along the above last mentioned division line the following seven (7) courses: 1) South 85 deg. 10 min. 34 sec. East 458.81 feet to a point; 2) thence North 05 deg. 05 min. 16 sec. East 2.60 feet to a point; 3) thence South 84 deg. 54 min. 44 sec. East 20.28 feet to a point; 4) thence North 05 deg. 05 min. 16 sec. East 15.45 feet to a point; 5) thence South 84 deg. 54 min. 44 sec. East 77.60 feet to a point; 6) thence South 69 deg. 56 min. 13 sec. East 69.85 feet to a point; and 7) thence South 84 deg. 54 min. 44 sec. East 474.13 feet to its intersection with the division line between the lands now or formerly of BASF Corporation as described in Book 1624 of Deeds at Page 320 on the East and the lands now or formerly of NYCOMED, Inc. and ORGANICHEM Corp. as described in Book 168 of Deeds at Page 168 on the West; thence along the above last mentioned division line the following four (4) courses: 1) North 04 deg. 56 min. 19 sec. East 500.97 feet to a point; 2) thence North 06 deg. 50 min. 14 sec. West 243.08 feet to a point; 3) thence North 82 deg. 03 min. 00 sec. West 20.00 feet to a point; and 4) thence North 07 deg. 57 min. 00 sec. East 70.00 feet to its intersection with the Southerly boundary of Rensselaer Avenue; thence along the Southerly boundary of Rensselaer Avenue, South 82 deg. 03 min. 00 sec. East 111.69 feet to its intersection with the Westerly boundary with U.S. Routes 9 and 20 (Columbia Turnpike); thence along the Westerly and Southwesterly boundary of U.S. Routes 9 and 20 (Columbia Turnpike) the following two (2) courses: 1) South 20 deg. 21 min. 50 sec. East 622.86 feet to a point; and 2) thence South 65 deg. 33 min. 49 sec. East 48.77 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of CSX Rail Corporation on the East; thence South 08 deg. 14 min. 10 sec. West along the above last mentioned division line 45.92 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the Northeast and the lands now or formerly of Niagara Mohawk Power Corporation on the Southwest; thence North 22 deg. 45 min. 50 sec. West along the above last mentioned division line 59.00 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the North and the lands now or formerly of Niagara Mohawk Power Corporation on the South; thence South 70 deg. 25 min. 56 sec. West along the above last mentioned division line 24.95 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of Niagara Mohawk Power Corporation on the East; thence South 05 deg. 14 min. 46 sec. West along the above last mentioned line 55.99 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the Southwest and the lands now or

formerly of Niagara Mohawk Power Corporation on the Northeast; thence South 22 deg. 47 min. 09 sec. East along the above last mentioned division line 95.00 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of CSX Rail Corporation on the East; thence South 08 deg. 05 min. 01 sec. West along the above last mentioned division line 25.18 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the North and the lands now or formerly of NYCOMED, Inc. on the South; thence North 85 deg. 13 min. 56 sec. West along the above last mentioned division line 109.70 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the West and the lands now or formerly of NYCOMED, Inc. on the East; thence South 04 deg. 46 min. 04 sec. West along the above last mentioned division line 55.75 feet to its intersection with the division line between the lands now or formerly of NYCOMED, Inc. on the North and the lands now or formerly of BASF Wyandotte Corp. as described in Book 1300 of Deeds at Page 746 on the South; thence South 84 deg. 54 min. 44 sec. East along the above last mentioned division line 107.82 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. as described in Book 1300 of Deeds at Page 746 on the West and the lands now or formerly of CSX Rail Corporation on the East; thence South 08 deg. 04 min. 16 sec. West along the above last mentioned division line 801.44 feet to a point; thence through the lands now or formerly of BASF Wyandotte Corp. along the Northerly and Westerly boundary of proposed Lot 2 the following two (2) courses: 1) North 84 deg. 45 min. 59 sec. West 783.73 feet to a point; and 2) thence South 06 deg. 23 min. 52 sec. West 505.59 feet to its intersection with the Southwesterly boundary of proposed Lot 2; thence South 62 deg. 31 min. 02 sec. East along the proposed Southerly boundary of Lot 2 continuing through the lands now or formerly of BASF Wyandotte Corp. 591.77 feet to its intersection with the Westerly boundary of Port Access Highway (1989); thence along the Westerly boundary of said Port Access Highway, South 06 deg. 47 min. 58 sec. West 51.26 feet to its intersection with the Northeasterly boundary of proposed Lot 1; thence through the lands now or formerly of BASF Wyandotte Corp. along the proposed Northeasterly and Northerly boundary of proposed Lot 1 the following six (6) courses: 1) North 55 deg. 15 min. 35 sec. West 28.52 feet to a point; 2) thence North 60 deg. 13 min. 58 sec. West 60.02 feet to a point; 3) thence North 62 deg. 37 min. 15 sec. West 122.43 feet to a point; 4) thence South 53 deg. 41 min. 02 sec. West 40.63 feet to a point; 5) thence North 59 deg. 29 min. 04 sec. West 221.56 feet to a point; and 6) in a generally Westerly direction along a curve to the left having a radius of 345.11 feet, a chord bearing of South 71 deg. 13 min. 01 sec. West and a chord distance of 279.18 feet an arc length of 287.42 feet to its intersection with the Easterly boundary of Riverside Avenue; thence North 14 deg. 55 min. 18 sec. East along the Easterly boundary of Riverside Avenue 65.68 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the South and the lands now or formerly of the Albany Port District Commission as described in Book 462 of Deeds at Page 338 on the North; thence North 69 deg. 27 min. 19 sec. East along the above last mentioned division line 153.46 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the East and the lands now or formerly of Albany Port District Commission on the West; thence North 14 deg. 55 min. 19 sec. East along the above last mentioned division line 51.73 feet to its intersection with the division line between the lands now or formerly of BASF Wyandotte Corp. on the Northeast and the lands now or formerly of Albany Port District Commission on the Southwest; thence North 62 deg. 32 min. 25 sec. West along the above last mentioned division line 141.97 feet to its intersection with the Northeasterly boundary of Riverside Avenue; thence

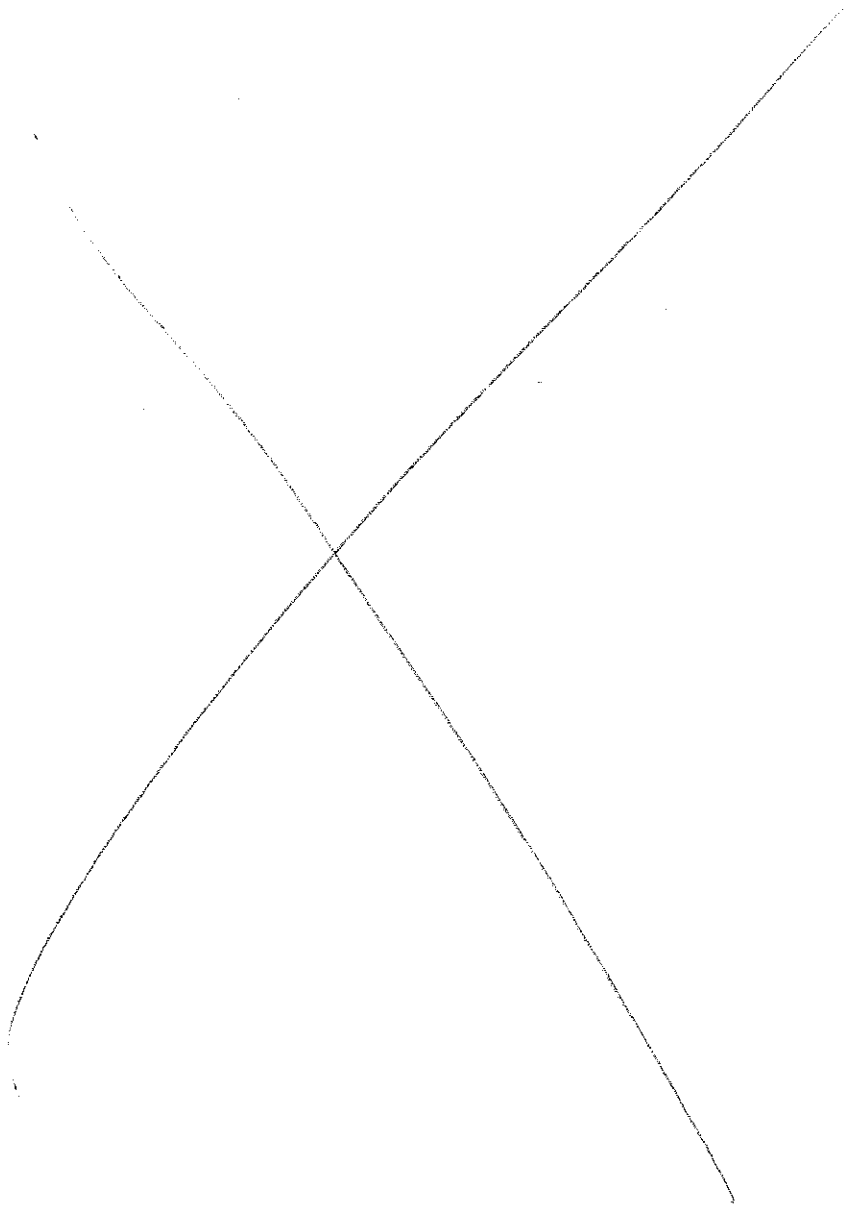
along the Northeasterly boundary of Riverside Avenue the following two (2) courses: 1) in a generally Northwesterly direction along a curve to the left having a radius of 115.00 feet; a chord bearing of North 37 deg. 52 min. 09 sec. West and a chord distance of 95.92 feet, an arc length of 98.94 feet to a point of tangency; and 2) thence North 62 deg. 31 min. 02 sec. West 491.03 feet to the point or place of beginning and containing 37.05 acres of land, more or less.

ALL THAT CERTAIN TRACT, PIECE OR PARCEL OF LAND situate, lying and being in the City of Rensselaer, County of Rensselaer, State of New York, lying Westerly of Riverside Avenue and Easterly of the Hudson River, and being more particularly bounded and described as follows:

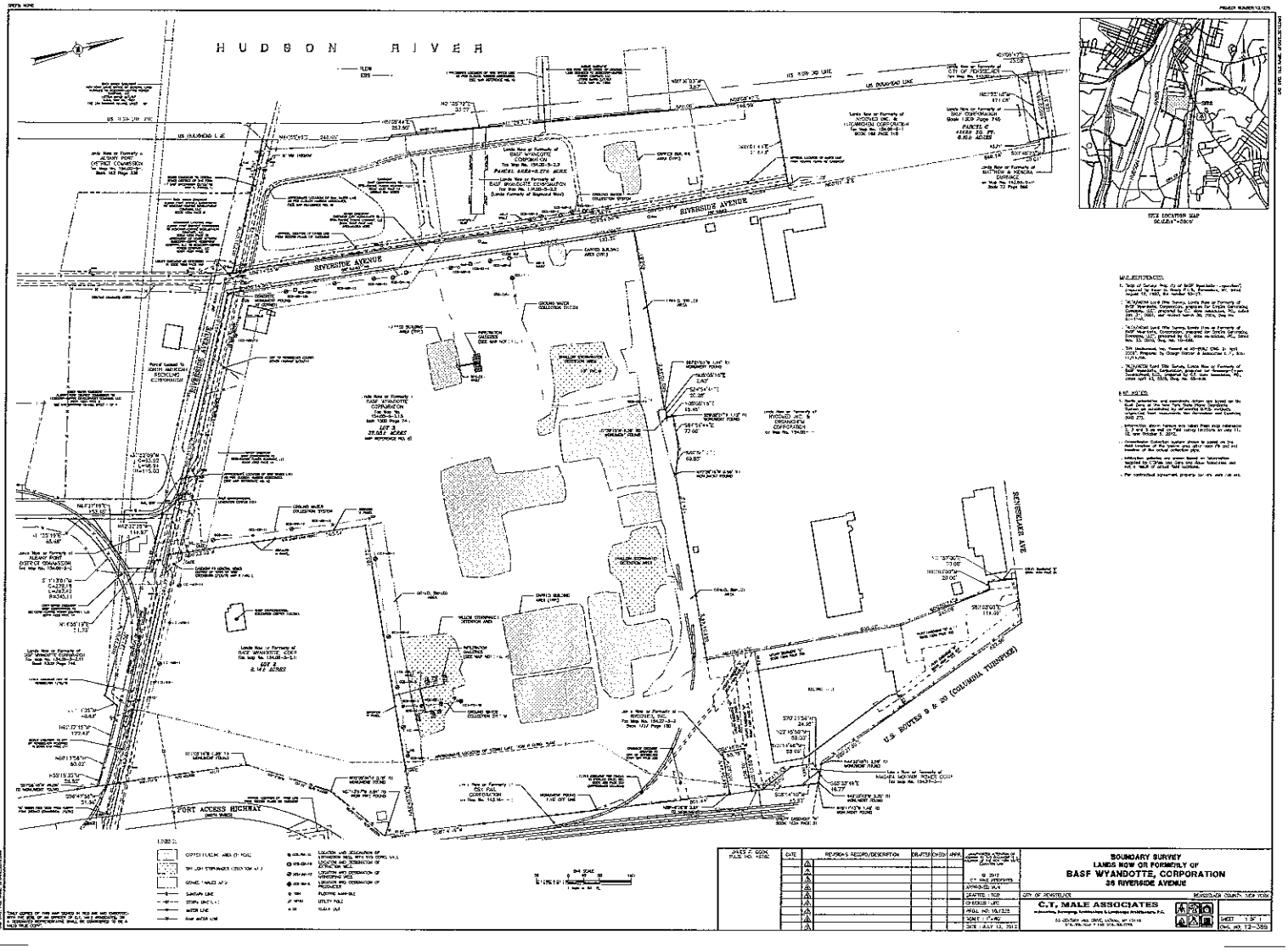
BEGINNING at a point at the intersection of the division line between the lands now or formerly of BASF Corporation on the Northeast and the lands now or formerly of Albany Port District Commission as described in Book 462 of Deeds at Page 338 on the Southwest with the Westerly boundary of Riverside Avenue and runs thence from said point of beginning North 62 deg. 31 min. 02 sec. West along the above mentioned division line 343.79 feet to its intersection with the Easterly pier and bulkhead line of the Hudson River; thence along said Easterly pier and bulkhead line the following six (6) courses: 1) North 14 deg. 55 min. 19 sec. East 248.65 feet to a point; 2) thence North 09 deg. 08 min. 44 sec. East 287.80 feet to a point; 3) thence North 09 deg. 35 min. 22 sec. East 33.07 feet to a point; 4) thence North 09 deg. 29 min. 57 sec. East 588.00 feet to a point; 5) thence North 80 deg. 06 min. 03 sec. West 3.87 feet to a point; and 6) thence North 09 deg. 08 min. 47 sec. East 146.50 feet to its intersection with the division line between the lands now or formerly of BASF Corporation on the South and the lands now or formerly of NYCOMED, Inc. and ORGANICHEM Corporation on the North; thence South 85 deg. 01 min. 44 sec. East along the above last mentioned division line 217.43 feet to its intersection with the above mentioned Westerly boundary of Riverside Avenue; thence along the Westerly boundary of Riverside Avenue the following three (3) courses: 1) South 04 deg. 58 min. 16 sec. West 405.54 feet to a point; 2) thence South 04 deg. 54 min. 56 sec. West 136.74 feet to a point; and 3) thence South 06 deg. 14 min. 56 sec. West 887.09 feet to the point or place of beginning and containing 8.27 acres of land, more or less.

APPENDIX "B"

[MAP]



Appendix B


HUDSON RIVER
RIVERSIDE AVENUE
SENSENBRAKE AVE.
U.S. ROUTES 9 & 9W (COLUMBIA TURNPIKE)
FORT ACCESS HIGHWAY
SURVEY NOTE
SURVEY NOTES
BASF WYANDOTTE, CORPORATION
35 RIVERSIDE AVENUE
C.T. MALE ASSOCIATES

APPENDIX C

Groundwater Treatment System Operation and Maintenance Plan

...making excellence a habit.™

BASF Corporation

Operating & Maintenance Manual

BASF Rensselaer Groundwater Treatment System

NYSDEC Site Number 4-42-027

October 2019 – Revision 5.0

BSI EHS Services and Solutions
Clifton, NJ

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1.0 INTRODUCTION

1.1 SYSTEM OBJECTIVES

BASF has been operating a treatment system at the Site since 2004 that extracted groundwater from a set of extraction wells. Groundwater is impacted from former manufacturing operations primarily with chlorinated benzenes, benzene, chlorinated ethanes (primarily 1,2-dichloroethane), and arsenic. The former treatment system experienced significant operational problems, mostly related to clogging of the air diffusers and encrustation of the carbon beds due to high levels of dissolved solids, calcium carbonate, iron, and manganese. In the summer of 2016, the former trailer-based groundwater treatment system (GWTS) was decommissioned and demolished and a new, skid-mounted system in a 40 x 40 foot structure on the existing 60 x 60 foot concrete containment pad was constructed. In the new system, water is treated using filtration, air stripping, and carbon adsorption before being reinjected into the onsite re-injection galleries. The system was designed to operate at a constant pumping rate of 25 gallons per minute (gpm) with a maximum flow rate of 35 gpm. Startup of the new system was achieved in July of 2016 with the shakedown period extending through the end of the year.

The primary objectives of the new GWTS are:

- Eliminate the exposure pathway of groundwater contaminants to human and ecological receptors; and
- Eliminate the transport of on-site contaminants to off-site properties and prevent the exceedance of New York State Department of Environmental Conservation-issued Effluent Limitations (**Appendix A**).

Based on treatment limitations of the GWTS, the current operational objective is to continuously operate as many of the available extraction wells that can be efficiently treated by the existing GWTS.

1.2 PERFORMANCE GOALS

Performance goals of the GWTS are the following:

- Maintain safe operations;
- Maintain efficient and cost-effective operations given the limitations in the GWTS;
- Obtain and record useful operational and analytical data from the extraction wells and overall system; and
- Achieve continuous operation of the GWTS with minimal downtime.

1.3 OPERATING PERSONNEL'S RESPONSIBILITY

It is the responsibility of the operating personnel to run the facility at the maximum attainable efficiency by:

1. Engaging in all the required safety practices pertaining to the operation and maintenance of the facility equipment.
2. Having a knowledge of the operation of the groundwater extraction and equalization system, the groundwater treatment system, the associated utility systems, and the control system associated with the entire groundwater treatment system.
3. Varying the operation of the units to accommodate fluctuations in groundwater flow rates and concentrations of inorganic metals, anions, and volatile organic compounds (VOCs) by maintaining proper air flow and chemical addition.
4. Performing routine and subcontracted maintenance in a timely manner, to ensure the continuity of operation of the extraction and treatment systems.
5. Ensuring that the site is maintained in a well-kept condition.
6. Keeping good control records of all phases of operation and maintenance, including daily logs, weekly and monthly reports, and reports of all unusual events.
7. Keeping informed of training sessions, educational opportunities, or new operation and maintenance practices.
8. Notifying the proper agencies immediately of any permit issues, unsafe situations, accidents, or environmental releases.

1.4 GENERAL SETTING AND OVERALL SYSTEM DESCRIPTION

The BASF Site is approximately 35 acres. The Site consists of two structures – a Wildlife Habitat and Environmental Education Classroom and the GWTS containment area with a 40 x 40' treatment building with related equipment.

Groundwater flow is generally to the west (toward the Hudson River). Utilities, sewers and storm water pipes have caused anomalies to this westerly flow. The depth to the shallow water bearing unit averages from 5 feet (along the eastern boundary) to 15 feet (near the Hudson River) below the ground surface. A clay layer separates this shallow groundwater from a deeper water bearing unit.

The focus of the Site is shallow groundwater contaminated with VOCs from manufacturing operations of the former BASF chemical manufacturing plant. The shallow aquifer is characterized by high concentrations of benzene, chlorobenzene, and 1,2-dichloroethane. Total VOCs may range from less than 1.0 mg/L to over 100 mg/1, depending on the area of the Site.

The GWTS consists of groundwater extraction and equalization, chemical treatment to control iron / manganese precipitation, filtration, air stripping, additional filtration, and final treatment of the air stripper off gas and treated groundwater with Granular Activated Carbon (GAC). At this time, treated groundwater is discharged to two infiltration galleries within the zone of capture of the extraction system. Possibly in the future, the effluent may be directed to the Hudson River via an on-site storm sewer.

2.0 PERMITS AND STANDARDS

2.1 GENERAL

The New York State Department of Environmental Conservation (NYSDEC) issued Effluent Limitations and Monitoring Requirements ("permit") in 2005, which is included as **Appendix A**. The Effluent Limitations are consistent with the NYS GA standards for groundwater and surface waters (Table 1 [Section 703.5] – Water Quality Standards Surface Waters and Groundwater.

2.2 GROUNDWATER DISCHARGE

The 2005 permit requirements include weekly sampling of effluent parameters. For the first 6 months of the new GWTS operation, weekly samples (or more, as needed) were collected to assess performance of the system and to assist in operational decisions. The results of these samples indicate that the treatment process removes the constituents of concern from groundwater. Because treated groundwater is currently re-injected into two infiltration galleries within the interior of the former plant Site (and not into surface water); the sampling plan was revised to consist of bi-weekly samples to assess operational efficiency and adherence to the Effluent Limitations. Refer to Section 8 Analysis and Testing for further detail.

2.3 AIR EMISSIONS

The GWTS has the following two emission points related to the discharge of VOCs air associated with the BASF Rensselaer GWTS:

- Equalization Tank Vent
- Air Stripper Exhaust

The GWTS is exempt from air permitting via NYSDEC 6 CRR-NY 201-3.3, 29(ii). The equalization tank is vented to the outside atmosphere, however, groundwater is not agitated in the EQ tank.

As detailed in Section 3.0, the air stripper was designed to reduce the concentration of all vapor-phase contaminants in the discharge to zero. The stripper, with a max VOC loading of 4,500 ppb (greater than the total mass of VOCs in the site groundwater) was designed to remove >99.9% removal of VOCs at the design flow rate, except for 1,2 dichloroethane (98.69% removal). Actual testing has indicated that 12-DCA is removed at a rate of 98.7% and other VOCs tested are removed at 99.9%. VOCs that are stripped are directed to vapor granulated activated carbon (VGAC) and are removed prior to the emission point.

2.4 MONITORING AND REPORTING REQUIREMENTS AND PROCEDURES FOR EXCEEDANCES

2.4.1 Non-Compliance Reporting

An accidental discharge of partially treated groundwater into an infiltration gallery is unlikely but may occur. If a release occurs or if any of the effluent limitations are surpassed for any reason, the Site Manager must report the occurrence to the New York State Department of Environmental Conservation (NYSDEC) for guidance on non-compliance reporting.

2.4.2 Air Emissions Reporting

Any operation of the equipment which causes a release of air contaminants in a quantity or concentration which poses a potential threat to human health or which might reasonably result in citizen complaints shall be reported immediately by the Site Manager by calling the NYSDEC.

2.5 MUNICIPAL WATER SUPPLY

The potable water supply to the groundwater treatment plant (GWTP) connects to a sink near the sump in the process area. This water is not used for potable purposes but to hose down equipment, clean filters and various system components and the floors. The physical connection to the municipal drinking water supply at the Site has a backflow prevention device from the Rensselaer Water Department. The device is certified bi-annually by a New York state certified backflow prevention inspector.

3.0 DETAILED OPERATION

3.1 SYSTEM SUMMARY

The GWTS includes the treatment train for liquids generated by the extraction well pumps. The extraction well influent streams enter the GWTS separately but are combined before treatment. The treatment train includes ultraviolet (UV) treatment (for extraction wells 3 and 8 only), equalization, solids filtration, air stripping, and carbon adsorption. All of the groundwater equipment is contained inside of a pre-fabricated GWTS building. The air stripper off-gas treatment is located on the containment pad outside of the GWTS building.



3.2 GWTS TREATMENT TRAIN

Seven (7) extraction wells, located across the site transfer water from well sumps to the GWTS for treatment. The extraction wells are EW-3, EW-6, EW-8, EW-12, EW-14, EW-15, and EW-16. EW-12 and EW-16 are manifolded together and only



have one influent line to the outside containment pad. The extracted groundwater comes up above grade onto the 60' x 60' concrete containment pad, enters the treatment system, passes through individual flowmeters, in route to the treatment equipment identified below. Details related to the treatment process and various controls are detailed on the attached **Figure 1**, Process & Instrumentation Diagram. Specifications for the equipment described below are included in **Appendix A**.

3.3 FILTER HOUSING (FX-101)



Solids removal for extraction wells EW-3 and EW-8 occurs after the manifold using a tangential entry, up-flow cartridge filter housing. One (1) Model HUR 3X170FL-XP filter housing is equipped with three Harmsco Hurricane HC 170 series filter cartridges. These filter housings can complete solids removal at a flow rate up to 450 gpm and have a pressure rating of 150 PSIG.

3.4 ULTRAVIOLET (UV) DISINFECTION ASSEMBLY (UV-101)

Water from FX-101 enters a UV disinfection assembly where bacteria destruction takes place. Based on bench testing performed at the site, it was determined that UV disinfection could reduce the formation of bacteria by-products and potentially reduce scaling within the treatment system. The system utilizes a vertical UV system equipped with a High Output UV Lamp, quartz tube to protect the lamp, and manual quartz sleeve wiper for cleaning the tube. The quartz tube separates the lamp from the water stream. The unit can provide ultraviolet disinfection at flow rates up to 59 GPM.

3.5 EQUALIZATION TANK (EQ) (T-201) AND CHEMICAL FEED



Water from UV-101 mixes with the remaining extraction well influent lines and enters EQ Tank T-201. The mixed influent is dosed with iron and hardness sequestering agents that are fed via a metering pump and piped to the influent line. T-201 is a 1,500-gallon vertical high density polyethylene (HDPE) tank with piping entering and exiting the tank. The tank is model # VT1500-64. Additionally, water from the backwash supernatant tank (T-801) and the floor sump pump (P-1200) enter EQ Tank T-201. The tank is staged inside (but

vented outside of the treatment building) of the building to provide freeze protection during winter months, and serves as a storage tank for influent groundwater from the sumps, such that the pumps can operate for up to an hour at 25 GPM to limit downtime for routine or non-routine maintenance.

3.6 AIR STRIPPER FEED TRANSFER PUMP (P-201)

To convey the water from the 1,500-gallon equalization tank, transfer pump P-201 is utilized to transfer liquids from EQ Tank T-201 to the remaining components of the treatment train. The pump is a Goulds model 316L SS centrifugal transfer pump with a 5 HP 460V/3P motor (Model 2ST1J5H4) capable of pumping 50 gpm at an estimated 110 feet of total dynamic head (TDH). This pump is connected to a variable frequency drive (VFD) that allows the operator to modulate flow based on the rate of influent flow to the system, and the back pressure generated from the cartridge filters (FX-201 and FX-202).

3.7 FILTER HOUSING (FX-201 & 202)

Solids removal for the air stripper feed transfer pump (P-201) effluent is completed by Filter Housings FX-201 and FX-202. The flow to the filter housing units are controlled by a motor operated valve that adjusts the unit online based on pressure readings before the filters. Two (2) Model HUR 3X170FL-XP filter housing are equipped with three Harmsco Hurricane HC 170 series filter cartridges. These filter housings can complete solids removal at a flow rate up to 450 gpm and have a pressure rating of 150 PSIG. The filter housings have a fiberglass platform and rail system installed adjacent to them to facilitate easy and safe maintenance.



3.8 AIR STRIPPER AND ASSOCIATED BLOWER (AS-301, B-301)

Following solids filtration, the pressure created by transfer pump P-201 conveys the water to the top of a QED Model EZ-12.6SS air stripper (AS-301) for treatment of the influent groundwater. This primary treatment of VOCs is equipped with a 25 HP, 3,500 rpm regenerative blower (B-301) (FPZ Model SCL K09-TS-25-3B) capable of delivering 941 standard cubic feet per minute (scfm) of air flow to treat the influent groundwater. The use of this technology results in significant reductions in VOC and SVOC contaminant concentrations. Modeling for the treatment equipment resulted in 99.9% removal efficiency.

3.9 VAPOR-PHASE GRANULAR ACTIVATED CARBON VESSEL (VGAC-301, V-GAC-302) AND ION-EXCHANGE MEDIA (IOX-303)

The off-gas generated from the air stripper is routed through a series of vapor-phase granular activated carbon units (VGAC) and an ion-exchange unit for the purpose of off-gas treatment. The units are Tetrasolv Model VF-2000 vessels. Each of the VGAC units have approximately 1,500 pounds (lbs) of VGAC. The ion exchange vessel is filled with a 6% potassium permanganate impregnated media (HS-600 supplied by Tetrasolv filtration). This unit is primarily installed to treat vinyl chloride, which has a low affinity for VGAC treatment. The vessels are located outside of the treatment building and connects to AS-301 via 6-inch diameter schedule 80 polyvinyl chloride (PVC) piping.

3.10 EFFLUENT TRANSFER PUMP (P-301)

To convey water from the air stripper (AS-301) to the remainder of the treatment system and out for discharge effluent, transfer pump (P-301) is utilized. The transfer pump is a Goulds model 316L SS centrifugal transfer pump with a 5 HP 460V/3P motor capable of pumping 50 gpm at an estimated 134 feet of TDH. This pump is connected to a variable frequency drive (VFD) that allows the operator to modulate flow based on the rate of influent flow to the system, and the back pressure generated from the cartridge filters (FX-401 and FX-402).

3.11 FILTER HOUSING (FX-401 & 402)

Solids removal prior to liquid phase carbon treatment is completed by Filter Housings FX-401 and FX-402. The flow to the filter housing units are controlled by a motor operated valve that adjusts the online unit based on pressure readings before the filters. Two (2) Model HUR 3X170FL-XP filter housing are equipped with three Harmsco Hurricane HC 170 series filter cartridges. These filter housings can complete solids removal at a flow rate up to 450 gpm and have a pressure rating of 150 PSIG. The filter housings have a fiberglass platform and rail system installed adjacent to them to facilitate easy and safe maintenance.

3.12 LIQUID-PHASE GRANULAR ACTIVATED CARBON (LGAC) VESSELS (LGAC-501, LGAC-502, LGAC-503); BACKWASH TANK (T-701) AND PUMP (P-701); AND SUPERNATANT TANK (T-801)



Following solids removal, the process water is routed through a series of three (3) Tetrasolv HPAF-2000 LGAC vessels prior to discharge. The units are valved

so that the operator can utilize 1 unit, 2 units, or all 3 units in series. The units are filled with acid washed 8 x 30 lo-rise virgin media. The vessels are backwashed using water from a 1,500-gallon vertical tank (T-701) and a centrifugal transfer pump (P-701) with a 5 HP AMT Model # 3152-95. The backwash water is transferred to a 1,600-gallon cone bottom tank (T-801) for settling and removal of supernatant water. The LGACs have a fiberglass platform and rail system installed adjacent to them to facilitate easy and safe maintenance.

4.0 CONTROLS NARRATIVE

The following narratives provide an outline of operation of the GWTS treatment train and the controls in place to ensure proper operation. An interlock schedule, human machine interface (HMI) screen summary, and electrical one-line diagram are included in **Figures 4 and 5**.

4.1 GWTS TREATMENT TRAIN

The seven extraction wells extract groundwater for treatment within the groundwater treatment plant. Additionally, the Groundwater Collection Sump Overflow is a sump equipped with high and low liquid level ball floats (LSHH-1200, LAL-1200) that provide on and off controls for pump P-1200 (a Zoeller Model M57 3/10 HP, which pumps water from the GWTS floor sump into T-201. Alarms and instrumentation transmit information to the Productivity PAC P3-550 CPU, the P3000 Programmable Automation Controller, and the C-More HMI panel. The PLC instructs the pump to turn on or off and generate alarms based on set points (LSH, LSL, PSH, PSL) that are adjustable within the HMI. The alarms generated from any low-low or high-high liquid level conditions (LALL or LAHH) result in a notification via the telemetry system (Sierra Wireless Gateway) to the operators via email. The values generated from each sensor are available within the HMI for real-time viewing (locally and remotely). The control panels, HMI, and PLC are all located inside of a 10' x 10' operator's office. Remote access is available for HMI viewing and control.



The extracted groundwater that enters the GWTP from the six (6) lines (7 wells) passes through magnetic flowmeters (FQ/FIT-101 - 106) that transmit data back to the PLC/HMI. The data generated by these totalizers is available within the HMI for real-time viewing (locally and remotely). Water then flows into FIT-107 which provides total combined influent flow from the extraction wells.

Water from EW-3 and EW-8 flows into an ultraviolet light assembly. This assembly has a warning alarm (UVL-101) that provides information if the UV lamp sensitivity is low. This alerts the operator that UV treatment may be affected by current operating conditions.

Tank T-201 is equipped with a level transmitter, which governs the flow of P-201. A high-high level (LSHH-200) switch will shut off the extraction wells and requires a manual reset once the water level in T-201 recedes to acceptable levels.

The water exiting T-201 is then pumped through filter housings and to the air stripper. Pressure switches (PSH-201) will alert the operator if a high-pressure condition is observed before the air stripper. The units will adjust by opening and closing a motor operated valve (MOV-201), which will switch the flow between cartridge filters FX-201 and FX-202. Water leaving the air stripper via transfer pump (P-301) will be controlled by the air stripper level transmitter (AS-301). Air stripper high level (LSHH-300) or moisture separator high level (LSHH-301) alarms will stop system operation if an alarm condition is present. Additionally, a low vacuum switch on the blower (VSL-301) and high discharge pressure switch (PSH-301) will shut down the system in the event of a pipe break or vapor carbon blockage.

Water moved by pump P-301 to FX-401 and FX-402 will be routed via a differential pressure switch DPTH-401 between the filter housings. The operator will receive a notification when the differential pressure reaches a programed limit and again when DPTH-401 has diverted flow between the two housings. Pressure switches PSH-501 and PSH-600 will activate and shut down the system if pressure levels from the LGACs or effluent piping exceed the set point.

Water exiting the carbon units will pass through FIT-701 and FIT-702 that transmit data back to the PLC/HMI. The data generated by these totalizers is available within the HMI for real-time viewing (locally and remotely).

The building is also equipped with a low temperature alarm (TSL-1200) which will alert the operator if temperature levels in the building get below the set point in the HMI. Additionally, there is a main power alarm (FLT-PWR) which will alert the operator in the event of a power outage at the site. The building is equipped with a generator and auxiliary propane tank, which can operate lighting, one heater, and the heat trace for the outside lines.

5.0 GENERAL EQUIPMENT MAINTENANCE PROCEDURES

Maintenance personnel should consult the Standard Operating Procedures and the Job Safety Analyses located in the operator's office in the GWTS building before conducting any maintenance.

5.1 CARTRIDGE FILTER CHANGES

Cartridge filters are utilized for solids filtration prior to treatment via ultraviolet disinfection, air stripping, and carbon in the treatment train. The changeout frequency for the filters depends on the pressure differential before and after each filter. Normally, they will last approximately 2 weeks (~250,000 gallons of flow). Motor operated valves should be set in the hand position during changeout so that the filter can be changed without system interruption. Utilize the sample port on top of the cartridge filter to release air pressure prior to opening the units. There is a platform around the filter housings which facilitate maintenance.

5.2 AIR STRIPPER CLEANINGS

As is common with most air stripping operations, routine cleanings are required to address metals precipitation or other fouling that occurs with the units. The air stripper (AS-300) associated with the system treatment should be cleaned per manufacturer's preventative maintenance schedule. P-201 should be put into the OFF position to perform the cleaning. Water should be drained from the unit and the front door carefully removed. The trays slide out for easy cleaning. Typically, a power washer with a citric acid solution is utilized to clean the trays. Refer to the Air Stripper Standard Operating Procedure on the QED website for details.

5.3 ULTRAVIOLET DISINFECTION UNIT LAMP REPLACEMENT

The UV lamp inside of the disinfection unit is rated at an effective life of approximately 12,000 hours. The UV lamp should be replaced at that frequency, or annually. Shut off water flow to the unit and unplug the disinfection system before performing cleaning or maintenance activities. Never look at a UV lamp in operation. A sight tube and port is provided to view operation and light intensity safely. Follow maintenance instructions on page 7 of the UV unit manual. Take care when handling the quartz tube and UV bulbs. Do not overtighten nuts as glass will crack. Cleaning of the quartz tube is recommended at least annually but the lever on the tube should be pulled up-and-down at least once a day to clean the glass of any gross particulates. Allow the unit to cool before removing quartz tube and/or UV lamp.

5.4 CHEMICAL FEED STORAGE AND REPLACEMENT

Chemicals are utilized to reduce iron and hardness fouling in the treatment equipment and reduce foaming within the GWTS. As the only bulk chemicals stored onsite, the Safety Data Sheets (SDS) for the chemicals are stored onsite in a binder located on the wall next to the door to the plant office. The chemicals are delivered and stored in drums that are staged proximal to the air stripper and under the chemical feed pumps. A secondary containment berm is in place around the drums, such that a leak or rupture would be contained within.

6.0 PERSONNEL

6.1 GENERAL

The GWTS is staffed by a Site Manager and Operator who operates the plant processes efficiently and ensures that the treatment system effluent limitations are met. The system is automated and equipped by a PLC that allows sequential and safe shutdown of the GWTS in case of an equipment alarm.

It is intended that the GWTS be operated continuously, on a seven day per week basis, with an operator in attendance Monday through Friday 8:00 a.m. to 11:00 a.m. On some occasions, the Site Manager or Operator may visit the Site on weekends and holidays to maintain operations, especially with the understanding that the cartridge filters may fill up with excess mineral sludge. The GWTS process operation is controlled by the PLC that receives digital inputs to control process equipment. The PLC sends critical alarms via email and SMS message which allows the Site Manager and Operator to monitor operations via their phone or home computer.

6.2 MANPOWER REQUIREMENTS - STAFF AND JOB DESCRIPTIONS

6.2.1 Personnel Certification

At this time, New York State certification is not required for the operation of the GWTS. However, both the Site Manager and Operator have greater than 25 years of experience in water and wastewater treatment.

6.2.2 Operator

The Operator has direct responsibility for the overall operation and maintenance of the GWTS. He / she inspects the plant daily (Monday through Friday) to determine the efficiency of the plant operation and any required maintenance. He / she will initiate operational changes and repair operations with consultation of the Site Manager. He / she analyzes and evaluates operation and maintenance functions and initiates new procedures to ensure continued efficient operation of the plant. He / she also determines any remedial actions to be taken in emergencies with consultation of the Site Manager.

The Operator is alerted to alarms for the GWTS, which allows the Operator to determine if a visit to the Site is required. The Operator will have the capability of adjusting the process in response to the alarm or shut down the unit operation that is causing the alarm condition.

The Operator shall be a high school graduate and shall be an experienced groundwater treatment operator. He/she shall have 40 hours of Hazardous Waste Operations training and annual 8-hour refresher training along with appropriate wastewater / water operations training.

6.2.3 Site Manager

The Site Manager shall be a college graduate with a major in engineering or science, or equivalent work experience. The Site Manager is also responsible for the maintenance of records. He / she shall be knowledgeable of applicable state and federal regulations pertaining to groundwater treatment and hazardous waste generator requirements. The Site Manager supports the Operator and visits the Site on an as-needed basis.

7.0 RECORDS

7.1 GENERAL

The maintenance of good records is important to the efficient and orderly operation of the GWTS. Pertinent and complete records are a necessary aid to control procedures, since these records can be used as a basis for diagnosing system operation and recommending changes to the operating procedures of the GWTS. When accurately kept, records can be used to provide an essential basis for the design of future changes or expansions of the treatment system. In addition, these records can serve as proof of performance for improvements made to the system's facilities or to show that they are needed.

The following examples are types of records or reports that should be kept for the GWTS:

- Daily Treatment System Logs
- Maintenance records
- Analytical data
- Emergency conditions records
- Sign-in sheets and HASP acknowledgement
- Safety Data Sheets

Once made, these records should be carefully preserved and filed where they can be located rapidly. This requires a file system in the Site Office that can be used and understood by everyone concerned with making and using the records. Records should be made at the time the data are obtained by the person performing the task. The responsibility for the proper filing, care, and use of the records rests with the Site Manager. All records should be neat and accurate.

Additionally, there is a database which contains: extraction well and combined influent flows and flowrates, and groundwater analytical data. The database is maintained by the Site Manager at the Clifton office of BSI.

7.2 DAILY OPERATIONS

The Operator can usually tell how the GWTS is performing by monitoring the PLC and recording flow data because of his / her walk-through inspections of the GWTS. However, BASF management personnel, and interested agencies do not have the same contact with day-to-day operation of the plant, and therefore, a monthly Self-Monitoring Report (SMR) is prepared to keep other people informed.

7.2.1 Daily Treatment System Operations Log

A sample form for the daily Treatment System Log is included in **Appendix G**. The sheet should be filled in carefully and legibly daily; Monday through Friday and weekend if manned. Copies of the daily sheets are kept on file. Accumulation of these daily sheets provides the operating personnel with a continuous record of conditions that may adversely affect the quality of the GWTS's effluent. The sheets also provide operational data to help fill out monthly reports, institute new procedures, or determine causes of operational or maintenance problems. The entries to be made on the log are listed below.

1. Date.
2. Operator on duty.
3. Flowrate from the wells.
4. Total Groundwater volume processed.
5. Flowrate and Volume through Treatment System Components.
6. System Status.
7. Pump Pressures.
8. Blower Pressures.
9. LGAC Pressures.
10. Chemicals added to the system.
11. Unusual situations.
12. General comments

7.2.2 Reporting Requirements

Although the Operator will record flowrates and flow volumes on the daily logs, this operational data is downloaded every month from a secure NES website. Along with the lab data, the operational data is included in the monthly SMR. The data requirements and frequency of reporting are specified in **Appendix A** of this manual. NYSDEC requires monitoring (metals and volatile organics) to substantiate the performance of the remediation system. These analytical records must be maintained in accordance with the conditions and instructions stated in the permit limitations. The Site Manager is responsible for assuring biweekly monitoring is scheduled and reports are provided.

7.3 MAINTENANCE RECORDS

The equipment comprising the GWTS requires regular service and maintenance in accordance with the instructions provided with each piece of equipment. Preventive maintenance is performed on the emergency generator and the effluent pump P-301. All the other equipment operates until the equipment fails and requires replacement. Adequate records of service are maintained for each item

of equipment when replaced. Equipment service records can be very helpful in determining the best overall treatment system maintenance program and can serve as useful references when considering new equipment purchases. Service records will show which equipment requires less time, money, and parts to maintain. Records for each piece of equipment is maintained in the files of the Operator's office

7.4 ANALYTICAL RECORDS

Bi-weekly analytical samples of final effluent are collected and submitted to the laboratory with the appropriate chain of custody. In addition, at least one monthly sample is collected of the influent. The Site Operator is responsible for scheduling the laboratory and assuring the proper samples are collected. The Site Manager is responsible for assuring the biweekly report is received and that the data is reviewed for abnormalities or exceedances.

7.5 EMERGENCY CONDITIONS RECORD

A record of any significant incidents affecting the operation of the treatment facility should be maintained. Refer to Section 4, Incident Investigation and Reporting, of the site Health and Safety Plan for guidance.

8.0 ANALYSIS AND TESTING

8.1 GENERAL

Laboratory tests serve as operational tools which enable the Operator to monitor and control each treatment process to ensure an effluent quality which will meet the Effluent Limitations. Laboratory records are discussed in Section 5.0. The careful performance of sampling and laboratory procedures, and the analysis of all other operating records are important for the following reasons:

- To form a rational basis for control of the operation of the treatment plant processes.
- To define the operational efficiency of the processes.
- To monitor changes in groundwater quality as it passes through the treatment plant.
- To ensure that the discharge limitations required by the NYSDEC GA standards are met.
- To ensure that the data requirements of the Discharge to Groundwater Permit are met.

8.2 SAMPLING REQUIREMENTS OF THE PERMIT

The Effluent Limitations and Monitoring Requirements for this GWTS required that analyses be performed by a laboratory certified by the State of New York on a biweekly basis (except for Flow, which is continuous). As stated in Section 2.2, since this GWTS is new and has dual finishing treatment processes (GACs and air stripper), the sampling program has been reduced to bi-weekly, for the same set of parameters indicated on the permit.

Required Monitoring

Parameter	Frequency
Flow	Continuous
pH	Bi-Weekly
Benzene	Bi-Weekly
Chlorobenzene	Bi-Weekly
1,2, Dichloroethane	Bi-Weekly
Ethylbenzene	Bi-Weekly
Toluene	Bi-Weekly
1,2,4 Trichlorobenzene	Bi-Weekly
Vinyl Chloride	Bi-Weekly
Butylbenzyl phthalate	Bi-Weekly
Bis(2-ethylhexyl) phthalate	Bi-Weekly
Naphthalene	Bi-Weekly
Phenol	Bi-Weekly
Aluminum	Bi-Weekly
Arsenic	Bi-Weekly
Barium	Bi-Weekly
Chromium	Bi-Weekly
Cobalt	Bi-Weekly
Copper	Bi-Weekly
Iron	Bi-Weekly
Manganese	Bi-Weekly
Nickel	Bi-Weekly
Zinc	Bi-Weekly
Sodium	Bi-Weekly
Total Dissolved Solids	Bi-Weekly

8.2.1 Sampling Program

The validity of the laboratory test results depends on the reliability of the collected samples. To obtain accurate and precise laboratory results, samples must be collected in a manner so that no cross contamination, volatilization, loss, or change of sample occurs during the time between collection and laboratory analyses. The following type of sample will be collected:

Grab Sample -- The grab sample is a single sample taken at a specified time.

The following precautions should be taken while collecting samples:

- The containers used should be clean and decontaminated following specified decontamination procedures.
- Labeling of containers should be accurate to ensure correct identification.
- Samples not analyzed immediately should be refrigerated at 4°C to maintain their integrity.
- Bottles should be filled completely, with no air space, when sampling for volatile organics.
- Samples should be collected free of floating materials and large particles.
- Proper equipment and safety precautions should be used.

All samples shipped to outside laboratories must be accompanied by a completed Chain of Custody form, a blank sample of which is in **Appendix F**.

8.2.2 Interpretation of Laboratory Tests

The compounds to be tested for and the frequency of sampling are listed in Section 6.1. Definitions of these tests and the interpretation of the results of the tests are described in the following paragraphs. These tests are performed by an outside certified laboratory and are checked via on- site monitoring.

pH: pH is a term used to express the intensity of the acid or alkaline condition of a solution. The pH scale is usually represented as ranging from 0 to 14, with pH 7 representing absolute neutrality. Acid conditions increase as the pH values decrease, and alkaline conditions increase as the pH values increase. The pH of the treated effluent will be between 6.5 and 8.5 so that the receiving POTW is not adversely affected.

Total Volatile Organics: The effluent volatile organics levels will be compared against the required discharge standard to ensure that the treatment system is producing acceptable quality effluent.

Metals: The metals levels in the effluent will be monitored as a general indicator of discharge water quality and will be compared against the required discharge standard to ensure that the treatment system is producing acceptable quality effluent.

Total Dissolved Solids (TDS): Dissolved solids are those solids that can pass through a glass fiber filter of 1.5-micron pore size. The dissolved solids consist of both organic and inorganic molecules

and ions that are present in true solution in water. Dissolved solids will be monitored at the effluent as a general indicator of treated groundwater quality.

9.0 PREVENTIVE MAINTENANCE

9.1 GENERAL

Proper and timely maintenance of the GWTS is the safest and most efficient way of utilizing maintenance funds allocated to the treatment system. The Operator and contractors should work on a regular schedule covering the entire system, with greatest attention to known trouble areas and older equipment. The approved contractors for performing maintenance tasks are:

- Redux for groundwater treatment chemicals;
- Electrical Instrumentation and Controls for instrumentation, electrical work and heat tracing;
- FPI Mechanical for piping and major maintenance;
- Quantum Management Group for operation and maintenance support; and
- Evoqua for GAC

Maintenance of mechanical equipment is of prime importance to the overall operating performance of the extraction and treatment systems. Equipment must be in proper operating condition for the system to maintain peak performance. A sudden and unexpected breakdown of equipment can cause problems throughout the entire treatment process. These types of problems can be avoided if a proper maintenance program is set up and followed.

This portion of the manual has been set up and designed to assist the Operator in starting up and maintaining a sound maintenance management program. The recommended inspections and services are based on the recommendations of experienced engineers and operators, the maintenance guides of equipment manufacturers, and standard texts. It may be necessary, however, to adapt or modify these instructions occasionally to suit local conditions, since equipment may vary in design and use. Any necessary changes in the schedules or services provided in this manual should be based on a survey of local operating conditions, equipment, and the experienced judgment of the Operator and equipment manufacturers. The manufacturers' specifications and recommendations always supersede those presented in this manual.

9.2 EQUIPMENT RECORD SYSTEM

An equipment record system is a set of organized procedures developed to assist the Operator in providing economical and effective maintenance for system equipment and structures. The system helps the operating personnel organize their time and budget for a maintenance program. The system provides a means of anticipating problems and performing minor routine maintenance to prevent major equipment breakdown.

9.3 PLANNING AND SCHEDULING

The groundwater treatment system should operate almost continuously and must be maintained 365 days a year. Variations in flows and maintenance workloads occur, making it imperative that inspection and maintenance be planned and scheduled so that there is no idle time during peak workload periods. Inspection and maintenance planning and scheduling involves time, personnel, equipment, schedules, costs, work orders, and priorities. The Operator should continuously monitor the operations to determine other maintenance work to be accomplished. Any indication of trouble or equipment malfunction should be noted.

9.3.1 Preventative Maintenance Schedules

Each day, the Operator will perform the scheduled daily system surveillance in addition to any emergency maintenance or repair. The Operator must remember the importance of ensuring that all necessary parts, materials, and if required, outside help are available when the maintenance is scheduled, be it preventive or corrective.

The preventive maintenance schedules provided in this manual for each major piece of equipment in the system will assist the Operator and Site Manager in planning and scheduling the maintenance workload. As explained above, the procedure for using these preventive maintenance schedules is simple, and when followed, will provide a complete maintenance program.

9.3.2 Scheduled Maintenance System

As previously described, the daily inspections may reveal the need for non-routine maintenance of various structures or pieces of equipment. If the Operator has time, the work should be done as the need arises to prevent a backlog of pending maintenance or repair. If there is more work than can be done immediately, a backlog of work will develop. The operator can use this backlog (or list of jobs to do) in effectively planning the maintenance schedule to smooth out the workload. Any indications of trouble or equipment malfunction should be reported to the Site Manager.

When a backlog develops, the most critical unit should be repaired first, if parts and materials are available. Any parts orders should be placed immediately. When the parts arrive, the job should then be scheduled regarding the unit's importance in the operation of the system.

9.3.3 Maintenance

Any malfunctions in the instrumentation equipment should be corrected by sending the unit to the manufacturer's service department or arranging a field visit by the manufacturer's representative. If the unit can be fixed at the GWTS, only an instrument technician should attempt any work on the unit.

9.4 STOREROOM AND INVENTORY SYSTEM

Too large or too small an inventory can result in the wasting of time and money. The proper inventory should be developed by periodic review of the maintenance records. Appropriate changes may be made by increasing stocks of some parts or decreasing others as determined by experience. A spare parts inventory for the GWTS in listed in **Appendix E**. All suppliers of equipment were required to submit a recommended spare parts list for their equipment. These lists are included along with other engineering documents and operating instructions in the specific equipment sections of this manual. As these lists are generally prepared with the intention of maximizing the sale of spare parts by the supplier, they should be reviewed carefully by maintenance personnel and generally pared, as appropriate, to the essentials. The exact amount and type of spares kept in this inventory can only be determined by the personnel's experience with the equipment. The spare parts inventory is stored on the top of the GWTS office as indicated in **Figure 1.**

9.4.1 Spare Parts List

A recommended spare parts list is provided by all equipment manufacturers. These parts should be kept on hand for normal scheduled maintenance or repair of equipment. A Critical Spare Parts List is in **Appendix E**. The original is maintained by the Site Manager.

9.5 MAINTENANCE PERSONNEL

In Section 6, the job requirements of the Operator and Site Manager are defined. The Operator has the responsibility the day-to-day maintenance on the plant equipment of performing and testing of the system performance. Maintenance performed by the Operator should be limited to routine maintenance in the way of lubrication, replacing worn parts, general cleaning and inspection, etc. Special maintenance requirements such as electrical work, well pump inspection and cleaning, blower maintenance, instrumentation calibration, etc., should be reserved for qualified contractors to be hired by the Operation's Manager as the need arises.

9.6 HOUSEKEEPING

Housekeeping duties include general yard work, general cleaning, janitorial duties, and grounds keeping. It is the duty of the operating personnel to obtain the necessary tools, equipment, paint, supplies, etc., without delay.

9.7 SPECIAL TOOLS AND EQUIPMENT

Tools are an important part of a complete system maintenance program. They should be kept in good condition and used only for the purpose for which they were designed. The Operator should

conduct inspections of all tools and replace any tool which is found to be worn out or broken.

Housekeeping of tools is also important, not only for their care, but also for the prevention of accidents. Any special tools or equipment should be stored in a specific tool storage area when not in use. All tools should be returned to the appropriate shelf, rack, locker, etc., immediately after use and cleaning.

9.8 MAJOR EQUIPMENT INFORMATION

Equipment cut sheets are in **Appendix B**.

9.9 EQUIPMENT REVISION OR REARRANGEMENT

If equipment is rearranged or removed from the original design, a revision is noted in Section 3.0 of this document and on the PID in **Figure 2.**

10.0 EMERGENCY RESPONSE PROGRAM

Refer to the HASP Section 14.0 which discusses emergency response.

11.0 SAFETY

Refer to the Health and Safety Plan.

12.0 UTILITIES

12.1 GENERAL

The GWTS is provided with electrical power and water service. Telephone service is provided by individual mobile phones usage. The Environmental Center has electric power, telephone service, and potable water. The electrical service provides power to operate the entire groundwater remediation system, and to provide light and ventilation in the treatment plant. Electrical power is obtained from a pole-mounted National Grid transformer located along Riverside Avenue. This transformer furnishes the 480-volt, 3-phase power to the remediation system.

Telephone service provides a means of external communication for the plant personnel and the PLC.

12.2 ELECTRICAL SYSTEM

Electrical power is supplied to the main distribution panel, various transformers, and various motor control centers. Details of the electrical system are discussed in Section 11. In the event of any problems with the electrical service, contact a qualified electrical contractor.

12.3 POTABLE WATER SUPPLY

The City of Rensselaer is the source of potable water for the Environmental Center. The supply lines to the Environmental Center and the GWTP originates from the distribution system that serves the entire community. The water supply is reliable, and not dependent on electrical power service. There are backflow prevention devices in both the Environmental Center and GWTP.

12.4 TELEPHONE SYSTEM

Telephone services is provided by individual mobile phones. System alarms result in notification via the wireless modem in the control panel to the operators via email. The values generated from each sensor are available within the HMI for real-time viewing (locally and remotely). The control panels, HMI, and PLC are all located inside of a 10’ x 10’ operator’s office. Remote access is available for HMI viewing and control.

13.0 ELECTRICAL SYSTEM

13.1 GENERAL

The electrical system is singularly the most important system in treatment plants. Most all the process equipment, as well as the lighting, heating and ventilating systems are dependent on electric power for operation. Therefore, it is imperative that the electrical system be maintained in prime operating condition.

The operating personnel should thoroughly familiarize themselves with the entire system and make regular inspections of its various components for proper operation. Detailed schematics and layouts of the system are given in the contract drawings and the various shop drawings provided by suppliers. Detailed installation, operating and maintenance instructions, as well as spare parts information, are provided in the manuals, drawings, brochures supplied with the major pieces of electrical equipment.

Electrical service is provided to the GWTS by National Grid. Further discussion of the system is included in the following subsections:

- Power Source
- Power Distribution System
- Control and Monitoring System.

Line diagrams showing electrical distribution is provided in the detailed engineering drawings found in **Figures 4 and 5**.

13.2 POWER SOURCE

13.2.1 Purpose

To provide electrical service to the treatment facility for distribution via the distribution power panels.

13.2.2 Equipment

480 volt 3-phase power, originates from the National Grid pole mounted transformer. It is distributed via overhead service conductors to a metering cabinet along the fence line on Riverside Avenue. Service is then distributed to a 480-volt service 200 AMP disconnect inside the operator's office. From there, power is routed to two electrical transformers that reduce service to 240 VAC and 120 VAC. Both transformers are located on the containment pad, outside the operator's office. At each vault, a 480 to 240 VAC transformer exists to operate each well pump.

The GWTS also has a backup propane powered 220/115 VAC generator that is directed to heat tracing, emergency lighting and the heaters inside the process area and the sumps.

13.2.3 Operation

Since the 480-volt source servicing the GWTS is the responsibility of the utility (National Grid), any service interruption should be reported to the utility.

The existing 200-amp electrical service for the site was re-used for the construction of the new GWTP. The electrical contractor disassembled the electric distribution panel that was in the (former) main work trailer and reassembled it in the control room of the new building. New control panels, motor control circuits, and instrumentation control were installed. Electrical disconnects were installed near each major piece of equipment. Equipment was run at 120 V and 240 V to minimize arc flash health and safety concerns. An electrical one-line diagram is included in **Figures 4 and 5**. All electrical equipment was labeled with voltage, phase, and arc flash labeling where appropriate.

13.3 POWER DISTRIBUTION SYSTEM

13.3.1 Purpose

To provide serviceable operational power to process equipment and building systems.

13.3.2 Equipment

The GWTS has the following distribution equipment:

- 200 Amp, 3 phase, 480 VAC disconnect
- 200 Amp, 1 phase, 240/120 VAC disconnect
- 60 Amp, 1 phase, 240/120 VAC disconnect

13.3.3 Circuit Protective Devices

Power to process motors, well pumps, building equipment and instruments is fed via individual circuit breakers.

Process Motors: Short-circuit protection is provided by individual motor circuit protectors or disconnects.

Well Pumps: Short-circuit protection is provided by individual motor circuit protectors or circuit breakers. 480 VAC is distributed to the well vaults and voltage is reduced with individual transformers. Motor overloads for the Well Pumps are included in the motor starters. Integral overloads are provided in the Sump Pump motors.

Building Lighting, Convenience Receptacles, Heat Tracing and Miscellaneous: Circuit protection for the branch circuits is provided by circuit breakers.

Instrumentation: 120-volt input power for all instruments in the process area is provided by an

individual circuit breaker.

Surge Protection: Surge protection to protect instrumentation and control equipment from electrical surges and lightning strikes is provided by for instrumentation is protected by a surge protective device

13.3.4 Operation

Initial Startup: Before energizing all motor and process controls and panelboards, the electrical contractor should perform the following checks to ensure proper operation:

- All wiring should be inspected for possible short circuits.
- All switches, starters, circuit breakers and fuse holders should be inspected for the correct rating, overload/ protective device.

Normal Operation: The operations involving the various equipment controls will be described in conjunction with each piece of equipment in its respective subsection.

It should be noted that some of the process is provided with a safety disconnect switch installed adjacent to the equipment. This allows maintenance personnel to remove power from the equipment prior to performing repairs or routine maintenance. This safety feature ensures that the respective equipment cannot be energized since most all equipment controls are located remote from the equipment. Thus, care should be taken to make certain that the power is disconnected by the safety disconnect switch or the appropriate circuit breaker and tagged "Out of Service- Do Not Use" before any maintenance or repair is attempted on any of the powered equipment.

13.3.5 Maintenance

A routine inspection of the operation of all process and building equipment motors and controllers should be made to assure equipment is functional and the protective devices (fuses, overload heaters, circuit breakers) in the motor control center and panel boards have not "tripped".

In addition, an annual inspection and testing of all equipment electrical protective devices by experienced personnel should be made as a preventive measure to eliminate possible problems before they occur.

13.4 CONTROL AND MONITORING SYSTEM

13.4.1 General

The process control and monitoring system is controlled by a Programmable Logic Controller (PLC). The PLC is located inside a control panel and is linked with a panel mounted operator interface (HMI).

Data Management & Reporting: The system records process input and output flow and level accumulations which is downloaded each month and included in the Self-Monitoring Reports.

13.4.2 Purpose

To provide a means to monitor and control plant operating conditions.

13.4.3 Equipment

Alarms and instrumentation transmit information to the Productivity PAC P3-550 CPU, the P3000 Programmable Automation Controller, and the C-More HMI panel. The PLC instructs the pump to turn on or off and generate alarms based on set points (LSH, LSL, PSH, PSL) that are adjustable within the HMI. The alarms generated from any low-low or high-high liquid level conditions (LALL or LAHH) result in a notification via the telemetry system (Sierra Wireless Gateway) to the operators via email. The values generated from each sensor are available within the HMI for real-time viewing (locally and remotely). The control panels, HMI, and PLC are all located inside of a 10' x 10' operator's office. Remote access is available for HMI viewing and control.

The extracted groundwater that enters the GWTP from the six (6) lines (7 wells) passes through magnetic flowmeters (FQ/FIT-101 - 106) that transmit data back to the PLC/HMI. The data generated by these totalizers is available within the HMI for real-time viewing (locally and remotely). Water then flows into FIT-107 which provides total combined influent flow from the extraction wells.

13.4.4 Operation

Initial Startup: Before placing the control and monitoring systems into operation, the operating personnel should perform the following checks to ensure proper operation:

1. The instruments must be checked for proper installation and be calibrated during initial startup per the manufacturers' instructions and recommendations.
2. The switch settings for the various units and alarm conditions should be set per the manufacturers' instructions and recommendations. Settings should be left unchanged unless regular observation justifies a change in the settings. Any changes should be made by qualified personnel only.

With these checks completed, the control and monitoring systems are ready for operation.

14.0 STARTUP & SHUTDOWN PROCEDURES

14.1 SYSTEM STARTUP

The GWTS startup is to be completed by following these steps:

1. The personnel performing the system start up reviews the Health & Safety Plan.
2. A hard hat, safety glasses, and steel toe boots (Level D) personal protection are required.

3. The general area is checked for hazards, debris, etc.
4. Check to ensure the LGACs are hydrated.
5. Check that manual valves are in the proper position (normally open or closed).
6. Clear any alarms in the HMI by clicking on the Alarms button, then right-clicking and selecting "Acknowledge All".
7. Utilizing the Hand-Off-Auto (HOA) switch on the controls for EW Zone 1 and Zone 2 and ensure that water is present in tank T-201 above the T-201 effluent valve. Return the switch to the "off" position.
8. Set the MOV-201, MOV-401, MOV-600 switches to the appropriate set points (Auto or manual).
9. Set the MP-1001 metering pump to "Auto". Set the MP-1002 metering pump to "Auto", if in use.
10. Turn HOA switches to Auto for EW Zone 1, Zone 2, P-201, B-301, P-301, and P-1200 controls to auto.
11. Monitor temperature and pressure on tanks and units to ensure proper operation.
12. Once operation of treatment system components has been confirmed, the system operational parameters, including pressure, temperature, and flow rate throughout the system will be monitored, with adjustments made for optimal performance.
13. Once performance has been optimized, the ball valve allowing dilution air and bleed air for the air stripper should be utilized to set flow.
14. The system will be thoroughly inspected for any deficiencies, such as leaks, excessive vibration, or unusual noises. Any deficiencies will be noted in the field logbook and reported to the project manager.
15. Operating parameters will be recorded on the O&M Data Sheets.
16. Following start up, the project engineer or project manager will be contacted to discuss system performance and provide direction on operating parameters, if necessary.

14.2 SYSTEM SHUTDOWN

The system is to be shut down by following the steps below:

1. The personnel performing the system shut down reviews the Health & Safety Plan.
2. A hard hat, safety glasses, and steel toe boots (Level D) personal protection are required.
3. The general area is check for hazards, debris, etc.
4. In the HMI, set extraction well pumps to the "Off" position, then switch the HOA switches for these pumps to "Off".
5. Set pumps P-201, and P-1200 to "Off" in the HMI.
6. Set pump P-301 to "Off" in the HMI.
7. Wait 10 minutes and then set air stripper blowers B-301 to "Off" in the HMI.
8. Power to the motor starters and controls is controlled in the distribution panel and should be utilized for any control panel troubleshooting. Electrical disconnects are provided at each major motor for lock out/tag out work as well.
9. Implement lock out/tag out procedures to complete any repairs.

14.3 EMERGENCY SHUTDOWN PROCEDURES

In the event of an emergency, the system is to be shut down by following the steps below:

1. Utilize the emergency stop button on the control panel to power down system components.
2. Turn the main power disconnect (located at service meter along Riverside Avenue) to the "Off" position.
3. Proceed to lock out/tag out the main power disconnect.
4. Contact the BASF client to provide notification of the emergency.
5. If necessary, contact the appropriate local emergency response authorities.

If conditions are unsafe to implement the emergency shutdown procedures on-site, go to the site emergency muster point and contact authorized personnel to advise of conditions. A remote shutdown may be possible depending on the nature of the emergency.

TABLES

1. Cartridge Changeout
2. Filters Pulled and Replaced
3. Y-Strainer Changeout
4. Pump Changeout
5. Flow Totalizer Cleaning
6. GAC Units Backwash
7. Operations
8. Operations 2
9. Operations 3
10. Inspections
11. Skid Cleaning and Piping
12. Carbon Changeouts
13. UV System

Table 1. CARTRIDGE CHANGEOUT

BASF Rensselaer, NY - GWTP

DATE	X-101	X-201	X-202	X-401	X-402	Alarms
1/1/19	ONLINE	OFFLINE	ONLINE	ONLINE	OFFLINE	
1/2/19						
1/3/19						
1/4/19						
1/5/19						
1/6/19						
1/7/19						
1/8/19						
1/9/19						
1/10/19						
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1/28/19						
1/29/19						
1/30/19						
1/31/19						

Templates by Vertex42.com

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Table 2. FILTERS PULLED AND REPLACED

	Filters Drained	Cleaned & Vac'd FX-101	Filters Pulled FX-101	Filters replaced FX-101	Filters Drained	Cleaned & Vac'd FX-201	Filters Pulled FX-201	Filters replaced FX-201	Filters Drained	Cleaned & Vac'd FX-202	Filters Pulled FX-202	Filters replaced FX-202	Filters Drained	Cleaned & Vac'd FX-401	Filters Pulled FX-401	Filters Replaced FX-401	Filters Drained	Cleaned & Vac'd FX-402	Filters Pulled FX-402	Filters Replaced FX-402	Amount Trashed
1/1/19																					
1/2/19																					
1/3/19																					
1/4/19																					
1/5/19																					
1/6/19																					
1/7/19																					
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Table 3. Y-STRAINER CLEANING

BASF Rensselaer, NY - GWTP

DATE	P-201	P-301	P-701	P-801	Removed and flushed piping to P-201
1/1/19					
1/2/19					
1/3/19					
1/4/19					
1/5/19					
1/6/19					
1/7/19					
1/8/19					
1/9/19					
1/10/19					
1/11/19					
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1/25/19					
1/26/19					
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1/28/19					
1/29/19					
1/30/19					
1/31/19					

Table 4. PUMP CHANGEOUT

BASF Rensselaer, NY - GWTP

DATE	P-201	P-301	P-701	P-801	Cleaning parts for P-201	Cleaning parts for P-301	Cleaning parts for P-701	Cleaning parts for P-701
1/1/19								
1/2/19								
1/3/19								
1/4/19								
1/5/19								
1/6/19								
1/7/19								
1/8/19								
1/9/19								
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1/31/19								

Table 5. Flow Totalizer Cleaning

BASF Rensselaer, NY - GWTP

DATE	FIT-101	FIT-102	FIT-103	FIT-104	FIT-106	FIT-107	FIT-601	FIT-602	FIT-701
1/1/19									
1/2/19									
1/3/19									
1/4/19									
1/5/19									
1/6/19									
1/7/19									
1/8/19									
1/9/19									
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1/30/19									
1/31/19									

Table 6. GAC UNITS BACKWASH

BASF Rensselaer, NY - GWTP

DATE	GAC-501	GAC-502	GAC-503	BW RECIRCULATION
1/1/19				
1/2/19				
1/3/19				
1/4/19				
1/5/19				
1/6/19				
1/7/19				
1/8/19				
1/9/19				
1/10/19				
1/11/19				
1/12/19				
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1/29/19				
1/30/19				
1/31/19				

Table 7. Operations

BASF Rensselaer, NY - GWTP

DATE	Readings	T-201	UV	T-801	Pumped sludge from T-801	Dewatered sludge drums	Consolidate Sludge Drums	T-701	Clean Filters to F-301, 302	Change Filters to F-301, 302	Emptied Trap	Cleaned Sump	Put Water in LGAC Units	Replace diaphram to AMT Pump	Change out PSI on filter housing
1/1/19															
1/2/19															
1/3/19															
1/4/19															
1/5/19															
1/6/19															
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1/31/19															

T-201 - Dump Sludge from T-201 down sump to T-801.

UV - Clean the quartz sleeve.

T-801 - Pump through the system.

Pumped sludge from T-801 into the drums.

Dewatering of the sludge drums.

Pump sludge from 1 drum to another

T-701 - Adding clean water to the tank.

Blow out prefilters and filter for the blower

Change out filters for the blower

Table 8. Operations

BASF Rensselaer, NY - GWTP

DATE	M-1001	M-1002	FX-101	FX-201	FX-202	FX-401	FX-402	Vac'd out corner of the building	M-1001	M-1002	Mix Polymer	Sample/Lab	Washed T-801	Washed polymer line or changed line	Cleaned Storage Area	Salted Stairs	Triple Rinsed 5 gal pails	Performed Maint. On P-802
1/1/19																		
1/2/19																		
1/3/19																		
1/4/19																		
1/5/19																		
1/6/19																		
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M-1001 - Added Redux to drum via pump

M-1002 - Added foamtrol to drum via pump

Flushed out the bottom of the unit.

M-1001 - Cleaned strainer, removed air from line

M-1002 - Cleaned strainer

Table 9. Operations

BASF Rensselaer, NY - GWTP

DATE	PW Demister	Changed filter bag to T-801	Cleaned & Vac'd F-301 & 302	Cleaned site glass on stripper	Vac the Screen to the vent line	Changed out the Demister	Cleaned Pressure Switch to P-201	Performed Maintanance on Generator	Cleaned & Vac'd out T-201	Cleaned piping from Manifold to T-201 & REPLACED	Clean pipe from P-201 to FX 201 & 202 & REPLACED	Clean pipe from FX-201 & 202 to Stripper & replace	Cleaned the Stripper	Changed the sample ports to the manifold and GAC Units	Cleaned the outside sump
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Table 10. Inspections

BASF Rensselaer, NY - GWTP

DATE	Eyewash/Safety Shower	Potable Water Line	Fire Ext.	F-301 &302	VGAC 301, 302, 303	Moisture Trap	M-1001	M-1002	Safety Meetings	Outside Sump	Safety Orientation
1/1/19											
1/2/19											
1/3/19											
1/4/19											
1/5/19											
1/6/19											
1/7/19											
1/8/19											
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Table 11. Skid Cleaning and Piping

BASF Rensselaer, NY - GWTP

DATE	Skid 1	Skid 2	Skid 3	Skid 4	Skid 5	Skid 6	Skid 7	UV	Manifold	FX-101	FX-201	FX-202	FX-401	FX-402	Drum Containment Area
12/1/18															
12/2/18															
12/3/18															
12/4/18															
12/5/18															
12/6/18															
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Table 12. CARBON CHANGEOUTS

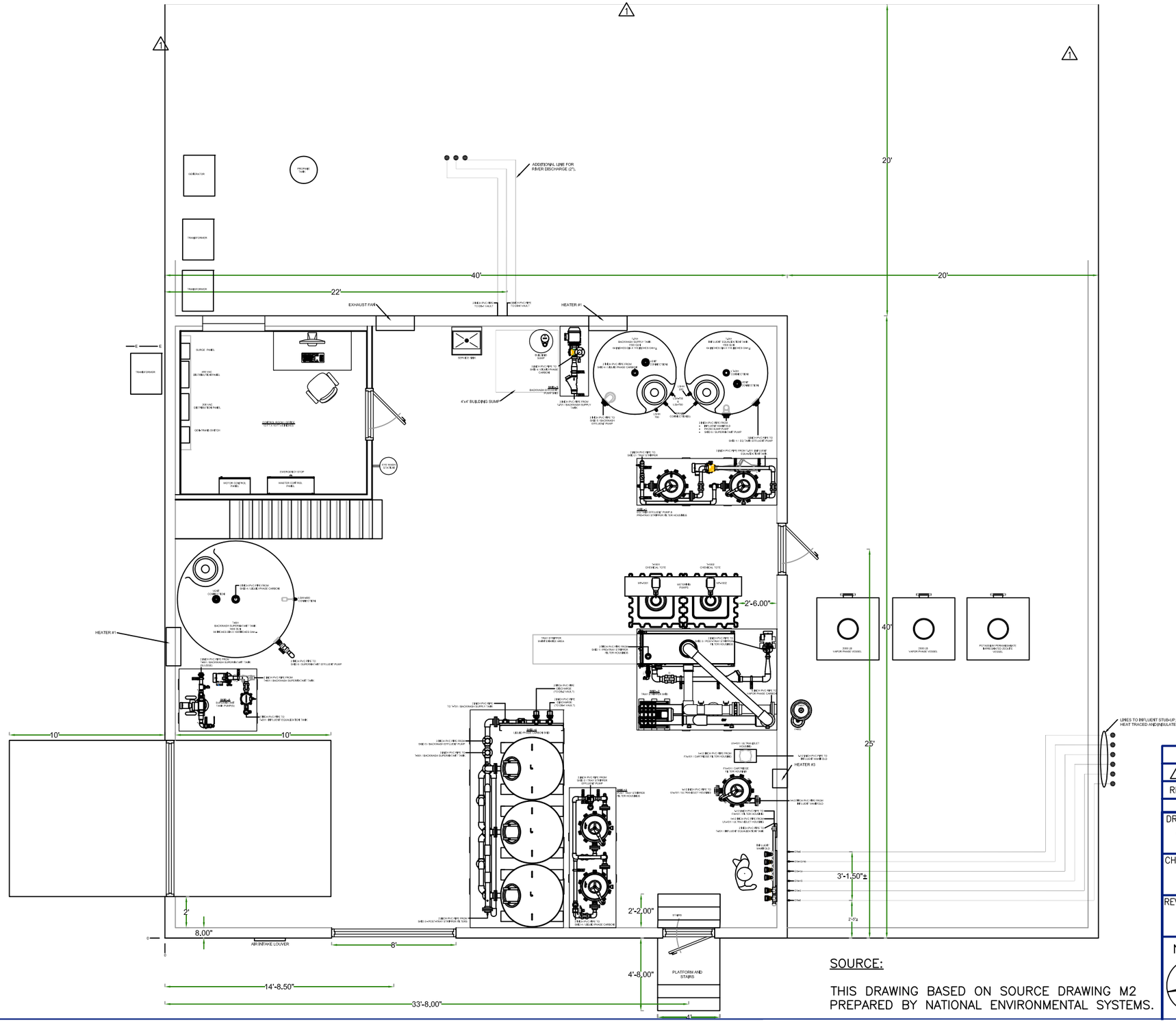
BASF Rensselaer, NY - GWTP

DATE	LGAC 501	LGAC 502	LGAC 503												
12/1/18															
12/2/18															
12/3/18															
12/4/18															
12/5/18															
12/6/18															
12/7/18															
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Table 13. UV System

Jan-19

DATE		STATUS	REASON OFF	FILTER CHANGE OUT	PI-107	PI-108
				DATE		
1/1/19						
1/2/19						
1/3/19						
1/4/19						
1/5/19						
1/6/19						
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SOURCE:

THIS DRAWING BASED ON SOURCE DRAWING M2 PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS.

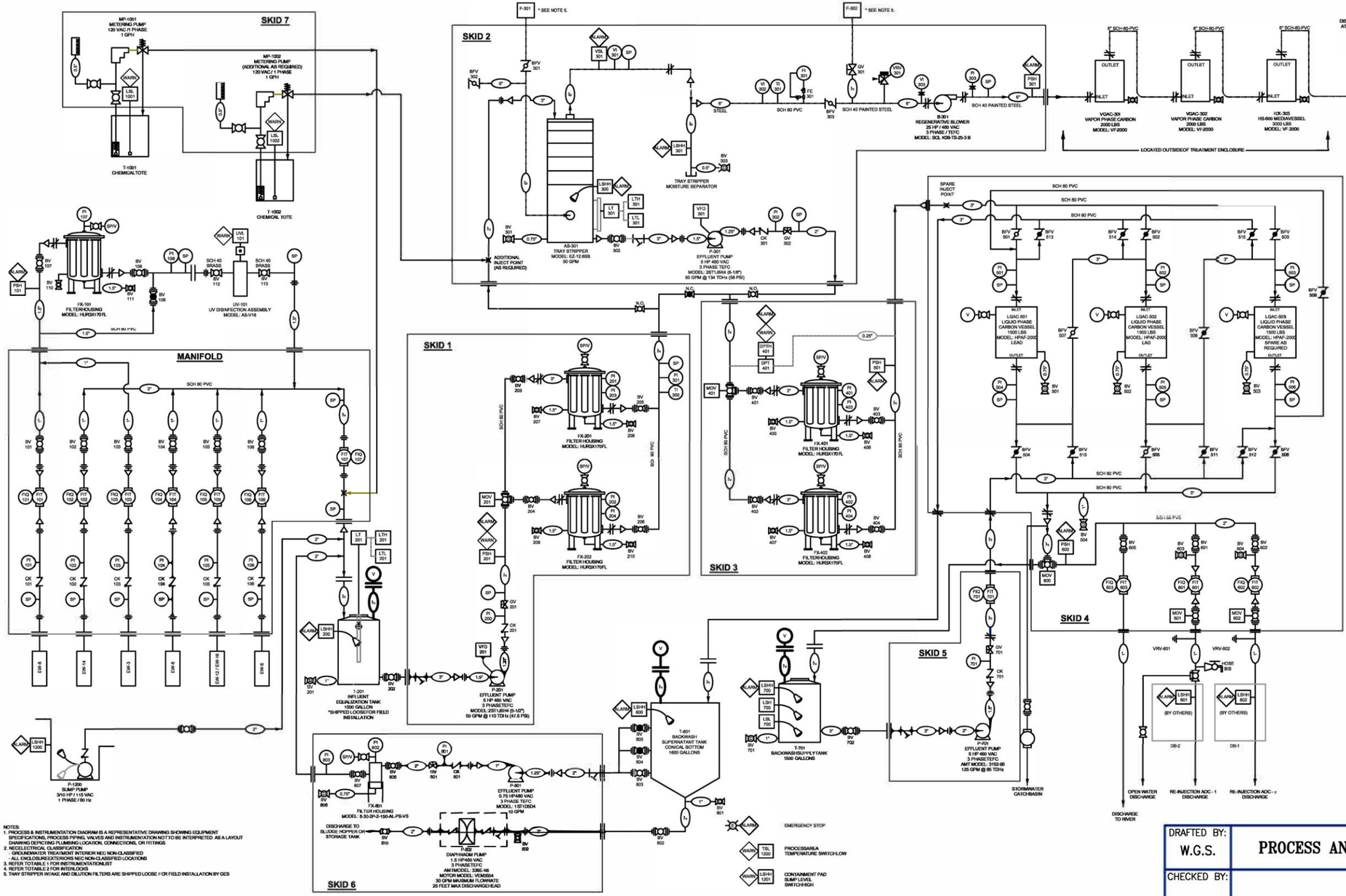
REV.	DESCRIPTION	DATE	APPROVAL
1	EXPAND CONTAINMENT AREA TO 60'x60'	1-28-16	–

REVISIONS

DRAFTED BY: W.G.S.	TREATMENT SYSTEM LAYOUT DRAWING AS-BUILT
CHECKED BY:	BASF FACILITY RENSSELAER, NY
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 16 MT. EBO ROAD SOUTH, SUITE 21, BREWSTER, NEW YORK 10509

NOT TO SCALE	DATE	FIGURE
	8-3-16	1

M:\Graphics\1100-Patterson-LHV\Misc\BASF\Rensselaer\15-183-M-2-90% Design(endosure).dwg, B-90%, WShea



NOTES:
1. PROCESS & INSTRUMENTATION DIAGRAM IS A REPRESENTATIVE DRAWING SHOWING EQUIPMENT SPECIFICATIONS, PROCESS PIPING, VALVES AND INSTRUMENTATION NOT TO BE INTERPRETED AS A LAYOUT DRAWING DEPICTING PLUMBING LOCATION, CONNECTIONS, OR FITTINGS
2. NEC ELECTRICAL CLASSIFICATION
   GROUNDWATER TREATMENT INTERIOR NEC NON-CLASSIFIED
   - ALL ENCLOSURES EXTERIORS NEC NON-CLASSIFIED LOCATIONS
3. REFER TO TABLE 1 FOR INSTRUMENTATION LIST
4. REFER TO TABLE 2 FOR INTERLOCKS
5. TRAY STRIPPER INTAKE AND DILUTION FILTERS ARE SHIPPED LOOSE FOR FIELD INSTALLATION BY GES

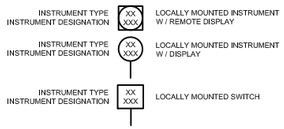
SOURCE:

THIS DRAWING BASED ON SOURCE DRAWING M1 PAGE 1of2
PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS.

DRAFTED BY: W.G.S.	PROCESS AND INSTRUMENTATION DIAGRAM	
CHECKED BY:	BASF FACILITY RENSSELAER, NY	
REVIEWED BY:	Groundwater & Environmental Services, Inc. 16 MT. EBO ROAD SOUTH, SUITE 21, BREWSTER, NEW YORK 10509	
	NOT TO SCALE	DATE 10–13–16 / FIGURE 2

M:\Graphics\1100-Patterson-LHV\Misc\BASF\Rensselaer\15-183-M-1-90% Design(P&ID & Legend).dwg, P&ID-90% (2), WShea

INSTRUMENT IDENTIFICATION



INSTRUMENTATION ABBREVIATIONS

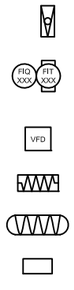
ADV	AUTOMATIC DRAIN VALVE
CC	CYCLE COUNTER
CF	COALESCING FILTER
D	DRAIN
DB	DISTRIBUTION BOX
DPI	DIFFERENTIAL PRESSURE INDICATOR
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
DPTH	DIFFERENTIAL PRESSURE TRANSMITTER HIGH
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIT	FLOW INDICATING TRANSMITTER
FIQ	FLOW TOTALIZER
FM	FLOW METER
FP	FLOW PORT
FS	FLOW SWITCH
FSL	FLOW SWITCH LOW
FT	FLOW TOTALIZER
LI	LEVEL INDICATOR
LIT	LEVEL INDICATING TRANSMITTER
LS	LEVEL SWITCH
LSHH	LEVEL SWITCH HIGH-HIGH
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW-LOW
LT	LEVEL TRANSMITTER
MOV	MOTOR OPERATED VALVE
OLH	OIL LEVEL HIGH
OLL	OIL LEVEL LOW
PF	PARTICULATE FILTER
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
PRV	PRESSURE REGULATING/RELIEF VALVE
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
PSV	PRESSURE SAFETY VALVE
PT	PRESSURE TRANSMITTER
SP	SAMPLE PORT
SP/V	SAMPLE PORT / VENT
SV	SOLENOID VALVE
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TIT	TEMPERATURE INDICATING TRANSMITTER
TS	TEMPERATURE SWITCH
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
UVL	ULTRAVIOLET LAMP SENSITIVITY LOW
V	VENT
VFD	VARIABLE FREQUENCY DRIVE
VI	VACUUM INDICATOR
VIT	VACUUM INDICATING TRANSMITTER
VRV	VACUUM RELIEF VALVE
VS	VACUUM SWITCH
VSH	VACUUM SWITCH HIGH
VSL	VACUUM SWITCH LOW
VSV	VACUUM SAFETY VALVE

PIPE DESIGNATION



AIR LINE
WATER LINE
WATER LINE HEAT TRACED AND INSULATED
CHEMICAL LINE
PRODUCT LINE
VENT LINE
CONTROL LINE
INTRINSICALLY SAFE LINE
ANALOG LINE
BREAK
FLOW DIRECTION
PIPE SIZE

SYMBOLS



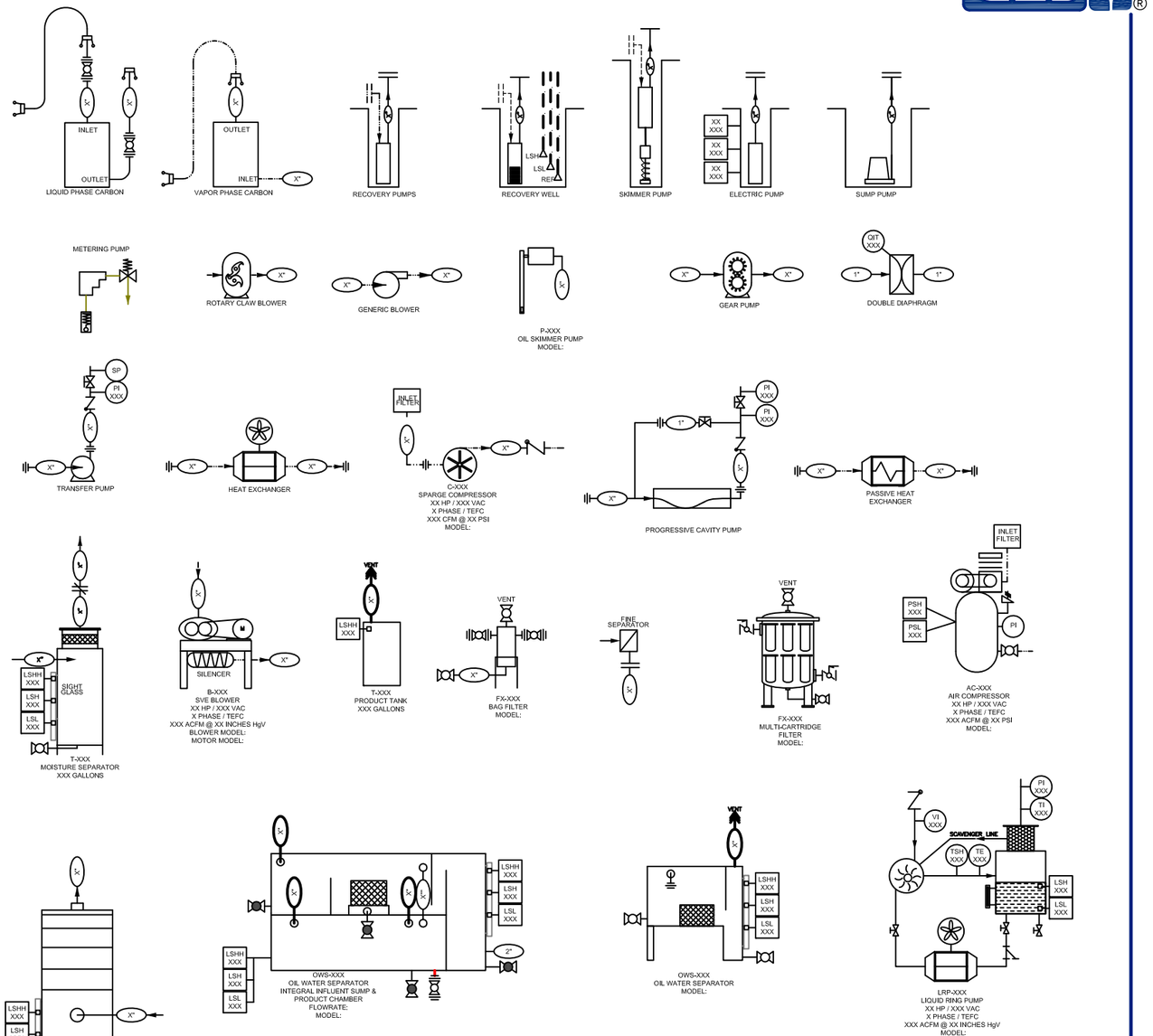
ROTAMETER
FLOW METER / TOTALIZER
VARIABLE FREQUENCY DRIVE
STATIC MIXER
DISCHARGE SILENCER
DILUTION AIR FILTER
INLET/INLINE FILTER
COALESCING FILTER
PARTICULATE FILTER
AUTOMATIC CONDENSATE DRAIN
ALARM DESIGNATION
WARNING INDICATION
MULTIFUNCTION VALVE
INJECT NOZZLE
METERING PUMP INLET CHECK VALVE
METERING PUMP FOOT VALVE
CONDUCTANCE PROBES
COPPER COIL
HOSE CONNECTION

SYMBOLS CONTINUED



FILTER REGULATOR
CALIBRATION COLUMN
GLOBE VALVE
GATE VALVE
TRUE UNION BALL VALVE
BALL VALVE
CHECK VALVE
RAIN CAP
BUTTERFLY VALVE
Y-STRAINER
RELIEF VALVE
FEMALE CAMLOCK
MALE CAMLOCK
SOLENOID VALVE
PRESSURE REGULATOR
SIPHON BREAK
UNION
CLEAR PVC
MECHANICAL FLOAT
PULSE-DAMPING SNUBBER
PITOT TUBE
SIGHT GLASS
DRAIN
VENT
E-STOP
NEEDLE VALVE
FLANGED CONNECTION
REQUIRED FIELD CONNECTION
FLEX CONNECTOR
CONCENTRIC REDUCER
ECCENTRIC REDUCER
MOTOR OPERATED BUTTERFLY VALVE
MOTOR OPERATED VALVE
3-WAY MOTOR OPERATED VALVE

SYMBOLS CONTINUED

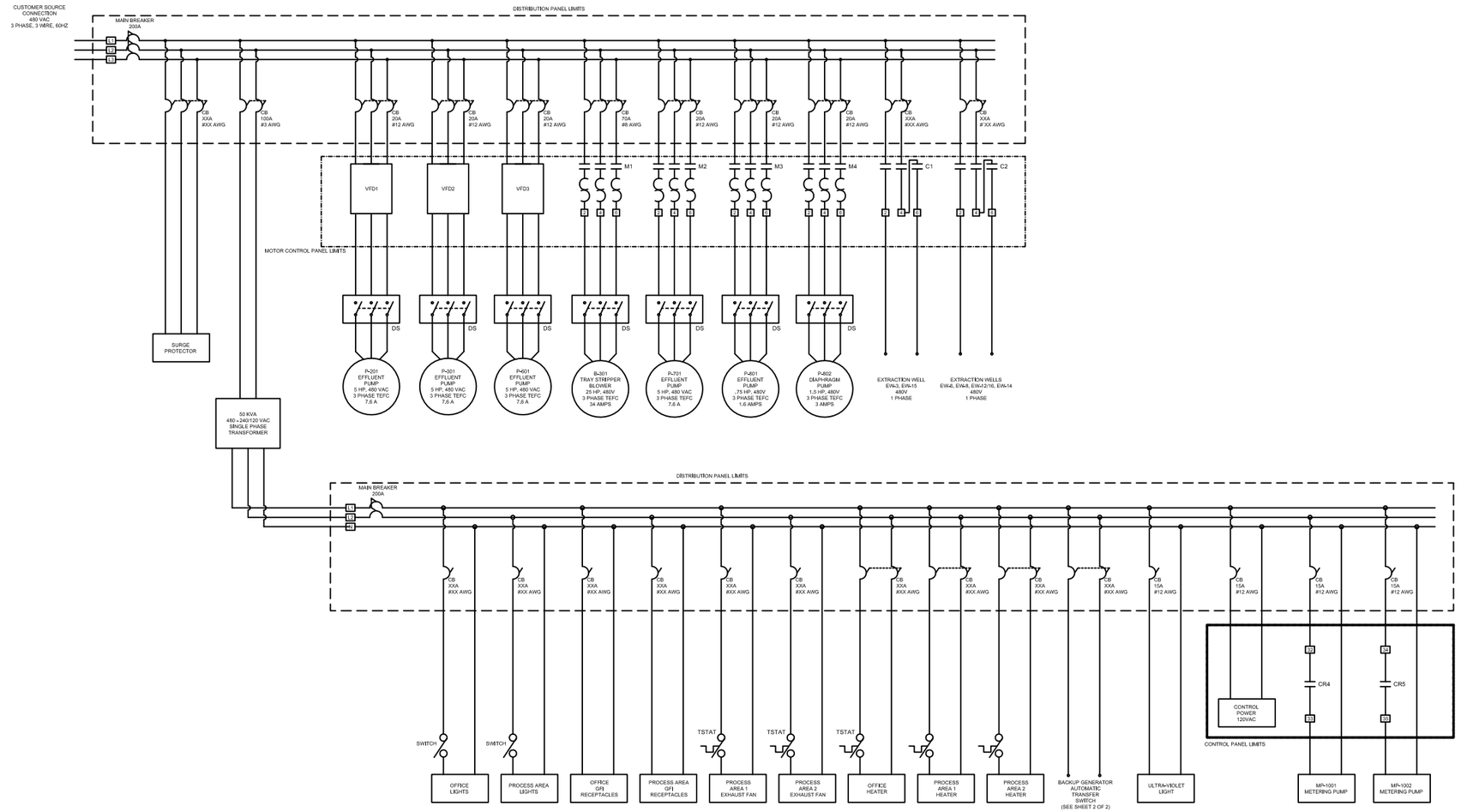


SOURCE:

THIS DRAWING BASED ON SOURCE DRAWING M1 PAGE 2of2 PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS.

DRAFTED BY: W.G.S. (N.J.)	P&ID LEGEND
CHECKED BY:	BASF FACILITY RENSSELAER, NY
REVIEWED BY:	Groundwater & Environmental Services, Inc. 16 MT. EBO ROAD SOUTH, SUITE 21, BREWSTER, NEW YORK 10509
	NOT TO SCALE / DATE 4-1-16 / FIGURE 3

M:\Graphics\1100-Patterson-LHV\Misc\BASF\Rensallear\15-183-M-1-90% Design(P&ID & Legend).dwg, Legend-90%, WShea



NOTES:
1. LOCAL CONTROL PANEL UL 508A LISTED.
2. GROUND CONDUCTORS NOT SHOWN. INSTALL ALL GROUNDS PER NEC ARTICLES 250.122 , LOCAL ELECTRICAL CODES, AND PER THE AUTHORITY HAVING JURISDICTION.

LEGEND	
ABBREV.	DESCRIPTION
AWG	AMERICAN WIRE GAUGE
C	CONTACTOR
CB	CIRCUIT BREAKER
CR	CONTROL RELAY
M	MOTOR STARTER
TSTAT	THERMOSTAT
VFD	VARIABLE FREQUENCY DRIVE
— —	DISTRIBUTION PANEL LIMITS
═══	MOTOR CONTROL PANEL
═══	CONTROL PANEL LIMITS
———	FIELD CONNECTIONS

SOURCE:

THIS DRAWING BASED ON SOURCE DRAWING E1 PAGE 1of2 PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS.

REV.	DESCRIPTION	DATE	APPROVAL
1	X	–	–

REVISIONS

DRAFTED BY: W.G.S. (N.J.)

CHECKED BY:

REVIEWED BY:

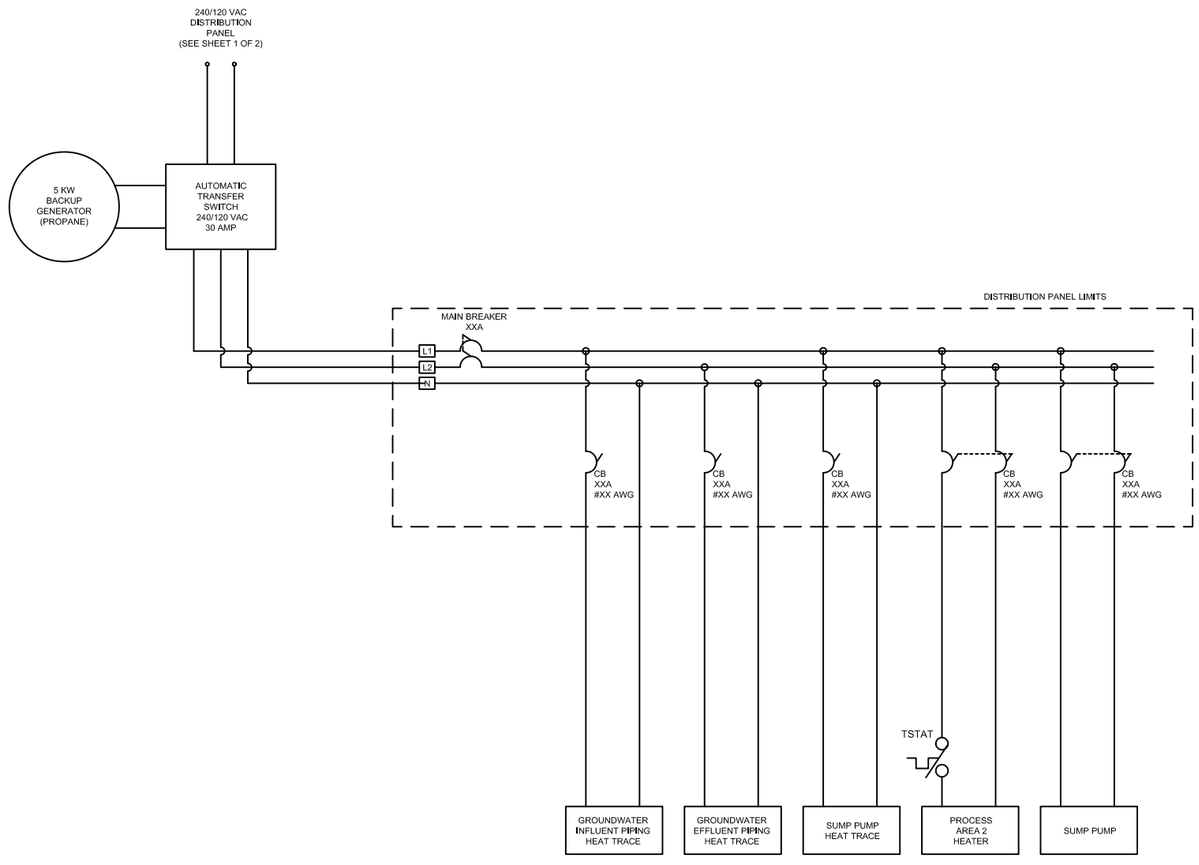
ELECTRICAL ONE LINE DRAWING (1 OF 2)

BASF FACILITY
RENSSELAER, NY

Groundwater & Environmental Services, Inc.
16 MT. EBO ROAD SOUTH, SUITE 21, BREWSTER, NEW YORK 10509

NOT TO SCALE	DATE	FIGURE
	4–1–16	4

M:\Graphics\1100-Patterson-LHV\Misc\BASF\Rensallear\15-183-E-1 - 60% Design(one line dwgs).dwg, B-, WShea



SOURCE:

THIS DRAWING BASED ON SOURCE DRAWING E1 PAGE 2of2
PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS.

REV.	DESCRIPTION	DATE	APPROVAL
1	X	–	–

REVISIONS

DRAFTED BY: X.X.X. (N.J.)

CHECKED BY:

REVIEWED BY:

ELECTRICAL ONE LINE DRAWING
(2 OF 2)

BASF FACILITY
RENSSELAER, NY

Groundwater & Environmental Services, Inc.
16 MT. EBO ROAD SOUTH, SUITE 21, BREWSTER, NEW YORK 10509

NOT TO SCALE	DATE	FIGURE
	4–1–16	5

M:\Graphics\1100-Patterson-LHV\Misc\BASF\Rensallear\15-183-E-1 - 60% Design(one line dwgs).dwg, B- (2), WShea

HIGH VOLTAGE PANEL (H)

1	20 AMP	P-801	Ext Wells	20 AMP	2
3		&	North		4
5		P-802	Heater 1	30 AMP	6
7	20 AMP	Ext Wells			8
9		East			10
11	20 AMP	P-701	Blue Building	60 AMP	12
13		&			14
15		P-201			16
17	20 AMP		Spare	90 AMP	18
19		P-301			20
21			Trans	100 AMP	22
23					24
25	50 AMP	B-301	Surge	100 AMP	26
27			Suppressor		28
29					30

LOW VOLTAGE PANEL

1	20 AMP	SUMP	SPARE	30 AMP	2
3		PUMP			4
5	20 AMP	OFF LT & REC	RECEPT	15 AMP	6
7	20 AMP	INSD SUMP	WARE LTS	20 AMP	8
9	15 AMP	SPARE	PIT HEATER	20 AMP	10
11	15 AMP	HT TRACE	HT TRACE	15 AMP	12

LOW VOLTAGE PANEL

1	20 AMP	5K	SPARE	30 AMP	2
3		HEATER	SPARE		4
5	20 AMP	AC	SPARE	15 AMP	6
7	20 AMP	AC	SPARE	20 AMP	8
9	15 AMP	METER PUMPS	SPARE	20 AMP	10
11	15 AMP	UV	SPARE	15 AMP	12
13	15 AMP	SPARE	FAN	15 AMP	14
15	15 AMP	SPARE	CONTROL PANEL	15 AMP	16
17	15 AMP	SPARE	SPARE	15 AMP	18
19	15 AMP	SPARE	SPARE	15 AMP	20
21	15 AMP	EM	SPARE	15 AMP	22
23	15 AMP	PANEL	SPARE	15 AMP	24

APPENDIX A – EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

New York State Department of Environmental Conservation
Division of Water
Bureau of Water Permits, 4th Floor
625 Broadway, Albany, New York 12233-3505
Phone: (518) 402-8111 • FAX: (518) 402-9029
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

RECEIVED
JAN 13 2005
REGION IV HEADQUARTERS
SCHENECTADY, N.Y. 12306

MEMORANDUM

TO: Daniel Lightsey , NYSDEC, R-4
FROM: Sudhir mahatma, DOW, BWP, Cental Office SM
SUBJECT: BASF - Rensselaer Facility , Site # 4-42-027
DRAINAGE BASIN: 13-01
DATE: January 12, 2005

In response to your request dated July 6,2004 and Andrea's email dated Sept.2,2004 , attached please find effluent criteria for the above noted remediation discharge.

The DOW does not have any regulatory authority over a discharge from a State, PRP, or Federal Superfund Site. DER will be responsible for ensuring compliance with the attached effluent criteria and approval of all engineering submissions. Footnote 1 identifies the appropriate DER Section Chief as the place to send all effluent results, engineering submissions, and modification requests. The Regional Water Engineer should be kept appraised of the status of this discharge and, in accordance with the attached criteria, receive a copy of the effluent results for informational purposes.

If you have any questions, please call me at 518-402-8126.

Attachment (Effluent Criteria)

cc: Fred Sievers, Regional Water Engineer, R-4 (w/Effluent Criteria)
Shayne Mitchell, BWP Section Chief, DOW (w/Effluent Criteria)
Ron Entringer, DOW (w/Effluent Criteria)

RECEIVED
APR 5 2005
By

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning January 2005

and lasting until January 2010

the discharges from the treatment facility to Hudson River, water index number H-portion, Class C and re-injected discharge from the treatment facility ,at select locations in the interior of the Main Plant, shall be limited and monitored by the operator as specified below:

Outfall Number and Parameter	Discharge Limitations		Units	Minimum Monitoring Requirements	
	Daily Avg.	Daily Max		Measurement Frequency	Sample Type
Outfall 001 - Treated Groundwater Remediation Discharge:					
Flow	Monitor	72,000	GPD	Continuous	Meter
pH (range)	6.5 to 8.5		SU	Weekly	Grab
Benzene	Monitor	1	µg/l	Weekly	Grab
Chlorobenzene	Monitor	5	µg/l	Weekly	Grab
1,2 Dichloroethane	Monitor	0.6	µg/l	Weekly	Grab
Ethylbenzene	Monitor	5	µg/l	Weekly	Grab
Toluene	Monitor	5	µg/l	Weekly	Grab
1,2,4 Trichlorobenzene	Monitor	5	µg/l	Weekly	Grab
Vinyl Chloride	Monitor	2	µg/l	Weekly	Grab
Butylbenzyl phthalate	Monitor	10	µg/l	Weekly	Grab
Bis(2-ethylhexyl)phthalate	Monitor	5	µg/l	Weekly	Grab
Naphthalene	Monitor	10	µg/l	Weekly	Grab
Phenol	Monitor	2	µg/l	Weekly	Grab
Aluminum	Monitor	2,000	µg/l	Weekly	Grab
Arsenic	Monitor	50	µg/l	Weekly	Grab
Barium	Monitor	1,200	µg/l	Weekly	Grab
Chromium	Monitor	100	µg/l	Weekly	Grab
Cobalt	Monitor	140	µg/l	Weekly	Grab
Copper	Monitor	330	µg/l	Weekly	Grab
Iron	Monitor	600	µg/l	Weekly	Grab

Manganese	Monitor	300	µg/l	Weekly	Grab
Nickel	Monitor	200	µg/l	Weekly	Grab
Zinc	Monitor	1,000	µg/l	Weekly	Grab
Sodium	Monitor	Monitor	µg/l	Weekly	Grab
Total Dissolved Solids	Monitor	Monitor	µg/l	Weekly	Grab

Additional Conditions:

(1) Discharge is not authorized until such time as an engineering submission showing the method of treatment is approved by the Department. The discharge rate may not exceed the effective or design treatment system capacity. All monitoring data, engineering submissions and modification requests must be submitted to:

Daniel Lightsey
Division of Environmental Remediation
NYSDEC,
1150 North Westcott Road
Schenctady, NY 12306-2014

518-357-2374

With a copy sent to:
Fred Sievers
Regional Water Engineer, Region-4
NYSDEC
1150 North Westcott Rd
Schenctady, NY 12306 - 2014

518-357-2045

(2) Only site generated wastewater is authorized for treatment and discharge.

(3) Authorization to discharge is valid only for the period noted above but may be renewed if appropriate. A request for renewal must be received 6 months prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

(4) Both concentration (mg/l or µg/l) and mass loadings (lbs/day) must be reported to the Department for all parameters except flow and pH.

(5) Any use of corrosion/scale inhibitors, biocidal-type compounds, or other water treatment chemicals used in the treatment process must be approved by the department prior to use.

(6) This discharge and administration of this discharge must comply with the substantive requirements of 6NYCRR Part 750.

APPENDIX B – EQUIPMENT SPECIFICATIONS/NES OPERATION & MAINTENANCE MANUAL/WARRANTY INFORMATION

National Environmental Systems
84 Dunham Street
Attleboro, MA 02703

NES MAJOR COMPONENT SUMMARY | **REVISION 0 (90%)** | MARCH 23, 2016

PROJECT NO.: **15-183** | GES - BASF FACILITY - RENSSELAER, NY

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
SECTION 1 - SUMMARY OF EQUIPMENT					
COMPONENT SUMMARY					
SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)					
M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)	M-1				
T-1, P&ID INSTRUMENTATION TABLE	T-1				
M-2, SYSTEM LAYOUT DRAWING	M-2				
M-3, INFLUENT MANIFOLD	M-3				
M-4, T-201 INFLUENT EQUALIZATION TANK	M-4				
M-5, SKID 1 - EQ TANK EFFLUENT PUMP & PRE-TRAY STRIPPER FILTER HOUSINGS	M-5				
M-6, SKID 2 - TRAY STRIPPER	M-6				
M-7, LT-301 LEVEL TRANSMITTER	M-7				
M-8, SKID 3 - POST-TRAY STRIPPER FILTER HOUSINGS	M-8				
M-9, SKID 4 - LIQUID PHASE CARBON	M-9				
M-10, T-701 BACKWASH SUPPLY TANK	M-10				
M-11, SKID 5 - BACKWASH FEED PUMP	M-11				
M-12, T-801 BACKWASH SUPERNATANT TANK	M-12				
M-13, SKID 6 - SUPERNATANT TANK PUMP(S)	M-13				
SECTION 3 - PROCESS EQUIPMENT					
CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN / OUT	FX-101	1	HARMSCO	HUR3X170FL-XP	
UV DISINFECTION ASSEMBLY	UV-101	1	PURTEST	AS-V16	
EQUALIZATION TANK, HDPE, 1500 GALLON, 1.7 SG	T-201	1	ACE ROTOMOLD	VT1500-64	
TRANSFER PUMP, CENTRIFUGAL, 5 HP, 5-1/2 IN IMPELLER	P-201	1	GOULDS	2ST1J5H4	
TRANSFER PUMP MOTOR, 5 HP 3-PHASE 460 VAC	P-201	1	BLUFFTON		
CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN / OUT	FX-201,202	2	HARMSCO	HUR3X170FL-XP	
BLOWER INLET FILTER / SILENCER, 6 IN	F-301	1	SOLBERG	FS-275P-600F	
BLOWER DILUTION FILTER / SILENCER, 3 IN	F-302	1	SOLBERG	FS-235P-300	
AIR STRIPPER, 6-TRAY, 304SS, 1-120 GPM	AS-301	1	QED	EZ TRAY 12.6SS	
TRANSFER PUMP, CENTRIFUGAL, 5 HP, 6-1/8 IN IMPELLER	P-301	1	GOULDS	2ST1J5K4	
TRANSFER PUMP MOTOR, 5 HP 3-PHASE 460 VAC TEFC	P-301	1	BLUFFTON		
REGENERATIVE BLOWER, 25HP, 650 CFM	B-301	1	FPZ	SCL K09-TS-25-3 B	
BLOWER MOTOR, 25HP 460VAC, TEFC	B-301	1	LAFERT		
VAPOR PHASE MEDIA VESSEL, 2000 LB VGAC / 3000 LB KMnO4 CAPACITY	VGAC-301, 302, IOX-303	3	TETRASOLV	VF-2000	
4 x 10 VIRGIN VGAC MEDIA	VGAC-301, 302	4000 LB	CARBON ACTIVATED	COC A60	
HS-600 MEDIA (6% KMnO4)	IOX-303	3000 LB	HYDROSIL	HS600	
CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN/OUT	FX-401,402	2	HARMSCO	HUR3X170FL-XP	
LIQUID PHASE CARBON VESSEL, 75 PSIG, 2000 LB	LGAC-501,502,503	3	TETRASOLV	HPAF-2000	
8 x 30 LO-RISE VIRGIN LGAC MEDIA	LGAC-501,502,503	4500	CARBON ACTIVATED	ACOL GL60	
BACKWASH SUPPLY TANK, HDPE, 1500 GALLON, 1.7 SG	T-701	1	ACE ROTOMOLD	VT01500-64	
TRANSFER PUMP, CENTRIFUGAL, 5 HP	P-701	1	AMT	3152-95	
TRANSFER PUMP MOTOR, 5 HP 3-PHASE 460 VAC TEFC	P-701	1	AMT	1626-352-00	
BACKWASH SUPERNATANT TANK, HDPE, 1600 GALLON, 30° CONICAL BOTTOM	T-801	1	ACE ROTOMOLD	CB1600-90	
BACKWASH SUPERNATANT TANK STAND, 30° CONICAL BOTTOM	T-801		ACE ROTOMOLD	CB90T-30ST	
TRANSFER PUMP, CENTRIFUGAL, 0.5 HP, 460 VAC, 3-PHASE, 4 3/4 IN IMPELLER	P-801	1	GOULDS	1ST1D5D4	
TRANSFER PUMP MOTOR, 0.5 HP 3-PHASE 460 VAC TEFC	P-801	1	BLUFFTON		
PUMP, DIAPHRAGM, 1.5 HP	P-802	1	AMT	336E-K6	
PUMP MOTOR, 1.5 HP 3-PHASE 460 VAC TEFC, 56C	P-802	1	BALDOR	VEM3554	
BAG FILTER HOUSING, TRADE SIZE 2, ALUMINUM	FX-801	1	MICRON TECH	8-30-2P-2-150-AL-PB-VS	
METERING PUMP, 1 GPH, 115 VAC	MP-1001, 1002	2	LMI	AD951-935SI	
SUMP PUMP, 3/10 HP 1-PHASE 115 VAC	P-1200	1	ZOELLER	M57	
SECTION 4 - PROCESS VALVES					
BALL VALVE, BRASS, 1 IN	BV-101 / 106	6	APOLLO	94A10501	
CHECK VALVE, BRASS, 1 IN	CK-101 / 106	6	LEGEND	105-105NL	
TRUE UNION BALL VALVE, PVC, 1-1/2 IN	BV-107 / 109	3	SPEARS	3639-015	
BALL VALVE, BRASS, 1-1/2 IN DRAIN	BV-110,111	2	APOLLO	94A10701	
BALL VALVE, BRASS, 1-1/2 IN	BV-112,113	2	APOLLO	94A10701	
BALL VALVE, BRASS, 1 IN DRAIN	BV-201	1	APOLLO	94A10501	
TRUE UNION BALL VALVE, PVC, 3 IN	BV-202	1	SPEARS	1832-030	
CHECK VALVE, BRASS, 2 IN	CK-201	1	LEGEND	105-108NL	
GATE VALVE, BRASS, 2 IN	GV-201	1	LEGEND	104-468	
TRUE UNION 3-WAY BALL VALVE, PVC, 2 IN	MOV-201, 401, 600	3	HAYWARD	TW1200ST-EK61	
ELECTRIC ACTUATOR	MOV-201, 401, 600	3	MAXAIRTECH	AE03-120VAC-LED	
TRUE UNION BALL VALVE, PVC, 2 IN	BV-203 / 206	4	SPEARS	3629-020	
BALL VALVE, BRASS, 1-1/2 IN	BV-207 / 210	4	APOLLO	94A10701	
BUTTERFLY VALVE, DUCTILE IRON, SS DISC, 6 IN	BFV-301 / 303	3	JOMAR	600-06 DSPL	
BALL VALVE, BRASS, 0.75 IN	BV-301	1	APOLLO	94A10401	

Operation & Maintenance Manual

NES PROJECT NUMBER: 15-183, June 2016
PROJECT NAME: Groundwater Treatment System – Process Equipment & Controls
BASF Facility
36 Riverside Avenue
Rensselaer, NY

Prepared for:

GES, Inc.
1599 Route 34
Wall, NJ 07727

Sales: (508)226-1100 Option 2
Technical Support: (508)226-1100 Option 3

Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz

OPERATION & MAINTENANCE MANUAL

NES 15-183 - GES - BASF FACILITY - RENSSELAER, NY

SECTION 1 - SUMMARY OF EQUIPMENT

COMPONENT SUMMARY

WARRANTY STATEMENT

SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)

M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)

T-1, P&ID INSTRUMENTATION TABLE

M-2, SYSTEM LAYOUT DRAWING

M-3, INFLUENT MANIFOLD

M-4, T-201 INFLUENT EQUALIZATION TANK

M-5, SKID 1 - EQ TANK EFFLUENT PUMP & PRE-TRAY STRIPPER FILTER HOUSINGS

M-6, SKID 2 - TRAY STRIPPER

M-7, LT-301 LEVEL TRANSMITTER

M-8, SKID 3 - POST-TRAY STRIPPER FILTER HOUSINGS

M-9, SKID 4 - LIQUID PHASE CARBON

M-10, T-701 BACKWASH SUPPLY TANK

M-11, SKID 5 - BACKWASH FEED PUMP

M-12, T-801 BACKWASH SUPERNATANT TANK

M-13, SKID 6 - SUPERNATANT TANK PUMP(S)

SECTION 3 - PROCESS EQUIPMENT

FX-101 CARTRIDGE FILTER HOUSING, (3) ELEMENTS, 3 IN IN / OUT - HARMSCO HUR3X170FL-XP

UV-101 UV DISINFECTION ASSEMBLY - PURTEST AS-V16

T-201 EQUALIZATION TANK, HDPE, 1500 GALLON, 1.7 SG - ACE ROTOMOLD VT1500-64

P-201 TRANSFER PUMP, CENTRIFUGAL, 5 HP, 5-1/2 IN IMPELLER - GOULDS 2ST1J5H4

FX-201,202 CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN / OUT - HARMSCO HUR3X170FL-XP

F-301 BLOWER INLET FILTER / SILENCER, 6 IN - SOLBERG FS-275P-600F

F-302 BLOWER DILUTION FILTER / SILENCER, 3 IN - SOLBERG FS-235P-300

AS-301 AIR STRIPPER (AS), 6-TRAY, 304SS, 1-120 GPM - QED EZ TRAY 12.6SS

P-301 TRANSFER PUMP, CENTRIFUGAL, 5 HP, 6-1/8 IN IMPELLER - GOULDS 2ST1J5K4

B-301 AS REGENERATIVE BLOWER, 25HP, 650 CFM - FPZ SCL K09-TS-25-3 B

VGAC-301, 302, IOX-303 VAPOR PHASE MEDIA VESSEL - TETRASOLV VF-2000

VGAC-301, 302 4 x 10 VIRGIN MEDIA – (2) x 2000 LB CARBON ACTIVATED COC A60

IOX-303 HS-600 MEDIA (6% KMnO4), 4 x 6 – 3000 LB HYDROSIL HS600

FX-401,402 CARTRIDGE FILTER HOUSING, (3) ELEMENTS, 3 IN IN/OUT - HARMSCO HUR3X170FL-XP

LGAC-501,502,503 LIQUID PHASE CARBON VESSEL, 75 PSIG - TETRASOLV HPAF-2000

LGAC-501,502,503 8 x 30 LO-RISE VIRGIN MEDIA (3) x 1500 LB - CARBON ACTIVATED ACOL GL60

T-701 BACKWASH SUPPLY TANK, HDPE, 1500 GALLON, 1.7 SG - ACE ROTOMOLD VT01500-64

P-701 TRANSFER PUMP, CENTRIFUGAL, 5 HP - AMT 3152-95

T-801 BACKWASH SUPERNATANT TANK, HDPE, 1600 GAL 30° CONICAL - ACE ROTOMOLD CB1600-90

T-801 BACKWASH SUPERNATANT TANK STAND, 30° CONICAL BOTTOM - ACE ROTOMOLD CB90T-30ST

P-801 TRANSFER PUMP, CENTRIFUGAL, 0.75 HP, 460 VAC, 3-PHASE, 4 3/4 IN IMPELLER - GOULDS 1ST1D5D4

P-802 PUMP, DIAPHRAGM, 1.5 HP - AMT 336E-K6

FX-801 BAG FILTER HOUSING, TRADE SIZE 2, ALUMINUM - MICRON TECH 8-30-2P-2-150-AL-PB-VS

MP-1001, 1002 METERING PUMP, 1 GPH, 115 VAC - LMI AD951-935SI

P-1200 SUMP PUMP, 0.3 HP, 1-PHASE, 115 VAC, 9.7A - ZOELLER M57-E

SECTION 4 - PROCESS VALVES

MOV-201, 401, 600 TRUE UNION 3-WAY BALL VALVE, PVC, 2 IN - HAYWARD TW1200ST-EK61

MOV-201, 401, 600 ELECTRIC ACTUATOR - MAXAIRTECH AE03-120VAC-LED

VRV-301 VACUUM RELIEF VALVE, 3 IN FNPT, ADJUSTABLE - FPZ VRL9

MOV-601,602 TRUE UNION BALL VALVE, PVC, 2 IN - HAYWARD TB1200ST-EK61

MOV-601,602 ELECTRIC ACTUATOR - MAXAIRTECH AE02-120VAC-LED

VRV-601,602 VACUUM RELIEF VALVE, 1 IN FNPT - PLASTOMATIC VBM100V-PV

SECTION 5 - PROCESS INSTRUMENTATION

PI-101 / 106 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

FIT-101 / 106 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-101 / 106 FLOW SENSOR INSTALLATION FITTING, 0.75 IN - GF SIGNET PV8T007

PSH-101 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

PI-107,108 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

FIT-107 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-107 FLOW SENSOR INSTALLATION FITTING, 2 IN - GF SIGNET PV8T020

LT-201 EQ TANK ULTRASONIC LEVEL TRANSMITTER - FLOWLINE - ECHOSPAN LU80-5101

LSHH-200 EQ TANK EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

PI-200 / 204 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

PSH-201 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

TI-300 TEMPERATURE INDICATOR, (-20) TO 120 F - AV 1NFY8

PI-301 PRESSURE INDICATOR, 0 - 15 PSI - AV 4FLC1

LT-301 TRAY STRIPPER LEVEL TRANSMITTER - FPI SENSOR L500-TRANS

LSHH-300 TRAY STRIPPER EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

LSHH-301 POST-TRAY STRIPPER MS LEVEL SWITCH HIGH-HIGH - DWYER F6-HPS-31

VSL-301 VACUUM SWITCH - LOW, 4 TO 20 IWC - DWYER 1950-20-2F

VI-301, 302 VACUUM INDICATOR, (-) 60 - 0 IWC(V) - DWYER LPG4-D7522N

VI-303 VACUUM INDICATOR, (-) 100 - 0 IWC(V) - DWYER LPG4-D7722N

TI-301 TEMPERATURE INDICATOR, 0 TO 250 F - AV 1NFY4

FE-301 FLOW ELEMENT PITOT TUBE, 6 IN - DWYER DS-300-6

FI-301 PITOT TUBE MAGNEHELIC GAUGE, 0-3 IWC - DWYER 2003

PI-303 PRESSURE INDICATOR, 0 - 60 IWC - DWYER LPG4-D8422N

PSH-301 PRESSURE SWITCH - HIGH, 0.5 TO 2 PSID - DWYER 1950P-2-2F

PI-302 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

PI-401 / 404 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

DPT-401 PRESSURE TRANSMITTER, 0 - 25 PSID - DWYER 629-03-CH-P2-E5-S1

PSH-501 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

PI-501 / 506 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

PSH-600 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

FIT-601, 602 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-601 FLOW SENSOR INSTALLATION FITTING, 1.5 IN - GF SIGNET PV8T015

LSHH-700 BACKWASH SUPPLY TANK EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

LSH-700, LSL-700 BACKWASH SUPPLY TANK HIGH & LOW LEVEL SWITCH - GEMS MBLU40T

PI-701 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

FIT-701 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-701 FLOW SENSOR INSTALLATION FITTING, 3 IN - GF SIGNET PV8T030

LSHH-800 BACKWASH SUPERNATANT TANK EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

PI-801 / 803 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

LSL, 1001, 1002 CHEMICAL DRUM LOW LEVEL SWITCH - DWYER F7-SS2

LSHH-1200 BUILDING SUMP HIGH LEVEL SWITCH - DWYER F7-SB

LSHH-1201 CONTAINMENT PAD SUMP HIGH LEVEL SWITCH - DWYER F7-SB

TSL-1200 PROCESS AREA TEMPERATURE SWITCH LOW - DAYTON 2NNR6

SECTION 6 - ELECTRICAL DRAWINGS & TABLE(S)

HMI SCREEN SUMMARY / INSTRUCTIONS

T-2, INTERLOCK SCHEDULE

I-1A, MASTER CONTROL PANEL LAYOUT DRAWING

I-1B, MOTOR CONTROL PANEL LAYOUT DRAWING

T-3, PANEL BILL OF MATERIAL(S)

I-2, WIRING DIAGRAMS AND TERMINAL DETAILS

E-1, LINE DIAGRAM

T-5, VFD SETTINGS TABLE(S)

SECTION 7 - MASTER CONTROL PANEL COMPONENTS

ENCLOSURE NEMA 4 36 X 36 X 12 - MILD STEEL/GRAY - HAMMOND EN4SD363612GY

UPS 350VA 200W 120V 1PH 3 UPS & SURGE OUTLET 3 SURGE ONLY - APC BE350G

3G WIRELESS GATEWAY EVDO 800/1900 MHZ - VERIZON - SIERRA WIRELESS LS300 - 1101489

STATIC IP 12 IN MAGNET MOUNT ANTENNA 10FT RG174 CABLE SMA-MALE - WILSON ELECTRONICS 301125

RF COAXIAL SURGE PROTECTOR 698 MHZ 2.7 GHZ - POLYPHASER TSX-NFF

CPU 266 MHz PROCESSOR 50MB MEMORY FOR P3000 PAC - ADI P3-550

16PT 12-24VDC INPUT SINK/SOURCE FOR P3000 PAC - ADI P3-16ND3

16CH ANALOG CURRENT INPUT 16-BIT MODULE FOR P3000 PAC - ADI P3-16AD-1

ANALOG 4-CH OUT VOLTAGE/CURRENT 16-BIT FOR P3000 - ADI P3-04DA

16PT RELAY OUTPUT SPST 6-27VDC / 6-240VAC FOR P3000 PAC - ADI P3-16TR

C-MORE TOUCH PANEL 10 IN COLOR TFT ETHERNET & USB - ADI EA9-T10CL

POWER SUPPLY 24 VDC 5A 120W DIN RAIL SLIM LINE - ADI PSP24-120S

MUSHROOM SWITCH RED TRIGGER ACTION - TURN TO RELEASE - SQUARE D ZB5AS844_

SECTION 8 - MOTOR CONTROL PANEL COMPONENTS

ENCLOSURE NEMA 4 36 X 30 X 12 - MILD STEEL/GRAY - HAMMOND EN4SD363012GY

VENT FAN 210CFM 115VAC 6 IN - HAMMOND FAN150AC115

VENT FAN ADJ. 30-140F BI-METAL TEMP SWITCH N.O. - HAMMOND SKT011419NO

VFD ETHERNET SWITCH UNMANAGED 10/100 BASET RJ45 PORTS - ADI SE-SW5U

DURAPULSE VFD 5 HP 9.6 AMP 460V 3-PHASE - ADI GS3-45P0

VFD ETHERNET MODULE 100Mbps FOR GS SERIES AC DRIVES - ADI GS-EDRV100

SECTION 1 - SUMMARY OF EQUIPMENT

COMPONENT SUMMARY

WARRANTY STATEMENT

Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
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National Environmental Systems
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Attleboro, MA 02703

NES MAJOR COMPONENT SUMMARY **REVISION A** JUNE 2016

PROJECT NO.: **15-183** **GES - BASF FACILITY - RENSSELAER, NY**

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
SECTION 1 - SUMMARY OF EQUIPMENT					
COMPONENT SUMMARY					
WARRANTY STATEMENT					
SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)					
M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)	M-1				
T-1, P&ID INSTRUMENTATION TABLE	T-1				
M-2, SYSTEM LAYOUT DRAWING	M-2				
M-3, INFLUENT MANIFOLD	M-3				
M-4, T-201 INFLUENT EQUALIZATION TANK	M-4				
M-5, SKID 1 - EQ TANK EFFLUENT PUMP & PRE-TRAY STRIPPER FILTER HOUSINGS	M-5				
M-6, SKID 2 - TRAY STRIPPER	M-6				
M-7, LT-301 LEVEL TRANSMITTER	M-7				
M-8, SKID 3 - POST-TRAY STRIPPER FILTER HOUSINGS	M-8				
M-9, SKID 4 - LIQUID PHASE CARBON	M-9				
M-10, T-701 BACKWASH SUPPLY TANK	M-10				
M-11, SKID 5 - BACKWASH FEED PUMP	M-11				
M-12, T-801 BACKWASH SUPERNATANT TANK	M-12				
M-13, SKID 6 - SUPERNATANT TANK PUMP(S)	M-13				
SECTION 3 - PROCESS EQUIPMENT					
CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN / OUT	FX-101	1	HARMSCO	HUR3X170FL-XP	10021
UV DISINFECTION ASSEMBLY	UV-101	1	PURTEST	AS-V16	16C0842
EQUALIZATION TANK, HDPE, 1500 GALLON, 1.7 SG	T-201	1	ACE ROTOMOLD	VT1500-64	N/A
TRANSFER PUMP, CENTRIFUGAL, 5 HP, 5-1/2 IN IMPELLER	P-201	1	GOULDS	2ST1J5H4	C1608070
TRANSFER PUMP MOTOR, 5 HP 3-PHASE 460 VAC	P-201	1	BLUFFTON	1313007189	K10D32E2EB16
CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN / OUT	FX-201,202	2	HARMSCO	HUR3X170FL-XP	10020, 10022
BLOWER INLET FILTER / SILENCER, 6 IN	F-301	1	SOLBERG	FS-275P-600F	N/A
BLOWER DILUTION FILTER / SILENCER, 3 IN	F-302	1	SOLBERG	FS-235P-300	N/A
AIR STRIPPER, 6-TRAY, 304SS, 1-120 GPM	AS-301	1	QED	EZ TRAY 12.6SS	16T01400 4/04/16 JH
TRANSFER PUMP, CENTRIFUGAL, 5 HP, 6-1/8 IN IMPELLER	P-301	1	GOULDS	2ST1J5K4	C1608049
TRANSFER PUMP MOTOR, 5 HP 3-PHASE 460 VAC TEFC	P-301	1	BLUFFTON	1313007189	K10D32E2EB1G
REGENERATIVE BLOWER, 25HP, 650 CFM	B-301	1	FPZ	SCL K09-TS-25-3 B	F20464 2016
BLOWER MOTOR, 25HP 460VAC, TEFC	B-301	1	LAFERT	AM160LXAZ	1154610
VAPOR PHASE MEDIA VESSEL, 2000 LB VGAC / 3000 LB KMnO4 CAPACITY	VGAC-301, 302, IOX-303	3	TETRASOLV	VF-2000	4611JB-1, 4611JB-2, 4611JB-3
4 x 10 VIRGIN VGAC MEDIA	VGAC-301, 302	4000 LB	CARBON ACTIVATED	COC A60	N/A
HS-600 MEDIA (6% KMnO4), 4 x 6	IOX-303	3000 LB	HYDROSIL	HS600	61524
CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN/OUT	FX-401,402	2	HARMSCO	HUR3X170FL-XP	10023, 10019
LIQUID PHASE CARBON VESSEL, 75 PSIG, 2000 LB	LGAC-501,502,503	3	TETRASOLV	HPAF-2000	4612JB-1, 4612JB-2, 4612JB-3
8 x 30 LO-RISE VIRGIN LGAC MEDIA	LGAC-501,502,503	4500	CARBON ACTIVATED	ACOL GL60	N/A
BACKWASH SUPPLY TANK, HDPE, 1500 GALLON, 1.7 SG	T-701	1	ACE ROTOMOLD	VT01500-64	N/A
TRANSFER PUMP, CENTRIFUGAL, 5 HP	P-701	1	AMT	3152-95	N/A
TRANSFER PUMP MOTOR, 5 HP 3-PHASE 460 VAC TEFC	P-701	1	AMT (US motor)	1626-352-00	W11 7634078-0045 M 0020
BACKWASH SUPERNATANT TANK, HDPE, 1600 GALLON, 30° CONICAL BOTTOM	T-801	1	ACE ROTOMOLD	CB1600-90	N/A
BACKWASH SUPERNATANT TANK STAND, 30° CONICAL BOTTOM	T-801		ACE ROTOMOLD	CB90T-30ST	N/A
TRANSFER PUMP, CENTRIFUGAL, 0.75 HP, 460 VAC, 3-PHASE, 4 3/4 IN IMPELLER	P-801	1	GOULDS	1ST1D5D4	E1504864
TRANSFER PUMP MOTOR, 0.75 HP 3-PHASE 460 VAC TEFC	P-801	1	BLUFFTON	1313460103	1503100392
PUMP, DIAPHRAGM, 1.5 HP	P-802	1	AMT	336E-K6	N/A
PUMP MOTOR, 1.5 HP 3-PHASE 460 VAC TEFC, 56C	P-802	1	BALDOR	VEM3554	F1603232908
BAG FILTER HOUSING, TRADE SIZE 2, ALUMINUM	FX-801	1	MICRON TECH	8-30-2P-2-150-AL-PB-VS	SN-030716-9A
METERING PUMP, 1 GPH, 115 VAC	MP-1001, 1002	2	LMI	AD951-935SI	16034139954-1, 16034139954-2
SUMP PUMP, 0.3 HP, 1-PHASE, 115 VAC, 9.7A	P-1200	1	ZOELLER	M57-E	3/1/2015
SECTION 4 - PROCESS VALVES					
BALL VALVE, BRASS, 1 IN	BV-101 / 106	6	SPEARS	3629-010	N/A
CHECK VALVE, BRASS, 1 IN	CK-101 / 106	6	LEGEND	105-105NL	N/A
TRUE UNION BALL VALVE, PVC, 1-1/2 IN	BV-107 / 109	3	SPEARS	3639-015	N/A
BALL VALVE, BRASS, 1-1/2 IN DRAIN	BV-110,111	2	APOLLO	94A10701	N/A
BALL VALVE, BRASS, 1-1/2 IN	BV-112,113	2	APOLLO	94A10701	N/A
BALL VALVE, BRASS, 1 IN DRAIN	BV-201	1	APOLLO	94A10501	N/A
TRUE UNION BALL VALVE, PVC, 3 IN	BV-202	1	SPEARS	1832-030	N/A
CHECK VALVE, BRASS, 2 IN	CK-201	1	LEGEND	105-108NL	N/A
GATE VALVE, BRASS, 2 IN	GV-201	1	LEGEND	104-468	N/A
TRUE UNION 3-WAY BALL VALVE, PVC, 2 IN	MOV-201, 401, 600	3	HAYWARD	TW1200ST-EK61	N/A
ELECTRIC ACTUATOR	MOV-201, 401, 600	3	MAXAIRTECH	AE03-120VAC-LED	E1602649, E1602651, E1602650
TRUE UNION BALL VALVE, PVC, 2 IN	BV-203 / 206	4	SPEARS	1839-020	N/A
BALL VALVE, BRASS, 1-1/2 IN	BV-207 / 210	4	APOLLO	94A10701	N/A
BUTTERFLY VALVE, DUCTILE IRON, SS DISC, 6 IN	BFV-301 / 303	3	JOMAR	600-06 DSPL	14060338109, 14032636637, 14060338109

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NES MAJOR COMPONENT SUMMARY **REVISION A** JUNE 2016

PROJECT NO.: **15-183** **GES - BASF FACILITY - RENSSELAER, NY**

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
BALL VALVE, BRASS, 0.75 IN	BV-301	1	APOLLO	94A10401	N/A
TRUE UNION BALL VALVE, PVC, 3 IN	BV-302	1	SPEARS	1832-030	N/A
CHECK VALVE, BRASS, 2 IN	CK-301	1	LEGEND	105-108NL	N/A
GATE VALVE, BRASS, 2 IN	GV-301, 302	2	LEGEND	104-468	N/A
VACUUM RELIEF VALVE, 3 IN FNPT, ADJUSTABLE	VRV-301	1	FPZ	VRL9	N/A
TRUE UNION BALL VALVE, PVC, 2 IN	BV-401 / 404	4	SPEARS	1839-020	N/A
BALL VALVE, BRASS, 1-1/2 IN	BV-405 / 408	4	APOLLO	94A10701	N/A
BUTTERFLY VALVE, DUCTILE IRON, SS DISC, 3 IN	BFV-501 / 513	15	JOMAR	600-03 DSPL	055,063,075,056,078,088,059,050,074,076,087,079,082,072
BALL VALVE, BRASS, 0.75IN	BV-501 / 503	3	RuB	S.92	N/A
BALL VALVE, BRASS, 0.75IN	BV-504	1	APOLLO	94A10401	N/A
TRUE UNION BALL VALVE, PVC, 2 IN	BV-601,602	2	SPEARS	1839-020	N/A
BALL VALVE, BRASS, 0.5 IN DRAIN	BV-603,604	2	APOLLO	94A10301	N/A
TRUE UNION BALL VALVE, PVC, 2 IN	MOV-601,602	2	HAYWARD	TB1200ST-EK61	N/A
ELECTRIC ACTUATOR	MOV-601,602	2	MAXAIRTECH	AE02-120VAC-LED	E1602645 / E_ _ _ _ _ 47
VACUUM RELIEF VALVE, 1 IN FNPT	VRV-601,602	2	PLASTOMATIC	VBM100V-PV	N/A
BALL VALVE, BRASS, 1 IN DRAIN	BV-701	1	APOLLO	94A10501	N/A
TRUE UNION BALL VALVE, PVC, 3 IN	BV-702	1	SPEARS	1832-030	N/A
CHECK VALVE, BRASS, 3 IN	CK-701	1	LEGEND	105-110NL	N/A
GATE VALVE, BRASS, 3 IN	GV-701	1	LEGEND	104-470	N/A
BALL VALVE, BRASS, 1 IN DRAIN	BV-801	1	APOLLO	94A10501	N/A
TRUE UNION BALL VALVE, PVC, 2 IN	BV-802 / 807	6	SPEARS	1839-020	N/A
BALL VALVE, BRASS, 3/4 IN DRAIN	BV-808,809	2	APOLLO	94A10401	N/A
BALL VALVE, BRASS, 2 IN	BV-810,811	2	APOLLO	94A10801	N/A
CHECK VALVE, BRASS, 2 IN	CK-801	1	LEGEND	105-108NL	N/A
GATE VALVE, BRASS, 2 IN	GV-801	1	LEGEND	104-468	N/A
CHECK VALVE, BRASS, 2 IN	CK-1201	1	LEGEND	105-108NL	N/A
TRUE UNION BALL VALVE, PVC, 2 IN	BV-1201	1	SPEARS	1839-020	N/A
BALL VALVE, PLATED BRASS, 1/4 IN	SP	26	MIDLAND	46-931	N/A
SECTION 5 - PROCESS INSTRUMENTATION					
PRESSURE INDICATOR, 0 - 60 PSI	PI-101 / 106	6	DWYER	SGZ-D10422N-GF	N/A
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-101 / 106	6	GF SIGNET	3-2551-P0-22	61603140326/294530, 61603140333/294493, 61603140336/294533, 61604130278/299586, 61603140328/293541, 61603140331/294534
FLOW SENSOR INSTALLATION FITTING, 0.75 IN	FIT-101 / 106	6	GF SIGNET	PV8T007	N/A
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-101	1	DWYER	A1F-PC-SS-1-2	N/A
PRESSURE INDICATOR, 0 - 60 PSI	PI-107,108	2	DWYER	SGZ-D10422N-GF	N/A
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-107	1	GF SIGNET	3-2551-P0-22	61604250408/301321
FLOW SENSOR INSTALLATION FITTING, 2 IN	FIT-107	1	GF SIGNET	PV8T020	N/A
EQ TANK ULTRASONIC LEVEL TRANSMITTER	LT-201	1	FLOWLINE - ECHOSPAN	LU80-5101	160316-003278
EQ TANK EMERGENCY HIGH LEVEL SWITCH	LSHH-200	1	GEMS	MYEL40T	N/A
PRESSURE INDICATOR, 0 - 100 PSI	PI-200 / 204	5	DWYER	SGZ-D10522N-GF	N/A
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-201	1	DWYER	A1F-PC-SS-1-2	N/A
TEMPERATURE INDICATOR, (-20) TO 120 F	TI-300	1	AV	1NFY8	N/A
PRESSURE INDICATOR, 0 - 15 PSI	PI-301	1	AV	4FLC1	N/A
TRAY STRIPPER LEVEL TRANSMITTER	LT-301	1	FPI SENSOR	L500-TRANS	1516
TRAY STRIPPER EMERGENCY HIGH LEVEL SWITCH	LSHH-300	1	GEMS	MYEL40T	N/A
POST-TRAY STRIPPER MS LEVEL SWITCH HIGH-HIGH	LSHH-301	1	DWYER	F6-HPS-31	N/A
VACUUM SWITCH - LOW, 4 TO 20 IWC	VSL-301	1	DWYER	1950-20-2F	N/A
VACUUM INDICATOR, (-)60 - 0 IWC(V)	VI-301, 302	1	DWYER	LPG4-D7522N	N/A
VACUUM INDICATOR, (-)100 - 0 IWC(V)	VI-303	1	DWYER	LPG4-D7722N	N/A
TEMPERATURE INDICATOR, 0 TO 250 F	TI-301	1	AV	1NFY4	N/A
FLOW ELEMENT PITOT TUBE, 6 IN	FE-301	1	DWYER	DS-300-6	N/A
PITOT TUBE MAGNEHELIC GAUGE, 0-3 IWC	FI-301	1	DWYER	2003	N/A
PRESSURE INDICATOR, 0 - 60 IWC	PI-303	1	DWYER	LPG4-D8422N	N/A
PRESSURE SWITCH - HIGH, 0.5 TO 2 PSID	PSH-301	1	DWYER	1950P-2-2F	N/A
PRESSURE INDICATOR, 0 - 100 PSI	PI-302	1	DWYER	SGZ-D10522N-GF	N/A
PRESSURE INDICATOR, 0 - 100 PSI	PI-401 / 404	4	DWYER	SGZ-D10522N-GF	N/A
PRESSURE TRANSMITTER, 0 - 25 PSID	DPT-401	1	DWYER	629-03-CH-P2-E5-S1	N/A
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-501	1	DWYER	A1F-PC-SS-1-2	N/A
PRESSURE INDICATOR, 0 - 100 PSI	PI-501 / 506	6	DWYER	SGZ-D10522N-GF	N/A
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-600	1	DWYER	A1F-PC-SS-1-2	N/A
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-601, 602	2	GF SIGNET	3-2551-P0-22	61603090477/293551, 61603140339/294499
FLOW SENSOR INSTALLATION FITTING, 1.5 IN	FIT-601	2	GF SIGNET	PV8T015	N/A
BACKWASH SUPPLY TANK EMERGENCY HIGH LEVEL SWITCH	LSHH-700	1	GEMS	MYEL40T	N/A
BACKWASH SUPPLY TANK HIGH & LOW LEVEL SWITCH	LSH-700, LSL-700	2	GEMS	MBLU40T	N/A

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NES MAJOR COMPONENT SUMMARY **REVISION A** JUNE 2016

PROJECT NO.: **15-183** **GES - BASF FACILITY - RENSSELAER, NY**

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
PRESSURE INDICATOR, 0 - 60 PSI	PI-701	1	DWYER	SGZ-D10422N-GF	N/A
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-701	1	GF SIGNET	3-2551-P0-22	61603140338/293542
FLOW SENSOR INSTALLATION FITTING, 3 IN	FIT-701	1	GF SIGNET	PV8T030	N/A
BACKWASH SUPERNATANT TANK EMERGENCY HIGH LEVEL SWITCH	LSHH-800	1	GEMS	MYEL40T	N/A
PRESSURE INDICATOR, 0 - 60 PSI	PI-801 / 803	3	DWYER	SGZ-D10422N-GF	N/A
CHEMICAL DRUM LOW LEVEL SWITCH	LSL, 1001,1002	2	DWYER	F7-SS2	N/A
BUILDING SUMP HIGH LEVEL SWITCH	LSHH-1200	1	DWYER	F7-SB	N/A
CONTAINMENT PAD SUMP HIGH LEVEL SWITCH	LSHH-1201	1	DWYER	F7-SB	N/A
PROCESS AREA TEMPERATURE SWITCH LOW	TSL-1200	1	DAYTON	2NNR6	N/A
SECTION 6 - ELECTRICAL DRAWINGS & TABLE(S)					
HMI SCREEN SUMMARY / INSTRUCTIONS					
T-2, INTERLOCK SCHEDULE	T-2				
I-1A, MASTER CONTROL PANEL LAYOUT DRAWING	I-1A				
I-1B, MOTOR CONTROL PANEL LAYOUT DRAWING	I-1B				
T-3, PANEL BILL OF MATERIAL(S)	T-3				
I-2, WIRING DIAGRAMS AND TERMINAL DETAILS	I-2				
T-4, NEC LOAD CALCULATIONS	T-4				
E-1, LINE DIAGRAM	E-1				
T-5, VFD SETTINGS TABLE(S)	T-5				
SECTION 7 - MASTER CONTROL PANEL COMPONENTS					
ENCLOSURE NEMA 4 36 X 36 X 12 - MILD STEEL/GRAY	ENCL	1	HAMMOND	EN4SD363612GY	UL: A-11975165
BACK-PANEL 36 X 36 MILD STEEL/WHT	ENCL	1	HAMMOND	EP3636	N/A
MOUNTING FEET SET OF 4 - ZINC PLATED	ENCL	1	HAMMOND	EZPMFHD	N/A
PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	ENCL	2	SCE	SCE-PLWKB	N/A
UPS 350VA 200W 120V 1PH 3 UPS & SURGE OUTLET 3 SURGE ONLY	UPS	1	APC	BE350G	4B1602P29875
3G WIRELESS GATEWAY EVDO 800/1900 MHZ - VERIZON	CM	1	SIERRA WIRELESS	LS300 - 1101489	JN61110472001011
LS300 BRACKET-DIN MOUNT	CM	1	SIERRA WIRELESS	6000558	N/A
STATIC IP 12 IN MAGNET MOUNT ANTENNA 10FT RG174 CABLE SMA-MALE	CM	1	WILSON ELECTRONICS	301125	N/A
RF COAXIAL SURGE PROTECTOR 698 MHZ 2.7 GHZ	CM	1	POLYPHASER	TSX-NFF	N/A
FOR POLYPHASER 1 FT LMR-195 COAXIAL CABLE ASSEMBLY	CM	1	GET WIRELESS	GW195-12-SM-NM	N/A
FOR POLYPHASER N MALE TO SMA FEMALE ADAPTER	CM	1	RF INDUSTRIES	RSA-3478	N/A
11-SLOT I/O BASE FOR P3000 PAC REQ P3-01AC OR P3-01DC	PLC	1	ADI	P3-11B	16222F100C1
POWER SUPPLY 100-240VAC FOR P3000 PAC	PLC	1	ADI	P3-01AC	16115F003D
CPU 266 MHz PROCESSOR 50MB MEMORY FOR P3000 PAC	PLC	1	ADI	P3-550	16126F163D2
16PT 12-24VDC INPUT SINK/SOURCE FOR P3000 PAC	PLC	4	ADI	P3-16ND3	161078061 / 161078068 / 161078069
16CH ANALOG CURRENT INPUT 16-BIT MODULE FOR P3000 PAC	PLC	1	ADI	P3-16AD-1	15Y17F071B
ANALOG 4-CH OUT VOLTAGE/CURRENT 16-BIT FOR P3000	PLC	1	ADI	P3-04DA	15Z29F013A4
16PT RELAY OUTPUT SPST 6-27VDC / 6-240VAC FOR P3000 PAC	PLC	2	ADI	P3-16TR	161148084 / 161148090
FILLER MODULE FOR P3000 PAC	PLC	3	ADI	P3-FILL	162028006 / 16028008 / 162028009
TERMINAL BLOCK FOR ALL 8 & 16 POINT I/O MODULES FOR P3000 PAC	PLC	8	ADI	P3-RTB	N/A
CABLE C-MORE PANEL TO ADI PLC RJ12 PORT 10 FT RS232C	HMI	1	ADI	EA-2CBL	N/A
C-MORE TOUCH PANEL 10 IN COLOR TFT ETHERNET & USB	HMI	1	ADI	EA9-T10CL	15Z21B038
C-MORE AC DC POWER ADAPTER FOR EA7 & EA9	HMI	1	ADI	EA-AC	N/A
VER97303 HMI MEMORY CARD 8 GB NON-VOLATILE DATA STORAGE	HMI	1	VERBATIM	19NY57	N/A
POWER SUPPLY 24 VDC 5A 120W DIN RAIL SLIM LINE	PS	1	ADI	PSP24-120S	N/A
RELAY 120V 1PDT W/LIGHT BLADE PARALLEL	CR1-10,12	11	IDEC	RH1B-UL-AC120V	N/A
SOCKET DIN RAIL/SURFACE 5-BLADE FOR RH1B	CR1-10,12	11	IDEC	SH1B-05	N/A
RELAY 2PDT 10AMP 120VAC W/INDICATOR LIGHT	CR11	1	IDEC	RH2B-UL-AC120V	N/A
SOCKET DIN RAIL/SURFACE 8-BLADE FOR RH2B	CR11	1	IDEC	SH2B-05	N/A
RELAY RV 6MM ASSEMBLED 110-120V AC/DC 6AMPS	MR1-4	4	IDEC	RV8H-L-AD110	N/A
RELAY 6MM ASSEMBLED 5VDC	MR5	1	WEIDMULLER	1122740000	N/A
DUPLEX GFCI RECEPTACLE 125 VAC 15 AMP 2-POLE NEMA 5-15R WHITE	SR	1	LEGRAND	1595-TRWRW	N/A
1-GANG WEATHERPROOF RECEPT. BOX	SR	1	RED DOT	IHD3- 1	N/A
CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	CB	1	SQUARE D	MG24430_	N/A
MUSHROOM SWITCH RED TRIGGER ACTION - TURN TO RELEASE	ESTOP	1	SQUARE D	ZB5AS844_	N/A
PILOT LIGHT HEAD - RED	LT	2	SQUARE D	ZB5AV043_	N/A
PILOT LIGHT HEAD - YELLOW	LT	1	SQUARE D	ZB5AV053_	N/A
CONTACT BLOCK 1-N.O. SCREW CLAMP	PB	2	SQUARE D	ZBE101_	N/A
CONTACT BLOCK 1-N.C. SCREW CLAMP	PB	1	SQUARE D	ZBE102_	N/A
PUSH BUTTON OPERATOR NON-ILLUM BLACK	PB	1	SQUARE D	ZB5AA2_	N/A
MOUNTING COLLAR LATCH	PB	2	SQUARE D	ZB5AZ009_	N/A
MOUNTING BASE120V GREEN PROTECTED LED	SW	1	SQUARE D	ZB5AVG3_	N/A
MOUNTING BASE120V RED PROTECTED LED	SW	2	SQUARE D	ZB5AVG4_	N/A
MOUNTING BASE120V YELLOW PROTECTED LED	SW	1	SQUARE D	ZB5AVG5_	N/A
2 POS SELECTOR SWITCH ILLUM. GREEN MAINTAINED	SW	1	SQUARE D	ZB5AK1233_	N/A

National Environmental Systems
84 Dunham Street
Attleboro, MA 02703

NES MAJOR COMPONENT SUMMARY **REVISION A** JUNE 2016

PROJECT NO.: **15-183** **GES - BASF FACILITY - RENSSELAER, NY**

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	TB	145	SQUARE D	NSYTRV22	N/A
TERMINAL BLOCK END BARRIERS GRAY	TB	9	SQUARE D	NSYTRAC22	N/A
TERMINAL BLOCK END ANCHORS	TB	6	SQUARE D	NSYTRAABV35	N/A
TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	TB	6	SQUARE D	NSYTRV22PE	N/A
LOAD CENTER GROUND BAR 15 TERMINALS	GB	1	SQUARE D	PK15GTA	N/A
SECTION 8 - MOTOR CONTROL PANEL COMPONENTS					
ENCLOSURE NEMA 4 36 X 30 X 12 - MILD STEEL/GRAY	ENCL	1	HAMMOND	EN4SD363012GY	UL: A-11975166
BACK-PANEL 36 X 30 MILD STEEL/WHT	ENCL	1	HAMMOND	EP3630	N/A
MOUNTING FEET SET OF 4 - ZINC PLATED	ENCL	1	HAMMOND	EZPMFHD	N/A
PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	ENCL	2	SCE	SCE-PLWKB	N/A
VENT FAN 210CFM 115VAC 6 IN	VF	1	HAMMOND	FAN150AC115	N/A
VENT FAN ADJ. 30-140F BI-METAL TEMP SWITCH N.O.	VF	1	HAMMOND	SKT011419NO	N/A
VENT FAN FINGER GUARD 6 IN	VF	1	HAMMOND	FAN150FG	N/A
VENT FAN 6 IN RAIN HOOD GRILL & SOLID COVER KIT	VF	2	HAMMOND	RHA40000G	N/A
VENT FAN 6 IN RAIN HOOD NEMA 3R	VF	2	HAMMOND	RHA40000GY	N/A
VENT FAN POWER CORD 24 IN	VF	1	HAMMOND	DNMFC	N/A
VENT FAN 6 IN FILTER FOR LOUVER KIT	VF	1	HOFFMAN	AFLT66	N/A
CONTACTOR 3PST-NO 120VAC 50A DIN RAIL (EXISTING EXTRACTION WELLS)	C1, C2	2	SQUARE D	LC1D50AG7	N/A
CONTACTOR 3PST-NO 120VAC 50A DIN RAIL	M1	1	SQUARE D	LC1D50AG7	N/A
3PH O/L RELAY 25-40 AMPS	M1	1	SQUARE D	LRD340L	N/A
CONTACTOR 3PST-NO 120VAC 20A DIN RAIL	M2,M3,M4	3	SQUARE D	LC1D09G7	N/A
3PH O/L RELAY 5.5-8 AMPS	M2	1	SQUARE D	LRD12	N/A
3PH O/L RELAY 1 - 1.6 AMPS	M3	1	SQUARE D	LRD06	N/A
3PH O/L RELAY 1.6-2.5 AMPS	M4	1	SQUARE D	LRD07	N/A
ETHERNET SWITCH UNMANAGED 10/100 BASET RJ45 PORTS	ESW	1	ADI	SE-SW5U	T15A004962
DURAPULSE VFD 5 HP 9.6 AMP 460V 3-PHASE	VFD 1,2	2	ADI	GS3-45P0	W15430038 / W15430100
GS3 VFD FLUSH MOUNT BEZEL FOR KEYPAD (MOUNT IN MCP)	VFD 1,2	2	ADI	GS3-BZL	N/A
DURAPULSE REMOTE VFD KEYPAD CABLE 16 FT	VFD 1,2	2	ADI	GS-CBL2-5L	N/A
CABLE GS DRIVE/EDRV 6.6FT RJ12-RJ12 6-WIRE RS485	VFD 1,2	2	ADI	GS-EDRV-CBL-2	N/A
ETHERNET MODULE 100Mbps FOR GS SERIES AC DRIVES	EIC 1,2	2	ADI	GS-EDRV100	N/A
TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	TB	136	SQUARE D	NSYTRV22	N/A
TERMINAL BLOCK END BARRIERS GRAY	TB	3	SQUARE D	NSYTRAC22	N/A
TERMINAL BLOCK END ANCHORS	TB	2	SQUARE D	NSYTRAABV35	N/A
TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	TB	1	SQUARE D	NSYTRV22PE	N/A
LOAD CENTER GROUND BAR 15 TERMINALS	GB	1	SQUARE D	PK15GTA	N/A

WARRANTY

All products not manufactured by RapidTech LLC d/b/a National Environmental Systems, carry the original manufacturer's warranty. Copies are available on request.

RapidTech LLC d/b/a National Environmental Systems, warrants its packaged and manufactured equipment against any defect in material or workmanship, under normal use and storage for a period of eighteen (18) months from date of manufacture and invoice, regardless of system start-up date. In the event that products are found to be defective within the warranty period, RapidTech LLC d/b/a National Environmental Systems, sole obligation and remedy shall be the furnishing of replacements for any defective parts, and such replacement parts shall be furnished but not installed by RapidTech LLC d/b/a National Environmental Systems RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, WILL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES IN ANY CLAIM SUIT OR PROCEEDINGS ARISING UNDER WARRANTY, NOR WILL RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, ACCEPT ANY LIABILITY FOR CLAIMS FOR LABOR, LOSS OR PROFIT, REPAIRS OR OTHER EXPENSES INCIDENTAL TO REPLACEMENT.

The warranty requires that the purchaser complete all operations and maintenance as detailed in each section of the Operation & Maintenance Manual supplied with the purchased system. In addition installation must comply with nationally recognized electrical and mechanical standards as well as best engineering practices in effect at the time of purchase.

The product warranty expressed above is our only warranty and may not be verbally changed or modified by any representative of RapidTech LLC d/b/a National Environmental Systems All freight costs incurred in shipping parts to or from RapidTech LLC d/b/a National Environmental Systems, or to the manufacturer if necessary are at the expense of the customer.

RapidTech LLC dba National Environmental Systems, will invoice the cost of any replacement parts. These parts will be credited upon certification the original part was defective and the defective part was returned within one week of notifying RapidTech LLC d/b/a National Environmental Systems, of the malfunction. If the part is found to have been misused no credit will be issued. In order for RapidTech LLC d/b/a National Environmental Systems, to ship a replacement part on account, all outstanding invoices must be current.

RapidTech LLC d/b/a National Environmental Systems, expressly disclaims any warranties, expressed or implied, including any warranty of merchantability or fit for particular purpose or any warranty arising from a course of dealing or usage of trade. Except to the extent required by applicable law. RapidTech LLC d/b/a National Environmental Systems, shall not be liable, in tort, contract or otherwise, for any loss or damage, whether direct, consequential or incidental, of any person or entity arising in connections with the equipment.

SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)

M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)

T-1, P&ID INSTRUMENTATION TABLE

M-2, SYSTEM LAYOUT DRAWING

M-3, INFLUENT MANIFOLD

M-4, T-201 INFLUENT EQUALIZATION TANK

M-5, SKID 1 - EQ TANK EFFLUENT PUMP & PRE-TRAY STRIPPER FILTER HOUSINGS

M-6, SKID 2 - TRAY STRIPPER

M-7, LT-301 LEVEL TRANSMITTER

M-8, SKID 3 - POST-TRAY STRIPPER FILTER HOUSINGS

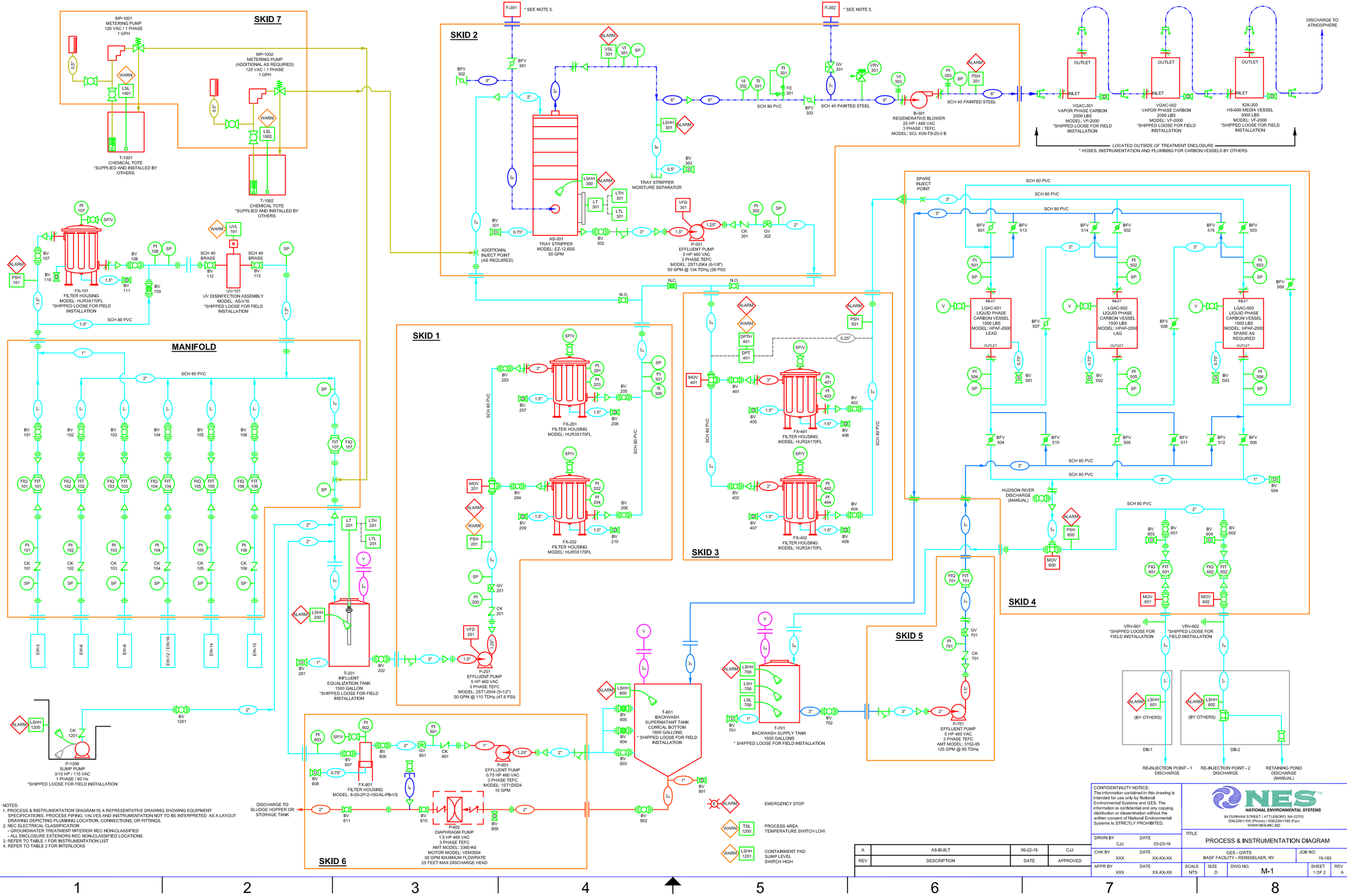
M-9, SKID 4 - LIQUID PHASE CARBON

M-10, T-701 BACKWASH SUPPLY TANK

M-11, SKID 5 - BACKWASH FEED PUMP

M-12, T-801 BACKWASH SUPERNATANT TANK

M-13, SKID 6 - SUPERNATANT TANK PUMP(S)


SKID 7
MP-1001
METERING PUMP
120 VAC / 1 PHASE
1 GPH
MP-1002
METERING PUMP
(ADDITIONAL AS REQUIRED)
120 VAC / 1 PHASE
1 GPH
T-1001
CHEMICAL TOTE
*SUPPLIED AND INSTALLED BY OTHERS
T-1002
CHEMICAL TOTE
*SUPPLIED AND INSTALLED BY OTHERS
FX-101
FILTER HOUSING
MODEL: HUR3X170FL
*SHIPPED LOOSE FOR FIELD INSTALLATION
UV-101
UV DISINFECTION ASSEMBLY
MODEL: AS-V16
*SHIPPED LOOSE FOR FIELD INSTALLATION
SCH 80 PVC
SCH 40 BRASS
MANIFOLD
EW-3
EW-4
EW-8
EW-12 / EW-16
EW-14
EW-15
P-1200
SUMP PUMP
3/10 HP / 115 VAC
1 PHASE / 60 Hz
*SHIPPED LOOSE FOR FIELD INSTALLATION
SKID 2
F-301
* SEE NOTE 5.
F-302
* SEE NOTE 5.
AS-301
TRAY STRIPPER
MODEL: EZ-12.6SS
50 GPM
TRAY STRIPPER
MOISTURE SEPARATOR
ADDITIONAL
INJECT POINT
(AS REQUIRED)
P-301
EFFLUENT PUMP
5 HP 460 VAC
3 PHASE TEFC
MODEL: 2ST1J5K4 (6-1/8")
50 GPM @ 134 TDH± (58 PSI)
SCH 80 PVC
B-301
REGENERATIVE BLOWER
25 HP / 460 VAC
3 PHASE / TEFC
MODEL: SCL K09-TS-25-3 B
SCH 40 PAINTED STEEL
VGAC-301
VAPOR PHASE CARBON
2000 LBS
MODEL: VF-2000
*SHIPPED LOOSE FOR FIELD INSTALLATION
VGAC-302
VAPOR PHASE CARBON
2000 LBS
MODEL: VF-2000
*SHIPPED LOOSE FOR FIELD INSTALLATION
IOX-303
HS-600 MEDIA VESSEL
3000 LBS
MODEL: VF-2000
*SHIPPED LOOSE FOR FIELD INSTALLATION
DISCHARGE TO ATMOSPHERE
LOCATED OUTSIDE OF TREATMENT ENCLOSURE
* HOSES, INSTRUMENTATION AND PLUMBING FOR CARBON VESSELS BY OTHERS
SKID 1
FX-201
FILTER HOUSING
MODEL: HUR3X170FL
FX-202
FILTER HOUSING
MODEL: HUR3X170FL
SKID 3
FX-401
FILTER HOUSING
MODEL: HUR3X170FL
FX-402
FILTER HOUSING
MODEL: HUR3X170FL
SKID 4
LGAC-501
LIQUID PHASE
CARBON VESSEL
1500 LBS
MODEL: HPAF-2000
LEAD
LGAC-502
LIQUID PHASE
CARBON VESSEL
1500 LBS
MODEL: HPAF-2000
LAG
LGAC-503
LIQUID PHASE
CARBON VESSEL
1500 LBS
MODEL: HPAF-2000
SPARE AS
REQUIRED
HUDSON RIVER
DISCHARGE
(MANUAL)
VRV-601
*SHIPPED LOOSE FOR
FIELD INSTALLATION
VRV-602
*SHIPPED LOOSE FOR
FIELD INSTALLATION
(BY OTHERS)
(BY OTHERS)
DB-1
DB-2
RE-INJECTION POINT - 1
DISCHARGE
RE-INJECTION POINT - 2
DISCHARGE
RETAINING POND
DISCHARGE
(MANUAL)
SKID 5
T-701
BACKWASH SUPPLY TANK
1500 GALLONS
* SHIPPED LOOSE FOR FIELD INSTALLATION
P-701
EFFLUENT PUMP
5 HP 460 VAC
3 PHASE TEFC
AMT MODEL: 3152-95
125 GPM @ 85 TDH±
T-801
BACKWASH
SUPERNATANT TANK
CONICAL BOTTOM
1600 GALLONS
* SHIPPED LOOSE FOR FIELD INSTALLATION
T-201
INFLUENT
EQUALIZATION TANK
1500 GALLON
*SHIPPED LOOSE FOR FIELD INSTALLATION
P-201
EFFLUENT PUMP
5 HP 460 VAC
3 PHASE TEFC
MODEL: 2ST1J5H4 (5-1/2")
50 GPM @ 110 TDH± (47.6 PSI)
P-801
EFFLUENT PUMP
0.75 HP 480 VAC
3 PHASE TEFC
MODEL: 1ST1D5D4
10 GPM
SKID 6
P-802
DIAPHRAGM PUMP
1.5 HP 460 VAC
3 PHASE TEFC
AMT MODEL: 336E-K6
MOTOR MODEL: VEM3554
30 GPM MAXIMUM FLOWRATE
25 FEET MAX DISCHARGE HEAD
DISCHARGE TO
SLUDGE HOPPER OR
STORAGE TANK
EMERGENCY STOP
PROCESS AREA
TEMPERATURE SWITCH LOW
CONTAINMENT PAD
SUMP LEVEL
SWITCH HIGH
NOTES:
1. PROCESS & INSTRUMENTATION DIAGRAM IS A REPRESENTATIVE DRAWING SHOWING EQUIPMENT SPECIFICATIONS, PROCESS PIPING, VALVES AND INSTRUMENTATION NOT TO BE INTERPRETED AS A LAYOUT DRAWING DEPICTING PLUMBING LOCATION, CONNECTIONS, OR FITTINGS.
2. NEC ELECTRICAL CLASSIFICATION
- GROUNDWATER TREATMENT INTERIOR NEC NON-CLASSIFIED
- ALL ENCLOSURE EXTERIORS NEC NON-CLASSIFIED LOCATIONS
3. REFER TO TABLE 1 FOR INSTRUMENTATION LIST
4. REFER TO TABLE 2 FOR INTERLOCKS
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NATIONAL ENVIRONMENTAL SYSTEMS
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508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ
TITLE
PROCESS & INSTRUMENTATION DIAGRAM
GES - GWTS
BASF FACILITY - RENSSELAER, NY
JOB NO.
15-183
DRWN BY CJJ DATE 03-23-16
CHK BY XXX DATE XX-XX-XX
APPR BY XXX DATE XX-XX-XX
SCALE NTS
SIZE D
DWG NO. M-1
SHEET 1 OF 2
REV A
REV A AS-BUILT 06-22-16 CJJ
REV DESCRIPTION DATE APPROVED

INSTRUMENT IDENTIFICATION

INSTRUMENT TYPE / INSTRUMENT DESIGNATION (XX / XXX) — LOCALLY MOUNTED INSTRUMENT W / REMOTE DISPLAY

INSTRUMENT TYPE / INSTRUMENT DESIGNATION (XX / XXX) — LOCALLY MOUNTED INSTRUMENT W / DISPLAY

INSTRUMENT TYPE / INSTRUMENT DESIGNATION (XX / XXX) — LOCALLY MOUNTED SWITCH

INSTRUMENTATION ABBREVIATIONS

ADV	AUTOMATIC DRAIN VALVE
CC	CYCLE COUNTER
CF	COALESCING FILTER
D	DRAIN
DB	DISTRIBUTION BOX
DPI	DIFFERENTIAL PRESSURE INDICATOR
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
DPTH	DIFFERENTIAL PRESSURE TRANSMITTER HIGH
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIT	FLOW INDICATING TRANSMITTER
FIQ	FLOW TOTALIZER
FM	FLOW METER
FP	FLOW PORT
FS	FLOW SWITCH
FSL	FLOW SWITCH LOW
FT	FLOW TOTALIZER
LI	LEVEL INDICATOR
LIT	LEVEL INDICATING TRANSMITTER
LS	LEVEL SWITCH
LSHH	LEVEL SWITCH HIGH-HIGH
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW-LOW
LT	LEVEL TRANSMITTER
MOV	MOTOR OPERATED VALVE
OLH	OIL LEVEL HIGH
OLL	OIL LEVEL LOW
PF	PARTICULATE FILTER
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
PRV	PRESSURE REGULATING/RELIEF VALVE
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
PSV	PRESSURE SAFETY VALVE
PT	PRESSURE TRANSMITTER
SP	SAMPLE PORT
SP/V	SAMPLE PORT / VENT
SV	SOLENOID VALVE
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TIT	TEMPERATURE INDICATING TRANSMITTER
TS	TEMPERATURE SWITCH
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
UVL	ULTRAVIOLET LAMP SENSITIVITY LOW
V	VENT
VFD	VARIABLE FREQUENCY DRIVE
VI	VACUUM INDICATOR
VIT	VACUUM INDICATING TRANSMITTER
VRV	VACUUM RELIEF VALVE
VS	VACUUM SWITCH
VSH	VACUUM SWITCH HIGH
VSL	VACUUM SWITCH LOW
VSV	VACUUM SAFETY VALVE

PIPE DESIGNATION

- AIR LINE
- WATER LINE
- WATER LINE HEAT TRACED AND INSULATED
- CHEMICAL LINE
- PRODUCT LINE
- VENT LINE
- CONTROL LINE
- INTRINSICALLY SAFE LINE
- ANALOG LINE
- BREAK
- FLOW DIRECTION
- PIPE SIZE (X")

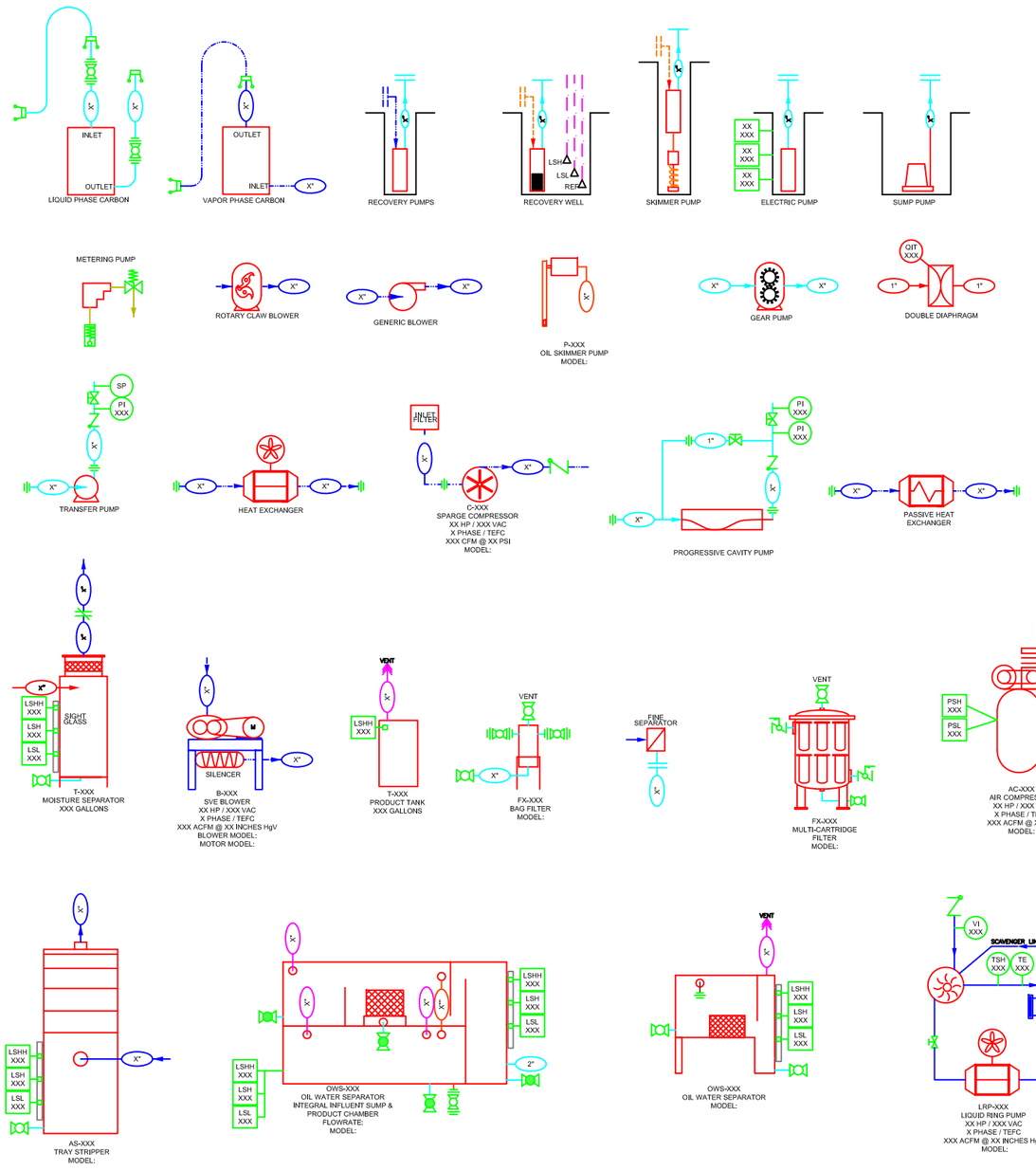
SYMBOLS

- ROTAMETER
- FLOW METER / TOTALIZER (FIQ XXX, FIT XXX)
- VARIABLE FREQUENCY DRIVE (VFD)
- STATIC MIXER
- DISCHARGE SILENCER
- DILUTION AIR FILTER
- INLET/INLINE FILTER
- COALESCING FILTER (CF)
- PARTICULATE FILTER (PF)
- AUTOMATIC CONDENSATE DRAIN (CD)
- ALARM DESIGNATION (ALARM)
- WARNING INDICATION (WARN)
- MULTIFUNCTION VALVE
- INJECT NOZZLE
- METERING PUMP INLET CHECK VALVE
- METERING PUMP FOOT VALVE
- CONDUCTANCE PROBES
- COPPER COIL
- HOSE CONNECTION

SYMBOLS CONTINUED

- FILTER REGULATOR (FR)
- CALIBRATION COLUMN
- GLOBE VALVE
- GATE VALVE
- TRUE UNION BALL VALVE
- BALL VALVE
- CHECK VALVE
- RAIN CAP
- BUTTERFLY VALVE
- Y-STRAINER
- RELIEF VALVE
- FEMALE CAMLOCK
- MALE CAMLOCK
- SOLENOID VALVE (SV XXX)
- PRESSURE REGULATOR
- SIPHON BREAK
- UNION
- CLEAR PVC
- MECHANICAL FLOAT
- PULSE-DAMPING SNUBBER
- PITOT TUBE
- SIGHT GLASS
- DRAIN (D)
- VENT (V)
- E-STOP (E)
- NEEDLE VALVE
- FLANGED CONNECTION
- REQUIRED FIELD CONNECTION
- FLEX CONNECTOR
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- MOTOR OPERATED BUTTERFLY VALVE (MOV XXX)
- MOTOR OPERATED VALVE (ADV XXX)
- 3-WAY MOTOR OPERATED VALVE (MOV XXX)

SYMBOLS CONTINUED



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REV	DESCRIPTION	DATE	APPROVED
A	AS-BUILT	06-22-16	CJJ

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DRWN BY	CJJ
DATE	03-23-16
CHK BY	XXX
DATE	XX-XX-XX
APPR BY	XXX
DATE	XX-XX-XX
TITLE	P&ID MASTER LEGEND
	GES - GWTS BASF FACILITY - RENSSELAER, NY
JOB NO.	15-183
SCALE	NTS
SIZE	D
DWG NO.	M-1
SHEET	2 OF 2
REV	A

TABLE 1
PROCESS INSTRUMENTATION DIAGRAM INSTRUMENT LIST

REVISION A JUNE 2016

15-183 GES - BASF FACILITY - RENSSELAER, NY

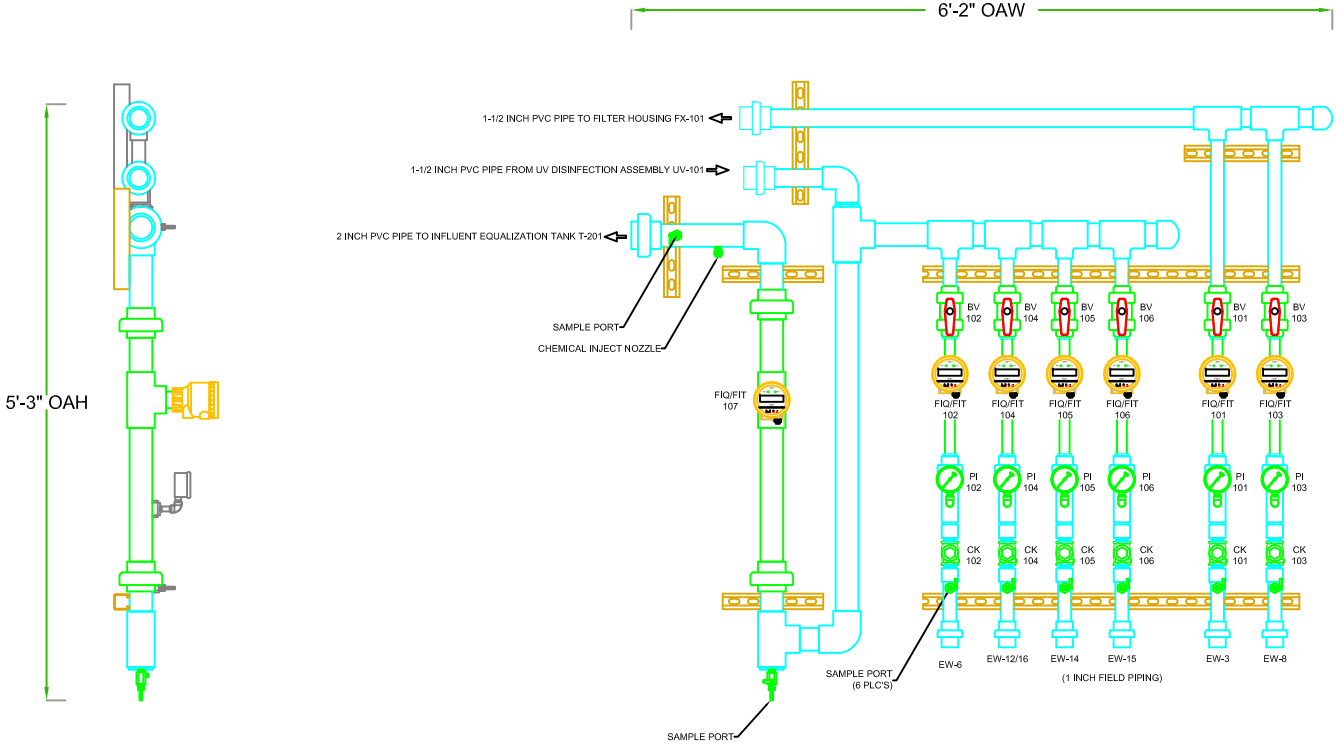
TAG	ITEM	MODEL	MANUFACTURER	SPECIFICATION
PI-101 / 106	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
FIT-101 / 106	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-101 / 106	FLOW SENSOR INSTALLATION FITTING, 0.75 IN	PV8T007	GF SIGNET	FLOWMETER INSTALLATION TEE / PVC / 0.75 IN
PSH-101	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
PI-107,108	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
FIT-107	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-107	FLOW SENSOR INSTALLATION FITTING, 2 IN	PV8T020	GF SIGNET	FLOWMETER INSTALLATION TEE / PVC / 2 IN
LT-201	EQ TANK ULTRASONIC LEVEL TRANSMITTER	LU80-5101	FLOWLINE - ECHOSPAN	ULTRASONIC LEVEL TRANSMITTER 9.8 FT RANGE / 4 IN DEAD BAND / PVDC WITH VITON GASKET / 12-28 VDC INPUT / 4-20 MA, 2-WIRE OUTPUT
LSHH-200	EQ TANK EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
PI-200 / 204	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
PSH-201	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
TI-300	TEMPERATURE INDICATOR, (-20) TO 120 F	1NFY8	AV	BIMETAL THERMOMETER / -20 TO 120 F / 2.5 INCH STEM / 3 INCH DIAL / 0.5 INCH MNPT BACK-MOUNT / SS CASE
PI-301	PRESSURE INDICATOR, 0 - 15 PSI	4FLC1	AV	0 TO 15 PSI / 2.5 INCH POLY CASE / BRASS INTERNALS / 0.25 INCH BOTTOM MOUNT / 212 F MAX PROCESS
LT-301	TRAY STRIPPER LEVEL TRANSMITTER	L500-TRANS	FPI SENSOR	CONTINUOUS LEVEL TRANSMITTER / SS ROD / 2 INCH NPT / SS FLOAT - S.G. 0.60 / N.C. - HH / 9.25 INCH UDB, 11 INCH MR, 2 INCH LDB / SPST / 50W / 10-30 VDC / 4-20 MA OUTPUT
LSHH-300	TRAY STRIPPER EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
LSHH-301	POST-TRAY STRIPPER MS LEVEL SWITCH HIGH-HIGH	F6-HPS-31	DWYER	HORIZONTAL MOUNT LEVEL SWITCH / POLYPROPYLENE FLOAT AND STEM / TEMPERATURE LIMIT 176 F / PRESSURE LIMIT 116 PSIG / SPECIFIC GRAVITY 0.6 MINIMUM
VSL-301	VACUUM SWITCH - LOW, 4 TO 20 IWC	1950-20-2F	DWYER	ADJUSTABLE 0.4 TO 20 IWC / 0.6 MAX DEAD BAND / -40 TO 140 F TEMP LIMITS / 45 IWC MAX PRESSURE / SPDT SWITCH TYPE / 15AMP @ 125 VAC SWITCH RATING / 0.125 INCH CONNECTION
VI-301, 302	VACUUM INDICATOR, (-)60 - 0 IWC(V)	LPG4-D7522N	DWYER	(-)60 TO 0 IWC-V / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT CONNECTION
VI-303	VACUUM INDICATOR, (-)100 - 0 IWC(V)	LPG4-D7722N	DWYER	(-)100 TO 0 IWC-V / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT CONNECTION
TI-301	TEMPERATURE INDICATOR, 0 TO 250 F	1NFY4	AV	BIMETAL THERMOMETER / 0 TO 250 F / 2.5 INCH STEM / 3 INCH DIAL / 0.5 INCH MNPT BACK-MOUNT / SS CASE
FE-301	FLOW ELEMENT PITOT TUBE, 6 IN	DS-300-6	DWYER	6 INCH AVERAGING STYLE PITOT TUBE / STAINLESS STEEL CONSTRUCTION WITH BRASS ISOLATION VALVE / 0 - 200 F TEMPERATURE LIMITS
FI-301	PITOT TUBE MAGNEHELIC GAUGE, 0-3 IWC	2003	DWYER	0 - 3 IN WC D.P. RANGE (MINOR DIV. 0.10) / CAST ALUMINUM CASE / 4 IN ACRYLIC COVER / -20 IN Hg TO 15 PSIG PRESSURE LIMITS / 20 - 140 F RANGE / 0.125 IN CONNECTIONS
PI-303	PRESSURE INDICATOR, 0 - 60 IWC	LPG4-D8422N	DWYER	0 - 60 IWC / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT

TABLE 1
PROCESS INSTRUMENTATION DIAGRAM INSTRUMENT LIST

REVISION A JUNE 2016

15-183 GES - BASF FACILITY - RENSSELAER, NY

TAG	ITEM	MODEL	MANUFACTURER	SPECIFICATION
PSH-301	PRESSURE SWITCH - HIGH, 0.5 TO 2 PSID	1950P-2-2F	DWYER	ADJUSTABLE / 0.5 TO 2 PSID / 0.3 MAX DEAD BAND @ 0.5 PSID / (-)40 TO 140 F TEMP RATING / 35 PSI MAX PRESSURE / SPDT SWITCH TYPE / 15AMP @ 125 VAC SWITCH RATING / 0.125 INCH PROCESS
PI-302	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
PI-401 / 404	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
DPT-401	PRESSURE TRANSMITTER, 0 - 25 PSID	629-03-CH-P2-E5-S1	DWYER	WET-WET DIFFERENTIAL PRESSURE TRANSMITTER / 25 PSID 0.5% ACCURACY / 316L SS / 0 - 200 F TEMP LIMITS / 50 PSI MAX PRESS / 4 - 20mA OUTPUT - 2 WIRE / 0.25 INCH FNPT / NEMA 4X CONDUIT
PSH-501	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
PI-501 / 506	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
PSH-600	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
FIT-601, 602	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-601	FLOW SENSOR INSTALLATION FITTING, 1.5 IN	PV8T015	GF SIGNET	FLOWMETER INSTALLATION TEE / PVC / 1.5 IN
LSHH-700	BACKWASH SUPPLY TANK EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
LSH-700, LSL-700	BACKWASH SUPPLY TANK HIGH & LOW LEVEL SWITCH	MBLU40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY OPEN / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
PI-701	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
FIT-701	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-701	FLOW SENSOR INSTALLATION FITTING, 3 IN	PV8T030	GF SIGNET	FLOWMETER INSTALLATION TEE - SADDLE / PVC / 3 IN
LSHH-800	BACKWASH SUPERNATANT TANK EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
PI-801 / 803	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
LSL, 1001,1002	CHEMICAL DRUM LOW LEVEL SWITCH	F7-SS2	DWYER	FLOAT SWITCH SG 0.75 / 316SS FLOAT, 316SS STEM / 300°F TEMP LIMIT / 450 PSIG PRESSURE LIMIT / 25 VA: 1A @ 200 VAC
LSHH-1200	BUILDING SUMP HIGH LEVEL SWITCH	F7-SB	DWYER	FLOAT SWITCH SG 0.60 / BUNA-N EPOXY 316 SS CONSTR / 220 F TEMP LIMIT / 150 PSIG PRESS LIMIT 0.125 IN PROCESS CONNECTION / 25 VA:1A @ 220 VAC
LSHH-1201	CONTAINMENT PAD SUMP HIGH LEVEL SWITCH	F7-SB	DWYER	FLOAT SWITCH SG 0.60 / BUNA-N EPOXY 316 SS CONSTR / 220 F TEMP LIMIT / 150 PSIG PRESS LIMIT 0.125 IN PROCESS CONNECTION / 25 VA:1A @ 220 VAC
TSL-1200	PROCESS AREA TEMPERATURE SWITCH LOW	2NNR6	DAYTON	LINE VOLTAGE THERMOSTAT / 0-120F RANGE / SINGLE POLE DOUBLE THROW



REV	DESCRIPTION	DATE	APPROVED
A	AS-BUILT	06-06-16	CJJ

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DRWN BY CJJ DATE 03-23-16

CHK BY DATE

APPR BY DATE

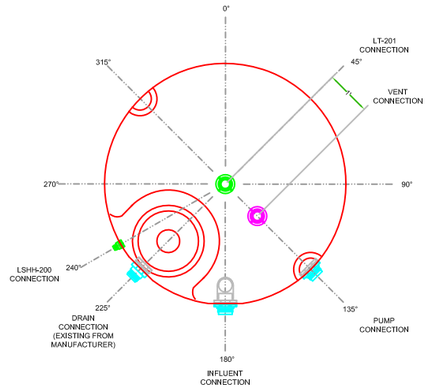
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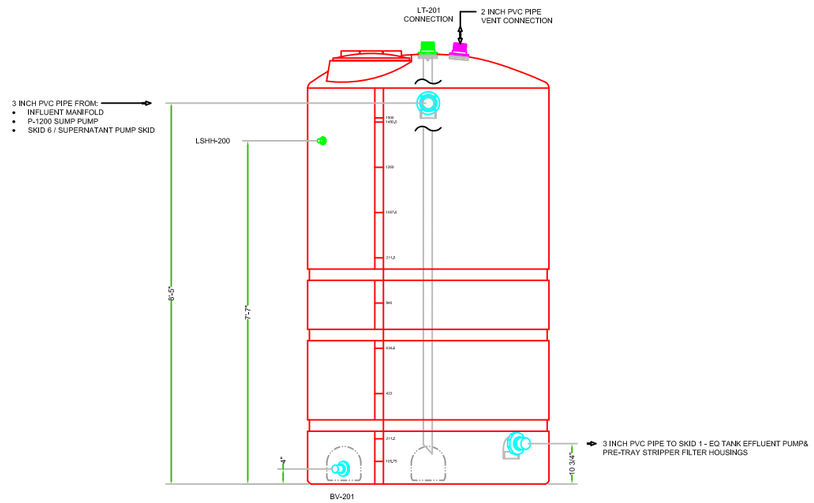
GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

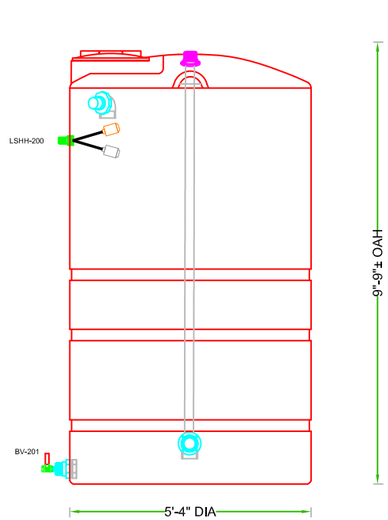
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10	C	M-3	1 OF 1	A



TANK FITTING LAYOUT
PLAN VIEW



TANK FITTING LAYOUT
FRONT ELEVATION
VIEW



TANK FITTING LAYOUT
135° ELEVATION VIEW

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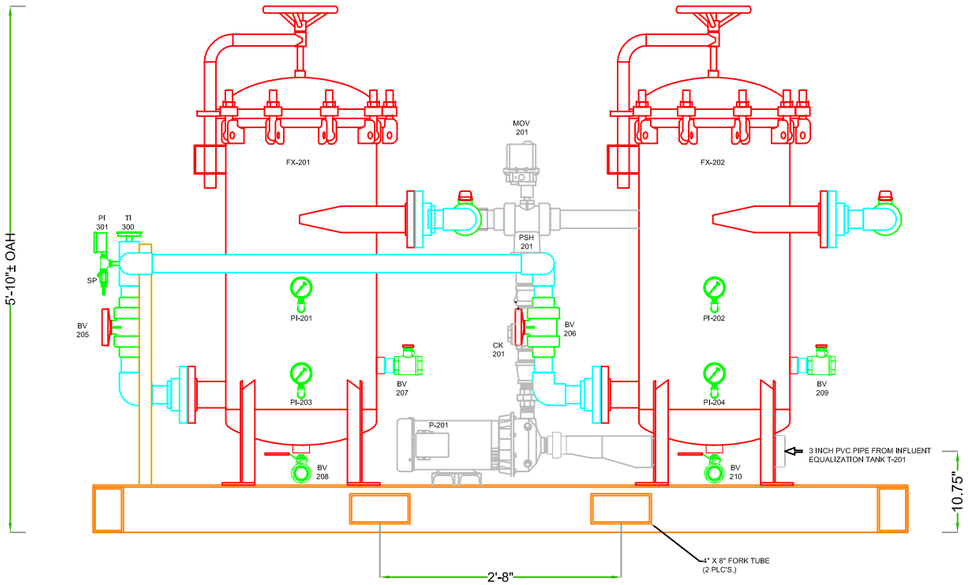
DRWN BY CJJ | DATE 03-23-16
CHK BY | DATE
APPR BY | DATE

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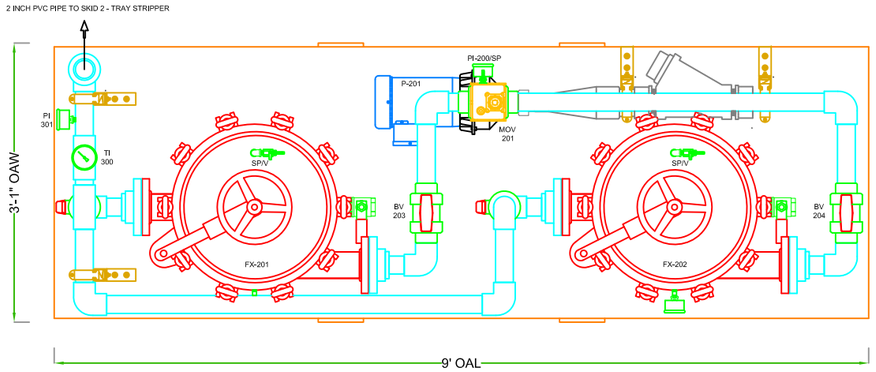
GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
20	D	M-4	1 OF 1	A



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

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REV	DESCRIPTION	DATE	APPROVED
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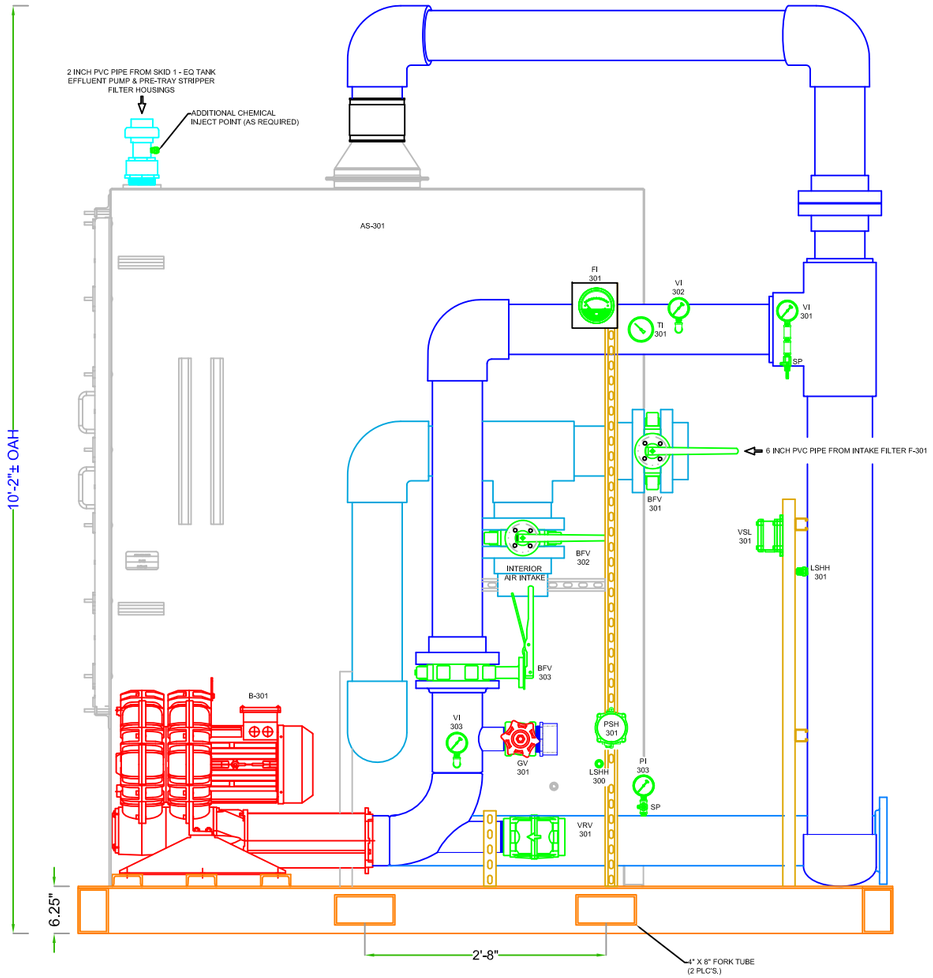
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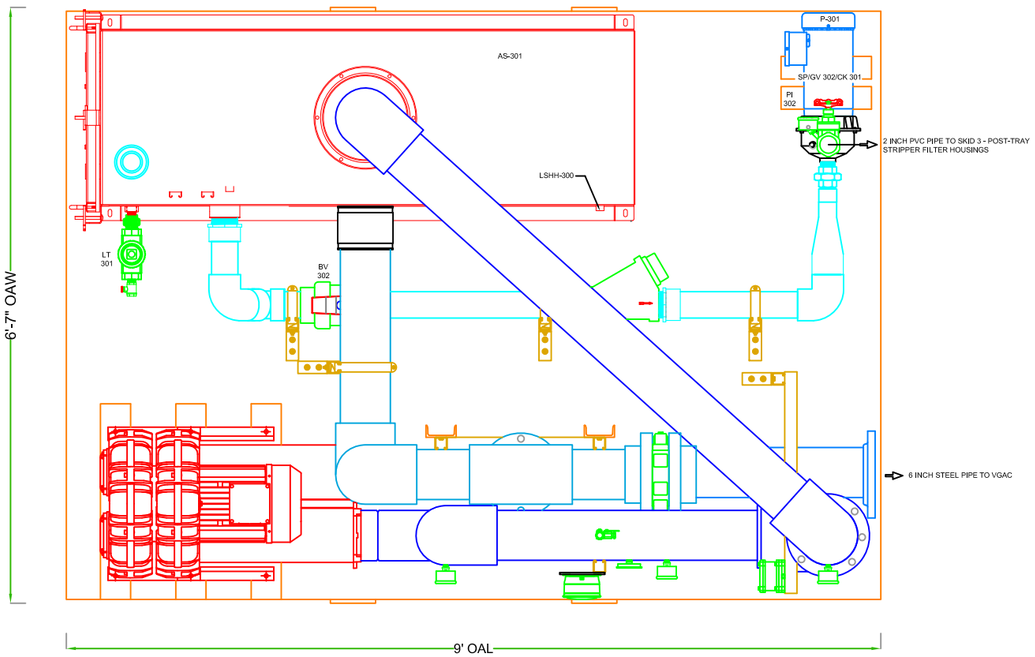
TITLE SKID 1 - EQ TANK EFFLUENT PUMP & PRE-TRAY STRIPPER FILTER HOUSINGS

GES - GWTS
BASF FACILITY - RENSSELAER, NY
JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
10	D	M-5	1 OF 1	A



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

REV	DESCRIPTION	DATE	APPROVED
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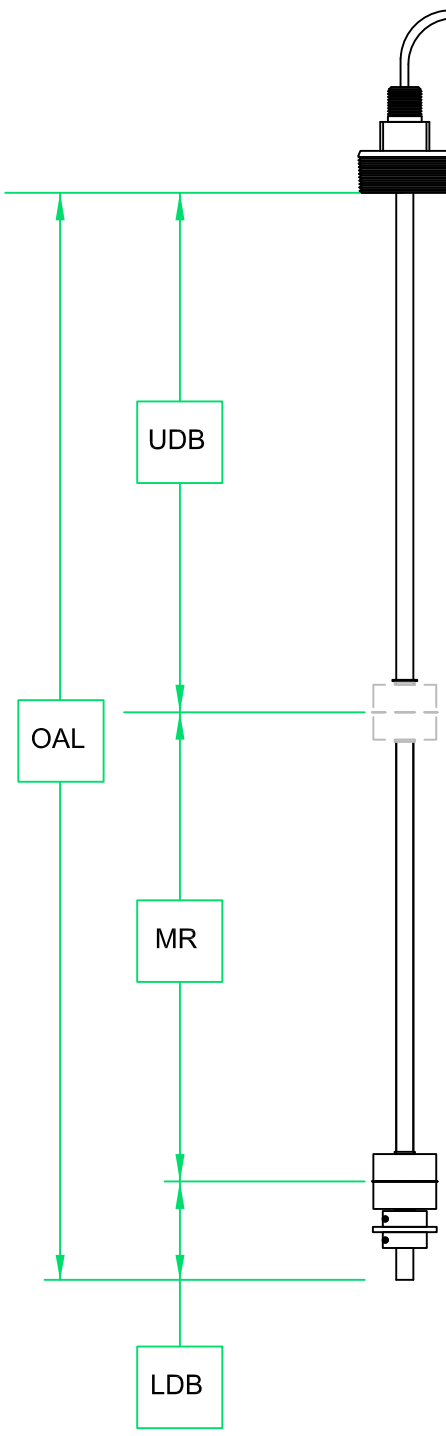
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DATE	03-23-16
CHK BY	
DATE	
APPR BY	
DATE	
TITLE	SKID 2 - TRAY STRIPPER
	GES - GWTS BASF FACILITY - RENSSELAER, NY
JOB NO.	15-183
SCALE	10
SIZE	D
DWG NO.	M-6
SHEET	1 OF 1
REV	A

RED	SIGNAL
BLK	NEGATIVE VOLTAGE
	(LOOP POWERED 10-30 VDC)



UL LISTED	
HOUSING	N/A
CONDUIT CONNECTION	½ NPT
FITTING AND STEM MATERIAL	STAINLESS STEEL
STEM DIAMETER	½ INCH
FITTING SIZE	2 INCH NPT
FLOAT STOP	SNAP RING / COLLAR
FLOAT MATERIAL	STAINLESS STEEL
OUTPUT	4-20 mA
SPECIFIC GRAVITY	0.6
CENTERING DISC	STAINLESS STEEL

OAL - 27.75 INCHES +/-
MR - 12 INCHES
UDB - 13.25 INCHES
LDB - 2.5 INCHES
CABLE LENGTH - 120 INCHES
U.L. LISTED

NOTES:
1. FOR TERMINAL BLOCK LOCATION SEE DRAWING (I-1)
2. FOR WIRING TERMINAL DESIGNATION SEE DRAWING (I-2)

REV	DESCRIPTION	DATE	APPROVED
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CHK BY	DATE
XXX	XX-XX-XX
APPR BY	DATE
XXX	XX-XX-XX

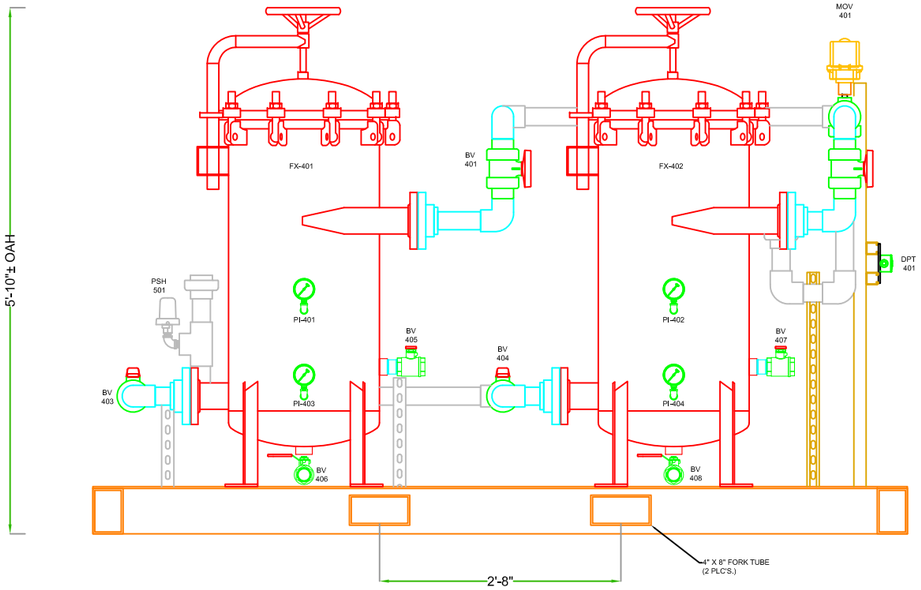
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TITLE
LT-301 LEVEL TRANSMITTER

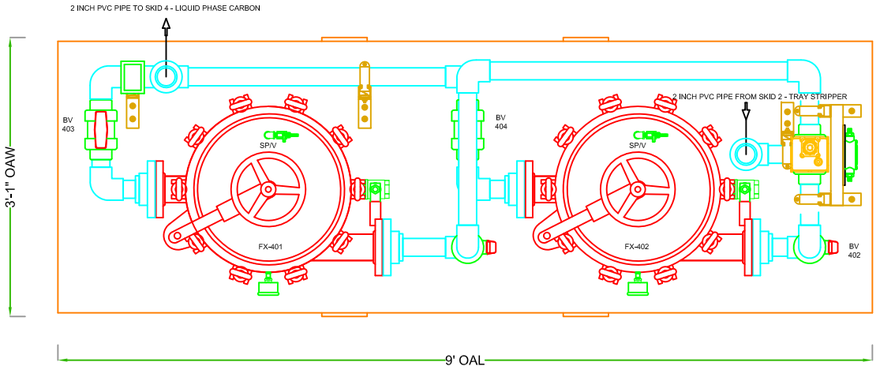
GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	M-7	1 OF 1	A



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

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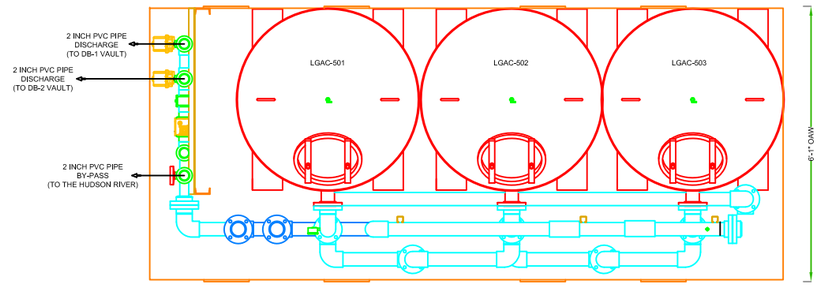
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A	AS-BUILT	06-06-16	CJJ

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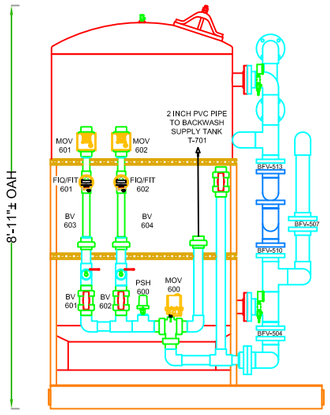
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DATE	03-23-16
CHK BY	
DATE	
APPR BY	
DATE	
TITLE	SKID 3 - POST-TRAY STRIPPER FILTER HOUSINGS
	GES - GWTS BASF FACILITY - RENSSELAER, NY
JOB NO.	15-183
SCALE	10
SIZE	D
DWG NO.	M-8
SHEET	1 OF 1
REV	A

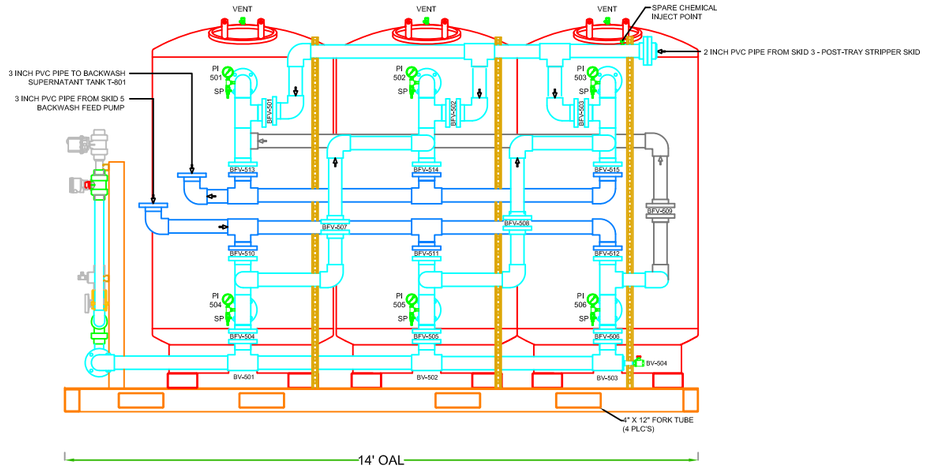
LIQUID PHASE CARBON VALVE DESIGNATION			
VALVE TAG NUMBER	LGAC-501 PRIMARY / LGAC-502 SECONDARY	LGAC-502 PRIMARY / LGAC-503 SECONDARY	LGAC-503 PRIMARY / LGAC-501 SECONDARY
BFV-501	OPEN	CLOSED	CLOSED
BFV-502	CLOSED	OPEN	CLOSED
BFV-503	CLOSED	CLOSED	OPEN
BFV-504	CLOSED	CLOSED	OPEN
BFV-505	OPEN	CLOSED	CLOSED
BFV-506	CLOSED	OPEN	CLOSED
BFV-507	OPEN	CLOSED	CLOSED
BFV-508	CLOSED	OPEN	CLOSED
BFV-509	CLOSED	CLOSED	OPEN
BFV-510	CLOSED	CLOSED	CLOSED
BFV-511	CLOSED	CLOSED	CLOSED
BFV-512	CLOSED	CLOSED	CLOSED
BFV-513	CLOSED	CLOSED	CLOSED
BFV-514	CLOSED	CLOSED	CLOSED
BFV-515	CLOSED	CLOSED	CLOSED



SKID LAYOUT
PLAN VIEW



SKID LAYOUT
LEFT SIDE ELEVATION



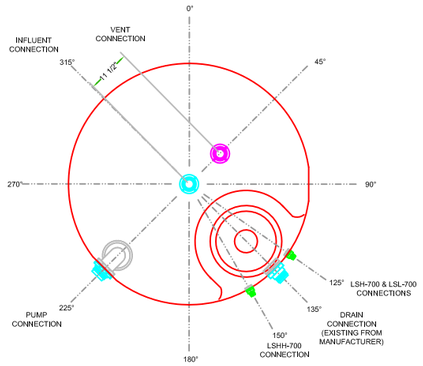
SKID LAYOUT
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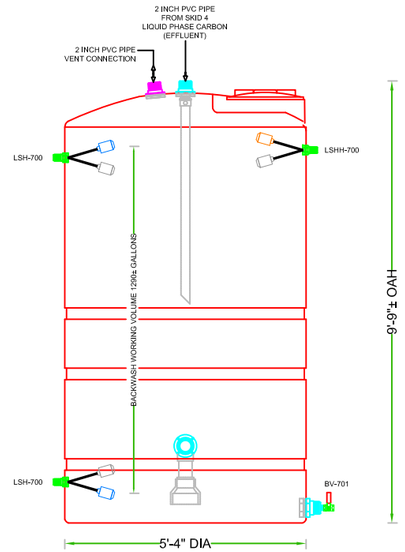
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DRWN BY	DATE	TITLE	
CJJ	03-23-16	SKID 4 - LIQUID PHASE CARBON	
CHK BY	DATE	GES - GWTS BASF FACILITY - RENSSELAER, NY	JOB NO. 15-183
APPR BY	DATE	SCALE 20 / SIZE D / DWG NO. M-9 / SHEET 1 OF 1 / REV A	



TANK FITTING LAYOUT
PLAN VIEW

TANK FITTING LAYOUT
FRONT ELEVATION
VIEW



TANK FITTING LAYOUT
225° ELEVATION VIEW

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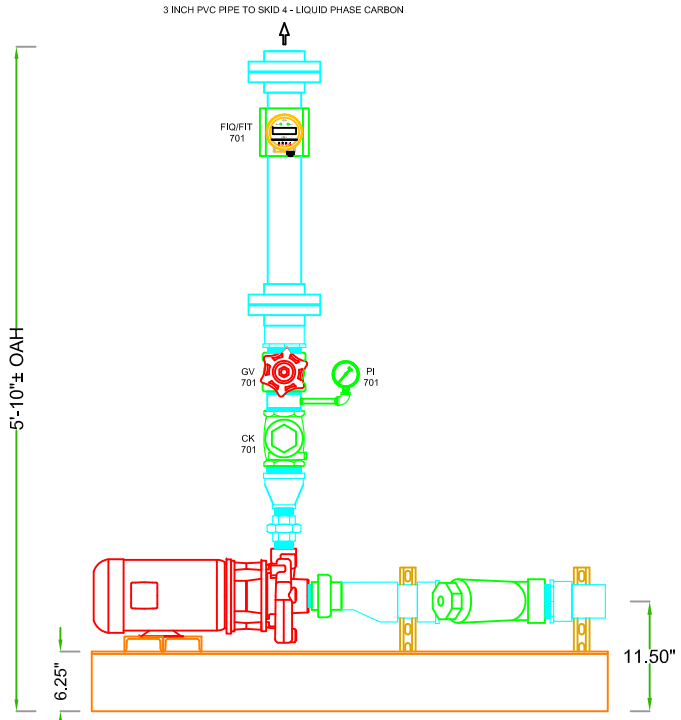
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TITLE
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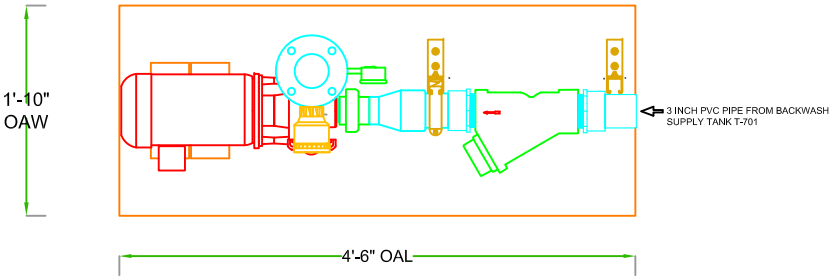
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BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
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SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

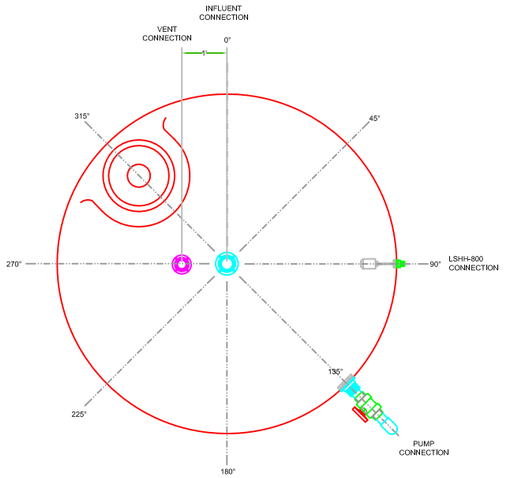
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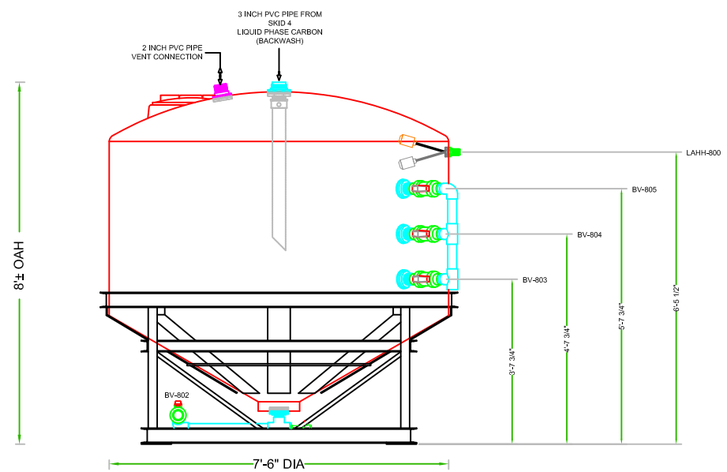
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DRWN BY	DATE	TITLE	
CJJ	03-23-16	SKID 5 - BACKWASH FEED PUMP	
CHK BY	DATE	GES - GWTS BASF FACILITY - RENSSELAER, NY	JOB NO. 15-183
APPR BY	DATE		

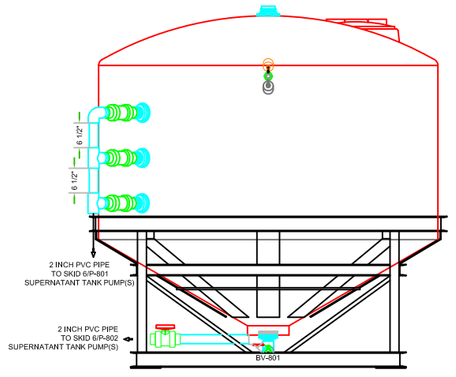
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TANK FITTING LAYOUT
PLAN VIEW



TANK FITTING LAYOUT
180° ELEVATION VIEW



TANK FITTING LAYOUT
90° ELEVATION VIEW

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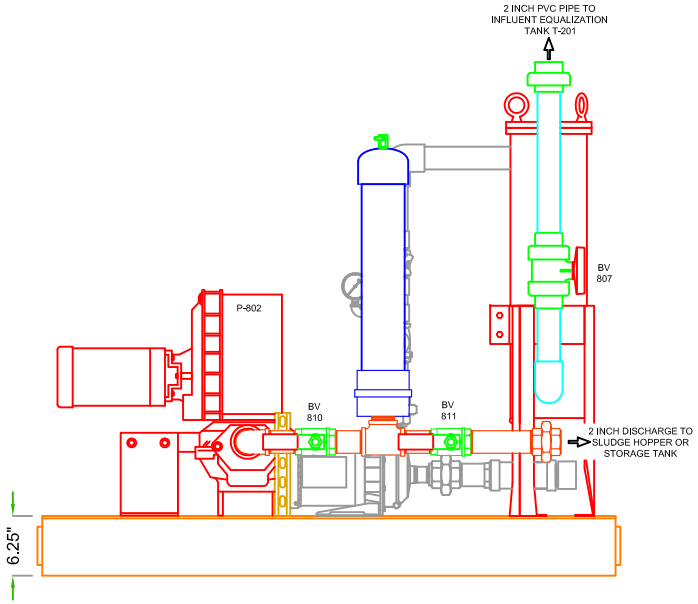
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DATE	

TITLE
T-801 BACKWASH SUPERNATANT TANK

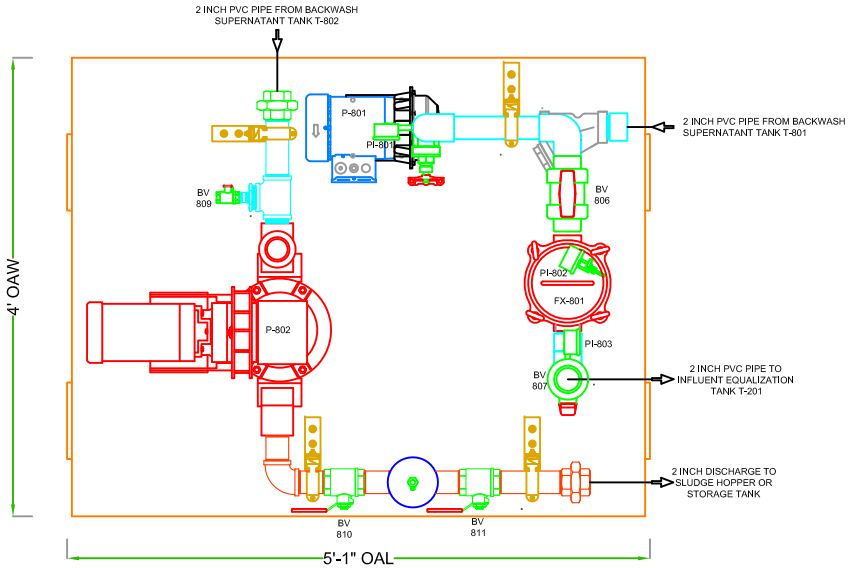
GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
20	D	M-12	1 OF 1	A



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

REV	DESCRIPTION	DATE	APPROVED
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TITLE
SKID 6 - SUPERNATANT TANK PUMP(S)

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183
SCALE 10
SIZE C
DWG NO. M-13
SHEET 1 OF 1
REV A

SECTION 3 - PROCESS EQUIPMENT

FX-101 CARTRIDGE FILTER HOUSING, (3) ELEMENTS, 3 IN IN / OUT - HARMSCO HUR3X170FL-XP

UV-101 UV DISINFECTION ASSEMBLY - PURTEST AS-V16

T-201 EQUALIZATION TANK, HDPE, 1500 GALLON, 1.7 SG - ACE ROTOMOLD VT1500-64

P-201 TRANSFER PUMP, CENTRIFUGAL, 5 HP, 5-1/2 IN IMPELLER - GOULDS 2ST1J5H4

FX-201,202 CARTRIDGE FILTER HOUSING, THREE ELEMENTS, 3 IN IN / OUT - HARMSCO HUR3X170FL-XP

F-301 BLOWER INLET FILTER / SILENCER, 6 IN - SOLBERG FS-275P-600F

F-302 BLOWER DILUTION FILTER / SILENCER, 3 IN - SOLBERG FS-235P-300

AS-301 AIR STRIPPER (AS), 6-TRAY, 304SS, 1-120 GPM - QED EZ TRAY 12.6SS

P-301 TRANSFER PUMP, CENTRIFUGAL, 5 HP, 6-1/8 IN IMPELLER - GOULDS 2ST1J5K4

B-301 AS REGENERATIVE BLOWER, 25HP, 650 CFM - FPZ SCL K09-TS-25-3 B

VGAC-301, 302, IOX-303 VAPOR PHASE MEDIA VESSEL - TETRASOLV VF-2000

VGAC-301, 302 4 x 10 VIRGIN MEDIA – (2) x 2000 LB CARBON ACTIVATED COC A60

IOX-303 HS-600 MEDIA (6% KMnO4), 4 x 6 – 3000 LB HYDROSIL HS600

FX-401,402 CARTRIDGE FILTER HOUSING, (3) ELEMENTS, 3 IN IN/OUT - HARMSCO HUR3X170FL-XP

LGAC-501,502,503 LIQUID PHASE CARBON VESSEL, 75 PSIG - TETRASOLV HPAF-2000

LGAC-501,502,503 8 x 30 LO-RISE VIRGIN MEDIA (3) x 1500 LB - CARBON ACTIVATED ACOL GL60

T-701 BACKWASH SUPPLY TANK, HDPE, 1500 GALLON, 1.7 SG - ACE ROTOMOLD VT01500-64

P-701 TRANSFER PUMP, CENTRIFUGAL, 5 HP - AMT 3152-95

T-801 BACKWASH SUPERNATANT TANK, HDPE, 1600 GAL 30° CONICAL - ACE ROTOMOLD CB1600-90

T-801 BACKWASH SUPERNATANT TANK STAND, 30° CONICAL BOTTOM - ACE ROTOMOLD CB90T-30ST

P-801 TRANSFER PUMP, CENTRIFUGAL, 0.75 HP, 460 VAC, 3-PHASE, 4 3/4 IN IMPELLER - GOULDS 1ST1D5D4

P-802 PUMP, DIAPHRAGM, 1.5 HP - AMT 336E-K6

FX-801 BAG FILTER HOUSING, TRADE SIZE 2, ALUMINUM - MICRON TECH 8-30-2P-2-150-AL-PB-VS

MP-1001, 1002 METERING PUMP, 1 GPH, 115 VAC - LMI AD951-935SI

P-1200 SUMP PUMP, 0.3 HP, 1-PHASE, 115 VAC, 9.7A - ZOELLER M57-E

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HFP

FX-101

QA INSPECTION SHEET

TANK MODEL #: H4R3X170FL-XP **MFG ORDER #:** 64780

INVENTORY CONTROL #: 91514 #3 **SERIAL #:** 10021

Q. A. CHECKPOINT #1 INSPECTION

- ✓ CLOSURE HARDWARE CORRECT
- ✓ INLET/OUTLET FLANGE CORRECT
- ✓ 1/4" NPT GAUGE PORT THREADS CORRECT
- ✓ DRAIN PORT THREADS CORRECT
- ✓ VENT PORT THREADS CORRECT
- ✓ CARTRIDGE BTM SEAL DIAMETER & WELD CORRECT
- ✓ STANDPIPE ALIGNMENT CORRECT
- ✓ CLOSURE O-RING & SEAT FREE OF DEFECTS
- ✓ DIMENSIONS PER BLUEPRINT

CHECKED BY: SLH DATE: 9-15-14

Q. A. CHECKPOINT #2 FINAL ASSMBLY & PACKAGING

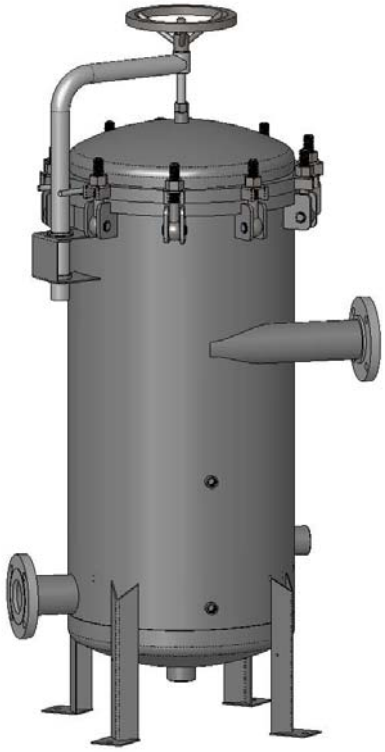
- ✓ STANDPIPE THREADS SEALED & TIGHT
- ✓ I&O MANUAL ATTACHED
- ✓ MODEL/SERIAL # DECAL & INLET/OUTLET LABELS CORRECT
- ✓ PLUG/HANDLE PACKAGED INSIDE HOUSING
- ✓ CLOSURE HARDWARE TIGHTENED
- ✓ PALLET & CRATE CORRECT & LABELED CORRECT

CHECKED BY: CDM DATE: 10-7-15

CORRECTIVE ACTONS LOG:

QA RELEASE FOR SHIPMENT BY: CDM DATE: 10-7-15

PRODUCT SPECIFICATION
Harmsco® Model #: HUR 3X170FL-XP



Description: Tangential Entry, Up-Flow Cartridge Filter Housing with; Swing Bolt Closure, Davit Cover Lift, and Flanged Connections.

Details:

1. Stainless steel construction, wetted metallic components are 304/304L ASTM A-240.
2. Electro-polish finish.
3. Swing bolt style housing closure. Swing bolts are SS alloy per ASTM A-193 B7.
4. NSF Certified using Genuine Harmsco® Hurricane® replacement filter cartridges.*
5. Tangential inlet and the integral inner-can, create a centrifugal flow that induces pre-filtration by heavy particulate separation.
6. Patented "Up-Flow" design that;
   a. Self purges housing of air.
   b. Eliminates by-pass contamination during servicing.
   c. Improves efficiency by creating an even flow distribution across filtering media.
7. Strong, durable, built to ASME Design Standards.
8. Utilizes three (3) Genuine Harmsco® Hurricane® HC/170 series filter cartridges. *
9. Inlet & Outlet are NPS 3 Flanges ANSI/ASME B16.5 Class 150
10. Drains (Qty 2) are 1-1/2" Female NPT (FPT) Couplings, Class 1000
11. Vent is 1/2" Female NPT (FPT) Coupling, Class 1000
12. Gauge Ports (Qty 2) are 1/2" Female NPT (FPT) Couplings, Class 1000
13. Closure Gasket is EPDM 70 Durometer O-ring.
14. Pressure Rating - 150 P.S.I.G.
15. Temperature Rating – Up to 140°F
    Note: Higher temperatures are possible, check cartridge specifications. **
16. Flow Rate – 450 GPM Maximum.
    See Pressure Drop vs. Flow Rate Curve, page 2.
17. One person can perform maintenance.

Requirements:

Floor Load:	Dry weight = 435 lbs. Volume = 61 US gallons x 8.337 lbs./US gallon (water) = 509 lbs. Total weight = 435 + 509 = 944 lbs. (housing + water) Floor contact area = .292 ft² Floor Load = 944 lbs. divided by .292 ft² = **3,250 pounds per square foot** (approx.) Note: Piping shall conform to all applicable codes and be independently supported. If floor strength is suspect, use appropriate measures to adequately distribute load.
Floor Space:	**4.5 ft²** (does not include Cover/Davit swing position), See Installation Diagram, page 3.
Service Height:	98-1/2", See Installation Diagram, page 3.
Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided.

Recommended Spare Parts:
Closure Gasket O-ring: PN 363-E
Set of 3 Harmsco® Hurricane® HC/170 replacement cartridges

* The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges in this filter housing voids certifications by NSF International.
** Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.
Notice: The information contained in this publication is considered accurate, and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest, most up to date, specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. End users should perform their own tests to determine suitability for each application.

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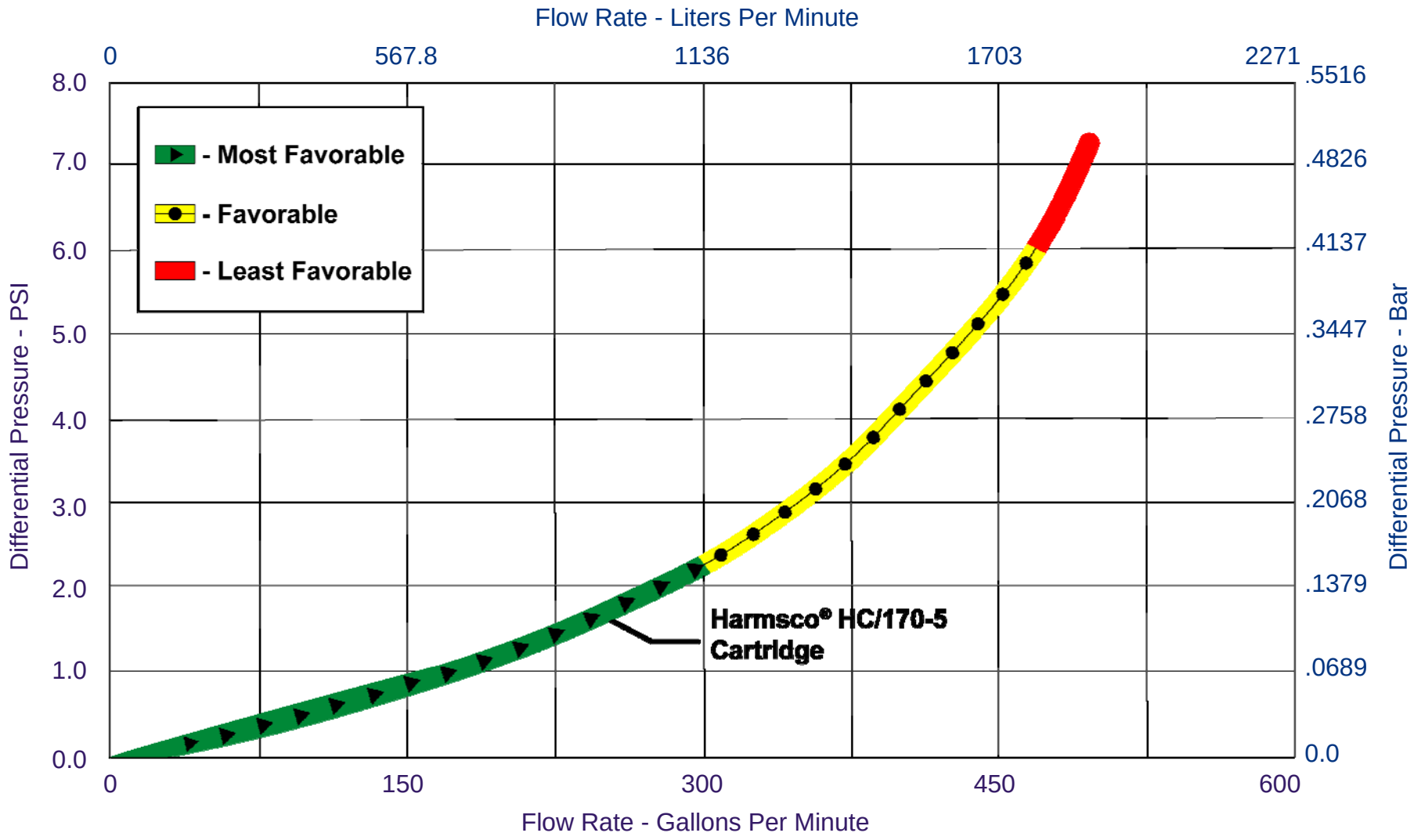
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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 3X170FL-XP

Hurricane® HC/170-5 Cartridges, Qty 3; with clean water.

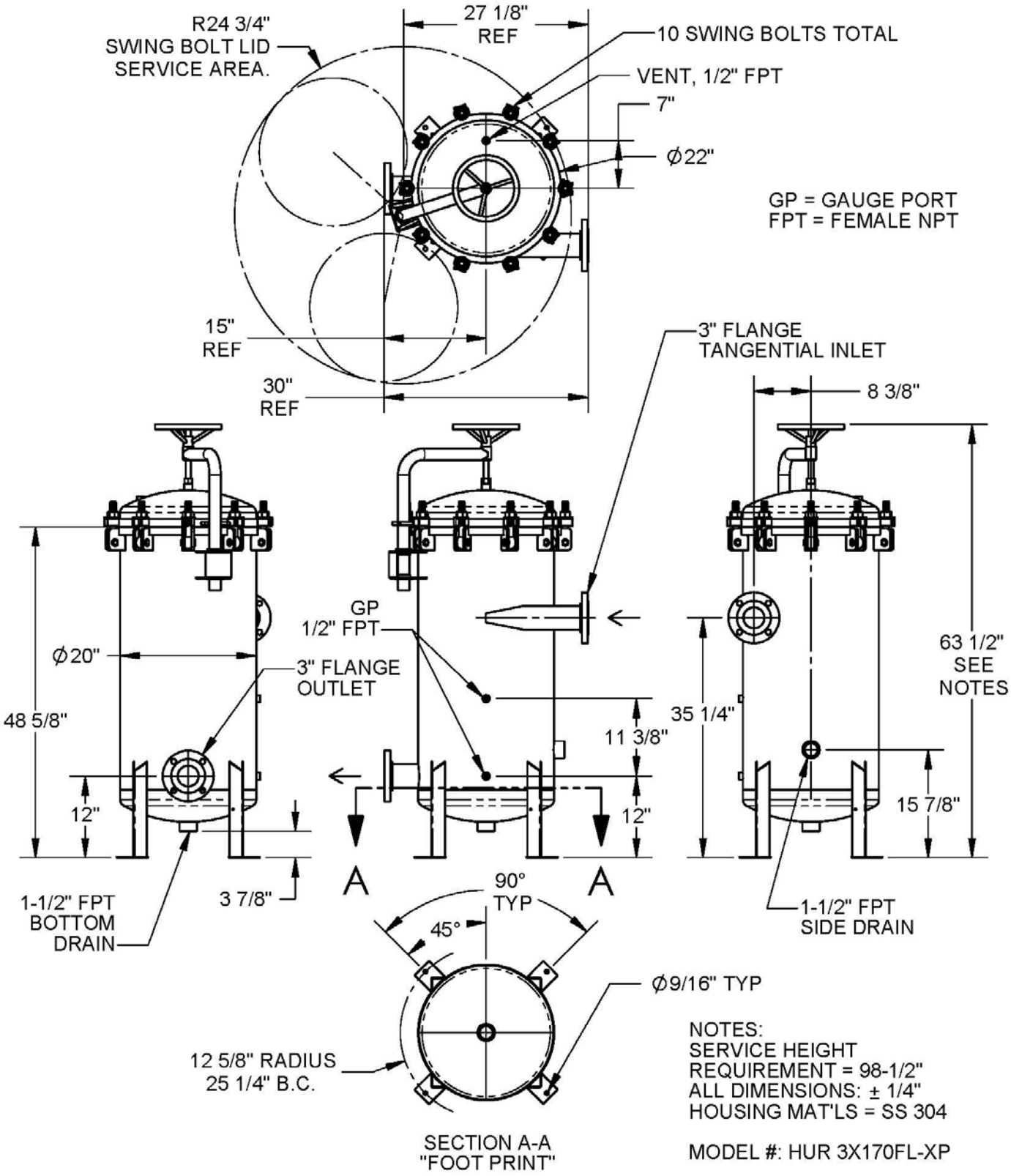


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Harmsco® Filtration Products
Installation Diagram
Hurricane® 3X170FL-XP Swing Bolt Housing



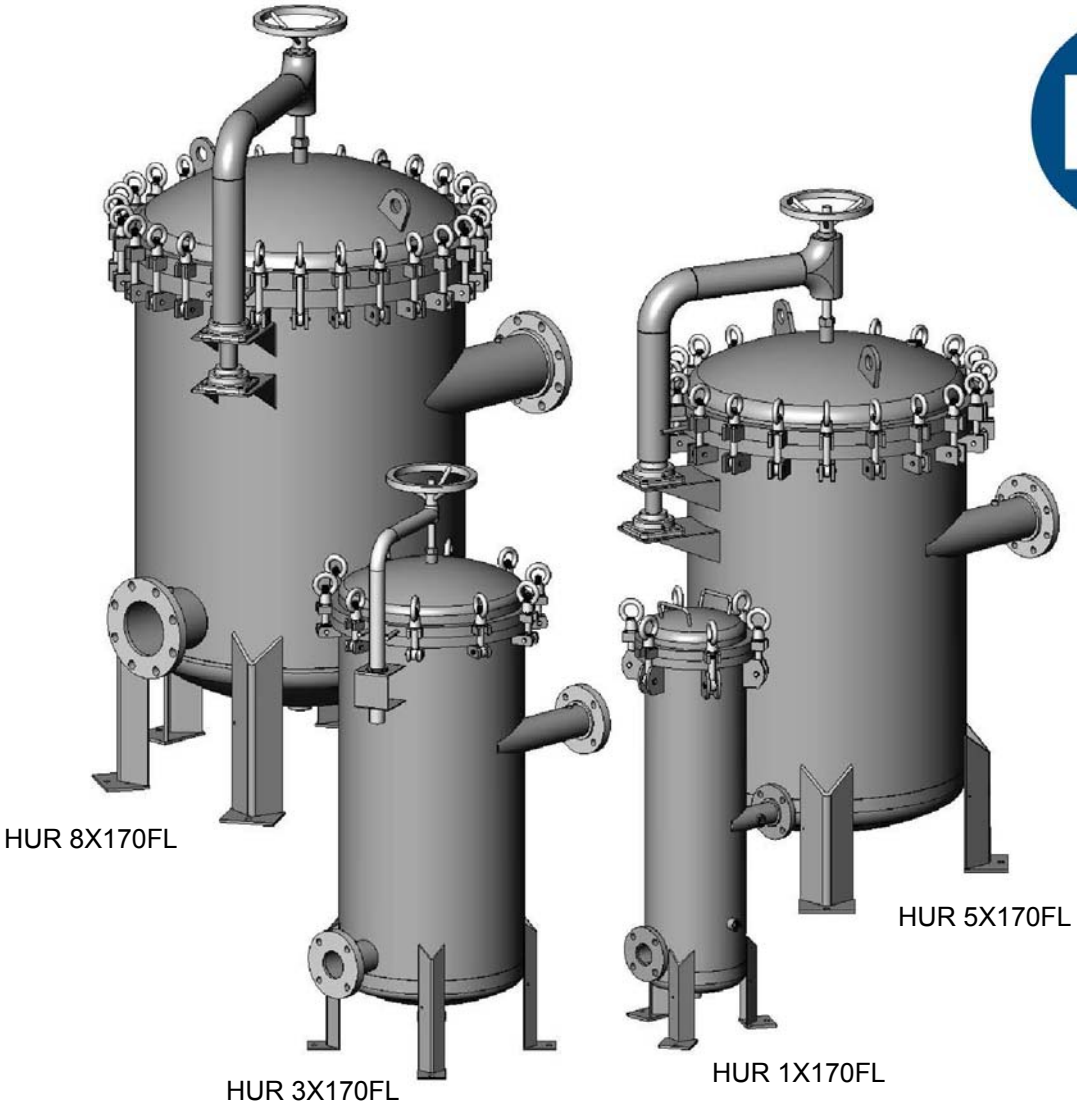
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HARMSCO® Hurricane®
Swing Bolt Water Filters
Models: HUR 1X170FL, HUR 3X170FL
HUR 5X170FL, & HUR 8X170FL

INSTALLATION AND OPERATION MANUAL



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With Patented Up-Flow and Tangential/Rotational Flow Filtration Technology

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1243-HP, MANUAL - HUR FL
Revised - 5/10

HARMSCO® Hurricane®
Swing Bolt Water Filters

INTRODUCTION

The Harmsco® Hurricane® Swing Bolt Water Filter is a water filtration device that utilizes the Harmsco® Hurricane® HC/170 size cartridge filter in various quantities from one per housing (HUR 1X170FL) to 8 per housing (HUR 8X170FL).

The Hurricane® HC/170 cartridges are available in many micron ratings, styles and materials of construction. High temperature cartridges are also available. Consult the Harmsco® Product Catalog (www.harmsco.com) or a Sales Representative for more details.

All of the Harmsco® Hurricane® Swing Bolt housings; **HUR 1X170FL**, **HUR 3X170FL**, **HUR5X170FL** & **HUR 8X170FL** are equipped with pipe flanges on both the inlet and the outlet, & cartridge lifting handle(s) (part # 362-L). All models are NSF Certified per Standard 61 when used with Genuine Harmsco® Hurricane® HC/170 cartridges.

The Harmsco® Hurricane® Swing Bolt Water Filter is designed as a strong economical filter that continuously improves the water quality with minimal maintenance.

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Requirements/Recommendations		Pg. 4
Installation/Set-up		Pg. 5
Specifications		Pg. 6
Installation Block Diagram		Pg. 7
Installation Diagrams -	HUR 1X170FL	Pg. 8
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	HUR 5X170FL	Pg. 10
	HUR 8X170FL	Pg. 11
Cartridge Replacement		Pgs. 12 - 18
Flow Curves	HUR 1X170FL	Pg. 19
	HUR 3X170FL	Pg. 20
	HUR 5X170FL	Pg. 21
	HUR 8X170FL	Pg. 22
Filter Cartridge Cleaning Instructions		Pg. 23
Cartridge Replacement Instructions (Quick Reference)		Pg. 24
Warranty Information		Pg. 25

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HARMSCO® Hurricane®
Swing Bolt Water Filters
INSTALLATION & OPERATION MANUAL

Safety Precautions:

Before using and installing this product or its components please read this entire manual. Failure to do so could result in serious personal injury or damage to the equipment and assembled components.

This product and all of its components MUST NOT be installed or used in any manner other than that which is specified in this manual.

! WARNINGS !

1. **Seek qualified assistance for installation. Piping shall conform to all applicable codes and be independently supported.**
2. **Do not install the unit where a temperature of 32° F or lower can occur. Damage caused by freezing shall void all warranties.**
3. **The unit shall be properly bonded in accordance with all applicable codes. A grounding lug is provided.**
4. **After unit is installed, flush (through outlet) to drain for 10 minutes at recommended flow rates prior to use.**
5. **Always isolate unit and relieve pressure before servicing.**
6. **Utilizes Genuine Harmsco® Hurricane® HC/170 filter cartridges, available in many micron ratings and styles.**
   The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges will void certifications by NSF International.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844. Other patents pending.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

REQUIREMENTS

- Only qualified personnel are to perform the installation.
- Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.
- Install shut off valves on both the inlet and the outlet to isolate unit while servicing.

RECOMMENDATIONS

- Plumb drains with appropriate valves to reduce service time.
- Include a by-pass with shut off valves between the inlet and outlet. See installation Block Diagram on page 7.
- Install appropriate pressure gauges into the gauge ports provided. Model HUR1X170FL outlet pressure gauge is to be installed in-line and in close proximity to the outlet flange.
- Install plug or appropriate valve into the vent port provided.
- Lubricate Swing Bolt Assemblies (all models) & Davit Assemblies (HUR 3X170FL, HUR 5X170FL & HUR 8X170FL) using Food Grade grease with PTFE and NSF rated H1 only.
- Replace cartridge(s) when certain conditions exist.
  For example: 1. Differential pressure is greater than 30 psi.
  2. Quality of water is unacceptable.
  3. Flow rate has diminished.
  4. Every 6 months
- **Spare Parts:**

  1. Sufficient supply of replacement cartridges.
     Note: Harmsco® Hurricane® HC/170 filter cartridges available include: Activated Carbon, High Temperature, SureSafe™, Poly-Mesh, Poly-Pleat™ & more.
     Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

  2. Housing O-ring Seal:

Model #	Part #		
	EPDM (std)	BunaN	Viton
HUR 1X170FL	361-E	361-B	361-V
HUR 3X170FL	363-E	363-B	363-V
HUR 5X170FL	365-E	365-B	365-V
HUR 8X170FL	368-E	368-B	368-V

  3. Optional: Cartridge Lifting Handle, Part #362-L



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HARMSCO® Hurricane®
Swing Bolt Water Filters

INSTALLATION/SET-UP

The following instructions & diagrams show the Harmsco® Hurricane® Swing Bolt Water Filter housing with typical plumbing hook-up requirements. All steps of the installation are to be performed by qualified personnel.

1. Always adhere to state and local plumbing codes and requirements for design and installation.
2. Mount and secure housing using the holes at the base of the legs - see Installation Diagrams, pages 8-11.
   Models HUR 5X170FL & HUR 8X170FL have two lifting lugs welded onto the lid for positioning of the housing. Swing bolts must be engaged and the housing must be empty prior to using the lifting lugs.
3. Bond the filter housing utilizing the grounding lug on the leg.
   - must be performed by a qualified electrician.
4. Install incoming water supply with shut off valve to flange marked "Inlet".
5. Install return line with shut off valve to flange marked “Outlet”.
6. Install plugs or valves in drain lines into the FPT couplings located at the bottom center and side of housing.
7. Install plugs or pressure gauges into the gauge ports.
8. Install plug or valve into the vent port.
9. Refer to Specifications, Installation Block Diagram & Installation Diagrams for more details, pages 6-11.

Notes:

- Shut-off valves shall be installed on inlet and outlet to isolate the filter when servicing.
- To protect against electrolysis, all filters shall be bonded.
  Failure to properly bond the filter will void all warranties.
- Valves, plugs and pressure gauges are not provided.
- Use gaskets, sealants and/or expansion/vibration coupling materials appropriate for the application.
- Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.
- For cartridge replacement, see pgs. 12 - 18, 24.
- For models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL, make sure sufficient space is available to rotate lid away from housing allowing access to all cartridges.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

SPECIFICATIONS

Specification	Model			
	HUR 1X170FL	HUR 3X170FL	HUR 5X170FL	HUR 8X170FL
Cartridge Quantity[1]	1	3	5	8
Recommended Flow Rate, gal/min	105	315	525	840
Max. Flow Rate, gal/min	150	450	750	1200
Pressure Rating, P.S.I.G. Max. *	150 *	150 *	150 *	150 *
Height, inches	48"	64"	74"	84"
Service Height, inches	77"	98-1/2"	98-1/2"	104-1/2"
Housing Diameter	11"	20"	30"	35-3/8"
Inlet/Outlet[2]	2" Flange	3" Flange	4" Flange	6" Flange
Height of Inlet, inches	23-5/8"	35-1/4"	38"	44-1/4"
Height of Outlet, inches	9 3/4	12"	14-1/8"	20-1/2"
Drain (Qty 2, Female)	3/4" NPT	1-1/2" NPT	1-1/2" NPT	1-1/2" NPT
Weight, Dry	150 lbs.	420 lbs.	1,100 lbs.	1,600 lbs.
Weight, Wet	284 lbs.	929 lbs.	2,284 lbs.	3,535 lbs.
Floor Contact Area	.188 ft²	.292 ft²	.776 ft²	1.164 ft²
Floor Load (approx.)[2,3]	1,515 lbs/ft²	3,200 lbs/ft²	3,000 lbs/ft²	3,100 lbs/ft²
Floor Space[4]	1.6 ft²	4.5 ft²	8.5 ft²	14.0 ft²

Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided on the leg.
Housing Material:	Stainless Steel Construction. All wetted metallic components are ASTM A-240
Finish:	Electro-polish
O-ring Material:	EPDM is standard. Buna-N & Viton are available
Temperature Rating:	Up to 140°F, Note: Higher temperatures are possible, check cartridge specifications and contact a Harmsco® sales engineer.

* Models with -HP suffix 200 P.S.I.G. Max.

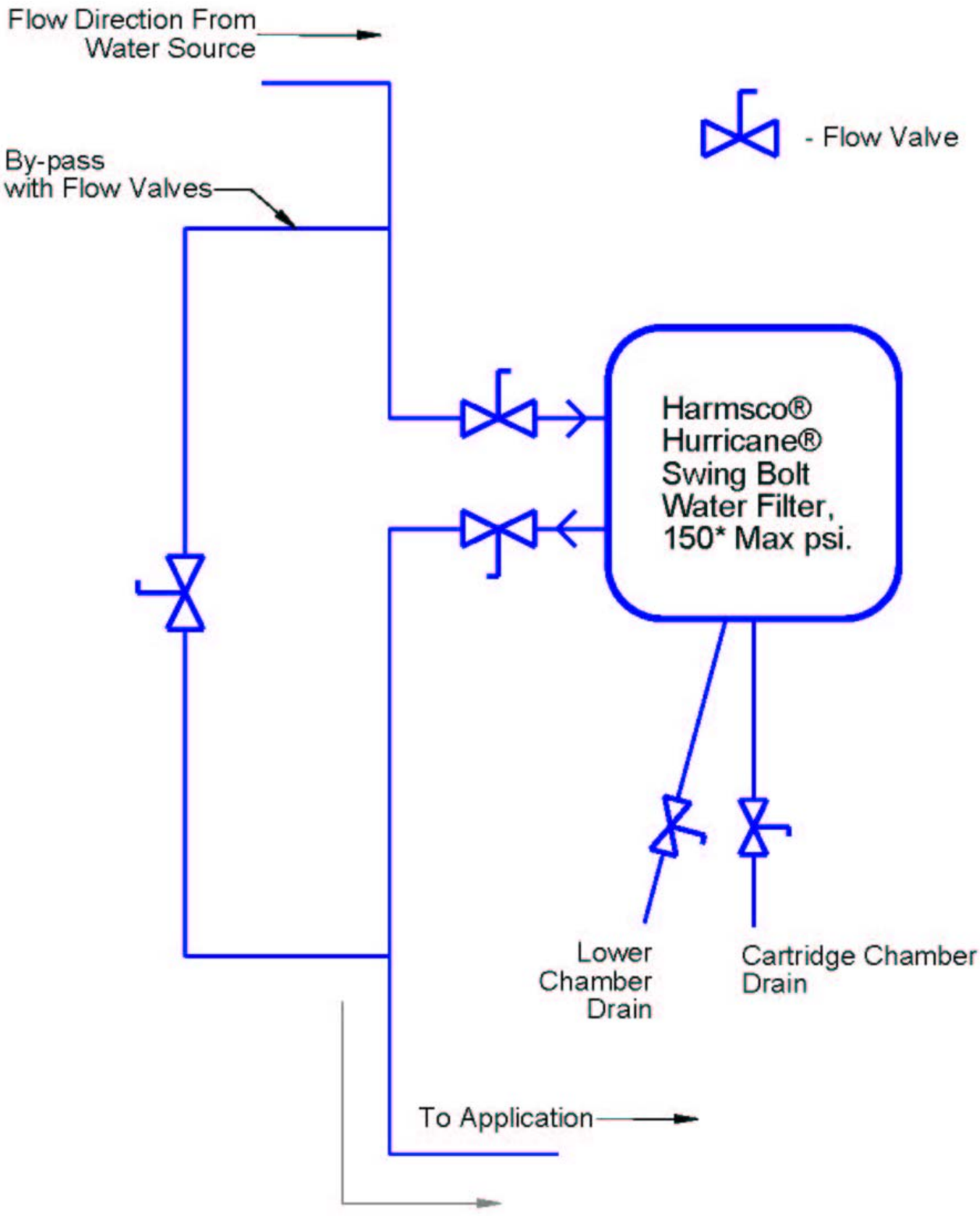
Notes:

1. Utilizes Genuine Harmsco® Hurricane® HC/170 cartridges.
   - HC/170 cartridge filters are available in many micron ratings and styles.
   - Activated carbon and several high temperature cartridges are also available.
   - The use of cartridges other than Genuine Harmsco® Hurricane® HC/170 filter cartridges will void certifications by NSF International.
2. Piping shall conform to all applicable codes and be independently supported.
3. If floor strength is suspect, use appropriate measures to adequately distribute load.
4. Does not include Cover/Davit swing position for models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

Installation Block Diagram

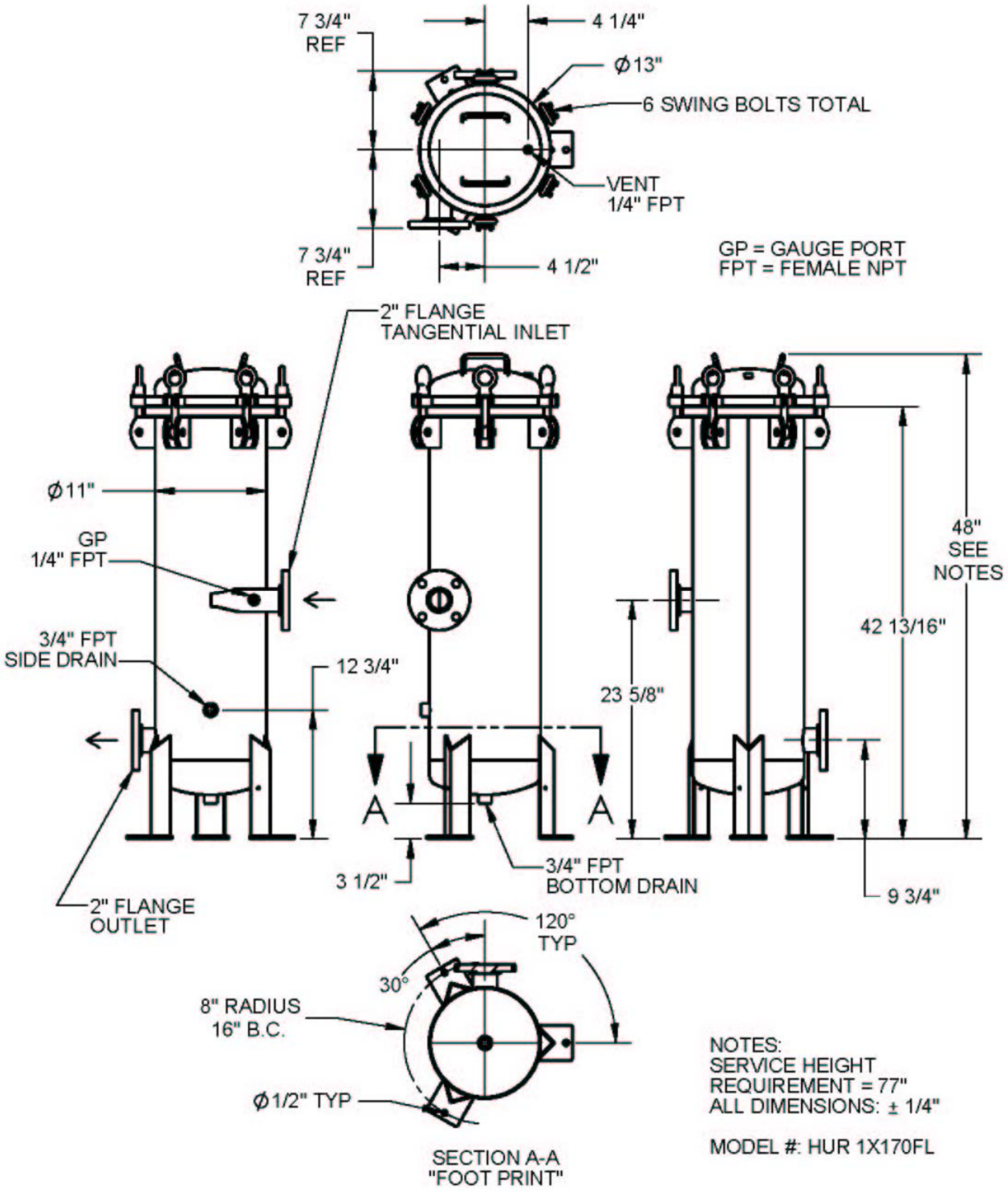


* Models with –HP suffix = 200 psi.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

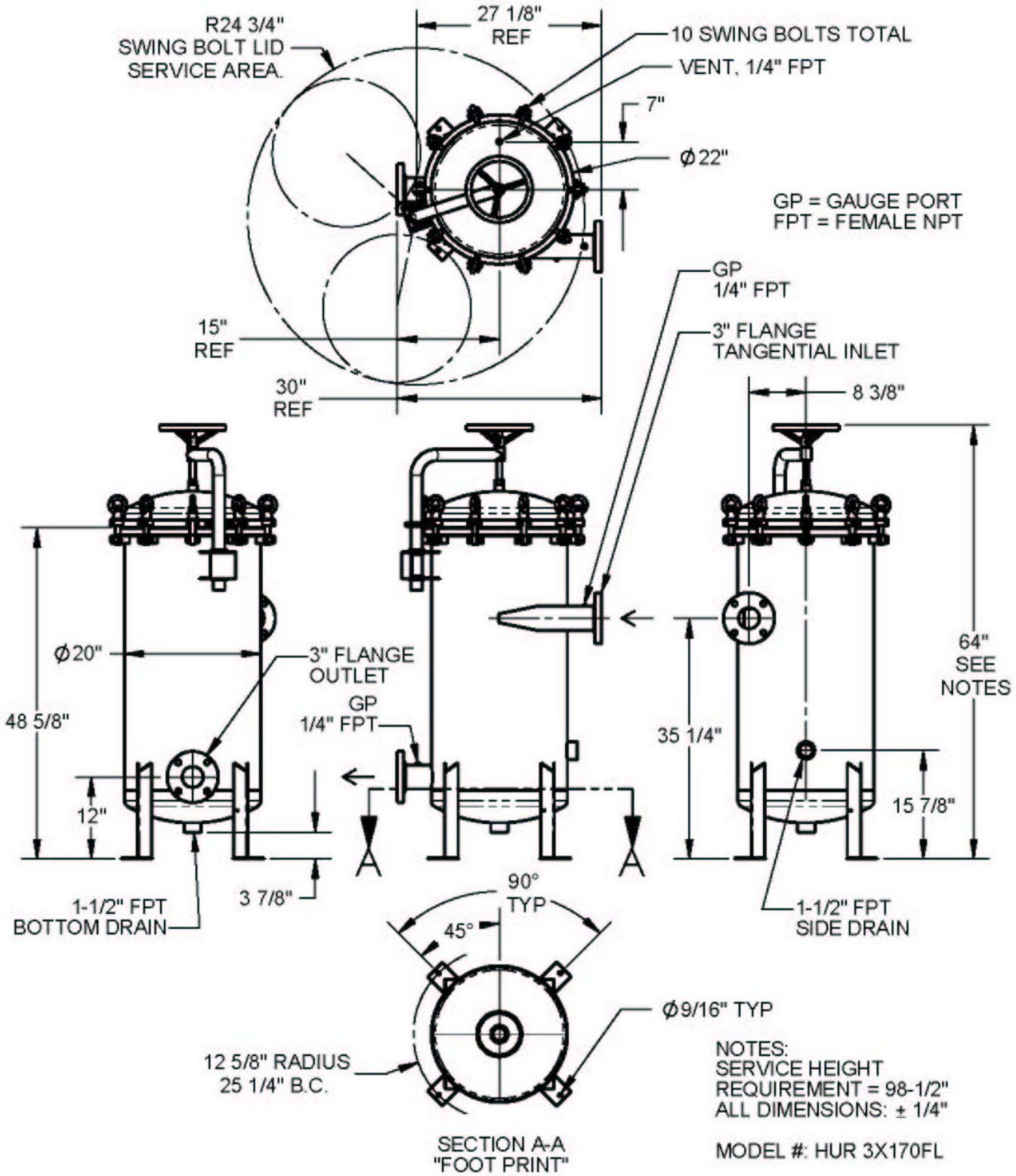
Installation Diagram
Model HUR 1X170FL



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HARMSCO® Hurricane®
Swing Bolt Water Filters

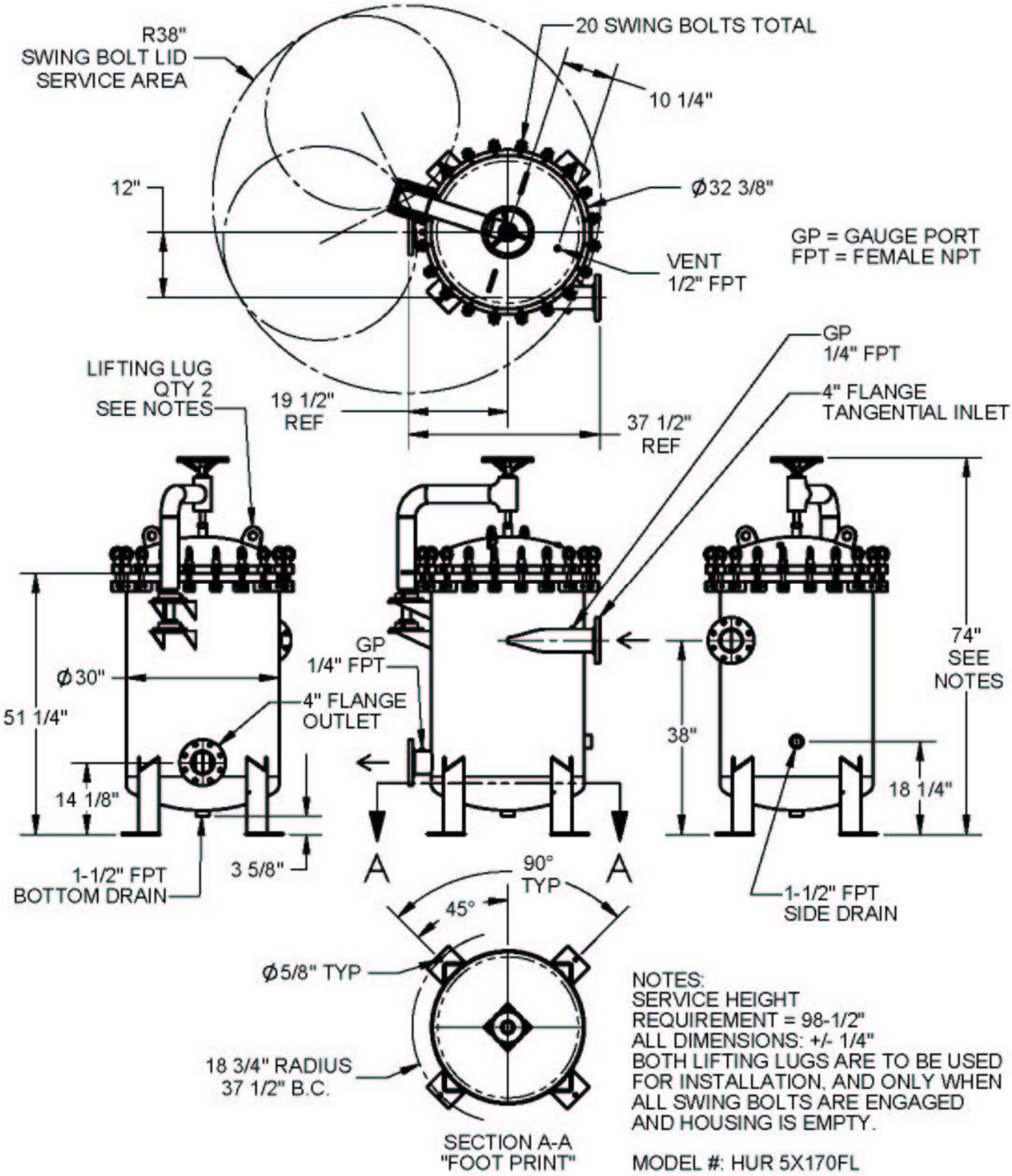
Installation Diagram
Model HUR 3X170FL



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HARMSCO® Hurricane®
Swing Bolt Water Filters

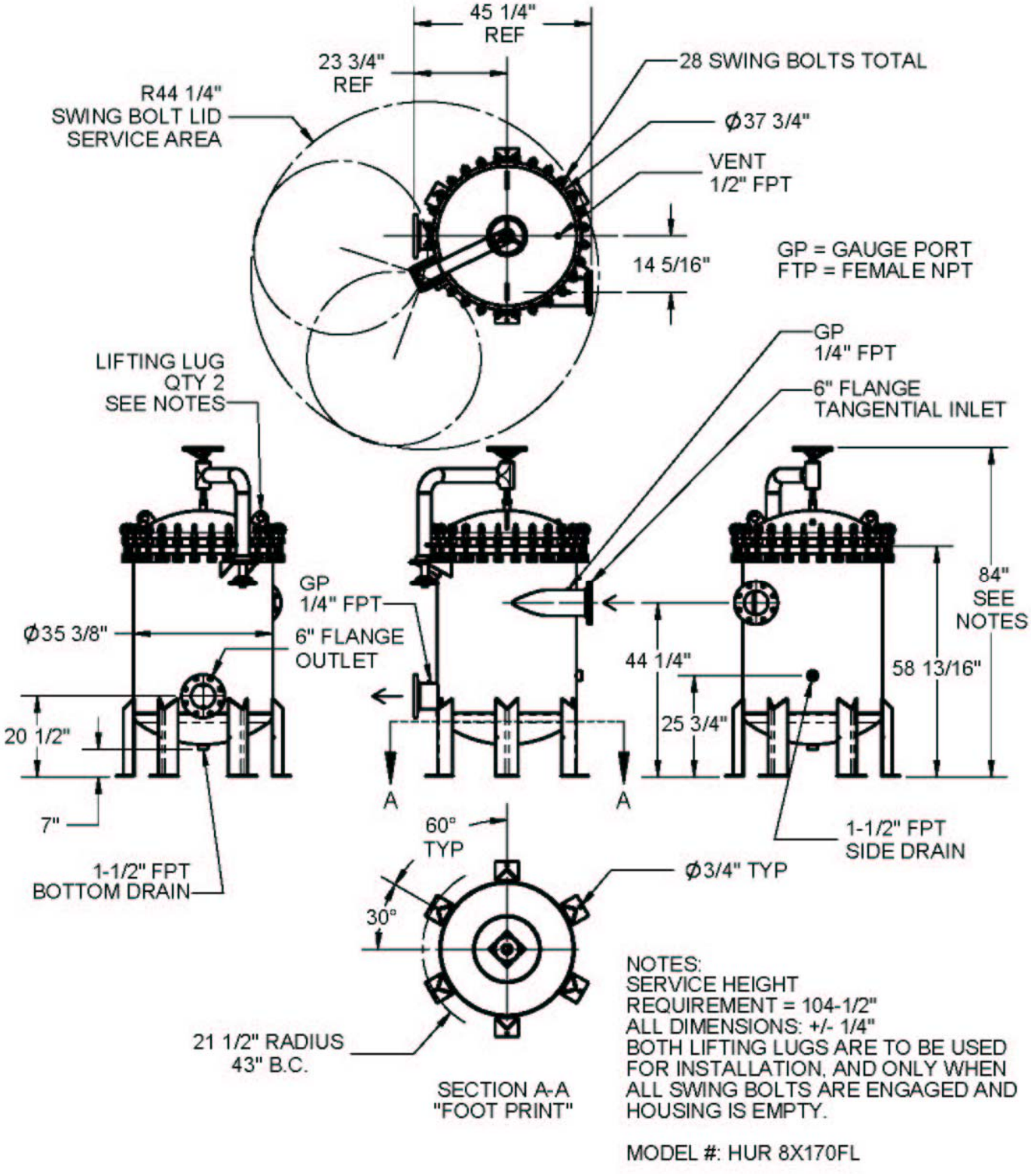
Installation Diagram
Model HUR 5X170FL



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Installation Diagram
Model HUR 8X170FL

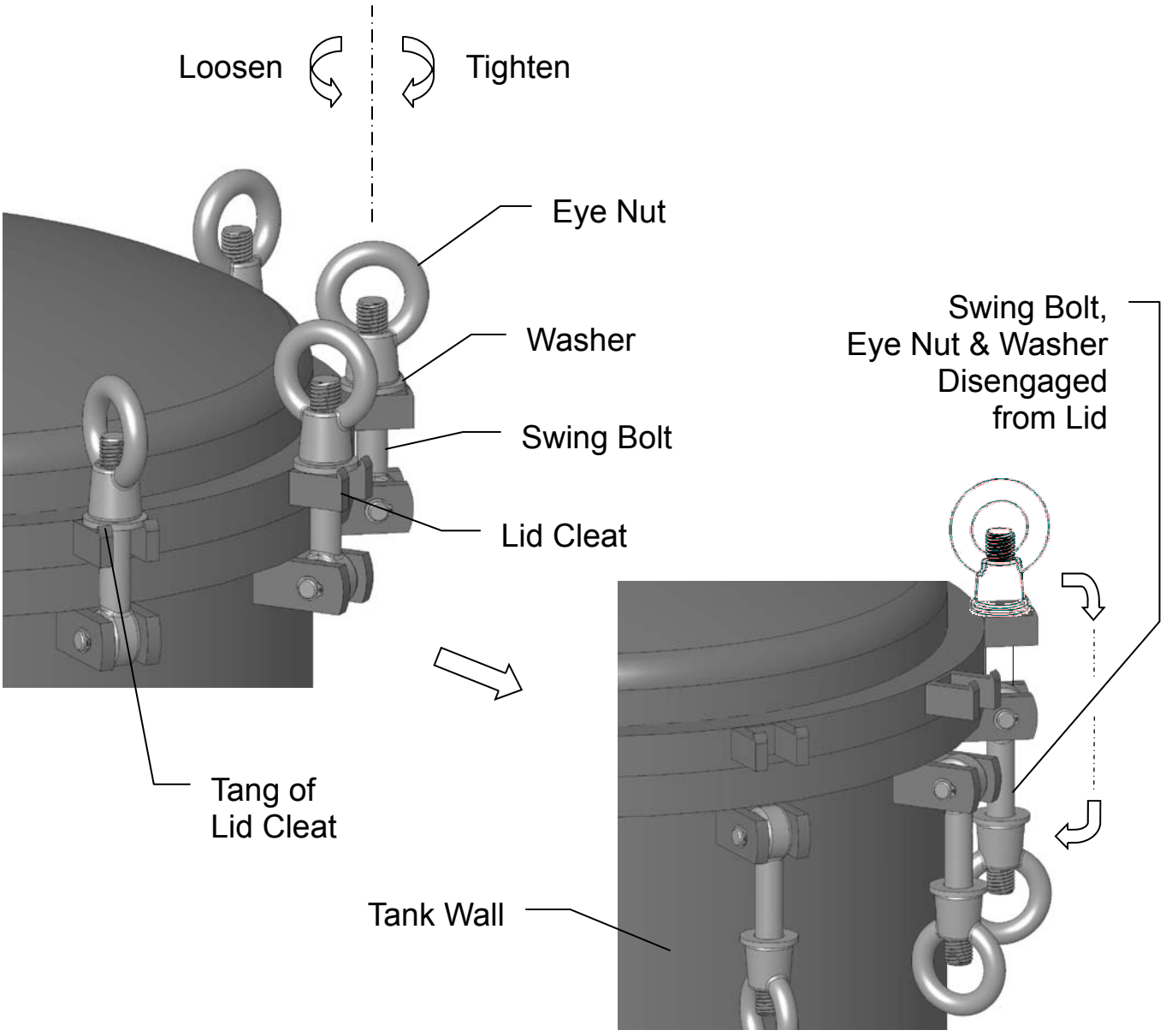


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HARMSCO® Hurricane®
Swing Bolt Water Filters

CARTRIDGE REPLACEMENT

1. Isolate unit from all water sources (close I/O lines) and relieve pressure to housing by first opening the housing's "Bottom Drain" and let drain completely. See Installation Diagrams (pgs. 8-11). This will protect the cartridges (installed) from experiencing a reverse flow that could cause damage.
2. Open Side Drain and let housing drain completely.
3. Loosen all Eye Nuts of Swing Bolts by 1/2 turn increments counter-clockwise to gradually step down load applied to swing bolts. Repeat process as needed.
4. Fully loosen Eye Nuts but do not remove from Swing Bolt. Lift Washer above Tangs in Lid Cleats and allow Swing Bolt to rotate downward along the side of the housing's Tank Wall.



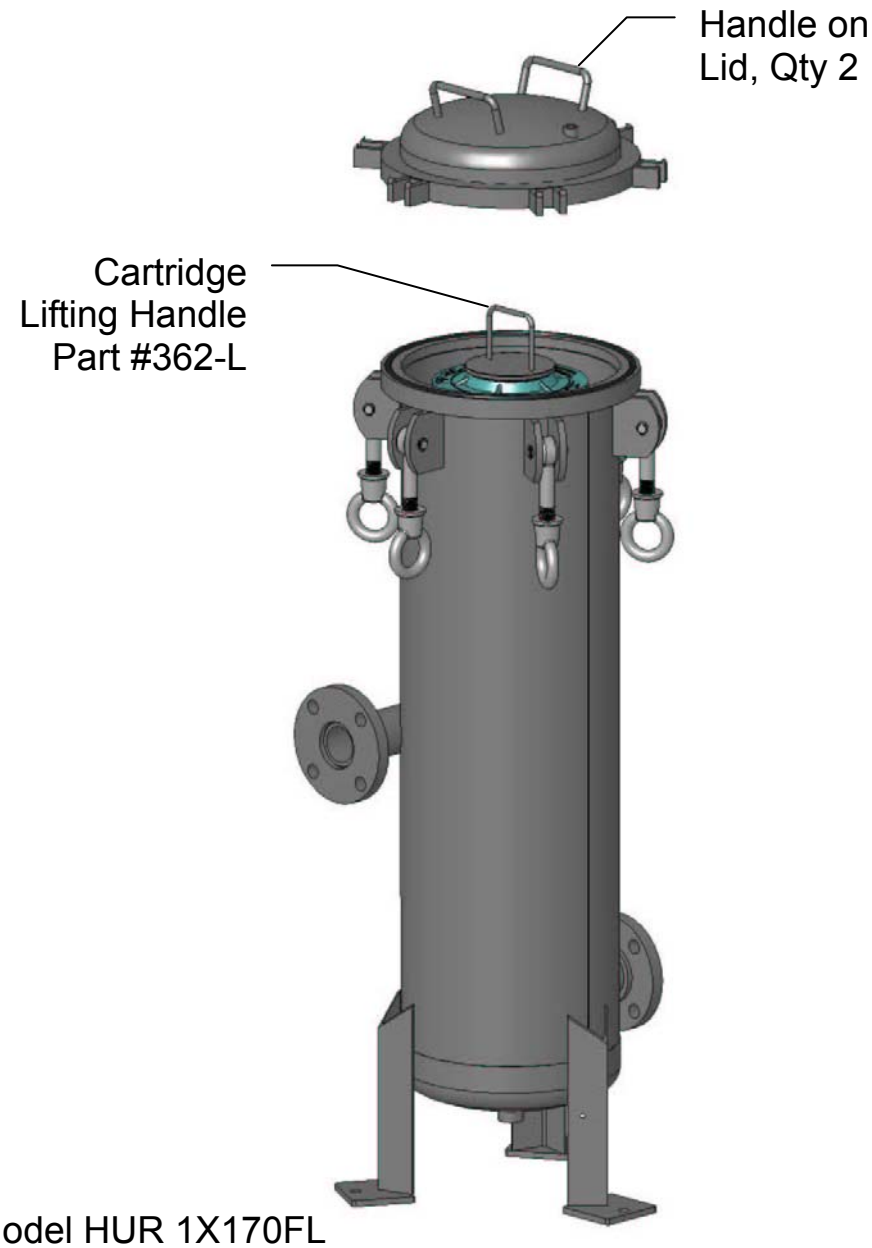
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CARTRIDGE REPLACEMENT cont.

5. When all of the Swing Bolt hardware is disengaged, the Lid can be removed.

5 a. For Model HUR 1X170FL the Handles on the Lid are used to raise and remove the Lid.

Note: The Lid must be raised sufficiently to clear the Cartridge Lifting Handle prior to removal.



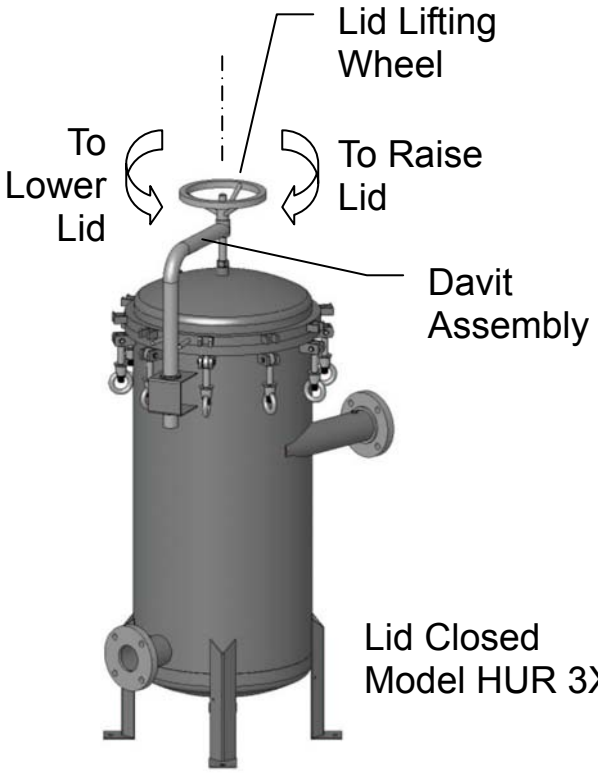
Model HUR 1X170FL

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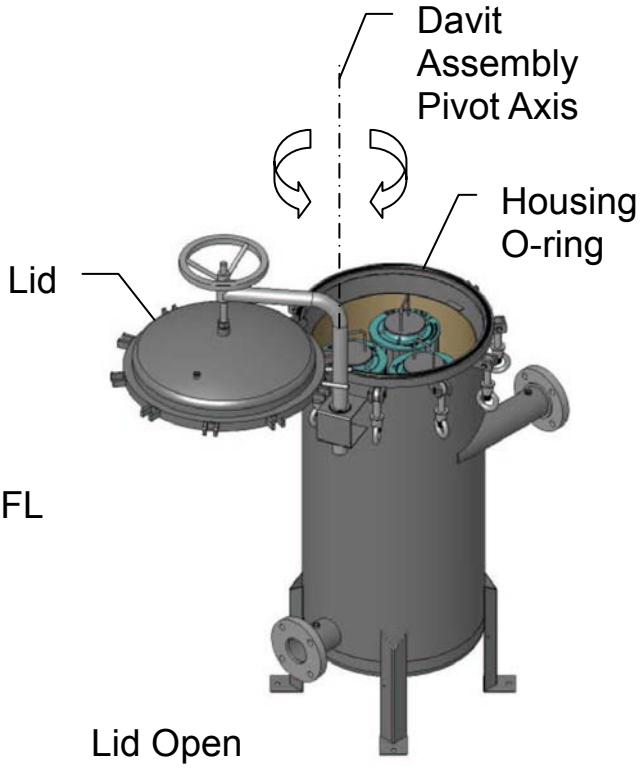
CARTRIDGE REPLACEMENT cont.

5 b. Models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL all have a Davit Assembly and Lid Lifting Wheel to raise and lower the Lid. To raise Lid, turn Lid Lifting Wheel clockwise. To lower Lid, turn Wheel counter-clockwise.
Note: Housing O-ring may stick to Lid. To prevent this, it is suggested to raise the Lid about 1/8” inch and move the Lid/Davit Assembly slightly sideways to free the O-ring from Lid while keeping the O-ring in its housing channel.
Continue raising Lid approximately 1” to clear housing. Swing Lid and Davit Assembly until cartridge compartment is fully exposed.

Caution: The Lid should be secured when servicing.



Lid Closed
Model HUR 3X170FL



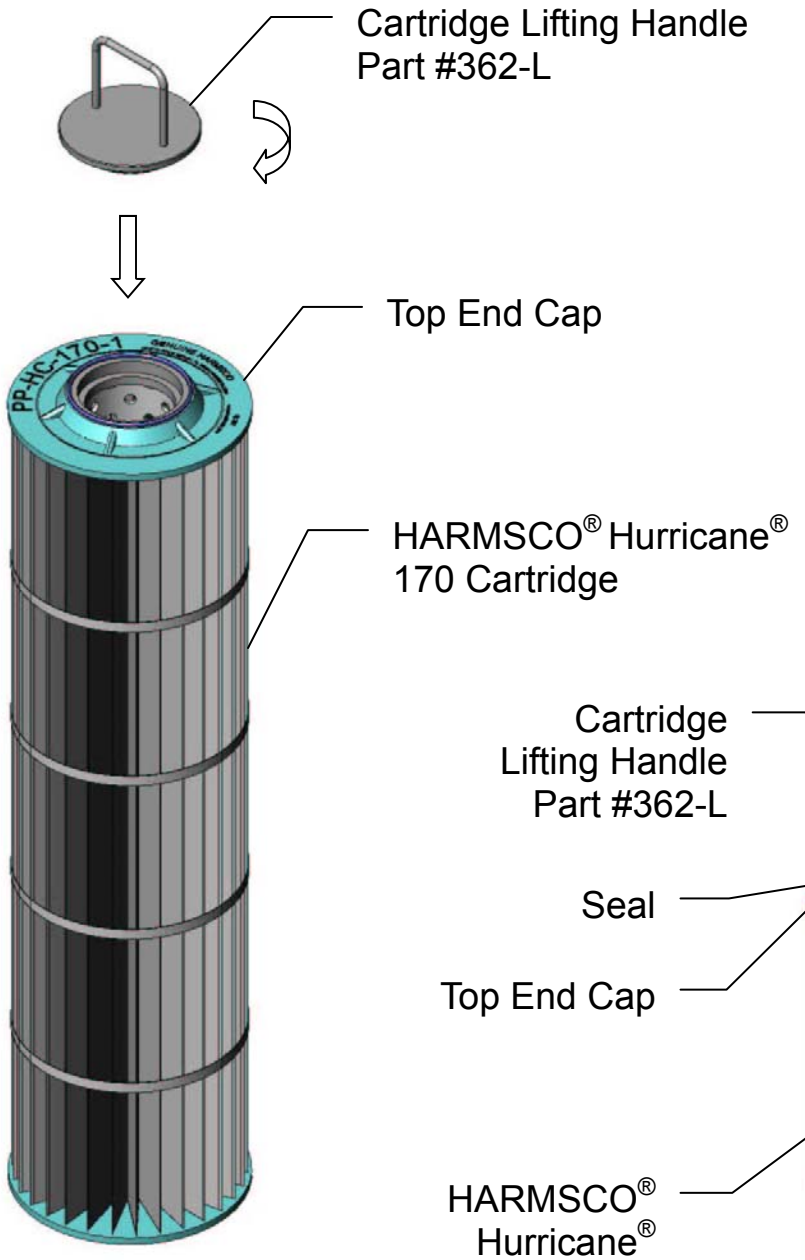
Lid Open
Model HUR 3X170FL

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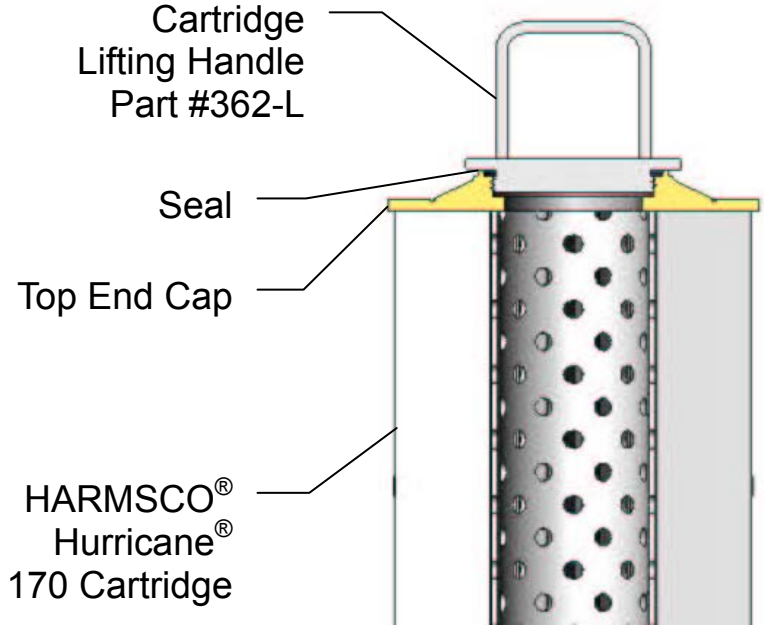
HARMSCO® Hurricane®
Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.

6. Install Cartridge Handle(s), part #362-L, to Cartridge(s). Tighten securely to seal with Top End Cap to prevent by-passing of the Cartridge.



Exploded View



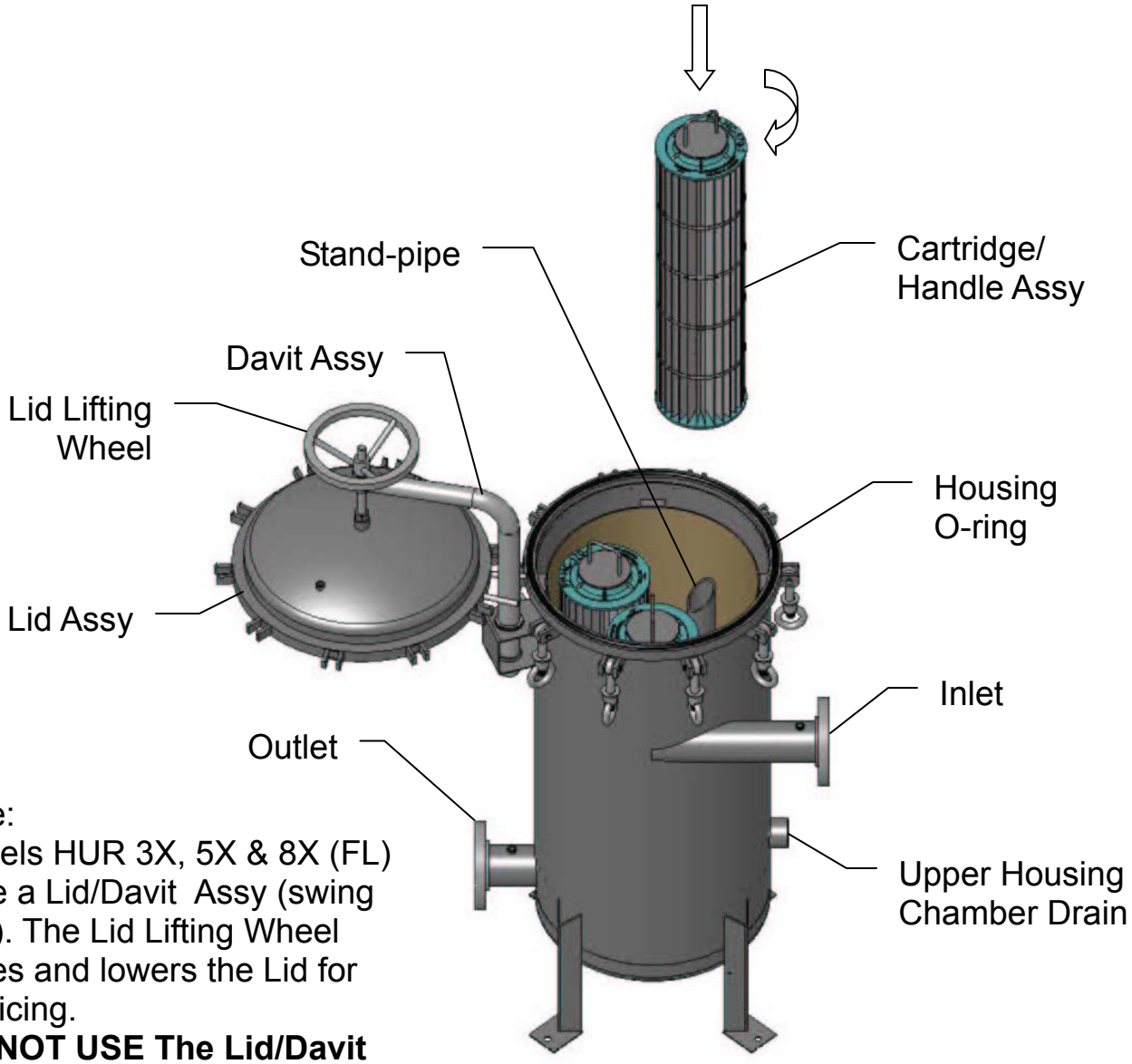
Partial Sectional View

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Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.

7. With swing bolts disengaged and lid removed, install Cartridge/Handle assembly(s) onto Stand-pipe(s). Position Cartridge/Handle assembly downward until Cartridge's Bottom End Cap contacts the housing's Tube Sheet. The Cartridge's Bottom End Cap will seal with the Stand-pipe Coupling to prevent by-passing. A clockwise rotating motion will help to position the Cartridge while engaging the Stand-pipe Coupling. Confirm all Cartridge/Handle assemblies are fully installed with all Cartridge Bottom End Caps contacting the housing's Tube Sheet, see illustrations on page 17.



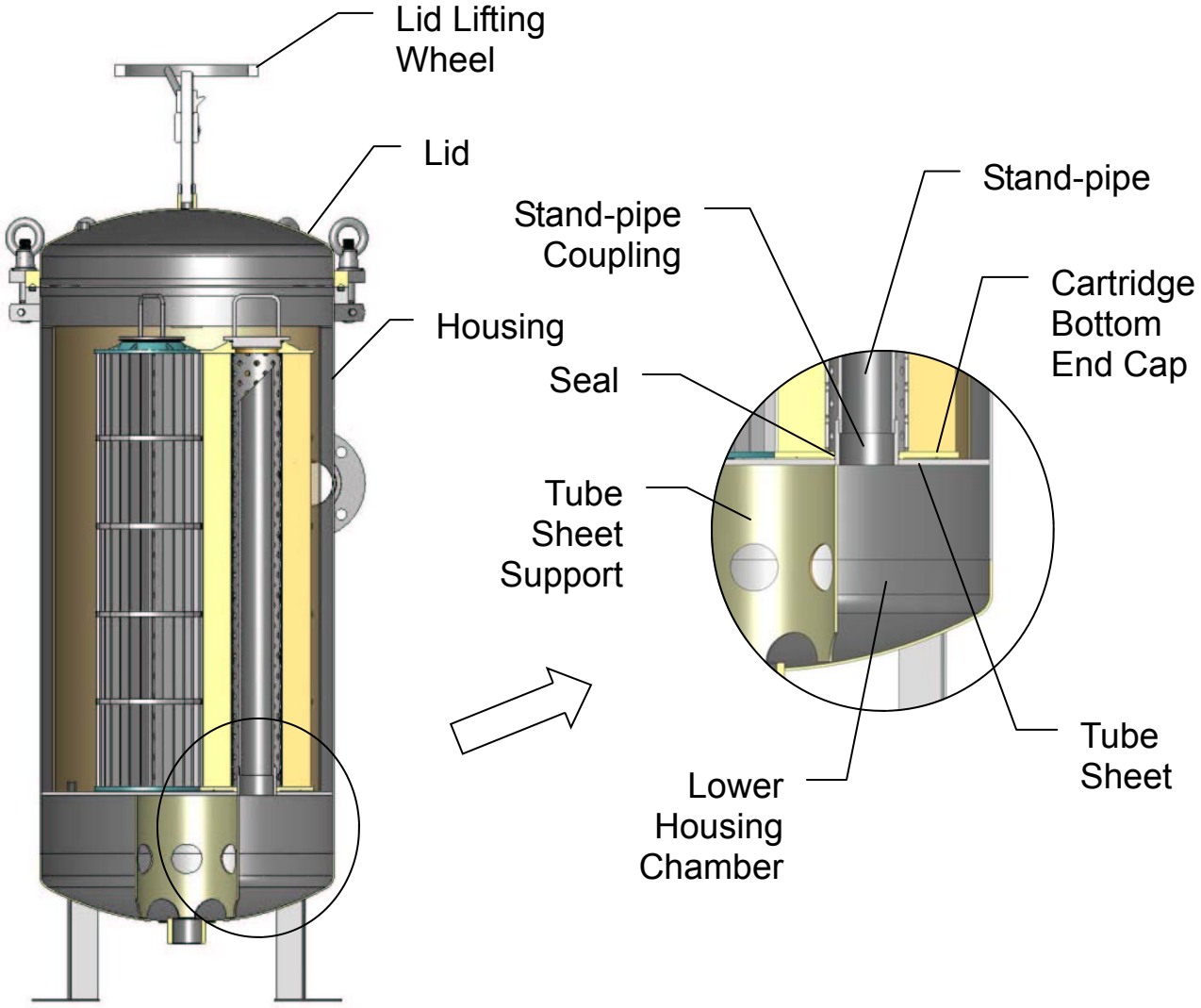
Model HUR 3X170FL

Note:
Models HUR 3X, 5X & 8X (FL) have a Lid/Davit Assy (swing arm). The Lid Lifting Wheel raises and lowers the Lid for servicing.
DO NOT USE The Lid/Davit Assy to raise the Lid while swing bolts are engaged.

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CARTRIDGE REPLACEMENT cont.



Section View
Model HUR 3X170FL

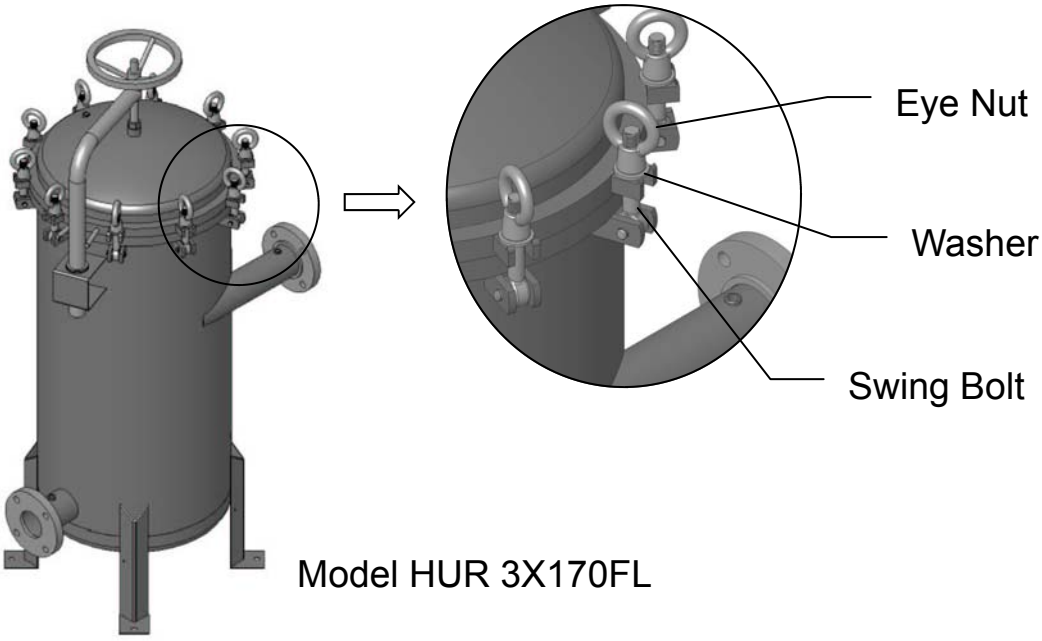
8. Inspect Housing O-ring and make sure that it is free from cracks and debris.
9. Clean Housing and Lid O-ring mating surfaces.
10. Place Housing O-ring into channel of Housing.
11. Return Lid to closure position and maintain alignment of Lid on Housing. Lower lid onto Housing O-ring. Make sure O-ring stays in the channel of the Housing. Do not allow tilting or cocking of Lid on the O-ring.

Note: The Lid/Davit Assembly is NOT to be carrying any load from the Lid at this time.

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CARTRIDGE REPLACEMENT cont.

12. Return all Swing Bolts, Eye Nuts, & Washers to their closure position.
13. Tighten all Eye Nuts by hand in a “star/criss-cross” pattern several times until all Eye Nuts are uniformly tight. Make sure Lid position and alignment to Housing is maintained.



Model HUR 3X170FL

14. Start the flow of water by first opening the inlet valve and allow the housing to completely fill, then, open the outlet valve.
15. Flush unit at recommended flow rate for 10 minutes prior to use. Inspect closure for any leaks. If a leak is observed, **Isolate and Remove Pressure in Housing,** then repeat steps 8 through 15.

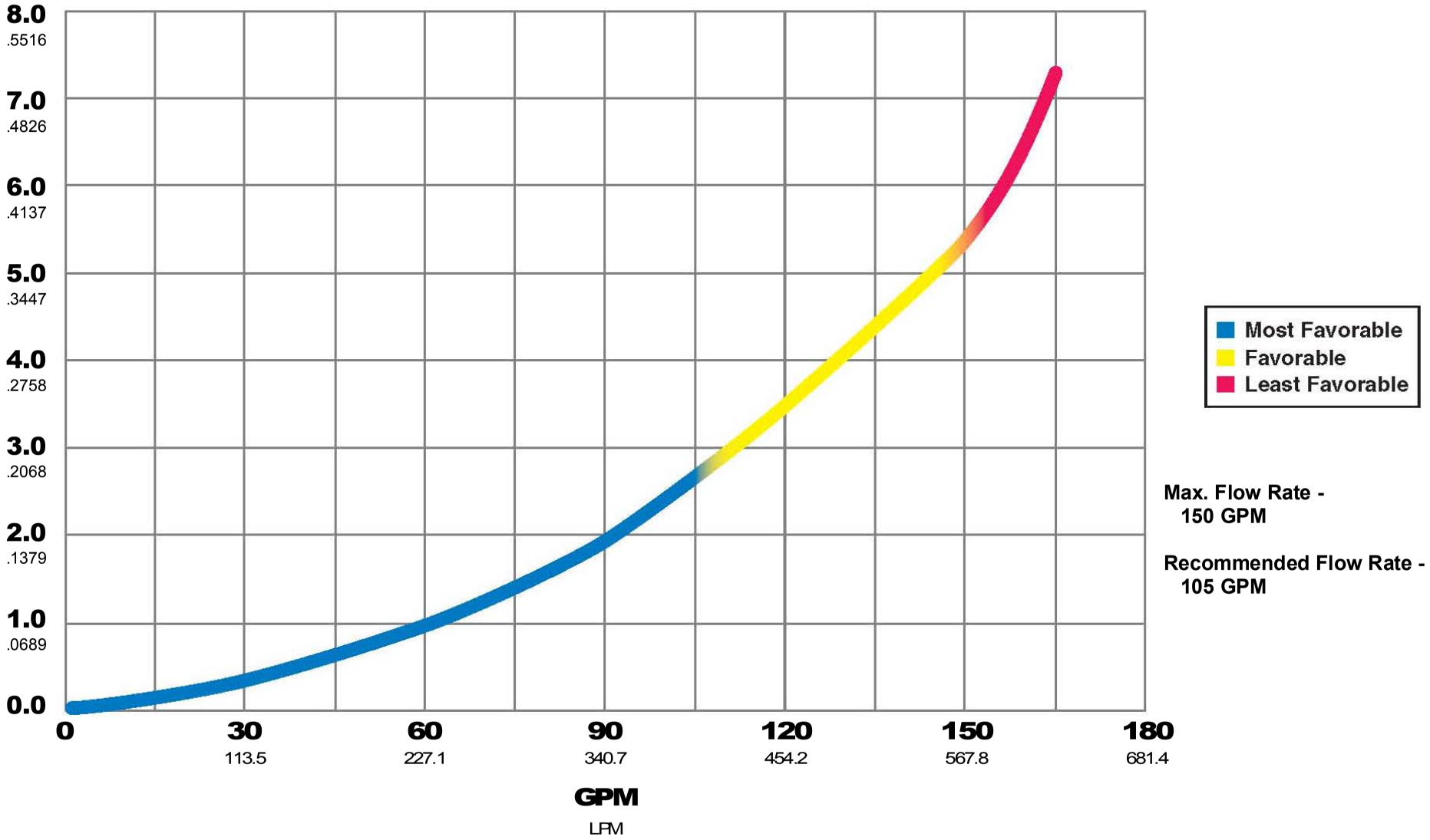
The Harmsco® Swing Bolt Water Filter is now operational.

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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 1X170FL
Hurricane® HC/170-20 Cartridge
Qty 1; with clean water.



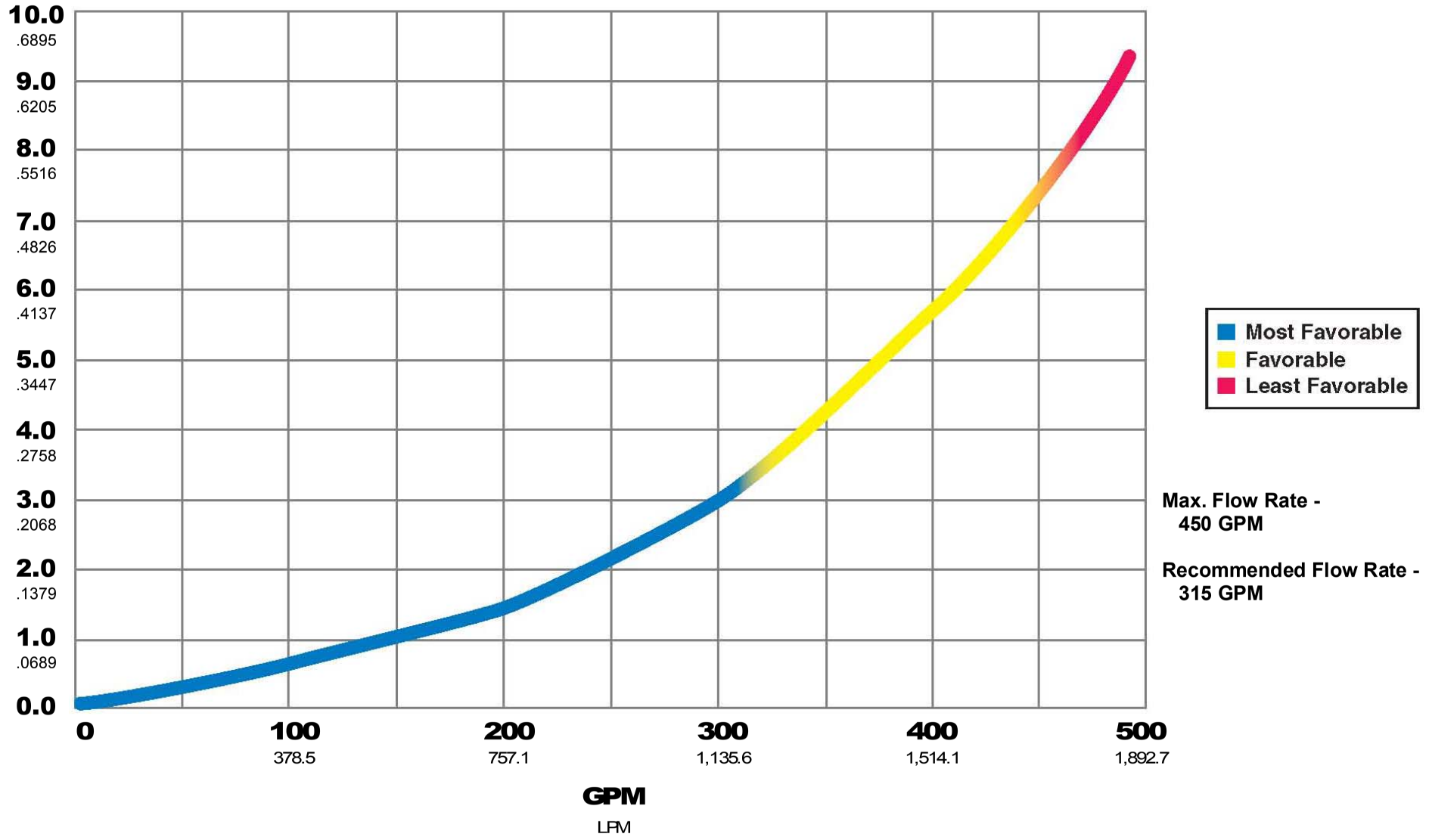
Max. Flow Rate -
150 GPM

Recommended Flow Rate -
105 GPM

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Pressure Drop vs. Flow Rate Curve

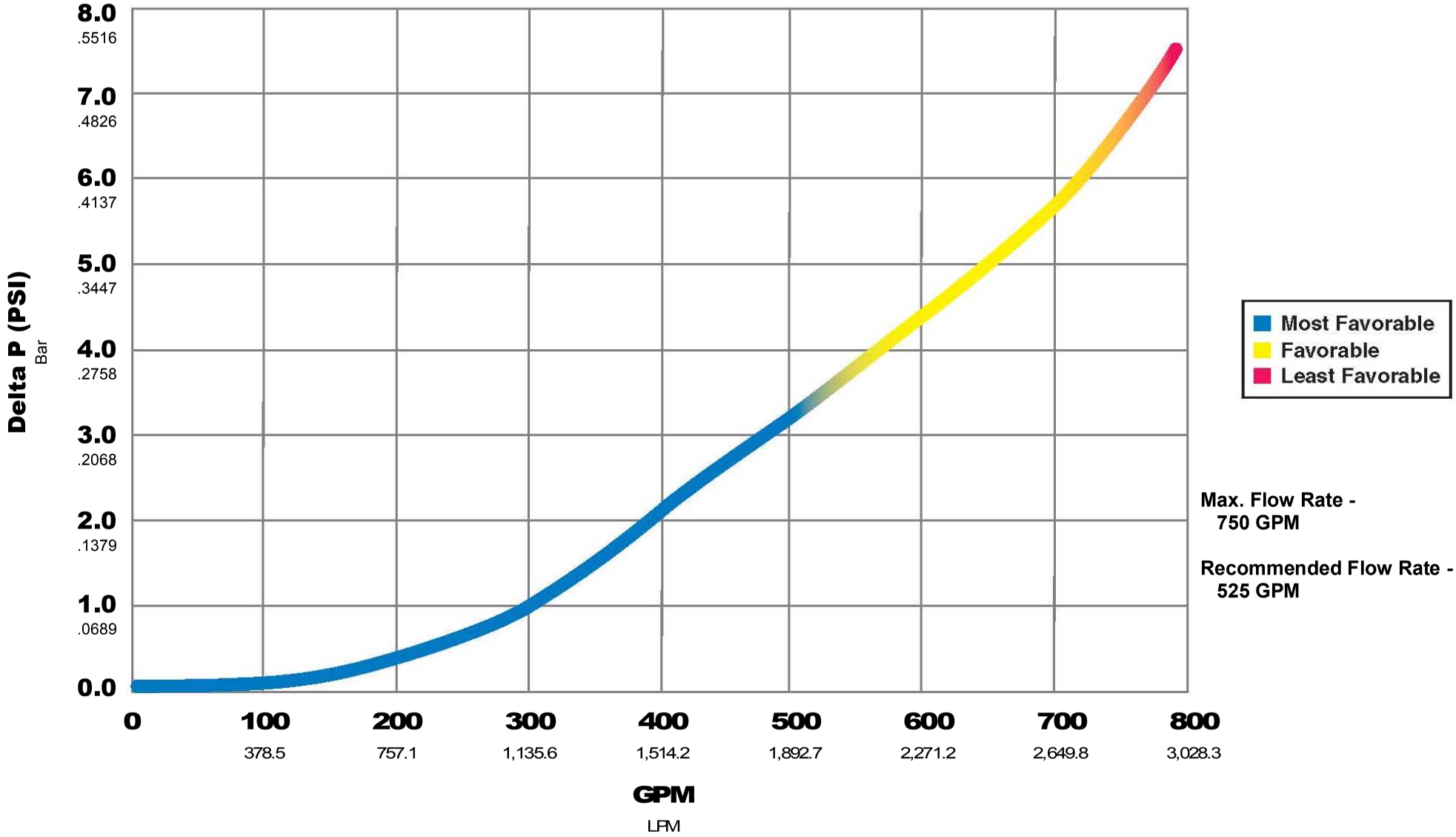
Harmsco® HUR 3X170FL
Hurricane® HC/170-20 Cartridges
Qty 3; with clean water.



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Pressure Drop vs. Flow Rate Curve

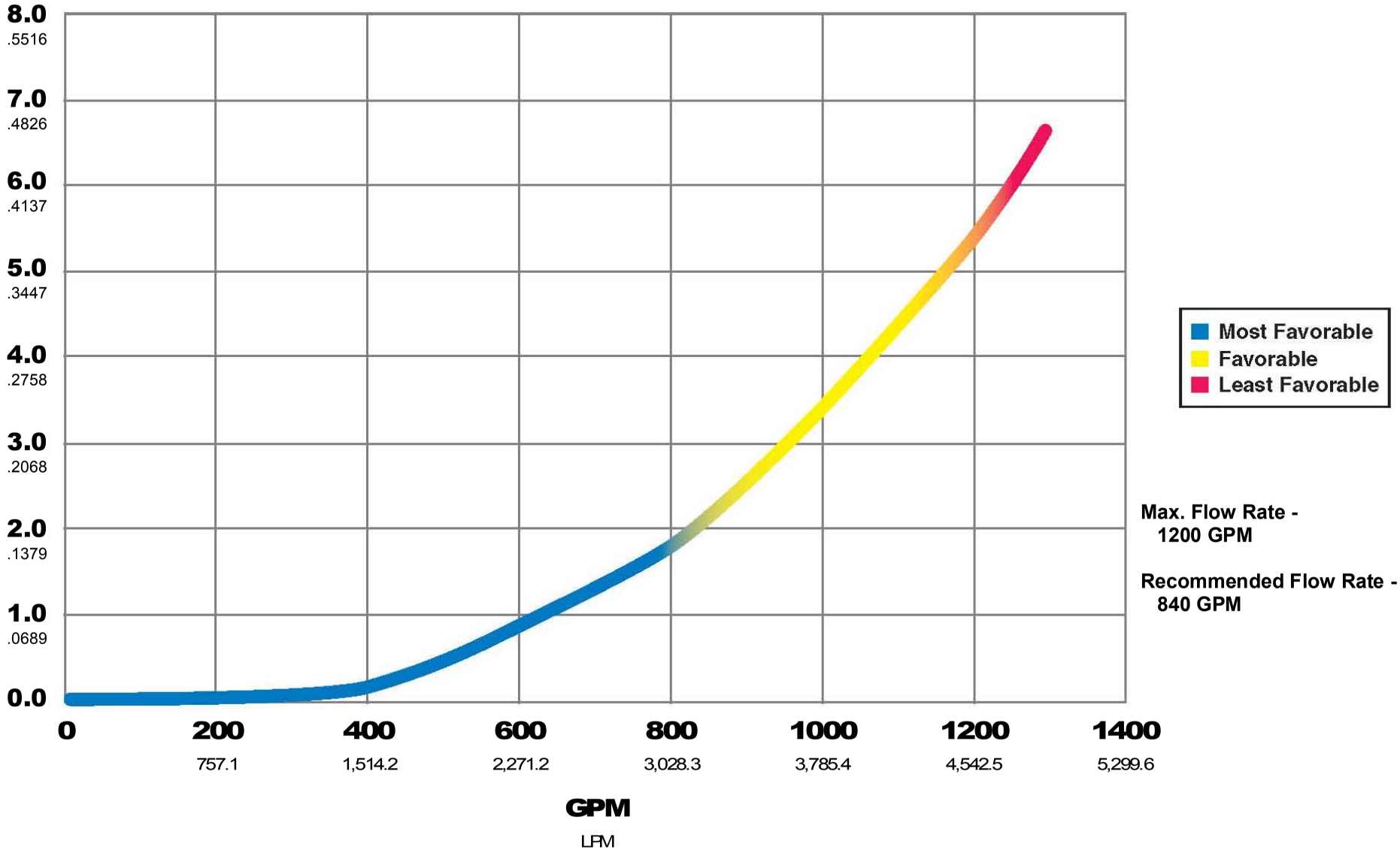
Harmsco® HUR 5X170FL
Hurricane® HC/170-20 Cartridges
Qty 5; with clean water.



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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 8X170FL
Hurricane® HC/170-20 Cartridges
Qty 8; with clean water.



HARMSCO® Hurricane®
Swing Bolt Water Filters

Filter Cartridge Cleaning Instructions:

For Filter Housings With Swing Bolt Closure.

*** * NOTICE * ***

THE FOLLOWING INSTRUCTIONS MUST BE READ AND FOLLOWED PRIOR TO USE.

Harmsco® Hurricane® cartridges are made of Polyester Plus™, a proprietary blend of polyester fibers, which can be cleaned, and re-used, in most applications and micron ratings. For best results, follow the directions described below.

Harmsco® is not held liable for determining cartridge cleaning applications and/or cleaning procedures implemented.

When Cartridge Cleaning is Possible:

Clean cartridge when pressure differential is 12 psi above start-up differential.

Normal Cleaning Procedure: Cartridge Cleaning in Aqueous Applications. For best results, clean cartridges with pressure nozzle using standard hose. Direct spray at an angle to remove particulate.

Special Cleaning Procedures:
For oils, soak cartridge in a solution of tri-sodium phosphate or equivalent detergent (two lbs. to ten gallons of water). Soak for up to 12 hours. Rinse thoroughly.

For organic matter, algae, use tri-sodium phosphate solution as described above, plus 1 pint of liquid chlorine. Soak cartridge for one hour, or until filter surface is not slippery. Rinse thoroughly.

For calcium mineral deposits, follow directions for oils described above, then soak cartridge for ten minutes in a solution of one part muriatic acid to twenty parts of water. Rinse thoroughly.

Non-cleanable Applications:

Replace cartridge when pressure differential is 30 psi above start-up differential, or when flow has diminished to an unacceptable level.

Generally, it is not possible to clean filter cartridges when filtering petroleum base liquids, cyst reduction applications, toxic substances, and 1 micron or smaller rating.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

Cartridge Replacement Instructions (Quick Reference):

For Filter Housings With Swing Bolt Closure.

*** * NOTICE * ***

THE FOLLOWING INSTRUCTIONS MUST BE READ AND FOLLOWED PRIOR TO USE.

1. **Always Isolate And Remove Pressure From Housing Before Servicing.** Housing is to be shut off and drained of fluid by first opening the lower drain.
2. Open filter housing by turning Eye Nuts counter-clockwise, disengaging Swing Bolts, and removing Lid. Take out used cartridge(s) and remove cartridge lifting handle(s).
3. Remove new cartridge(s) from packaging and make sure center cores are clear of all obstructions, dessicants and shipping materials.
4. Install cartridge lifting handle(s) into cartridge(s).
5. Insert Cartridge(s) into housing and onto Stand-pipe(s), cartridge(s) is(are) to contact Tube Sheet of housing.
6. Position housing O-ring seal in groove of housing.
7. Position Lid onto housing and properly align on O-ring before applying Swing Bolts. Do not allow tilting or cocking of Lid on the O-ring.
8. Close filter housing by tightening Eye Nuts clockwise by hand. Use a “star/criss-cross” pattern several times to tighten all of the Eye Nuts uniformly tight.
9. Open inlet valve and allow fluid to fill housing.
10. Open outlet valve.
11. Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.

Should a leak appear at the housing O-ring, isolate and relieve pressure and repeat steps 6 through 11. Always isolate and remove pressure from housing before servicing any part of filter.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.

Harmsco® Filtration Products

With Patented Up-Flow Filtration Technology

www.harmsco.com

(561) 848-9628

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Harmsco Inc. Industrial Filters Limited Warranty

1. Harmsco, Inc. warrants its line of Industrial Filters to be free of defects in material and workmanship for a period of one year from the date of installation.
2. The warranty for Industrial Filters ordered with special coatings is limited only to the recoating of the defective parts due to failure in materials or workmanship for one year from date of installation.
3. This warranty does not cover any equipment purchased for use in applications in which the product is not suited. It is the responsibility of the buyer to determine if a product is suitable for a particular application.
4. **THIS WARRANTY EXCLUDES THE FOLLOWING:**
   - **A.** Any fresh water unit installed for salt water use.
   - **B.** Damage caused by improper installation, operation or care.
   - **C.** Chemical attack.
   - **D.** Modification or alteration by other than Harmsco employees.
   - **E.** Rubber type parts and normal wear items i.e. "O" rings, rim gaskets, wing-nuts, pipe caps, holding rods.
   - **F.** Any costs of labor or expenses expended in the removal and/or installation of unit, or any surrounding device.
   - **G.** Damage caused by galvanic or electrolytic attack.
   - **H.** Altering or removing the Harmsco, Inc. information label.
   - **I.** Any unit not grounded.
5. Service under this warranty is to be provided by the distributor who sold the unit to the user. If the distributor is unable to provide warranty service, contact:

Harmsco, Inc., P.O. Box 14066
North Palm Beach, Florida, 33408, U.S.A.
Phone: (561) 848-9628 • Fax: (561) 845-2474

A Returned Goods Authorization (RGA) number must be received from the above office and placed on all shipments to and correspondence with Harmsco, Inc. Please be prepared with the following information: **1.** Model number and serial number. **2.** Date of installation. **3.** Name of installer **4.** Nature of problem. **5.** Your address and telephone number.

****NOTICE****

Some of the information contained in this publication has been obtained from outside sources and is considered accurate. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. For this reason, we do not assume any liability for the accuracy or completeness of the data in this publication. End users should perform their own tests to determine suitability for each application.

Available from:

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Toll Free: (800) 327-3248
Fax: (561) 845-2474
Local: (561) 848-9628
E-mail: sales@harmsco.com

MADE IN U.S.A.

Harmsco® Filtration Products

P.O. Box 14066, North Palm Beach, Florida 33408

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RLC Electronic Systems

CALIBRATION CERTIFICATE

UV PROBE CALIBRATION REPORT

This document states that the instrument described below meets or exceeds all manufacturer specifications and has been compared to standards which are directly traceable to the National Institute of Standards and Technology and whose procedures are in accordance with the requirements of ANSI/NCSL Z540-1-1994, ISO 10012-1:1992(E).

Calibration Date: 3-8-16 Next Cal Due:

Certificate #: 6-01095

Sensor Model: ATS-282x6 Sensor Serial Number: M282x6-01095

Calibration/Repair Remarks:

Light Meter Reading (in mW/cm	Probe Reading	Error (% of full scale)	Pass / Fail
10.00	9.97	0.003	P
8.00	8.05	0.006	P
6.02	6.07	0.008	P

* Set software parameters to match light meter reading.

Probe Temperature (start): 23.12 Probe Temperature (end): 25.81

Maximum Calibration Error: 0.008

Calibrated By: B. Gernert

The below listed instrumentation was used in the calibration.

Model & Serial #: IL1400A #6988 Cal Date: 03-Oct-14 Cert #: 1409261304E

Model & Serial #: XRL140T254 #1602 Cal Date: 02-Oct-14 Cert #: 410025203

Bulb wattage: 120 Ballast Model: Workhorse 7

RLC Electronic Systems
10 corporate blvd
Sinking spring, PA 19608
P 610-898-4902 / F 610-898 4903
www.rlcsystems.com

Aqua Treatment Service, Inc.

AMALGAM SERIES VERTICAL

UV SYSTEMS

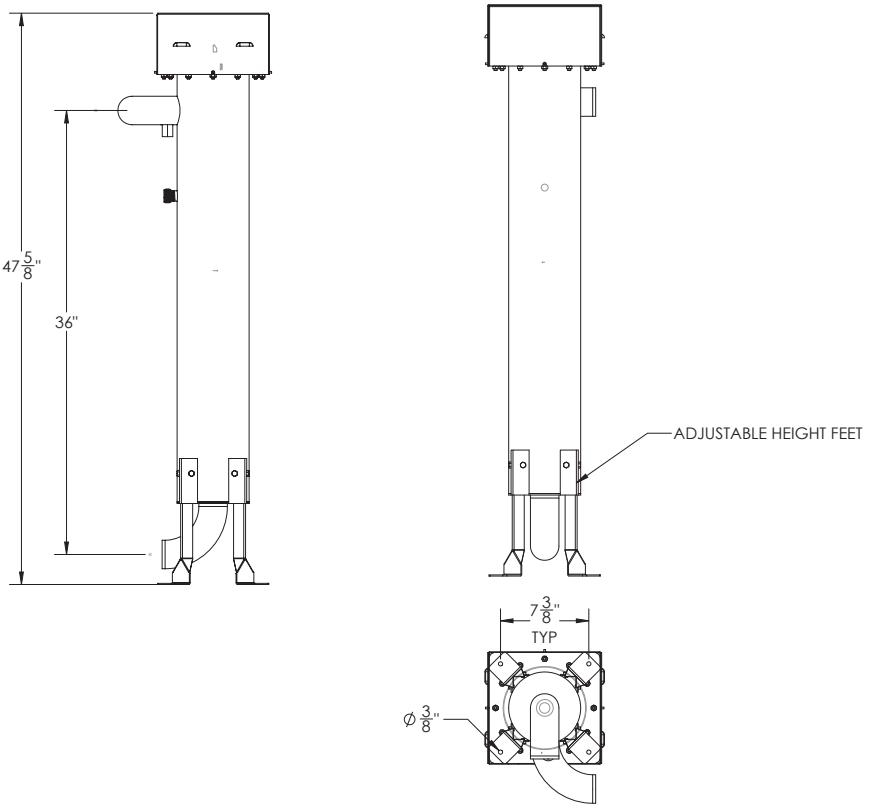


OPTIONS:

- Adjustble Settings Thermistor Overheat Safety Control
- Remote PLC Monitoring Connection
- Control Box Mounting Stand (powder coated)
- UV Intensity Monitor / NIST Traceable Calibrated UV Sensor
- Energy Saver Pacing
- 1/4" Sample Ports on Inlet / Outlet Riser
- 304 SS #4 Brushed Finish on Nema 4 Type Control Box
- 220 - 240 Volt / 50 - 60 Hz Electrical Components
- UV Light Traps on Inlet / Outlet
- Sanitary - Tri - Clamp Fittings
- Manual Quartz Sleeve Wiper
- 316 Stainless Steel Wetted Parts

FEATURES:

- Amalgam High Output UV Lamps
- 12,000 Hour Lamp Life
- UV Chamber Overheat Control
- UV Sight Port
- Flange or Threaded Inlet / Outlet Connections
- Internal Water Flow Diverter
- Internal Multi-Level Flow Balance System
- Internal Multi-Level Quartz Sleeve Stabilizer
- Removable UV Lamp / Quartz Sleeve Service Rack
- Nema 4 Type Electrical Box Enclosure
- Power ON/OFF Switch
- Fused Circuits
- Drain Valve
- Integral UV Light Traps



SPECIFICATIONS:

Model#	No. Lamps	KW @ 120V	AMP @ 120V	Pipe Size	Overall Dimensions L x W x D	Wetted Material	Shipping Weight
AS - V16	1	0.17	1	1.5”	47.5” x 10” x 17”	304 SS	35 lbs.
AS - V26	2	0.33	2	2”	47.5” x 11.25” x 17”	304 SS	45 lbs.
AS - V36	3	0.49	3	3”	47.5” x 11.25” x 17”	304 SS	60 lbs.
AS - V38	3	0.49	3	3”	47.5” x 12” x 19”	304 SS	98 lbs.
AS - V48	4	0.66	4	4”	47.5” x 12” x 19”	304 SS	105 lbs.
AS - V58	5	0.83	5	4”	47.5” x 12” x 19”	304 SS	165 lbs.
AS - V510	5	0.83	5	4”	47.5” x 14” x 21”	304 SS	45 lbs.
AS - V610	6	0.97	6	6”	47.5” x 14” x 21”	304 SS	60 lbs.
AS - V612	6	0.97	6	6”	47.5” x 16” x 21”	304 SS	98 lbs.
AS - V810	8	1.3	8	6”	47.5” x 16” x 21”	304 SS	105 lbs.
AS - V812	8	1.3	8	6”	47.5” x 16” x 23”	304 SS	165 lbs.

ULTRAVIOLET DOSAGE:

Model#	Flow = GPM @30K EOL	Flow = GPM @40K EOL	Flow = GPM @30K EOL	Flow = GPM @90K EOL	Flow = GPM @300K EOL
AS - V16	59	44	63	21	6
AS - V26	115	86	121	40	12
AS - V36	167	125	175	58	17
AS - V38	233	175	246	82	24
AS - V48	305	228	321	107	32
AS - V58	373	280	393	131	39
AS - V510	484	363	510	170	51
AS - V610	574	430	604	201	60
AS - V612	705	529	743	247	74
AS - V810	745	559	785	261	78
AS - V812	924	693	973	324	97

COLOR KEY:
- Clear Fresh Water at 94% UVT
- DI / RO Water at 99% UVT
- DI / RO Water (-03D) at 99% UVT
- DI / RO Water (TOCR) at 99% UVT

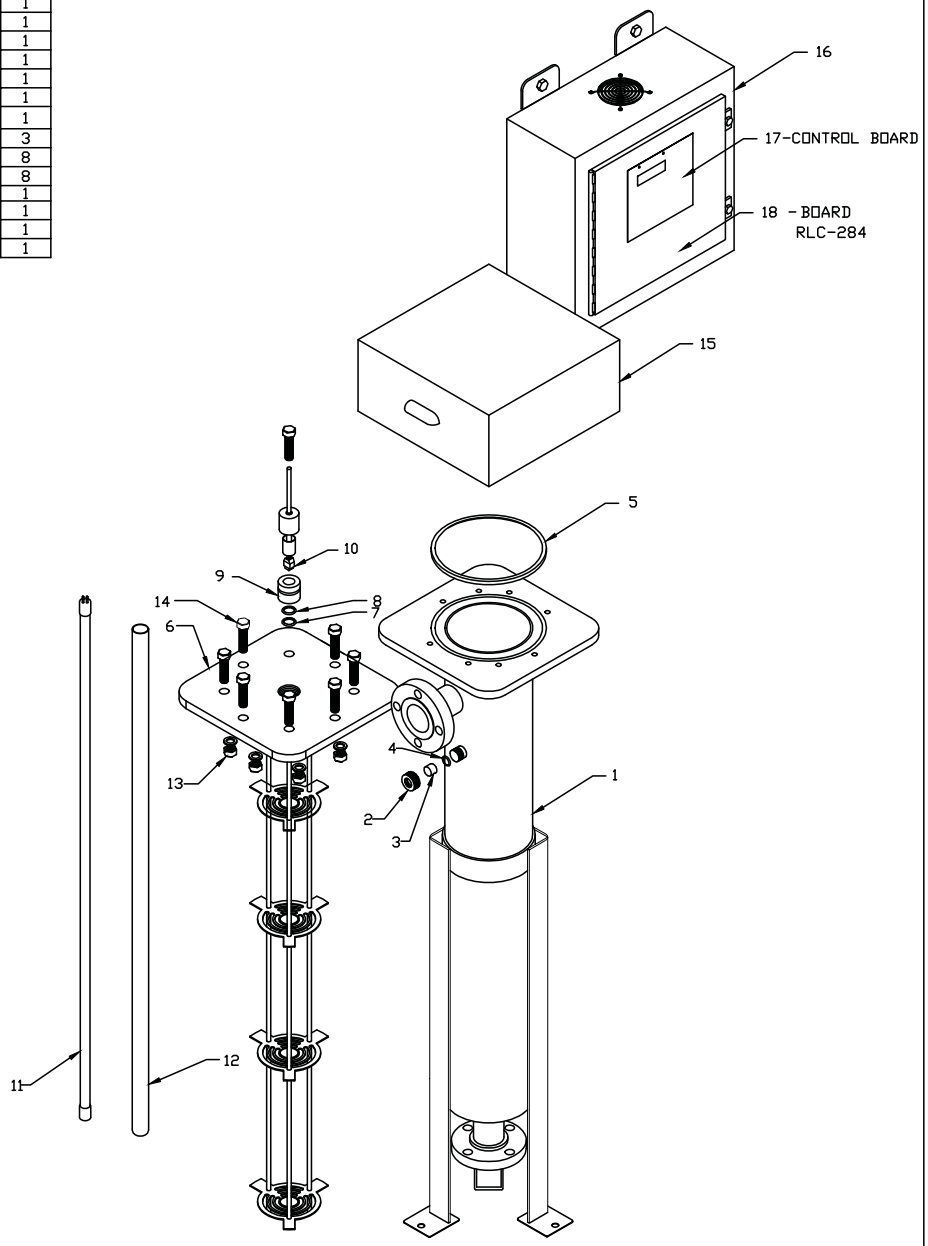
NOTES: 220V Specs are available upon request

ATS Aqua Treatment Service, Inc.
Providing Better Water For Better Living

Aqua Treatment Service, Inc
194 Hempt Rd,
Mechanicsburg, PA 17050
800 . 224 . 7476 fax: 800 . 787 . 0197
www.aquat.com

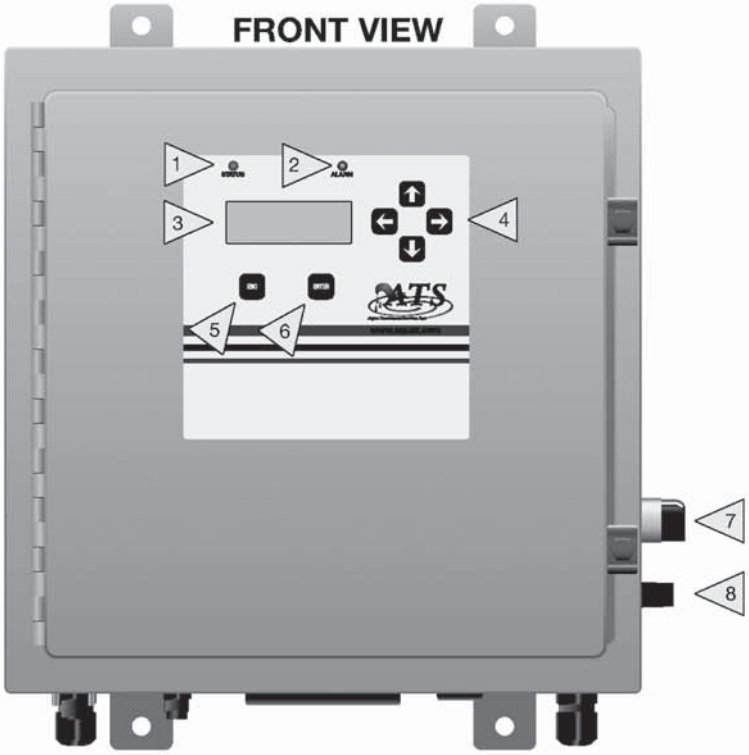
Parts Breakdown - AS-V16

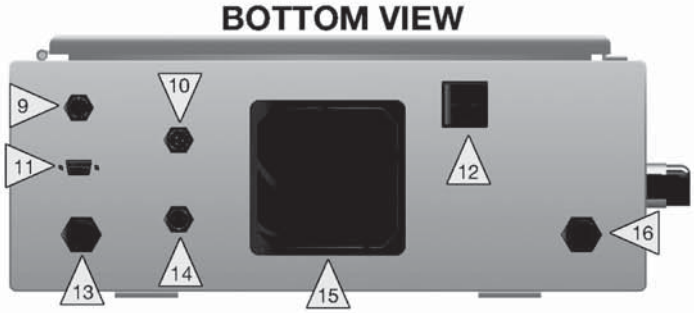
	P/N	QTY
1	ASV-20106-2.0	1
2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90006-DR	1
6	ASV-30106	1
7	ATS8-544	1
8	AS0-90000-RR	1
9	AS0-90000-EN	1
10	ASV-50100-4	1
11	ATS AS19-254	1
12	ATS28-889D	3
13	1170861	8
14	1170059	8
15	ASV-70006	1
16	CONTROL BOX	1
17	BALLAST ATS1-417	1
18	BOARD RLC-284	1



mat'l code 304 STAINLESS STEEL				tolerances unless otherwise specified			COPY 1	AQUA TREATMENT SERVICE, INC. 194 HEMPT ROAD MECHANICSBURG, PA 17050 (717) 697-4998 FAX (800) 787-0197
ltr	ecn no	dr	date	linear			CUSTOMER	
				angles				
				dr	T.GARLICK	8/13/12		P/N AS-V16
				engr				
				chr				AMALGAM STERILIZER VERTICAL SERIES
				appd				
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom								

Parts Breakdown - Electronic Control System





Monitor Parts Breakdown

Front View

1. System Status Lamp
2. Alarm Status Indicator Lamp
3. System Display Screen
4. Curser Direction Keys
5. Escape/Back Key
6. Enter Key
7. Off/On Power Switch
8. Fuse

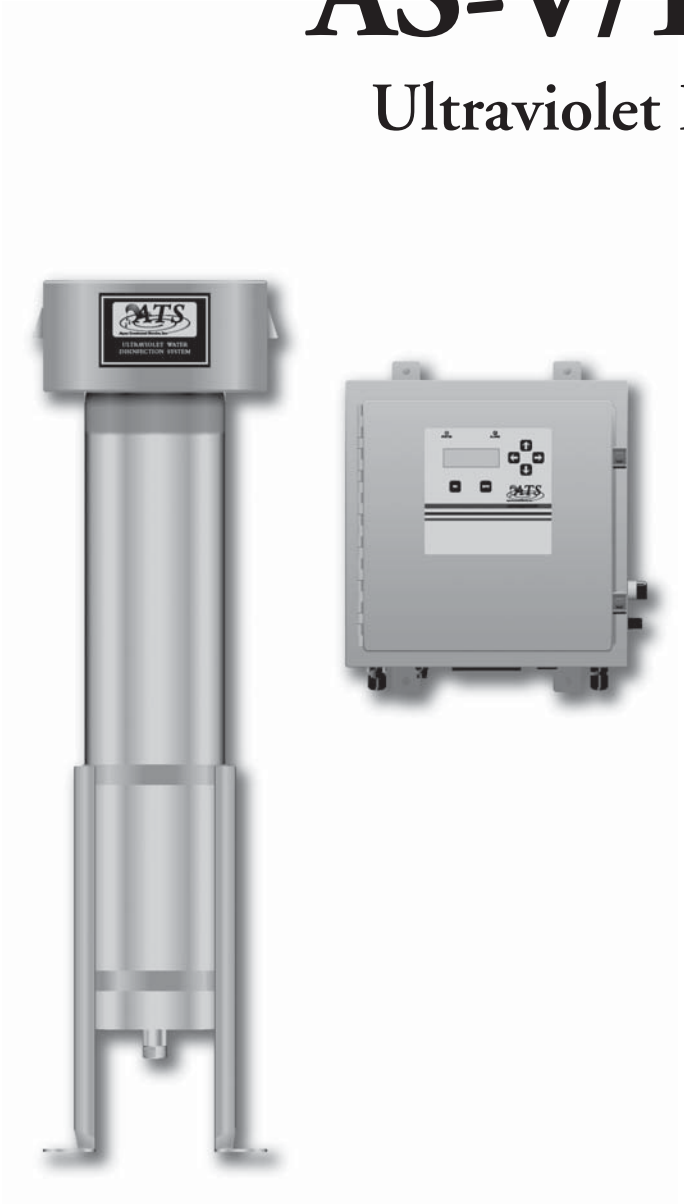
Bottom View:

9. UV Probe Connection
10. Flow Meter Connection
11. RS232 Connection for Software
12. Shutoff Solenoid Power Plug-in
13. Power Cord
14. Pressure Siwtch Connection
15. Cooling Fan
16. Cables Leads to Skid Unit

Aqua Treatment Service, Inc.

AS-V/186K Series

Ultraviolet Disinfection Systems



MODELS:

AS-V 16
AS-V 26
AS-V 36
AS-V 38
AS-V 48
ATS-186K-10
ATS-186K-20
ATS-186K-40
ATS-186K-60
ATS-186K-80
ATS-186K-120
ATS-186K-240
ATS-186K-480

Installation, Operation and Maintenance Manual

CAUTION: Read and Follow all safety rules and operating instructions before first use of product.

DEALER NAME: _____
DEALER PHONE #: _____
MODEL #: _____
SERIAL #: _____
DATE INSTALLED: _____

Aqua Treatment Service, Inc.
194 Hempt Road
Mechanicsburg, PA 17050
www.aquat.com

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General Safety Instructions

WARNING - to guard against injury, basic safety precautions should be observed, including the following:

1. READ AND FOLLOW ALL SAFETY INSTRUCTIONS.

2. DANGER - To avoid possible electric shock, special care should be taken since water is present near electrical equipment. Unless a situation is encountered that is explicitly addressed by the provided maintenance and troubleshooting sections, do not attempt repairs yourself, refer to an authorized service facility.

3. Carefully examine the disinfection system after installation. It should not be plugged in if there is water on parts not intended to be wet.

4. Do not operate the disinfection system if it has a damaged power cord or plug, if it is malfunctioning or if it is dropped or damaged in any manner.

5. Always shut off water flow and unplug the disinfection system before performing cleaning or maintenance activities. Never yank the power cord to remove it from an outlet. Grasp the plug and pull to disconnect.

6. Do not use this disinfection system for other than the intended use (potable water applications.) The use of attachments not approved, recommended or sold by the manufacturer / distributor may cause an unsafe condition.

7. Intended for indoor use. Do not install this disinfection system where it will be exposed to the weather. Do not store this disinfection system where it will be exposed to temperatures below freezing unless all the water has been drained from it and the water supply has been disconnected.

8. Read and observe all the important notices and warnings on the water disinfection system.

9. If an extension cord is necessary, a cord with a proper rating should be used. A cord rated for less Amperes or Watts than the disinfection system rating may over heat. Care should be taken to arrange the cord so that it will not be tripped over or accidentally pulled from the outlet.

1. SAVE THESE INSTRUCTIONS.

2. WARNING: The light given off by this unit can cause serious burns to unprotected eyes and skin. Never look directly at a lit UV lamp. When performing any work on the UV Disinfection System, always unplug the unit first. Never operate the UV system while the lamp is outside of the UV chamber.

3. WARNING: The UV lamp inside of the disinfection system is rated at an effective life of approximately 12,000 hours. To ensure continuous water treatment, replace the UV lamp annually with the appropriate Aqua Treatment Services UV lamp. Failure to comply may present a fire hazard.

Function

The function of this ultraviolet disinfection unit is to provide in excess of 99% reduction of all water borne pathogenic (disease causing) bacteria. The 186K Series will provide >4Log Reduction or 99.99% of bacteria, cysts, and viruses including adenovirus.

Applications:

Ultraviolet Germicidal Disinfection

A.T.S. Ultraviolet Disinfection Units are designed to destroy micro-organisms in water supplies. The Ultraviolet lamp peak radiation of 254 nanometer wavelength (nm) destroys or inactivates the D.N.A. (deoxyribonucleic acid) which absorbs the Ultraviolet radiation. A.T.S. Germicidal Disinfection units meet minimum dosages of 30,000 microwatt second per square centimeter. The 186K Series provides in excess of 186,000uws/cm2 UV dose.MAXIMUM CONCENTRATION LEVELS BEFORE ULTRAVIOLET:

Turbidity.....5 NTU	**Hardness.....7 gpg**
Color.....None	**Iron.....0.3 ppm**
Manganese.....0.05 ppm	**pH.....6.5 - 9.5ppm**

Important Note - Pre-filtration equipment may be required if these parameters cannot be maintained. Flow rate must not exceed rated capacity of the unit.

Description

The AS-V series are of unique design with an ultraviolet germicidal lamp housed within a single quartz sleeve surrounded by a stainless steel pressure chamber. The chamber is fabricated out of 304 Stainless Steel. A removable stainless steel cover exposes electrical components for servicing, when required.

The AS-V series come with an ultraviolet lamp designed with a four pin single end connection.

The quartz sleeve is intended to be placed through the disinfection chamber and will slightly protrude from each hole in the top plate. The ultraviolet lamp is placed within this quartz sleeve. The U.V. light shines through this specially designed hard quartz sleeve for maximum disinfection efficiency to meet the requirements for bacteria reduction in potable water.

The inlet is located at the bottom of the chamber and the outlet is located on the side of the chamber. A Site Port is provided for safe and easy view of operation.

Installation

Pre-Installation Check List

Water Pressure —— If the water pressure is over 100 psi, a pressure reducing valve must be installed before the equipment and set at 85 psi

Electrical —— A grounded electrical outlet with a continuous supply of 110 to 120 volt - 60 hertz current should be located at installation site of the equipment.

A drain, must be available within 20 feet of the equipment.

Location of the equipment must be where it is not subject to freezing, direct sunlight or room Temperature over 120°F.

The equipment must be installed on the cold water line after the well pressure tank or water meter and before it branches off to the water heater.

Before putting the unit into final operation follow sanitation procedures as outlined in this manual for proper disinfection. Sanitizing all discharge piping and fittings with chlorine or approved water piping disinfection process. from disinfection unit to point of use removes existing contaminants and gives the unit a "clean start." Be sure to rinse with U.V. treated water.

A proper flow control must be used to insure only the designated flow through the unit.

Installation

1. All plumbing must conform to local codes

2. Location Selection

- If it is likely that supplementary water treatment equipment will be required, make certain adequate additional space is available. The AS-V series are always placed after the pressure tank and any other type of treatment devices (i.e. softeners, filters). It is recommended to use some form of pre-treatment, such as a cartridge filter, to improve the clearity of the water and to safely disinfect the plumbing system.
- Do not install any equipment closer to a water heater than a total run of 10 feet of piping between the outlet of the equipment and the inlet to the heater.

3. Water Line Connection

- Close main water supply valve.
- Open faucets to relieve water pressure and drain system.
- Mount the equipment into installation position.
- Assess the installation (i.e. type of pipe, size of lines, etc.) and obtain necessary plumbing fittings for installation. Use Teflon tape on all threaded connections and avoid over tightening.

WARNING:

If your piping system is subject to impulse pressure resulting in a "water hammer" condition, a surge tank or other means must be provided to remove this condition; otherwise, this extreme shock pressure condition may rupture or fracture the quartz sleeve.

4. Quartz Sleeves and UV Lamps

- After mounting, install quartz sleeve, O-Ring, and bulb per instructions. Turn on the water slowly, check for leaks, and repair as needed prior to full service operation.

NOTE: For more detail on installation, cleaning and maintenance of the UV Lamps and Quartz Sleeves, see page 7 of this manual.

NOTE: Once the system has been pressure check for leaks, the system needs to be disinfection using the sanitation procedures. (See page 6 for instructions.)

5. Electrical Connection

- Remove twist tie from cord set and extend cord to its full length. Plug into socket that will accept 3-prong. Be sure the electrical outlet is not controlled by a wall switch. Turn power on and set electronic controls to current time of day (refer to user quick reference guide for setup instructions).If hard wiring electrical power make sure you review the wiring diagram and have electrical work done by a licenced electrician.

WARNING:

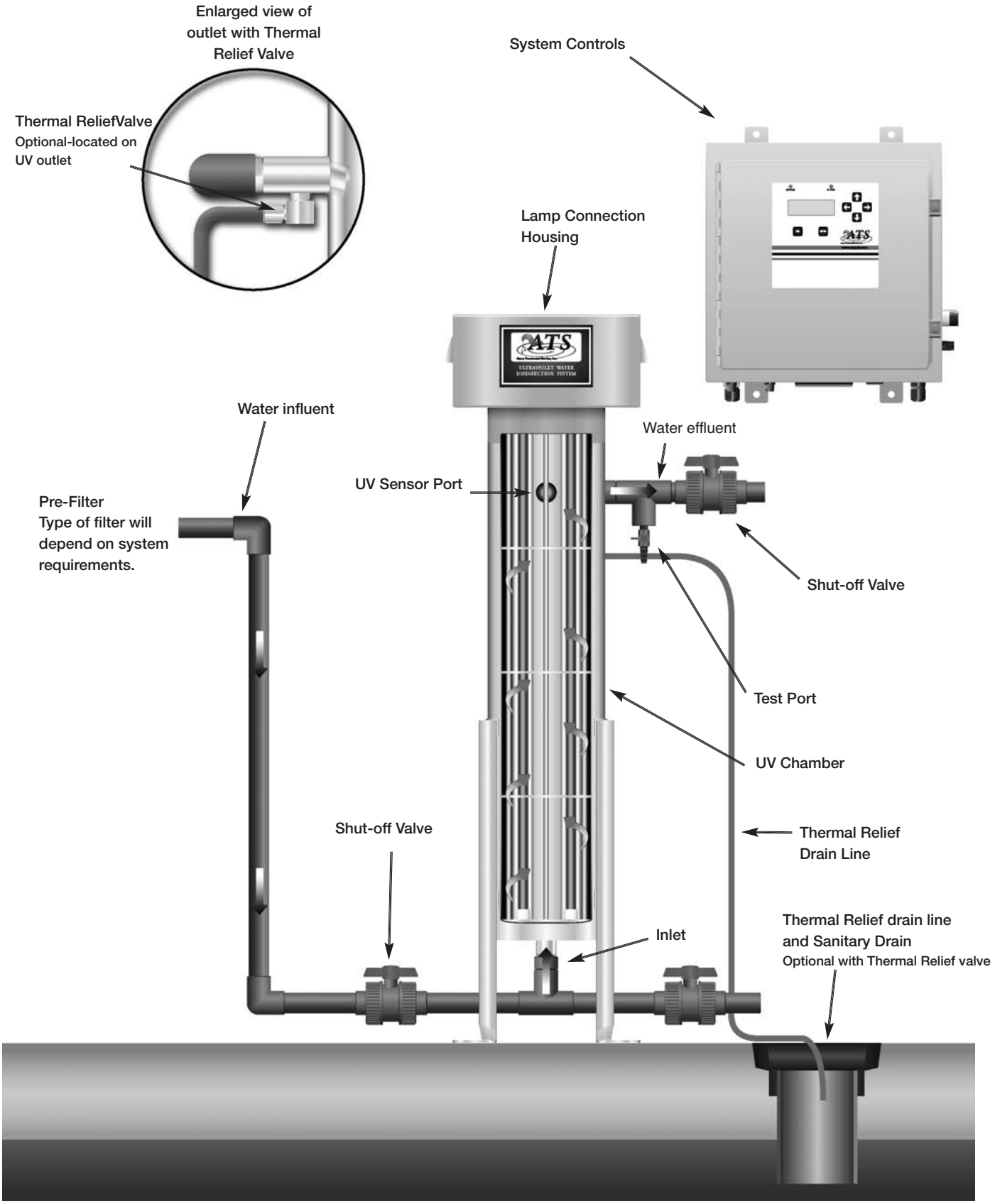
1. Always disconnect electrical power to any U.V. unit before servicing.

2. Under no circumstances should personnel look at a U.V. lamp in operation

(EXCEPT through an external Site Port lens located on the outside of the unit).

3. U.V. Disinfection units must always be properly grounded.

Installation Diagram



Sanitation Procedure

IMPORTANCE OF DISINFECTING A WATER SYSTEM:

Every new well, or existing water supply system that has been disrupted for service or repair, should be disinfected before it is returned to use. Water in the well and storage tank should be treated with a strong chlorine solution or approved disinfection process to destroy disease organisms. All pipelines and fixtures in the distribution system should be rinsed and flushed with chlorinated water. Upon installation of a U.V. disinfection unit or bulb replacement service, disinfection with chlorine to initially flush the system is recommended to assure line sanitation prior to U.V. start up.

The source of chlorine can be ordinary liquid laundry bleach (about 5.25% available chlorine). The quantity required depends on the volume of water to be treated. The United States Environment Protection Agency (EPA) indicated that about 100 parts of chlorine, by weight, mixed in a million parts of water will destroy essentially all water-borne disease organisms.

WARNING:

1. Always follow the sanitizing procedure required by applicable state or local laws.

2. Chlorine may break loose iron deposits, slime and organic material. This material will make the water run colored. The material broken loose may plug pump screens. Do not continue to run pump if water doesn't flow.

3. The high level of chlorine required to sanitize a water system is corrosive to most metals and chlorine solution must not be allowed to remain in water system more than 36 hours before being completely flushed from system.

1. Systems With Pre-filter

- Turn off water.
- Unscrew Sump, remove filter and fill sump with liquid chlorine or standard bleach. Reattach sump to filter head.
- Turn water supply on. Go to each cold water line and run the water untill the chlorine is detected. Once chlorine is detected, turn the running water off.
- Allow chlorine to sit in plumbing for 30 min.
- To flush chlorine from system, run water at each faucet for several min.
- After system has been completely flushed, reinstall the filter and perform a bacteriological analysis on the water following all applicable procedures.

2. Systems With No Pre-filter

- Turn off water.
- Drain UV Chamber and remove quartz sleeve.
- Add chlorine through opening down into chamber. (approx 1 qrt.)
- Reinstall quartz sleeve.
- Turn water supply on. Go to each cold water line and run the water untill the chlorine is detected. Once chlorine is detected, turn the running water off.
- Allow chlorine to sit in plumbing for 30 min.
- To flush chlorine from system, run water at each faucet for several min.
- After system has been completely flushed, perform a bacteriological analysis on the water following all applicable procedures.

Maintenance

QUARTZ SLEEVE:

Installation of the Quartz Sleeve:

Always handle quartz sleeves carefully to prevent breaking or chipping. The quartz sleeves are to be clean and free of fingerprints before installing.

Remove the compression nut. Install the quartz sleeve through the hole in the stainless steel top plate. Install the O-Ring down over and around the Quartz Sleeve. Place the retaining ring (with ark facing up) over the O-Ring and Quartz Sleeve. Hand-tighten each compression nut to form a compression seal around the Quartz Sleeve. Avoid over tightening the nuts, which may cause a fracture on the end of the Quartz Sleeve. Under normal operating conditions, hand-tightening will provide a 100 psi seal. Do not use any devices to tighten end nuts. Repeat this procedure for the remaining Quartz Sleeves in the chamber.

After you have tightened the compression nut and all other plumbing connections, open the outlet valve. Slowly open the inlet valve and flush out all remaining air. Then close the outlet valve and slowly open the inlet valve fully. Check the unit for leaks. If you find a leak at the compression nut, tighten the nut further. If the leak continues, drain the unit and inspect the quartz O-Ring and Quartz Sleeve for proper seal. Once you complete checking the unit, reassemble O-Ring, retaining ring and gland nut. Repressurize the unit and check again.

Requirements for Cleaning the Quartz Sleeve:

As water passes through the U.V., minerals, debris and other matter in the water may deposit onto the Quartz Sleeve. After sufficient film has formed on the Quartz Sleeve, the ability of the ultraviolet germicidal rays to pass though the Quartz Sleeve and into the water may be impaired. Therefore, it is necessary to determine a cleaning schedule for the Quartz Sleeve. The frequency will depend on the specific type of water conditions. If the water has been processed through deionization, reverse osmosis, or is distilled, cleaning may be required only once per year. If untreated water is used, the cleaning frequency will vary. A minimum of once yearly is standard recommendation for cleaning and lamp replacement. Your specific situation will vary the frequency time according to the water quality of the home or facility application.

Cleaning the Quartz Sleeve:

To clean the Quartz Sleeve, turn off the water flow to the disinfection unit, turn power off, and disconnect the electrical service to the lamp pins. Carefully remove the U.V. lamp. Loosen the compression nuts with O-Rings and remove the Quartz Sleeve while draining the water from the chamber. The Quartz Sleeve may then be washed with a mild soap and hot water solution and rinsed clean with hot water. Should this be insufficient to clean the Quartz Sleeve, a mild acid or an approved cleaning solution may be used (i.e. vinegar). Be certain to follow all recommended safety and handling procedures on the acid container. It is important to handle the Quartz Sleeve with care to prevent breakage. Make certain that all finger prints are wiped clean before reinstalling (see installation of the Quartz Sleeve). Replace O-Rings every time a Quartz Sleeve is cleaned or replaced.

UV LAMPS:

Installation of the UV Lamps:

****DO NOT PUT POWER ON AT THIS TIME!****

CAUTION: Never look directly at an operating U.V. lamp. Never operate a U.V. lamp outside the disinfection chamber.

Make sure unit is unplugged when installing or servicing ultraviolet lamp. Remove any paper tabs on the U.V. lamp and avoid allowing fingerprints and other debris to deposit. Carefully place the lamp inside the quartz sleeve leaving enough space to connect the socket connector to the lamp pins.

Requirements for Cleaning the UV Lamps:

The U.V. lamp is rated for 12,000 hours of continuous use. After this period of time, the U.V. lamp has undergone a photochemical change. While the lamp will not normally be burned out, the lamp quartz may no longer emit the 254-nm shortwave U.V. to effectively kill bacteria. Failure to replace the U.V. lamps every 12,000 hours may cause bacteriological breakthrough. Should the use of the disinfection unit be intermittent, in no case should the U.V. lamp be used for more than 16 months regardless of the number of hours of operation due to normal shelf life degradation of the U.V. bulb. Changing the quartz sleeve should be done at the same time U.V. lamp replacement is scheduled.

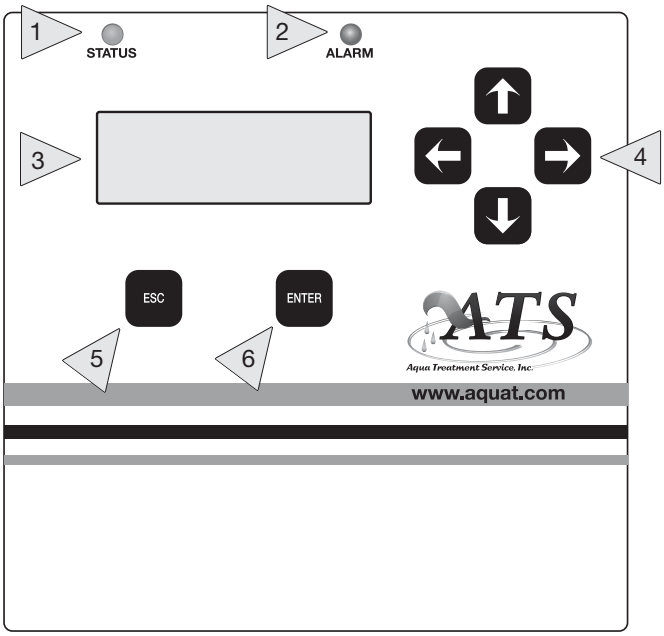
It is recommended that your water supply be tested periodically through your local health department or approved certified laboratory.

Maintenance Schedule:

Replace UV Lamps, Quartz Sleeves and O-Rings 16 months.

This will insure the propre function of the unit.

Electronic Controls Setup



Key-Pad

1. System Status Indicater Lamp
2. Alarm Status Indicater Lamp
3. System Display Screen
4. Curser Direction Keys
5. Escape / Back Key
6. Enter Key

Getting Started

Press the ENTER key to silence Alarms

1. Press the ENTER key to bring up the System Overview Menu on the System Display Screen.

2. Press the ↓ keys to scroll through the System Options. (see figure F1)

F1.

```
View Status
View Alarms
Technical Details
```

Screen Breakdown:

`View Status`: Date / Time, # Lamps ON, Months Remaining
Alarm Snooze / Hours, Prop Temp., AC Line

`View Alarms`: Alarm Log

`Tech. Details`: Lamp Details, Flowmeter Info.,
System Details, Software Version

3. Press the ENTER key to go to the next screen under each selected menu and ESC to step back to previous menu.

Standard System Setup (No-Probe)

1. To enter the System Setup Mode you must press and hold both the ← & ↑ at the same time.

   This will bring up the main Setup Screen on the System Display. (see figure F2, F3)

F2.

```
Exit á Save Settings
Lamp Setting
Set Clock
Software Version
```

F3.

```
Admin Settings
```

2. Press the ↓ keys to scroll through the System Options.
3. Press the ENTER key to go to the next screen under each selected menu and ESC to step back to previous menu.

Screen Breakdown:

`Exit á Save Settings >` Use once all appropriate settings have been made

`Lamp Settings >`

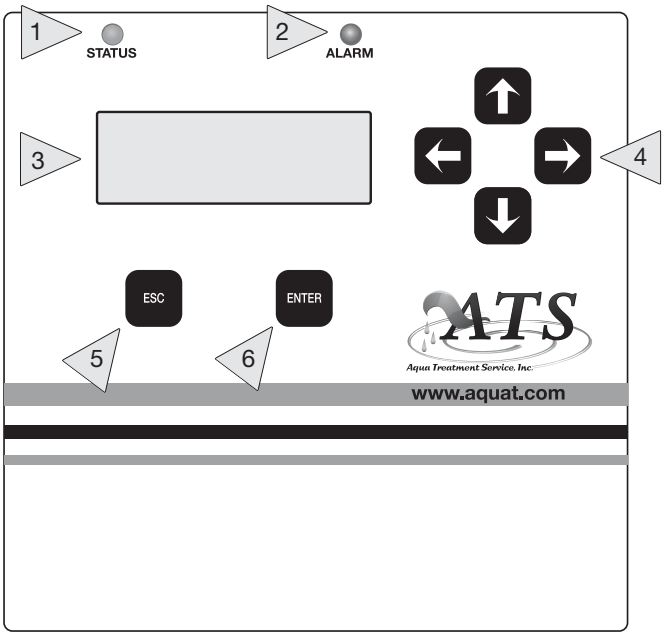
- `Lamp Type:` STD 12mo or HD 16mo
- `Nudge Lamp Month:` Factory Set
- `Lamps Per Ballast:` Factory Set
- `Start Auto Detect:` Run once Unit is installed
- `Review Lamps:` Review once Lamps have been Detected / Review to maintain System

`Set Clock >` May need to be reset once unit is installed

`Software Version >:` Factory Set and gives all pertinent info about the monitor unit

`Admin Settings >:` Factory Set. If upgrade or changes are required reference the Step-by-Step Manual.

Electronic Controls Setup



Key-Pad

1. System Status Indicater Lamp
2. Alarm Status Indicater Lamp
3. System Display Screen
4. Curser Direction Keys
5. Escape / Back Key
6. Enter Key

Getting Started

Press the ENTER key to silence Alarms

1. Press the ENTER key to bring up the System Overview Menu on the System Display Screen.

2. Press the ↓ keys to scroll through the System Options. (see figure F1)

F1.

```
View Status
View Alarms
Technical Details
```

Screen Breakdown:

`View Status`: Date / Time, # Lamps ON, Months Remaining
Alarm Snooze / Hours, Prop Temp., AC Line

`View Alarms`: Alarm Log

`Tech. Details`: Lamp Details, Flowmeter Info.,
System Details, Software Version

3. Press the ENTER key to go to the next screen under each selected menu and ESC to step back to previous menu.

Monitor System Setup

1. To enter the System Setup Mode you must press and hold both the ← & ↑ at the same time.

   This will bring up the main Setup Screen on the System Display. (see figure F2, F3 & F4)

F2.

```
Exit á Save Settings
Lamp Setting
UV Probe
Temperature Units
```

>

F3.

```
Water Cool Off
Flowmeter
Filter
Ozone / ChemPump
```

>

F4.

```
Energy Saving
Set Clock
Software Version
Admin Settings
```

2. Press the ↓ keys to scroll through the System Options.

3. Press the ENTER key to make a selection and ESC to step back to previous menu.

Screen Breakdown:

Exit á Save Settings > Use once all appropriate settings have been made

Lamp Settings >

- Lamp Type: Can be set to either, NO Lamp, STD 12mo or HD 16mo
- Nudge Lamp Month: Factory Set (to be used after either a software update or a monitor change)
- Lamps Per Ballast: Factory Set
- Start Auto Detect: Run once Unit is installed
- Review Lamps: Review once Lamps have been Detected / Review to maintain System

UV Probe >

- Probe Off:
- Lamp Min. @ 60%:
- Lamp Min. @ 70%: Recommended Setting
- Set 100% Point: MUST BE SET once Unit is installed
- AutoSet in 100 hrs: Factory Set
- Cancel Autoset

Temperature Units >

- Display in °F: Factory Set
- Display in °C

Water Cool Off > Factory Set to OFF

- Cooling Start Temp.: can be set from 85° to 100° in 5° increments
- Max Units of Time: can be set at 15, 30 and 60 sec amounts

Flowmeter > Factory Set to OFF, can be set to either 15 or 60 Pulses per Gal

Filter > Factory Set to OFF

- Timer Alarm: can be set from 3, 6 or 12 months time
- DP Switch: can be set either ON or OFF

Ozone / ChemPump > Factory Set to OFF, can be set to run via the Timer or Flow

Energy Saving > Factory Set to OFF

- Dimming Off:
- Dim via Temp.: can be set to 100°, 120° or 140°
- Dim via Flow: can be set to dim via the Flowmeter or Flowsensor

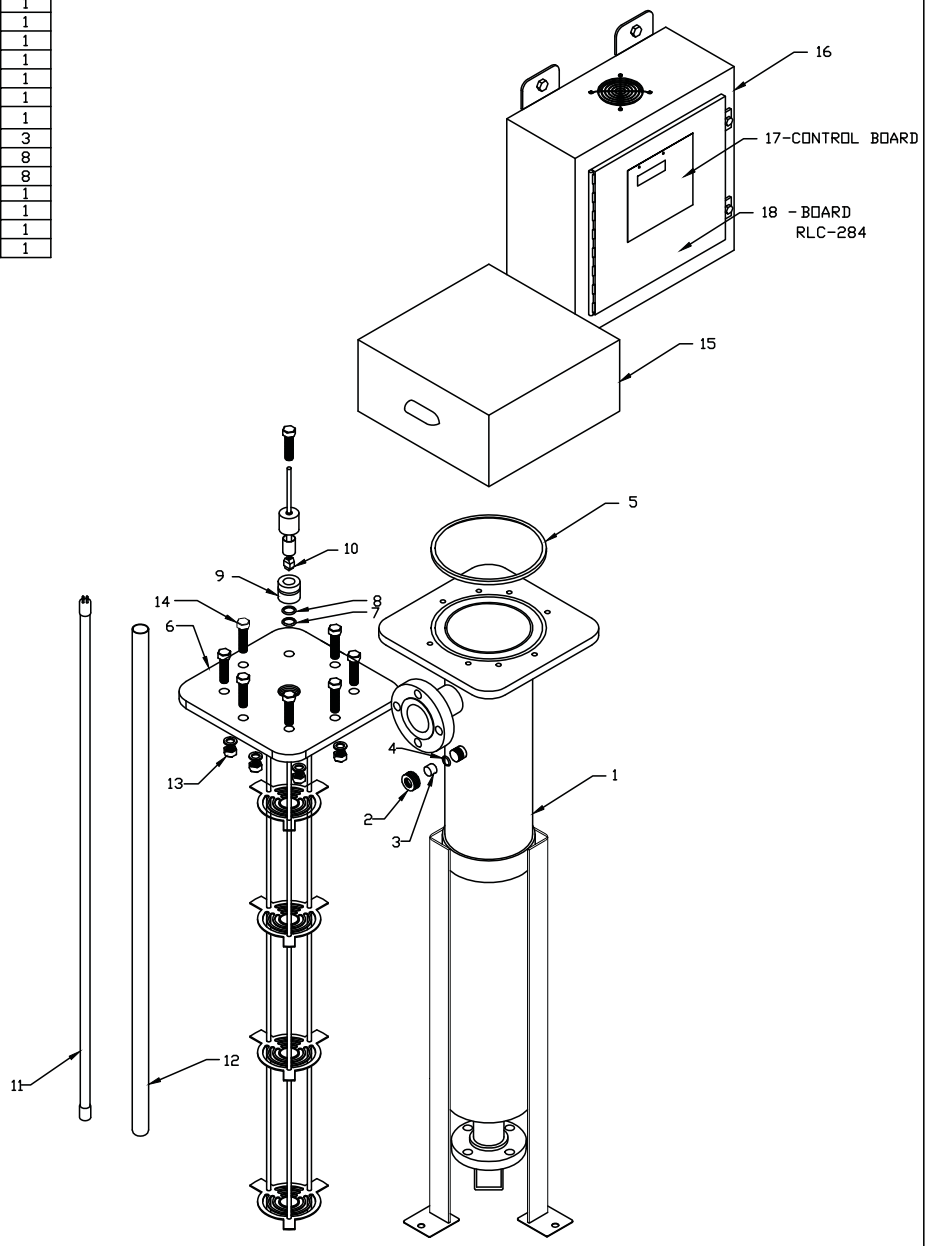
Set Clock > May need to be reset once unit is installed

Software Version >: Factory Set and gives all pertinent info about the monitor unit

Admin Settings >: Factory Set. If upgrade or changes are required reference the Step-by-Step Manual.

Parts Breakdown - AS-V16

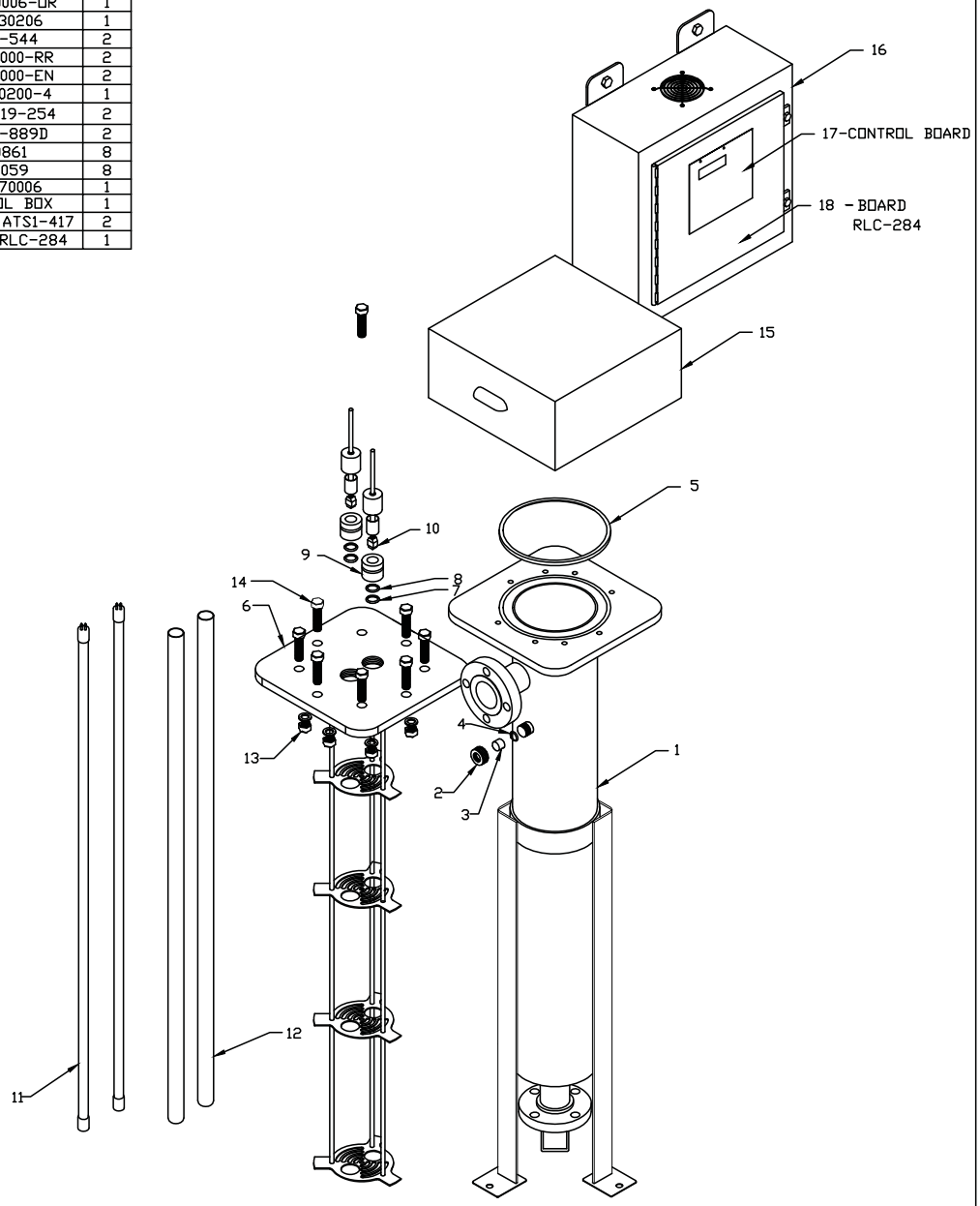
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2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90006-DR	1
6	ASV-30106	1
7	ATS8-544	1
8	AS0-90000-RR	1
9	AS0-90000-EN	1
10	ASV-50100-4	1
11	ATS AS19-254	1
12	ATS28-889D	3
13	1170861	8
14	1170059	8
15	ASV-70006	1
16	CONTROL BOX	1
17	BALLAST ATS1-417	1
18	BOARD RLC-284	1



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ltr	ecn no	dr	date	linear			CUSTOMER	
				angles				
				dr	T.GARLICK	8/13/12		P/N AS-V16
				engr				
				chr				AMALGAM STERILIZER VERTICAL SERIES
				appd				
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom								

Parts Breakdown - AS-V26

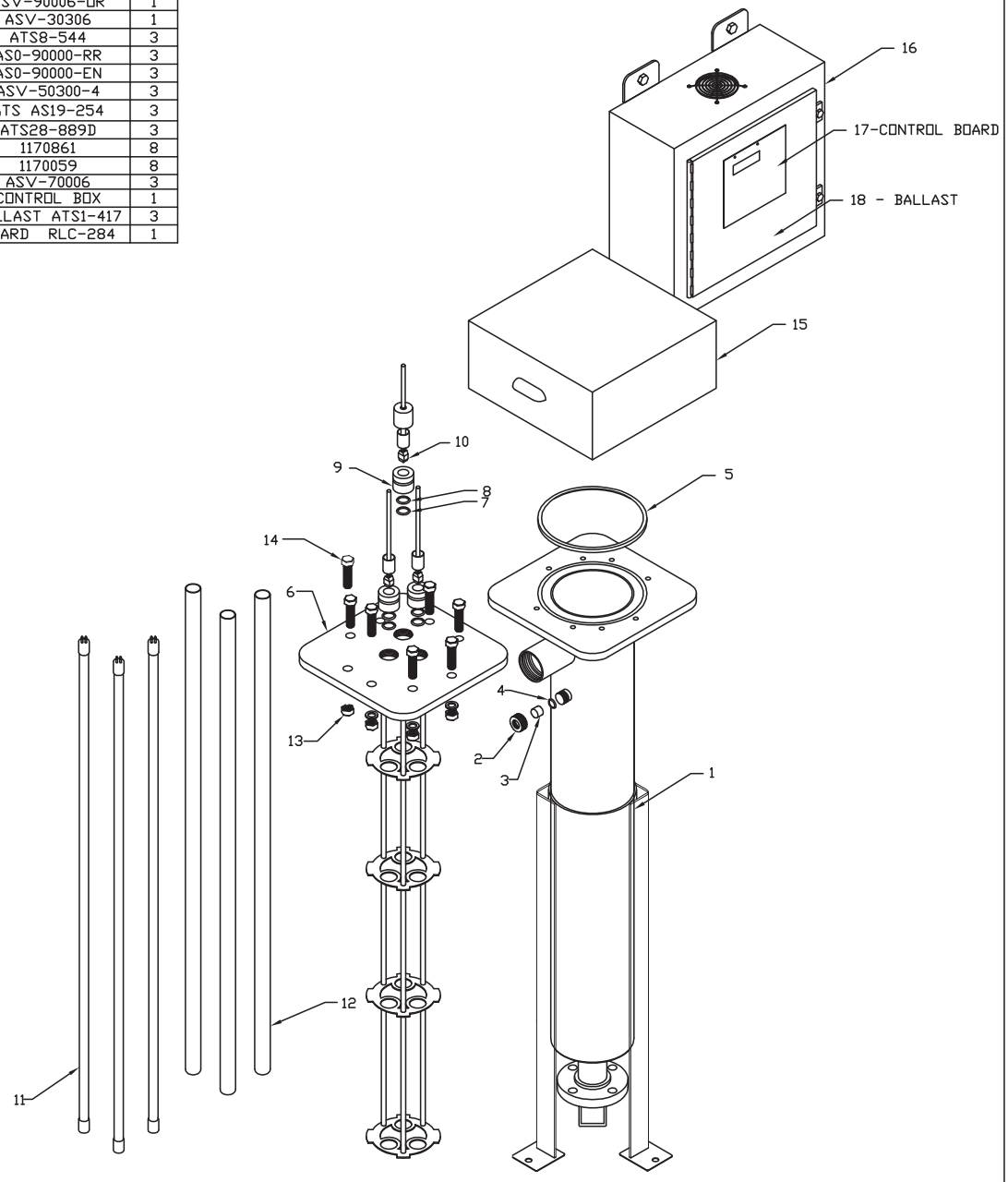
	P/N	QTY
1	ASV-20106-2.0	1
2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90006-□R	1
6	ASV-30206	1
7	ATS8-544	2
8	AS0-90000-RR	2
9	AS0-90000-EN	2
10	ASV-50200-4	1
11	ATS AS19-254	2
12	ATS28-889D	2
13	1170861	8
14	1170059	8
15	ASV-70006	1
16	CONTROL BOX	1
17	BALLAST ATS1-417	2
18	BOARD RLC-284	1



m.t'l code 304 STAINLESS STEEL				tolerances unless otherwise specified		COPY 1	AQUA TREATMENT SERVICE, INC. 194 HEMPT ROAD MECHANICSBURG, PA 17050 (717) 697-4998 FAX (800) 787-0197
ltr	ecn no	dr	date	linear		CUSTOMER	
				angles			
				dr	T.GARLICK	8/15/12	P/N AS-V26
				engr			
				chr			AMALGAM STERILIZER VERTICAL SERIES
				appd			
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom							

Parts Breakdown - AS-V36

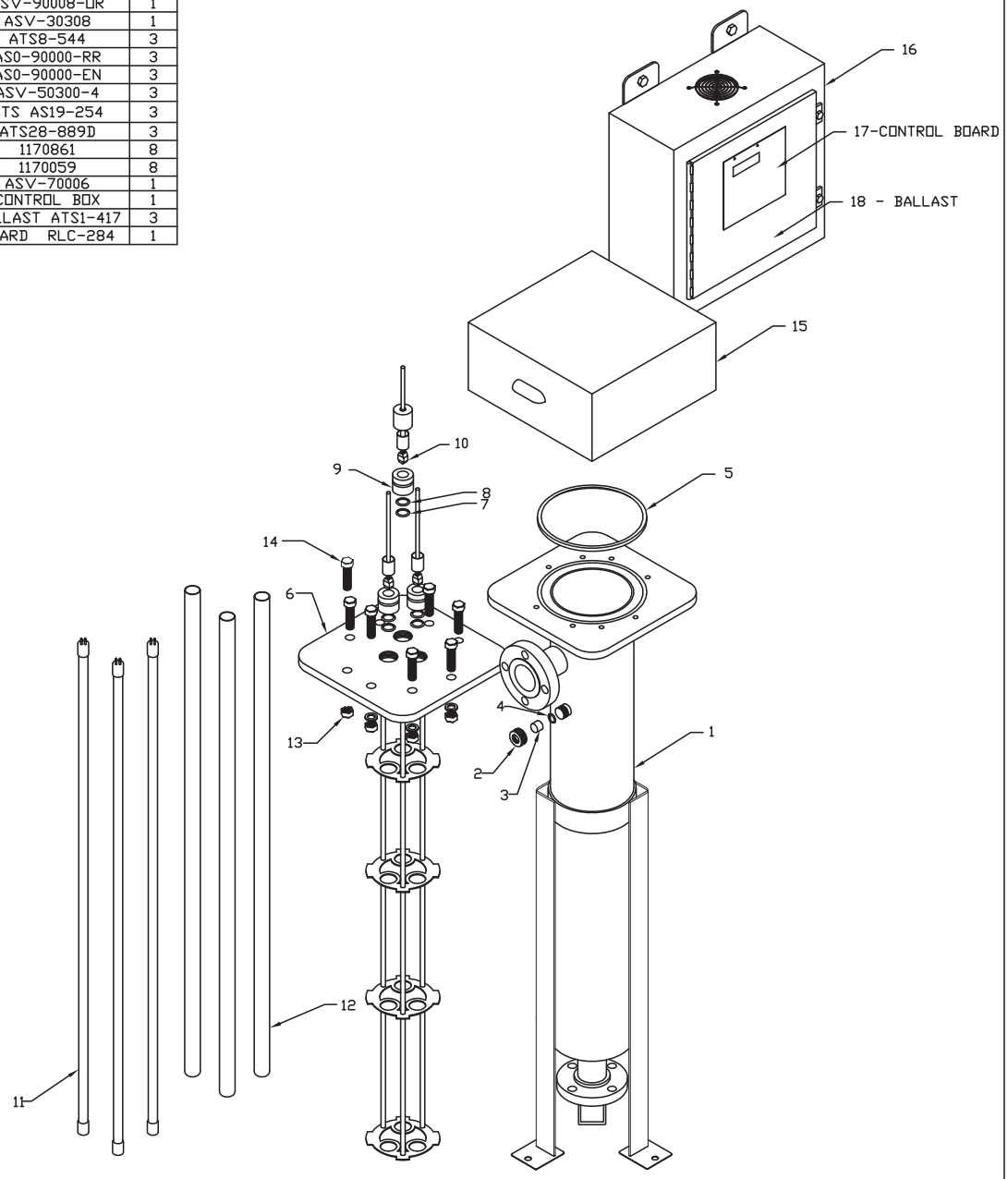
	P/N	QTY
1	ASV-20306-1.5	1
2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90006-DR	1
6	ASV-30306	1
7	ATS8-544	3
8	AS0-90000-RR	3
9	AS0-90000-EN	3
10	ASV-50300-4	3
11	ATS AS19-254	3
12	ATS28-889D	3
13	1170861	8
14	1170059	8
15	ASV-70006	3
16	CONTROL BOX	1
17	BALLAST ATS1-417	3
18	BOARD RLC-284	1



mat'l code: 304 STAINLESS STEEL	tolerances unless otherwise specified	COPY 1	AQUA TREATMENT SERVICE, INC. 194 HEMPT ROAD MECHANICSBURG, PA 17050 (717) 697-4998 FAX (800) 787-0197
ltr / ecn no / dr / date	linear	CUSTOMER	
	angles		
	dr: T.GARLICK 6/13/12		P/N AS-V36
	engr		
	chr		AMALGAM STERILIZER VERTICAL SERIES
	appd		
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom			

Parts Breakdown - AS-V38

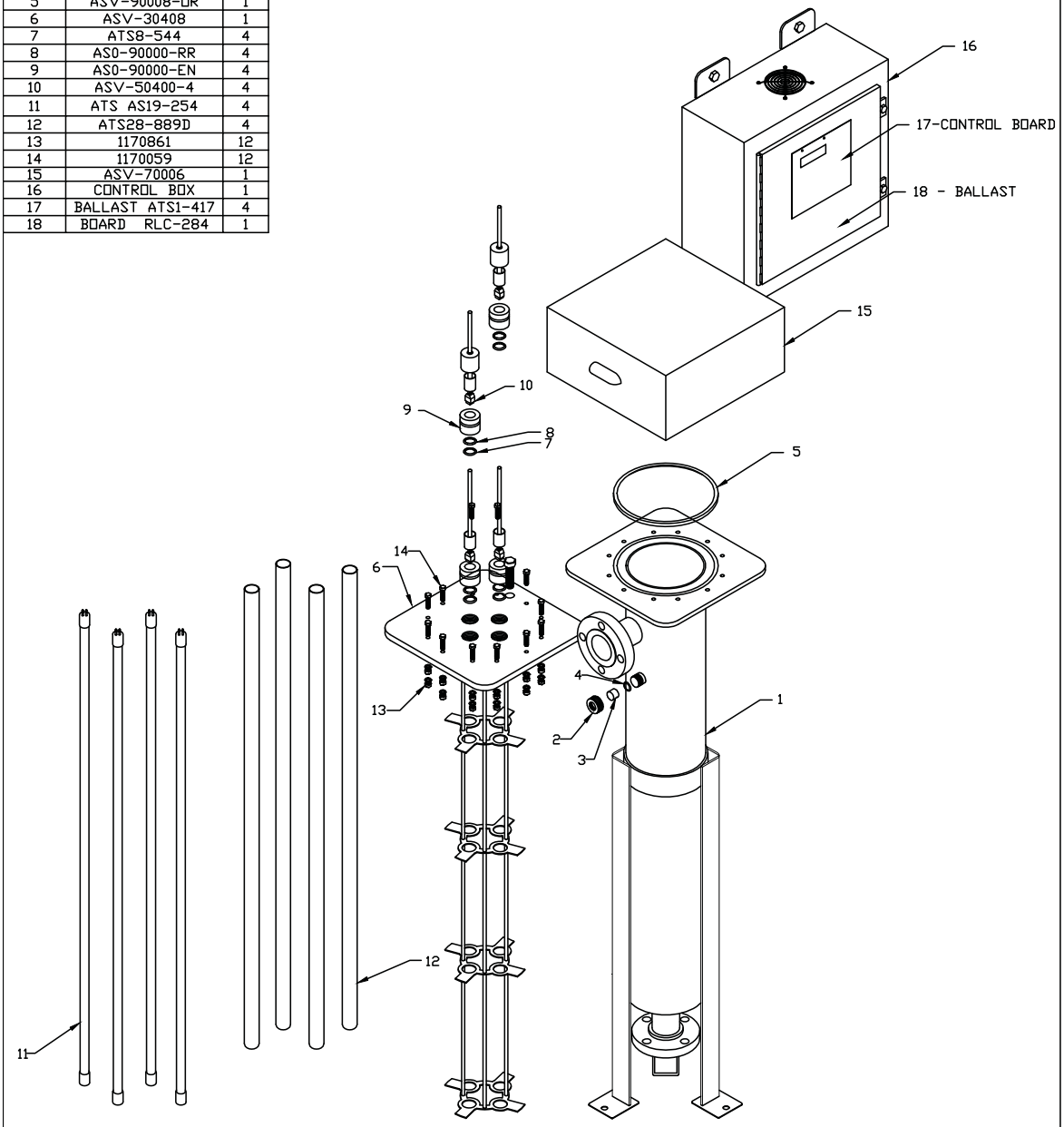
	P/N	QTY
1	ASV-20308-3	1
2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90008-OR	1
6	ASV-30308	1
7	ATS8-544	3
8	AS0-90000-RR	3
9	AS0-90000-EN	3
10	ASV-50300-4	3
11	ATS AS19-254	3
12	ATS28-889D	3
13	1170861	8
14	1170059	8
15	ASV-70006	1
16	CONTROL BOX	1
17	BALLAST ATS1-417	3
18	BOARD RLC-284	1



mat'l code: 304 STAINLESS STEEL	tolerances unless otherwise specified	COPY 1	AQUA TREATMENT SERVICE, INC. 194 HEMPT ROAD MECHANICSBURG, PA 17050 (717) 697-4998 FAX (800) 787-0197
ltr | ecn no | dr | date	linear	CUSTOMER	
	angles		
	dr T.GARLICK 8/15/12		P/N AS-V38
	engr		
	chr		AMALGAM STERILIZER VERTICAL SERIES
	appd		
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom			

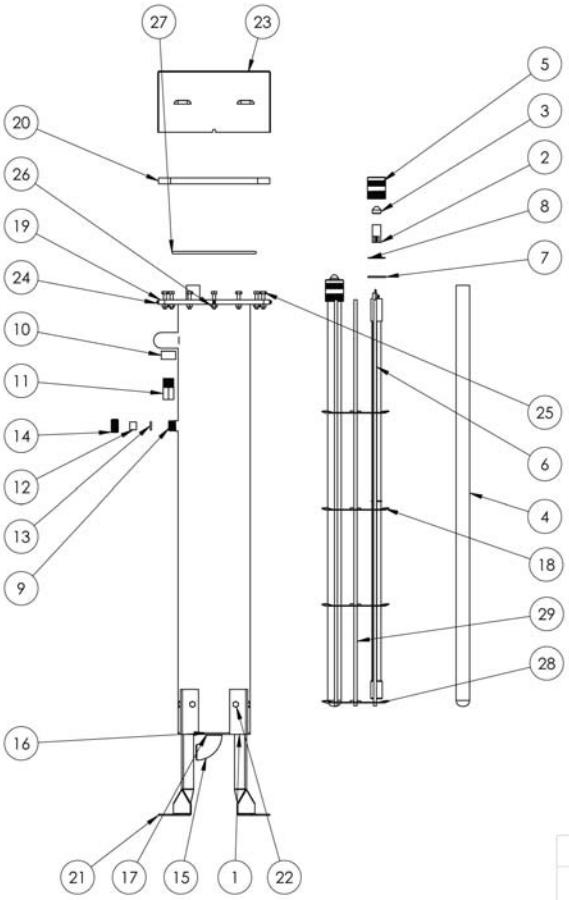
Parts Breakdown - AS-V48

	P/N	QTY
1	ASV-20408-4	1
2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90008-DR	1
6	ASV-30408	1
7	ATS8-544	4
8	AS0-90000-RR	4
9	AS0-90000-EN	4
10	ASV-50400-4	4
11	ATS AS19-254	4
12	ATS28-889D	4
13	1170861	12
14	1170059	12
15	ASV-70006	1
16	CONTROL BOX	1
17	BALLAST ATS1-417	4
18	BOARD RLC-284	1



mat'l code 304 STAINLESS STEEL	tolerances unless otherwise specified	COPY 1	AQUA TREATMENT SERVICE, INC. 194 HEMPT ROAD MECHANICSBURG, PA 17050 (717) 697-4998 FAX (800) 787-0197
ltr ecn no dr date	linear	CUSTOMER	
	angles		
	dr T.GARLICK 8/16/12		P/N AS-V48
	engr		
	chr		AMALGAM STERILIZER VERTICAL SERIES
	appd		
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom			

Parts Breakdown - ATS-186K-10



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
2	03-CS-006	Bayonet Socket		2
3	03-CS-007	Bayonet Socket Cap		2
4	ATS28-889D	Domed Quartz	116.95	2
5	ATS5-413	1.5" Amalgam End Nut		2
6	ATS-AS19-254	Amalgam Lamp		2
7	ATS8-545	End Nut O Ring	1.38	2
8	ATS-M4155	1.5" Amalgam Washer		2
9	ATS-5170	Viewport Nipple 304 SS	5.10	1
10	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
11	ATS-256-RV	Thermal Relief Valve	1.21	1
12	ATS-5172	Viewport Lens	.34	1
13	ATS-5173	Viewport O Ring	0.71	1
14	ATS-5171	Viewport End Nut		1
15	ATS-M4194	1" Butt Weld Elbow	7.65	2
16	STS-629	6" Chamber Side Shell 304 SS	662.30	1
17	ATS-M3602	6" UV Bottom Plate 304 SS	25.49	1
18	ATS-M2260	2 Quartz Holder	25.65	3
19	ATS-F4606	6"Ring Plate 304 SS	13.07	1
20	ATS-F6601	2 Lamp End Plate	80.40	1
21	ATS-M4899	Fixed Leg		4
22	ATS-M3850	1/4-20 X .375" 304 SS Hex Bolt		8
23	ATS-CO4600	Sheet Metal Cover		1
24	ATS-M4102	10-32 Round Head Screw		4
25	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
26	ATS-M3856	1/4-20 304 SS Hex Nut		12
27	ATS-M7187	6" OD O Ring .2" O Ring Gasket Material	13.45	1
28	ATS-M2260	Bottom Quartz Holder	26.04	1
29	ATS-M4130	Quartz Holder Support Rod	26.61	3

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± .25"
TWO PLACE DECIMAL ± .010"
THREE PLACE DECIMAL ± .002"

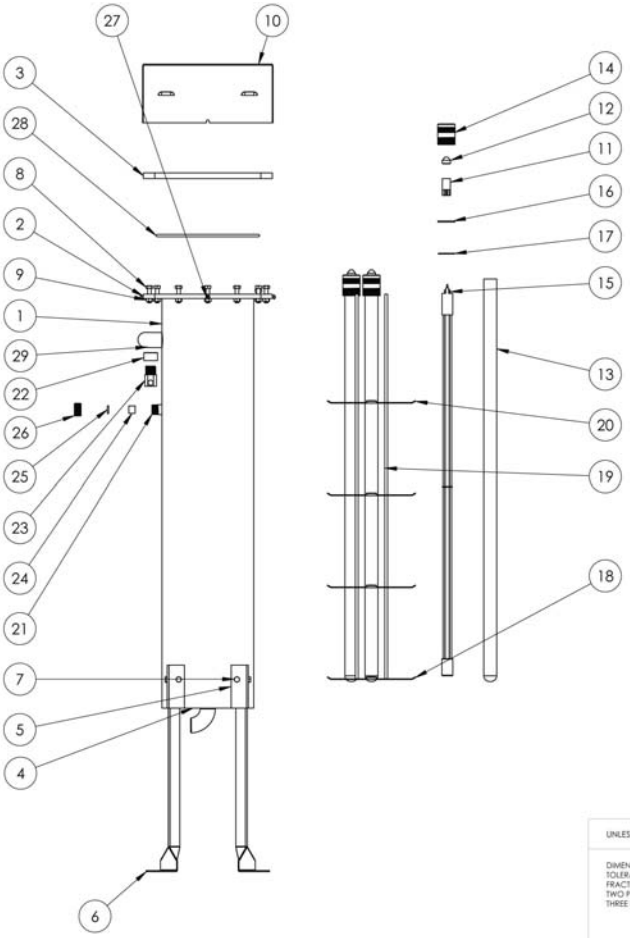
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	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

TITLE: ATS-186K-10

MATERIAL | FINISH | DO NOT SCALE DRAWING | SCALE: | SIZE B | DWG. NO. | REV A | WEIGHT: | SHEET 1 OF 1

Parts Breakdown - ATS-186K-20



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	ATS-C3082H	304 SS Side Shell	882.04	1
2	ATS-F3800	8" Ring Plate	17.04	1
3	ATS-F4804	4 Lamp End Plate	118.01	1
4	ATS-M4804	8" Chamber Bottom	44.18	1
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-CO4080	8" UV Sheet Metal Cover		1
11	03-CS-006	Bayonet Socket		4
12	03-CS-007	Bayonet Socket Cap		4
13	ATS28-889D	Domed Quartz	116.95	4
14	ATS5-413	1.5" Amalgam End Nut		4
15	ATS-AS19-254	Amalgam Lamp		4
16	ATS8-545	End Nut O Ring	1.38	4
17	ATS-M4155	1.5" Amalgam Washer		6
18	ATS-M2480	Bottom Quartz Holder	57.57	1
19	ATS-M4130	Quartz Holder Support Rod	26.41	4
20	ATS-M2480	Mid Quartz Holder	55.99	3
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-M7187	8" OD O Ring .2" O Ring Gasket Material	17.40	1
29	ATS-M4194	1" Butt Weld Elbow	7.65	2

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±.25"
TWO PLACE DECIMAL ±.010"
THREE PLACE DECIMAL ±.002"

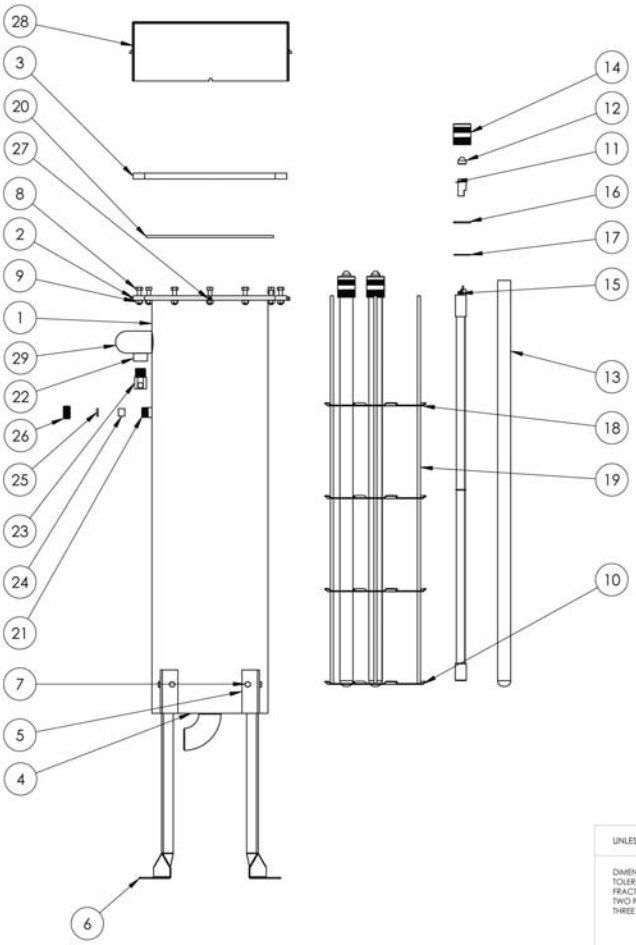
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	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

MATERIAL
FINISH
DO NOT SCALE DRAWING

TITLE: ATS-186K-20
SIZE: B
DWG. NO.
REV: A
SCALE:
WEIGHT:
SHEET 1 OF 1

Parts Breakdown - ATS-186K-40



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	ATS-C4010	304 SS Side Shell	1108.32	1
2	ATS-F4100	10" Ring Plate	21.28	1
3	ATS-F4105	5 Lamp End Plate	168.13	1
4	ATS-M4104	10" Chamber Bottom	67.64	1
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-M4100	Bottom Quartz Holder	70.96	1
11	03-CS-006	Bayonet Socket		5
12	03-CS-007	Bayonet Socket Cap		5
13	ATS28-889D	Domed Quartz	116.95	5
14	ATS5-413	1.5" Amalgam End Nut		5
15	ATS-AS19-254	Amalgam Lamp		5
16	ATS8-545	End Nut O Ring	1.38	5
17	ATS-M4155	1.5" Amalgam Washer		5
18	ATS-M4100	Mid Quartz Holder	70.57	3
19	ATS-M4130	Quartz Holder Support Rod	26.41	4
20	ATS-M7187	10" OD O Ring .2" O Ring Gasket Material	21.34	1
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-CO4010	10" UV Sheet Metal Cover		1
29	ATS-M4159	1.5" Butt Weld Elbow	17.87	2

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±.25"
TWO PLACE DECIMAL ±.010"
THREE PLACE DECIMAL ±.002"

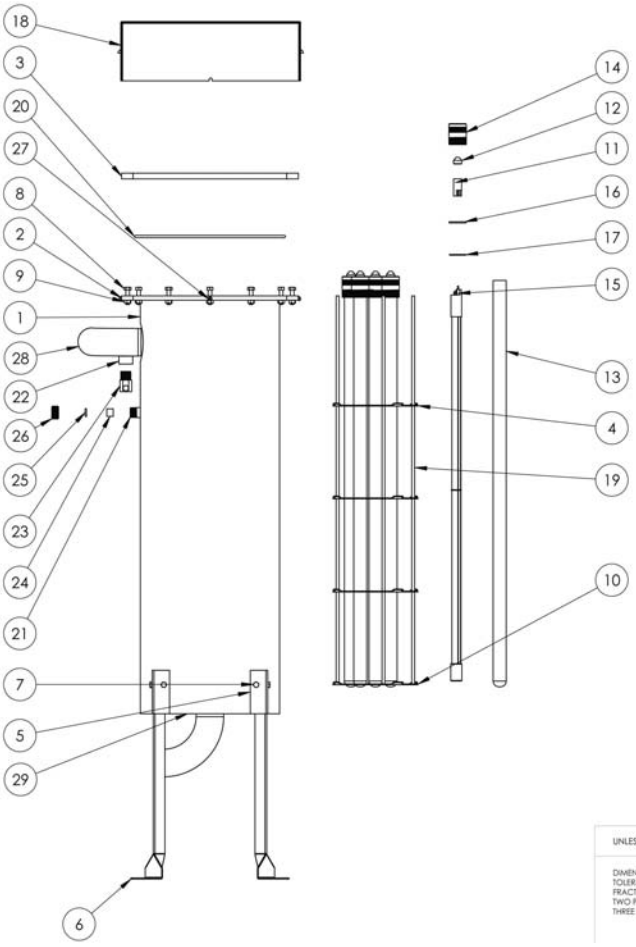
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	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

MATERIAL
FINISH
DO NOT SCALE DRAWING

TITLE: ATS-186K-40
SIZE: B
DWG. NO.
REV: A
SCALE:
WEIGHT:
SHEET 1 OF 1

Parts Breakdown - ATS-186K-60



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	STS-1236	304 SS Side Shell	1339.15	1
2	ATS-F4120	12" Ring Plate	25.38	1
3	ATS-F4126	6 Lamp End Plate	224.00	1
4	ATS-M4106	Mid Quartz Holder	56.62	3
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-M4106	Bottom Quartz Holder	58.56	1
11	03-CS-006	Bayonet Socket		6
12	03-CS-007	Bayonet Socket Cap		6
13	ATS28-889D	Domed Quartz	116.95	6
14	ATS5-413	1.5" Amalgam End Nut		6
15	ATS-AS19-254	Amalgam Lamp		6
16	ATS8-545	End Nut O Ring	1.38	6
17	ATS-M4155	1.5" Amalgam Washer		6
18	ATS-CO4012	12" UV Sheet Metal Cover		1
19	ATS-M4130	Quartz Holder Support Rod	26.41	4
20	ATS-M7187	12" OD O Ring .2" O Ring Gasket Material	25.29	1
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-M4290	2" Sch 40 Elbow 304 SS	47.91	2
29	ATS-M4129	12" Chamber Bottom	106.32	1

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± .25"
TWO PLACE DECIMAL ± .010"
THREE PLACE DECIMAL ± .002"

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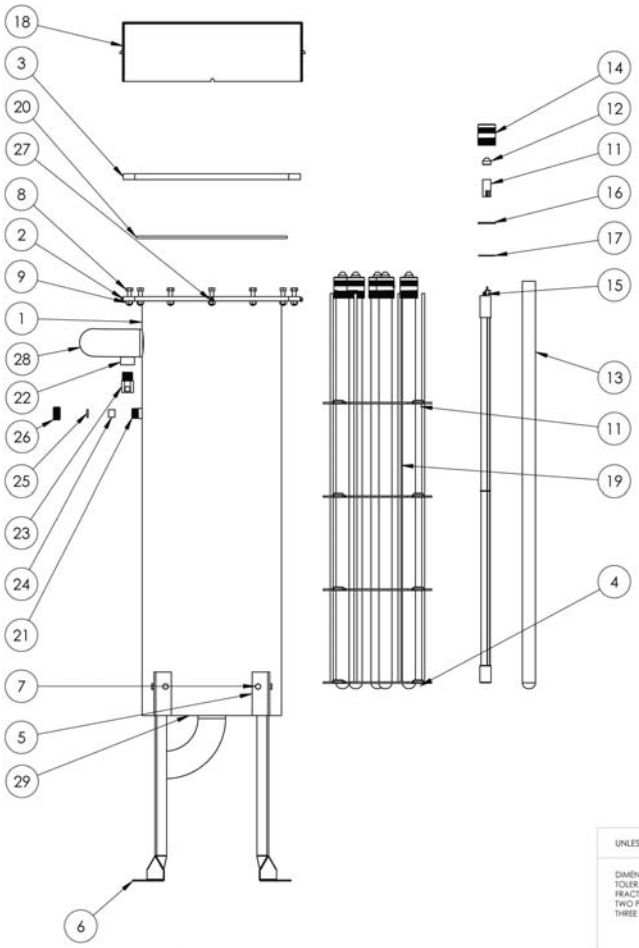
ATS Aqua Treatment Services, Inc.

	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

MATERIAL
FINISH
DO NOT SCALE DRAWING
SCALE:

TITLE: ATS-186K-60
SIZE: B
DWG. NO.
REV: A
WEIGHT:
SHEET 1 OF 1

Parts Breakdown - ATS-186K-80



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	STS-1236	304 SS Side Shell	1339.15	1
2	ATS-F4120	12" Ring Plate	25.38	1
3	ATS-F4128	8 Lamp End Plate	224.00	1
4	ATS-M4128	Bottom Quartz Holder	116.58	1
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-M4128	Mid Quartz Holder	116.58	3
11	03-CS-006	Bayonet Socket		8
12	03-CS-007	Bayonet Socket Cap		8
13	ATS28-889D	Domed Quartz	116.95	8
14	ATS5-413	1.5" Amalgam End Nut		8
15	ATS-AS19-254	Amalgam Lamp		8
16	ATS8-545	End Nut O Ring	1.38	8
17	ATS-M4155	1.5" Amalgam Washer		8
18	ATS-CO4012	12" UV Sheet Metal Cover		1
19	ATS-M4130	Quartz Holder Support Rod	26.41	4
20	ATS-M7187	12" OD O Ring .2" O Ring Gasket Material	25.29	1
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-M4290	2" Sch 40 Elbow 304 SS	47.91	2
29	ATS-M4129	12" Chamber Bottom	106.32	1

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± .25"
TWO PLACE DECIMAL ± .010"
THREE PLACE DECIMAL ± .002"

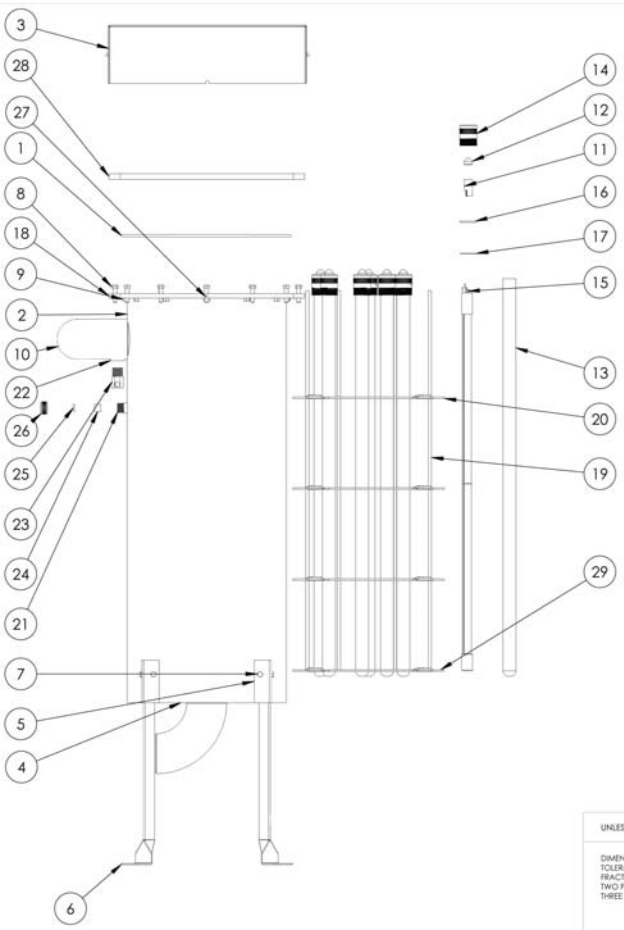
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	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

MATERIAL
FINISH
DO NOT SCALE DRAWING

TITLE: ATS-186K-80
SIZE: B
DWG. NO.
REV: A
SCALE:
WEIGHT:
SHEET 1 OF 1

Parts Breakdown - ATS-186K-120



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	ATS-M7187	14" OD O Ring .2" O Ring Gasket Material	29.24	1
2	STS-1436	304 SS Side Shell	1565.35	1
3	ATS-CO4014	14" UV Sheet Metal Cover		1
4	ATS-M4149	14" Chamber Bottom	142.26	1
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-M4390	3" Butt Weld Elbow 304 SS	72.39	2
11	03-CS-006	Bayonet Socket		10
12	03-CS-007	Bayonet Socket Cap		10
13	ATS28-889D	Domed Quartz	116.95	10
14	ATS5-413	1.5" Amalgam End Nut		10
15	ATS-AS19-254	Amalgam Lamp		10
16	ATS8-545	End Nut O Ring	1.38	10
17	ATS-M4155	1.5" Amalgam Washer		10
18	ATS-F4140	14" Ring Plate	29.68	1
19	ATS-M4130	Quartz Holder Support Rod	26.41	4
20	ATS-M4141	Mid Quartz Holder	246.50	3
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-F4141	10 Lamp End Plate	224.00	1
29	ATS-M4141	Bottom Quartz Holder	246.50	1

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± .25"
TWO PLACE DECIMAL ±.010"
THREE PLACE DECIMAL ±.002"

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ATS Aqua Treatment Service, Inc.

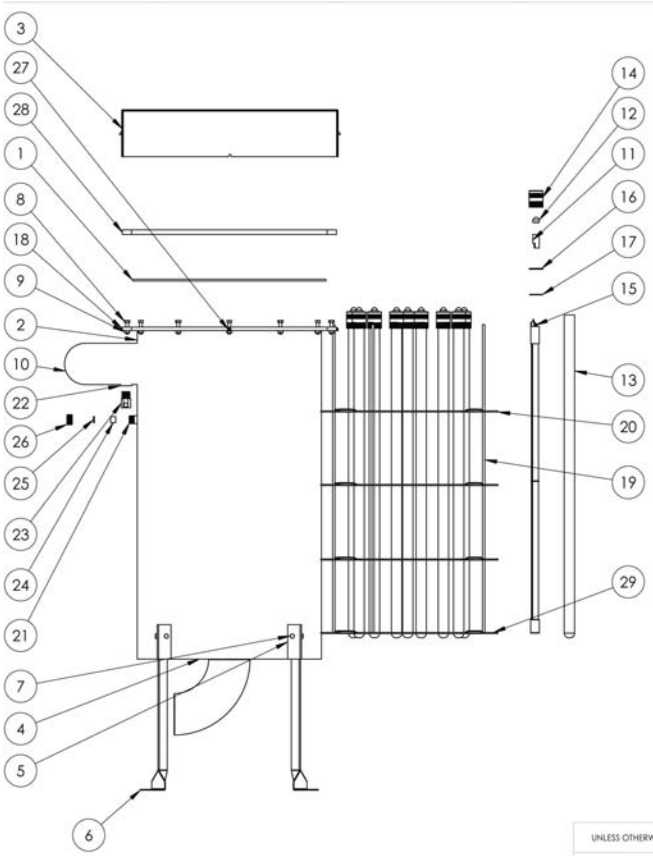
	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		
MATERIAL		
FINISH		
DO NOT SCALE DRAWING	SCALE:	

TITLE: ATS-186K-120

SIZE: B | DWG. NO. | REV: A

WEIGHT: | SHEET 1 OF 1

Parts Breakdown - ATS-186K-240



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	ATS-M7187	20" OD O Ring .2" O Ring Gasket Material	41.08	1
2	STS-2036	304 SS Side Shell	2233.25	1
3	ATS-CO4020	20" UV Sheet Metal Cover		1
4	ATS-M4209	20" Chamber Bottom	327.22	1
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-M4400	4" Butt Weld Elbow 304 SS	126.13	2
11	03-CS-006	Bayonet Socket		15
12	03-CS-007	Bayonet Socket Cap		15
13	ATS28-889D	Domed Quartz	116.95	15
14	ATS5-413	1.5" Amalgam End Nut		15
15	ATS-AS19-254	Amalgam Lamp		15
16	ATS8-545	End Nut O Ring	1.38	15
17	ATS-M4155	1.5" Amalgam Washer		15
18	ATS-F4200	20" Ring Plate	42.29	1
19	ATS-M4130	Quartz Holder Support Rod	26.41	4
20	ATS-M4200	Mid Quartz Holder	493.60	3
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-F4145	15 Lamp End Plate	521.82	1
29	ATS-M4200	Bottom Quartz Holder	493.60	1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±.25"
TWO PLACE DECIMAL ±.010"
THREE PLACE DECIMAL ±.002"

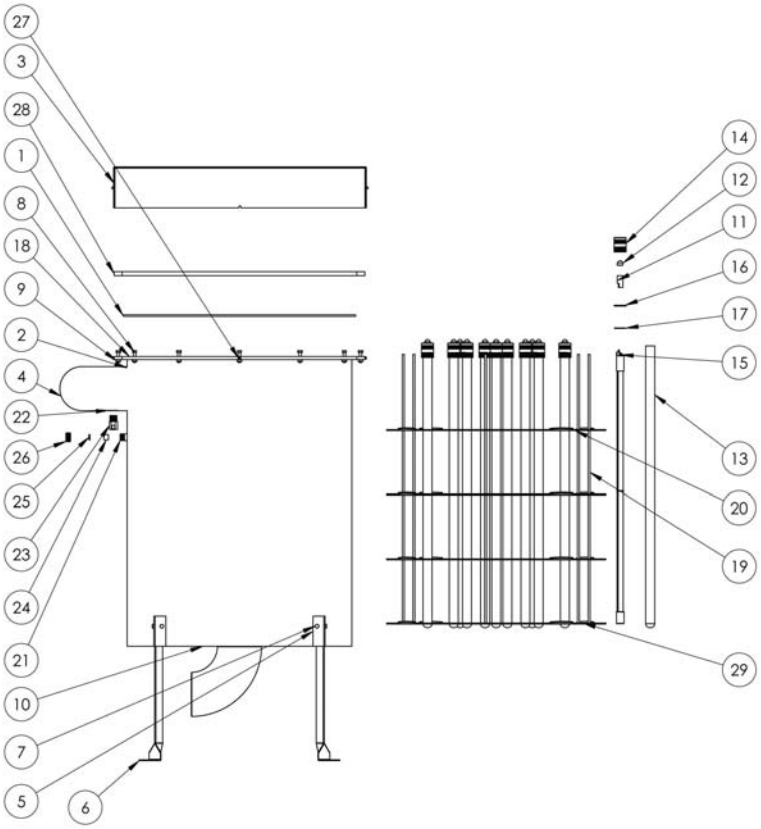
PROPRIETARY AND CONFIDENTIAL
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	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

MATERIAL
FINISH
DO NOT SCALE DRAWING
SCALE:
WEIGHT:
SHEET 1 OF 1

TITLE: ATS-186K-240
SIZE: B
DWG. NO.
REV: A

Parts Breakdown - ATS-186K-480



ITEM NO.	PART NO.	DESCRIPTION	SURFACE AREA (SQ. IN)	QTY.
1	ATS-M7187	28" OD O Ring .2" O Ring Gasket Material	56.87	1
2	STS-2836	304 SS Side Shell	3138.08	1
3	ATS-CO4028	28" UV Sheet Metal Cover		1
4	ATS-M4590	5" Butt Weld Elbow 304 SS	155.74	2
5	ATS-M4898	Fixed Leg Bracket 12 Ga. 304 SS		4
6	ATS-M4816	Fixed Leg 12 Ga. 304 SS		4
7	ATS-M3850	1/4-20 X .375" 304 Hex Bolt		8
8	ATS-M3849	1/4-20 X 2" 304 SS Hex Bolt		12
9	ATS-M3856	1/4-20 Hex Nut		12
10	ATS-M4289	28" Chamber Bottom	595.23	1
11	03-CS-006	Bayonet Socket		20
12	03-CS-007	Bayonet Socket Cap		20
13	ATS28-889D	Domed Quartz	116.95	20
14	ATS5-413	1.5" Amalgam End Nut		20
15	ATS-AS19-254	Amalgam Lamp		20
16	ATS8-545	End Nut O Ring	1.38	20
17	ATS-M4155	1.5" Amalgam Washer		20
18	ATS-F4228	28" Ring Plate	59.10	1
19	ATS-M4130	Quartz Holder Support Rod	26.41	6
20	ATS-M4280	Mid Quartz Holder	982.56	3
21	ATS-5170	Viewport Nipple 304 SS	5.10	1
22	ATS-CP4050	.5" Half Coupler 304 SS	2.63	1
23	ATS-256-RV	Thermal Relief Valve	1.21	1
24	ATS-5172	Viewport Lens	.34	1
25	ATS-5173	Viewport O Ring	0.71	1
26	ATS-5171	Viewport End Nut		1
27	ATS-M4102	10-32 Round Head Screw		4
28	ATS-F4282	20 Lamp End Plate	951.03	1
29	ATS-M4280	Bottom Quartz Holder	982.74	1

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± .25"
TWO PLACE DECIMAL ± .010"
THREE PLACE DECIMAL ± .002"

PROPRIETARY AND CONFIDENTIAL

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	NAME	DATE
DRAWN	TDB	7/8/14
CHECKED		
ENG APPR.		
MFG APPR.		

MATERIAL

FINISH

DO NOT SCALE DRAWING

SCALE:

TITLE: ATS-186K-480

SIZE: B

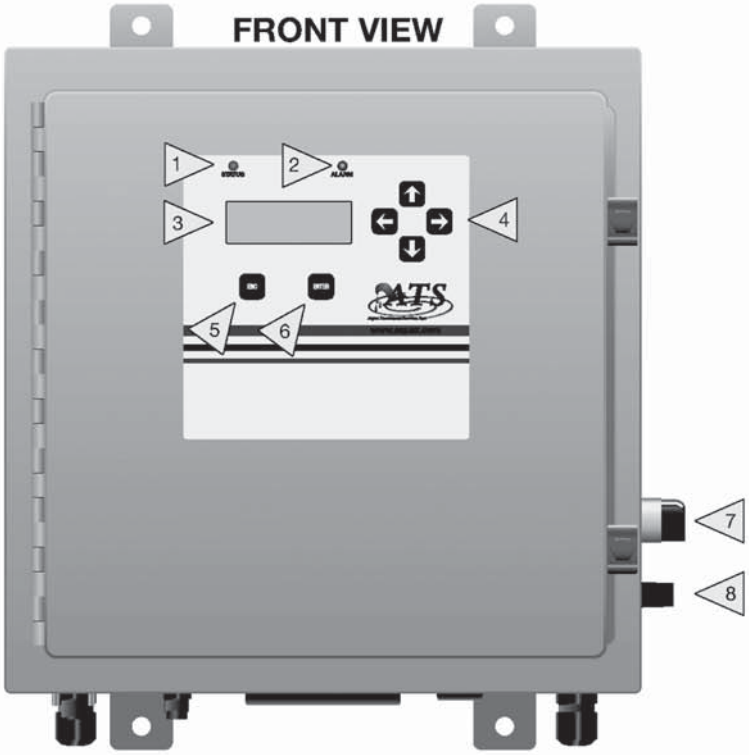
DWG. NO.

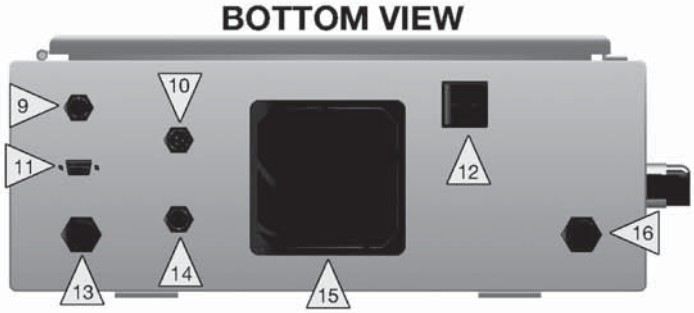
REV: A

WEIGHT:

SHEET 1 OF 1

Parts Breakdown - Electronic Control System





Monitor Parts Breakdown

Front View

1. System Status Lamp
2. Alarm Status Indicator Lamp
3. System Display Screen
4. Curser Direction Keys
5. Escape/Back Key
6. Enter Key
7. Off/On Power Switch
8. Fuse

Bottom View:

9. UV Probe Connection
10. Flow Meter Connection
11. RS232 Connection for Software
12. Shutoff Solenoid Power Plug-in
13. Power Cord
14. Pressure Siwtch Connection
15. Cooling Fan
16. Cables Leads to Skid Unit

Specifications

SPECIFICATIONS:

Model#	No. Lamps	KW @ 120V	AMP @ 120V	Pipe Size	Overall Dimensions L x W x D	Wetted Material	Shipping Weight
AS - V16	1	0.17	1	1”	36” x 10” x 17”	304 SS	35 lbs.
AS - V26	2	0.33	2	1.5”	36” x 10” x 17”	304 SS	45 lbs.
AS - V36	3	0.49	3	2”	36” x 10” x 17”	304 SS	60 lbs.
AS - V38	3	0.49	3	2”	36” x 12” x 19”	304 SS	98 lbs.
AS - V48	4	0.66	4	2”	36” x 12” x 19”	304 SS	105 lbs.

ULTRAVIOLET DOSAGE:

Model#	Flow = GPM @30K EOL	Flow = GPM @40K EOL	Flow = GPM @30K EOL	Flow = GPM @90K EOL	Flow = GPM @300K EOL
AS - V16	59	44	63	**21**	**6**
AS - V26	115	86	121	**40**	**12**
AS - V36	167	125	175	**58**	**17**
AS - V38	233	175	246	**82**	**24**
AS - V48	305	228	321	**107**	**32**

COLOR KEY:
- Clear Fresh Water at 94% UVT
- DI / RO Water at 99% UVT
- DI / RO Water (-03D) at 99% UVT
- DI / RO Water (TOCR) at 99% UVT

NOTES: 220V Specs are available upon request

OPTIONS:

ORDER #	DESCRIPTION
ATS - THERM	Adjustble Settings Thermistor Overheat Safety Control
ATS - RLCM	Remote PLC Monitoring Connection
ATS - STAND	Control Box Mounting Stand (powder coated)
ATS - 254P - RLC	UV Intensity Monitor / NIST Traceable Calibrated UV Sensor
ATS - ESP	Energy Saver Pacing
ATS - SP	1/4” Sample Ports on Inlet / Outlet Riser
ATS - 304NCB	304 SS #4 Brushed Finish on Nema 4 Type Control Box
ATS - 220V	220 - 240 Volt / 50 - 60 Hz Electrical Components
ATS - LT	UV Light Traps on Inlet / Outlet
ATS - STC	Sanitary - Tri - Clamp Fittings
ATS - MW	Manual Quartz Sleeve Wiper
ATS - 316 SS	316 Stainless Steel Wetted Parts

Specifications

SPECIFICATIONS:

Model#	No. Lamps	KW @ 120V	AMP @ 120V	Pipe Size	Overall Dimensions L x W x D	Wetted Material	Verified Flow 4 Log Red.	List Price
ATS-186K-10	2	.32	2	1”	36” x 10” x 17”	304 SS	10 gpm	Call for Price
ATS-186K-20	4	1.32	4	1”	36” x 12” x 19”	304 SS	20 gpm	Call for Price
ATS-186K-40	5	1.66	5	1 1/2”	36” x 14” x 21”	304 SS	40 gpm	Call for Price
ATS-186K-60	6	1.94	6	2”	36” x 16” x 23”	304 SS	60 gpm	Call for Price
ATS-186K-80	8	2.6	8	2”	36” x 16” x 23”	304 SS	80 gpm	Call for Price
ATS-186K-120	10	3.2	10	3”	36” x 18” x 25”	304 SS	120 gpm	Call for Price
ATS-186K-240	12	4.2	12	4”	72” x 18” x 25”	304 SS	240 gpm	Call for Price
ATS-186K-480	10	3.2	10	4”	72” x 18” x 25”	304 SS	480 gpm	Call for Price

OPTIONS:

Model#	Description	List Price
ATS -STAND	Control Box Mounting Stand (powder coated)	Call for Price
ATS -THERM	Adjustable Setting Thermistor Overheat Safety Control	Call for Price
ATS - ESP	Energy Saver Pacing	Call for Price
ATS - SP	1/4” Sample Port on Inlet/Outlet Riser	Call for Price
ATS - 304NCB	304 SS #4 Brushed Finish on Nema 4 Type Control Box	Call for Price
ATS - LT	UV Light Traps on Inlet/Outlet	Call for Price
ATS - STC	Sanitary-Tri-Clamp Fittings	Call for Price
ATS - MW	Manual Quartz Slaave Wiper	Call for Price
ATS - 316 SS	316 Stainless Steel Wetted Parts	Call for Price

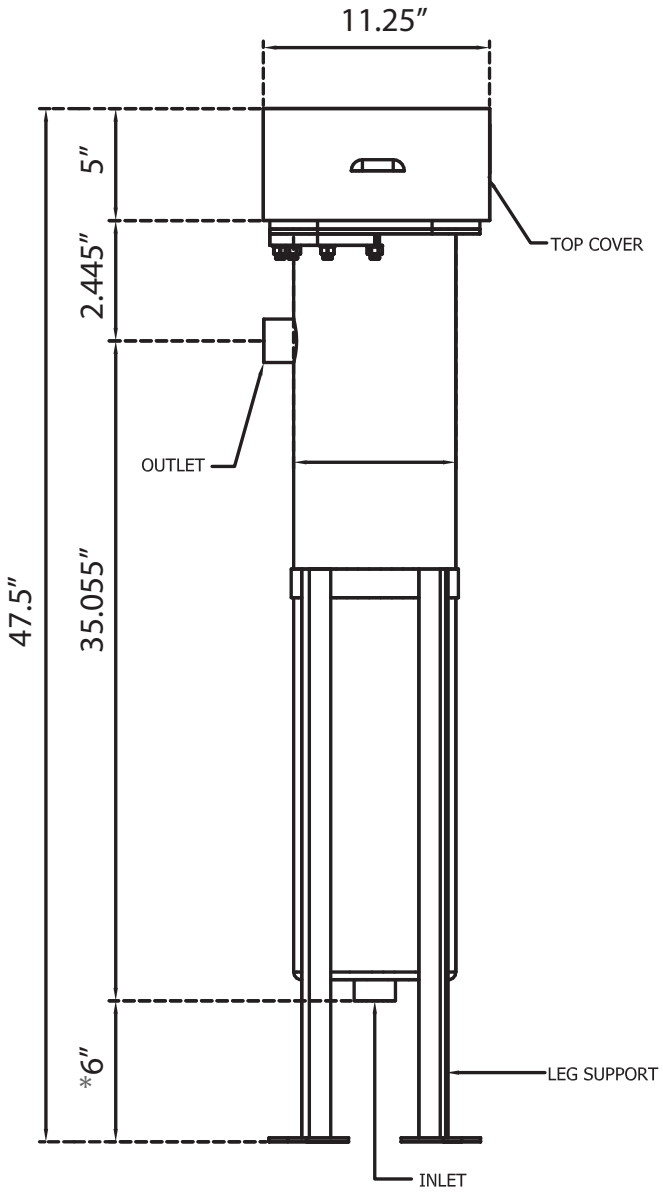
NOTES: 220V Specs are available upon request. System Options installed on Pre or Post Piping are done by Contractor and NOT factory. C.F.C. is Call For Cost See page 30 for replacement part.

Dimensions

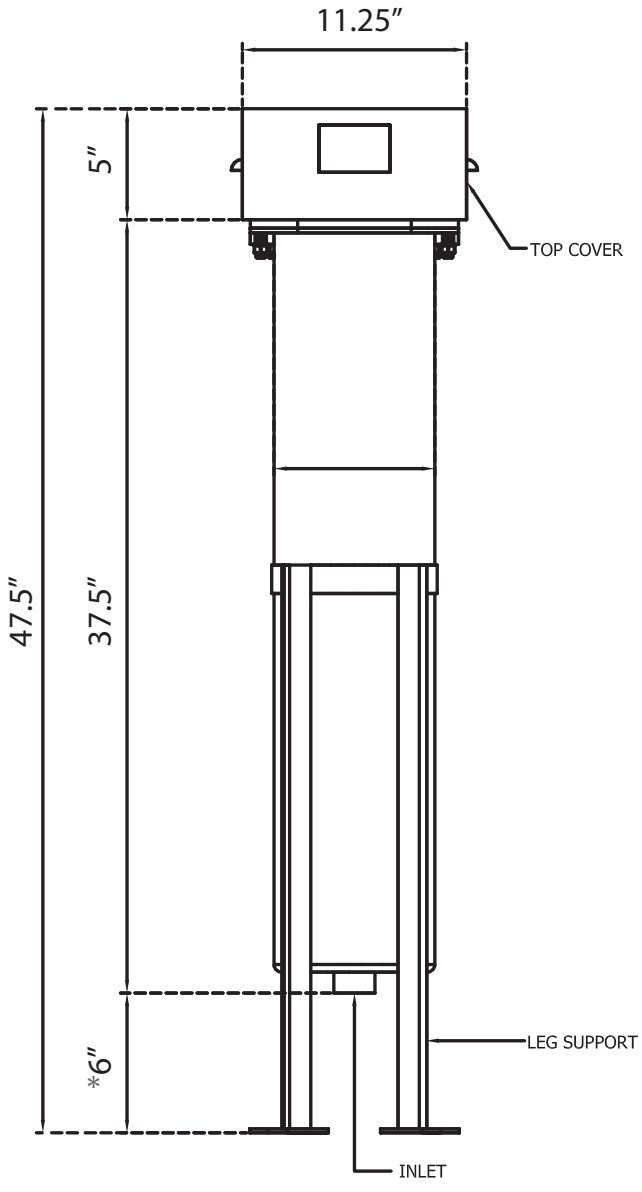
OVERAL DIMENSIONS FOR SAPCE REQUIREMENTS

Model AS-V 36

NOTE: Dimensions will very slightly with other models.



SIDE VIEW DETAIL



FRONT VIEW DETAIL

*6” is with 2” pipe, hight may change with larger pipe size.
This will also affect the Overall Hight.

Troubleshooting

TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	CORRECTION
U.V. lamp will not light	Check input voltage if below or above 120 volts	Install a voltage regulator
	Line cord disconnected or outlet defective	Check, replace
	Defective U.V. lamp	Replace
	Defective lamp ballast	Check output voltage Replace ballast
	Loose open-circuit wire	Trace out and repair
Leak at quartz nipple	Defective or cracked O-Ring	Replace O-Ring
	O-Ring not seated properly	Replace O-Ring

REV. March, 2008

MANUFACTURER'S LIMITED WARRANTY

In accordance with the Manufacturer's warranty, and subject to the conditions hereinafter set forth, ATS will repair or replace to the original user or consumer, equipment, parts or components found to be defective in manufacturing or workmanship.

WARRANTY PERIODS:

UV Chambers	10 yrs.
Electrical Components (excludes UV lamp)	2 yr.
UV Lamp, Quartz Sleeve	1 yr.

WARRANTIES NOT APPLICABLE: To defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions; failure to use ATS authorized replacement parts, to failures resulting from shipment or handling, abuse, accident, negligence, freezing, fire or heat, direct exposure to weather or sunlight, water temperatures and pressures exceeding specifications, flooding or other acts of God not considered normal operating condition; to normal maintenance services and the parts used in connection with such service; to units which are not installed in accordance with applicable local codes, ordinances and good trade practices; if the unit is moved from its original installation location; or if unit is used for purposes other than for what it was designed and manufactured.

LABOR COSTS, LIABILITY: Aqua Treatment Service, Inc., shall ***IN NO EVENT*** be responsible or liable for the cost of field labor or other charges incurred by any customer in installing, removing and/or reaffixing any ATS, part or component thereof, or be liable for any injury, loss or damage, direct or indirect, special or consequential, arising out of the use of, misuse, or the inability to use such product. Before use, Distributor, Dealer or User shall determine the suitability of the product for his/her intended purposes, and shall assume all risk and liability in connection therewith.

RETURNS: A ***RETURN MERCHANDISE AUTHORIZATION NUMBER (RMA #)*** is required on ***ALL RETURNS***. Contact ATS to obtain this number. The RMA # **MUST** be clearly written on the outside of the package. Address shipments to the Return Department ATS, 194 Hempt Road, Mechanicsburg, PA, 17050, and freight prepaid. All returns should be accompanied with a written description of mode or reason of failure.

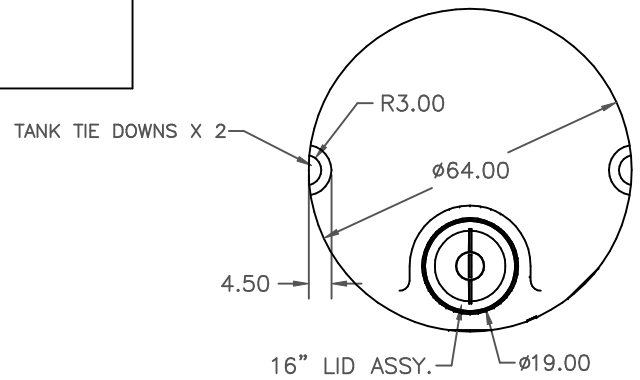
The customer must order ATS replacement parts if required as a standard purchase until the defective part is received and evaluated by the factory. ATS will inspect, test, and determine the cause of defective components or parts. ATS at its sole discretion will make necessary repairs to or replace components. ATS will determine the extent of the warranty coverage and the proper warranty credit to be applied. The return freight will be credited to the customer for warranty repairs or replacements.

For your warranty protection, the warranty card must be completed and returned to ATS within 10 days of installation. In the absence of other suitable proof of installation date, the effective date of this warranty will be based on the date of manufacture plus 30 days.

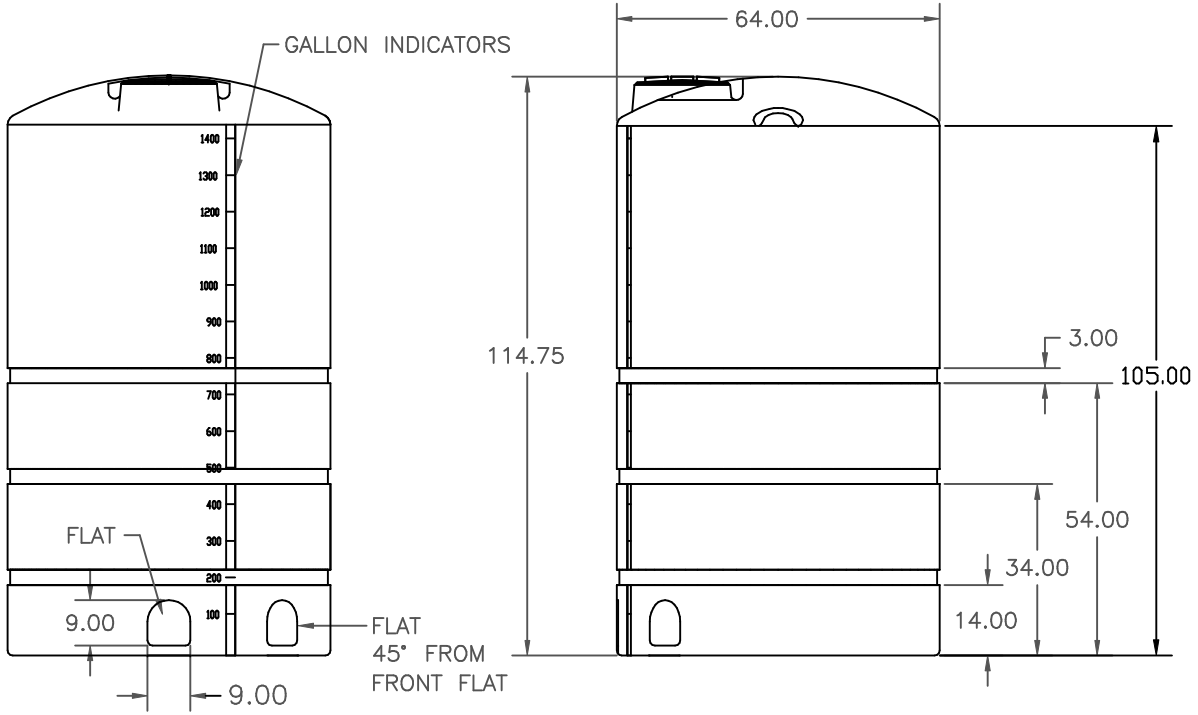
This warranty gives you specific legal rights and you may also have other rights, which vary, from state to state.

PROPRIETARY DATA

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1. HEAVY DUTY POLYETHYLENE CONSTRUCTION
2. 1 PIECE ROTATIONALLY MOLDED
3. TRANSLUCENT
4. FDA APPROVED RESIN
5. CALIBRATED IN GALLONS
6. THREE YEAR WARRANTY
7. UV STABILIZED



REV	DESCRIPTION	DATE	APPRD

DRAWN / DATE: DHJ 01/02/03

APPRD. / DATE: ADH 11/19/07

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M

MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET
FOR SPECIFIC PROPERTIES.

NOTES:
1. BLUE, YELLOW, WHITE, OR BLACK COLOR
2. SHOT WEIGHT 335 LBS.
3. NOM. WALL .340

ACE ROTO-MOLD
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4018 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION: 1500 GALLON VERTICAL TANK

SCALE: N.S.

PART NO.: VT1500-64

VERTICAL TANKS - DOME TOP

Syphon tube included with tanks 300 gallon or greater



VT1050-86



VT2050-86

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
VT0010-12†	10 GAL	9	12 X 25	8"	3/4"	2.0
VT0020-16†	20 GAL	15	16 X 28	8"	3/4"	2.0
VT0025-18†	25 GAL	14	18 X 30	5"	3/4"	2.0
VT0040-18†	40 GAL	19	18 X 43	5"	3/4"	2.0
VT0055-20†	55 GAL	23	20 X 47	5"	1"	2.0
VT0065-23†	65 GAL	27	23 X 42	5"	1"	2.0
VT0110-32	110 GAL	42	32 X 41	5"	2" TOP	2.0
VT0135-23	135 GAL	47	23 X 82	16"	1"	2.0
VT0300-42	300 GAL	74	42 X 55	8"	2"	2.0
VT0405-52	405 GAL	92	52 X 48	8"	2"	2.0
VT0425-42	425 GAL	102	42 X 75	8"	2"	2.0
VT0505-46	505 GAL	120	46 X 80	16"	2"	2.0
VT0550-52	550 GAL	118	52 X 66	8"	2"	2.0
VT0600-46	600 GAL	132	46 X 91	16"	2"	2.0
VT0625-64	625 GAL	102	64 X 50	8"	2"	2.0
VT0800-46	800 GAL	177	46 X 118	16"	2"	1.7
VT0900-46	900 GAL	222	46 X 132	16"	2"	1.7
VT1000-64	1000 GAL	252	64 X 81	16"	2"	1.7
VT1050-86	1050 GAL	192	86 X 54	16"	2"	1.7
VT1200-64	1200 GAL	277	64 X 97	16"	2"	1.7
~~VT1350-86~~	~~1350 GAL~~	~~230~~	~~86 X 65~~	~~16"~~	~~2"~~	~~1.7~~
VT1500-64	1500 GAL	337	64 X 115	16"	2"	1.7
~~VT1500-86~~	~~1500 GAL~~	~~252~~	~~86 X 69~~	~~16"~~	~~2"~~	~~1.7~~
VT1525-64	1525 GAL	352	64 X 122	16"	2"	1.7
VT1650-86	1650 GAL	280	86 X 74	16"	2"	1.7
VT2000-64	2000 GAL	467	64 X 156	16"	2"	1.7
VT2000-90	2000 GAL	377	90 X 84	16"	2"	1.7
VT2050-86	2050 GAL	402	86 X 93	16"	2"	1.7
VT2150-102	2150 GAL	417	102 X 71	16"	2"	1.7
VT2500-90	2500 GAL	422	90 X 103	16"	2"	1.7
VT3000-90	3000 GAL	552	90 X 120	16"	2"	1.7
VT3100-102*	3100 GAL	552	102 X 103	16"	2"	1.7
VT3400-102*	3400 GAL	587	102 X 107	16"	2"	1.7
VT4000-96*	4000 GAL	902	96 X 140	16"	2"	1.7
VT4200-96*	4200 GAL	952	96 X 148	16"	2"	1.7
VT4995-142*	4995 GAL	952	142 X 90	16"	3"	1.7
VT5000-102*	5000 GAL	1302	102 X 156	16"	3"	1.7
VT5150-102*	5150 GAL	1352	102 X 161	16"	3"	1.7
VT6250-102*	6250 GAL	1552	102 X 194	16"	3"	1.7
VT6500-120*	6500 GAL	1502	120 X 152	16"	3"	1.7
VT7000-142*	7000 GAL	1752	142 X 125	16"	3"	1.7
VT7800-120*	7800 GAL	1902	120 X 176	16"	3"	1.7
VT8000-120*	8000 GAL	1932	120 X 180	16"	3"	1.7
VT9150-120*	9150 GAL	2202	120 X 203	16"	3"	1.7
VT9500-120*	9500 GAL	2352	120 X 213	16"	3"	1.7
VT10500-2500*	10,500 GAL	2502	142 X 177	16"	3"	1.6
VT10500-2800*	10,500 GAL	2802	142 X 177	16"	3"	1.8
VT12500-142*	12,500 GAL	3402	142 X 208	16"	3"	1.7

† INDICATES CAN BE SHIPPED VIA UPS/FED EX
* HEAVY DUTY FITTING



WO2500-VT

WO3000-VT

WATER ONLY TANKS

Additional water only tanks available

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
WO2500-VT	2500 GAL	392	96 X 92	16"	2"	1.0
WO3000-VT	3000 GAL	487	96 X 109	16"	2"	1.0

Water Only Vertical Tanks

Water tanks are free standing for indoor or outdoor stationary applications. Tanks are manufactured from FDA compliant high-density polyethylene with UV inhibitors. They are designed for the storage of chemicals with a specific gravity of 1.0 or less and available in dark green. Contact customer service for additional water only options.

TECHNICAL BROCHURE
BNPE R2



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F R

Casing Rotation, Optional
R = 3 o'clock L = 9 o'clock
B = 6 o'clock
NOTE: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

Rotación de la cubierta, opcional
R = 3 hora L = 9 hora
B = 6 hora
NOTA: *Rotación cuando está visto del extremo de la succión de la bomba. La posición estándar de la descarga es las 12.*

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	Pump Size, *Tamaño de la bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

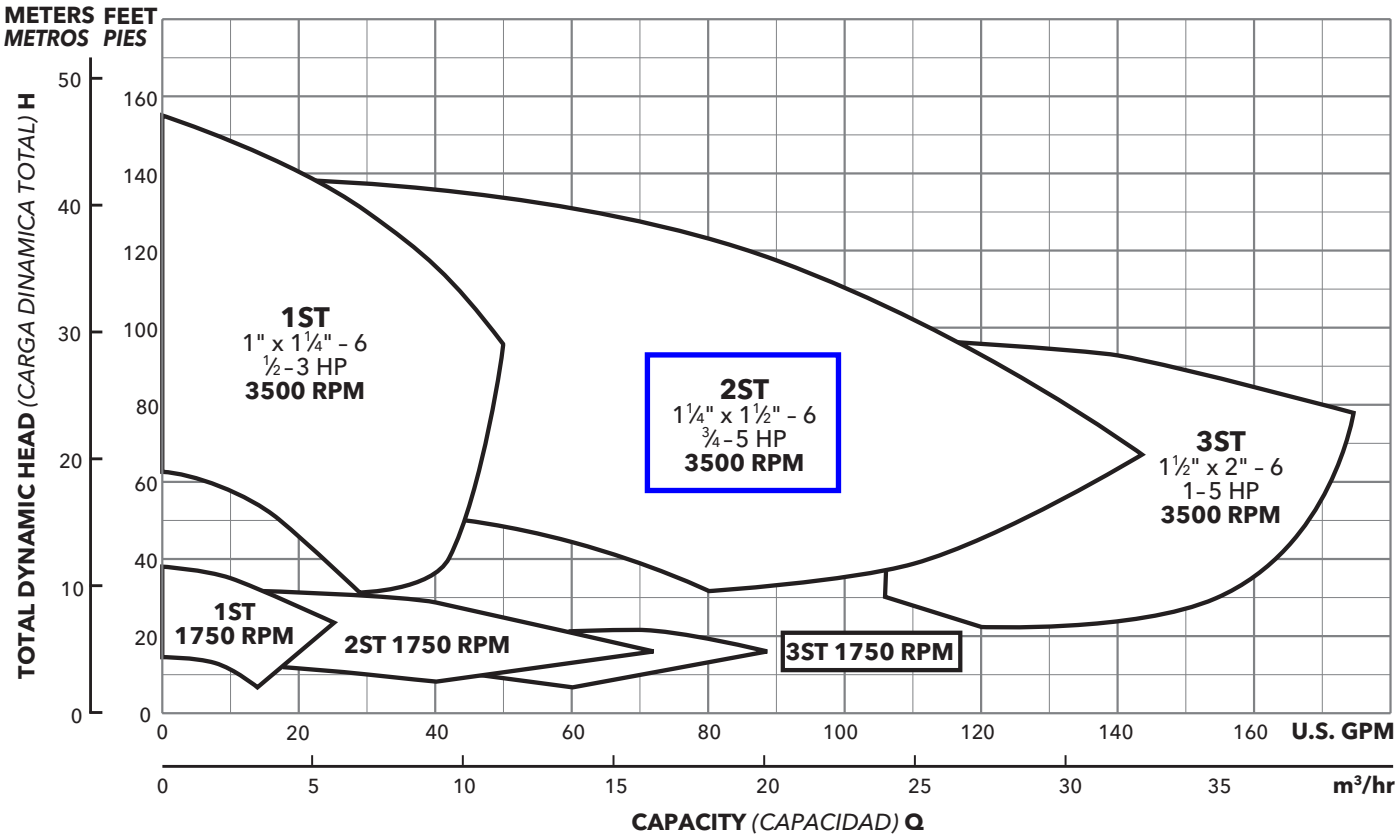
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

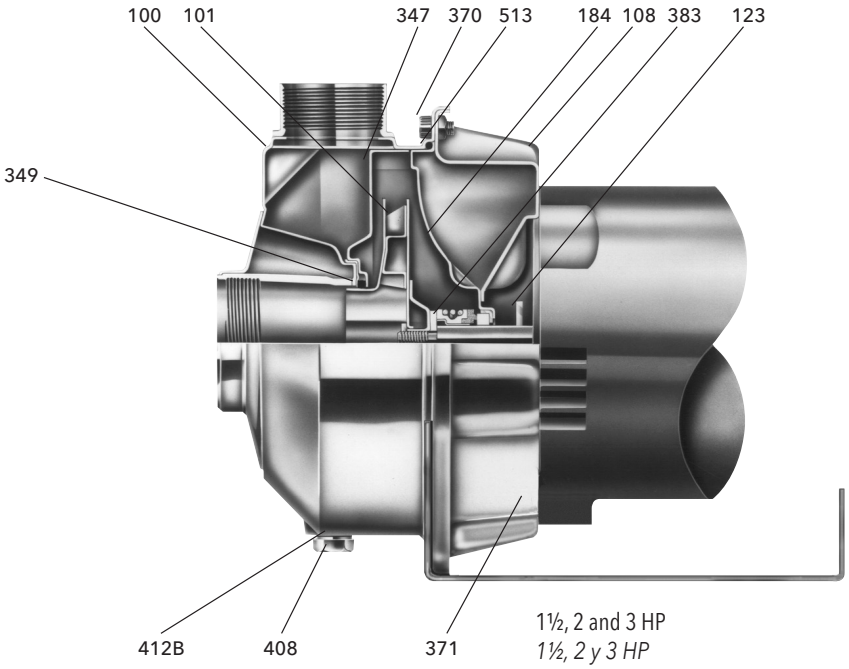
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

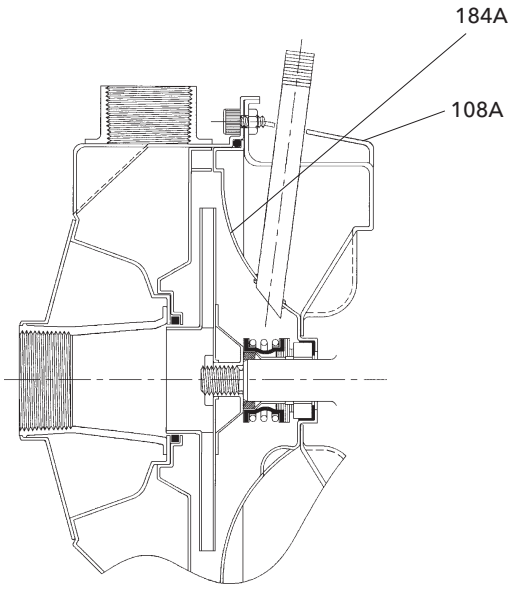
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

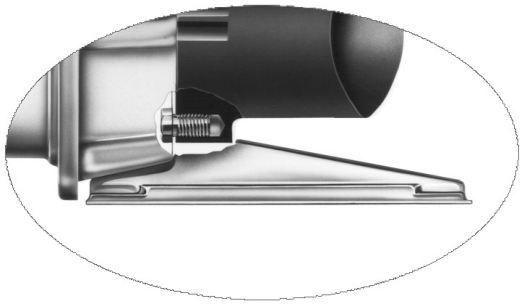


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370 *able*	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxid-*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408 *able*	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxid-*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

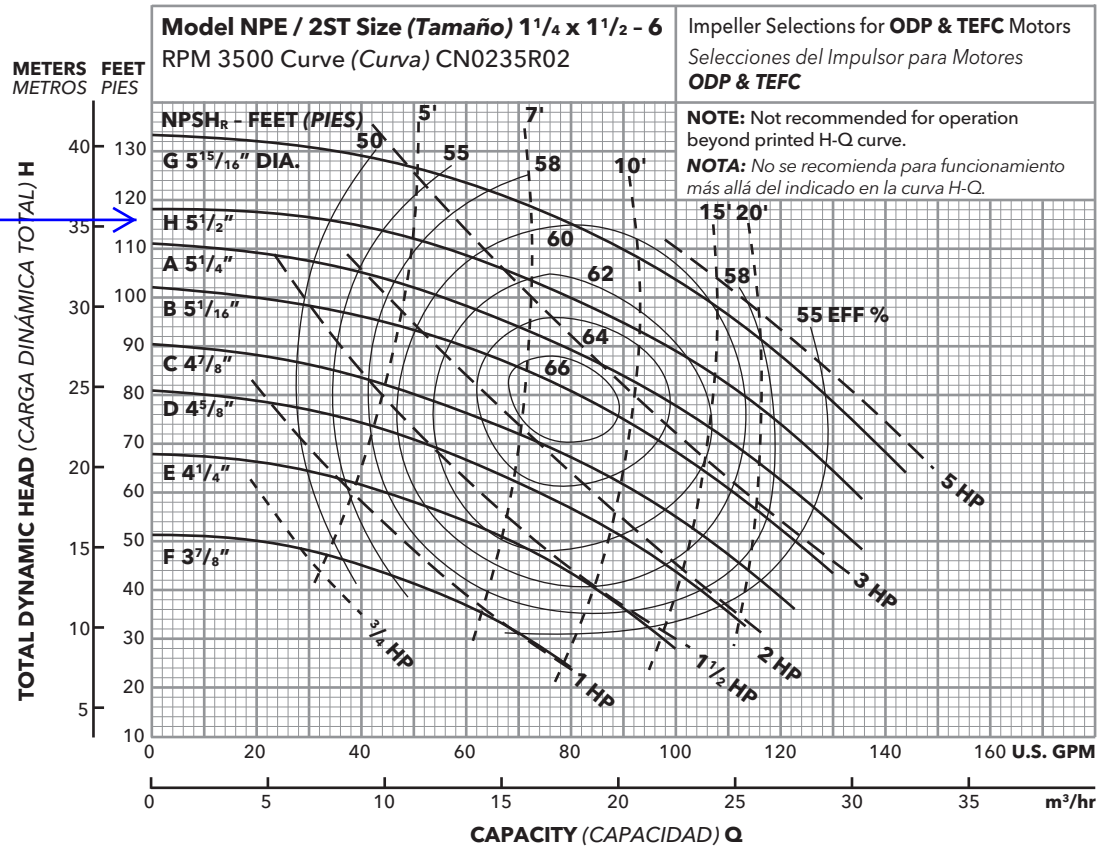


½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

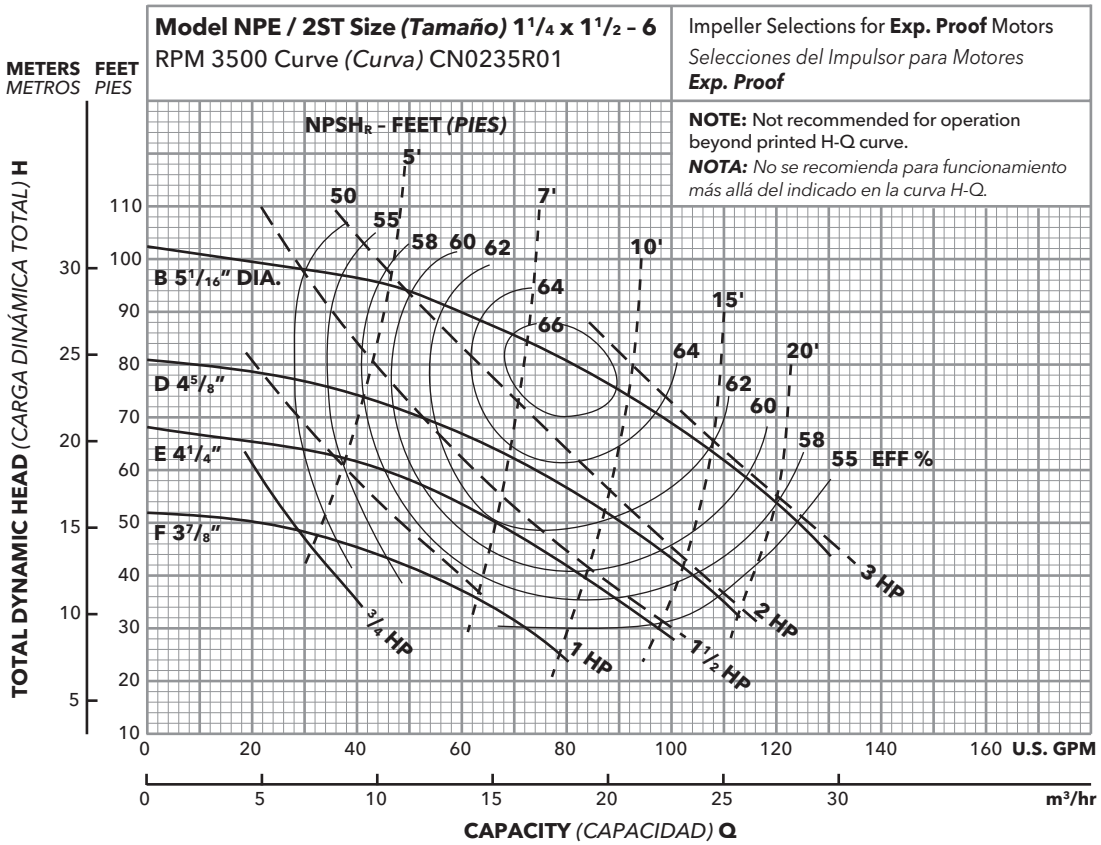
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	¾	3 7/8"
E	1	4 1/4
D	1½	4 5/8
C	2	4 7/8
B	3	5 1/16
A	3	5 1/4
H	5	5 1/2
G	5	5 15/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*



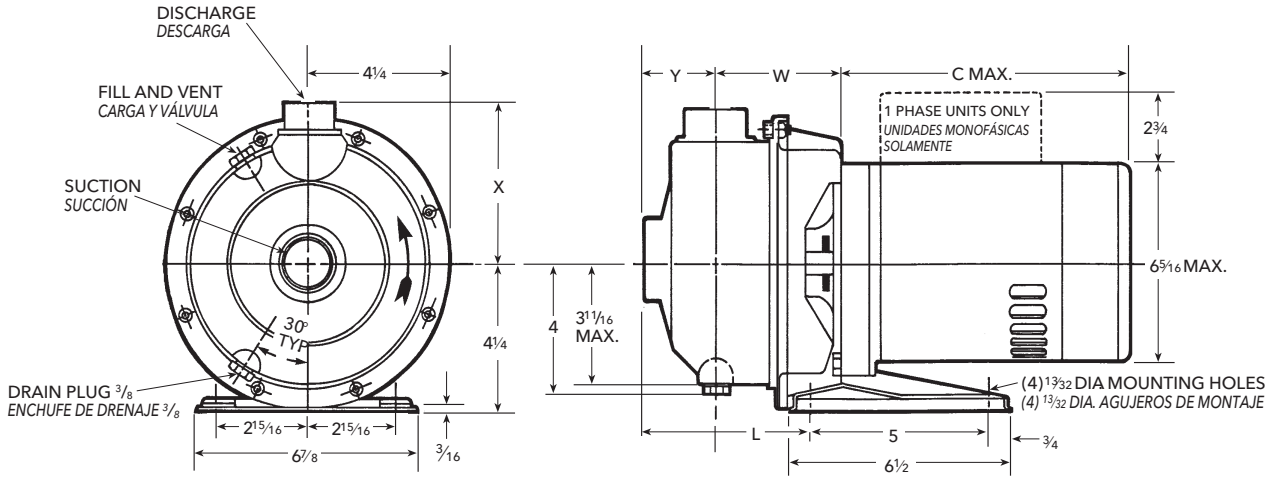
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	1	3 7/8"
E	1½	4 1/4
D	2	4 5/8
B	3	5 1/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

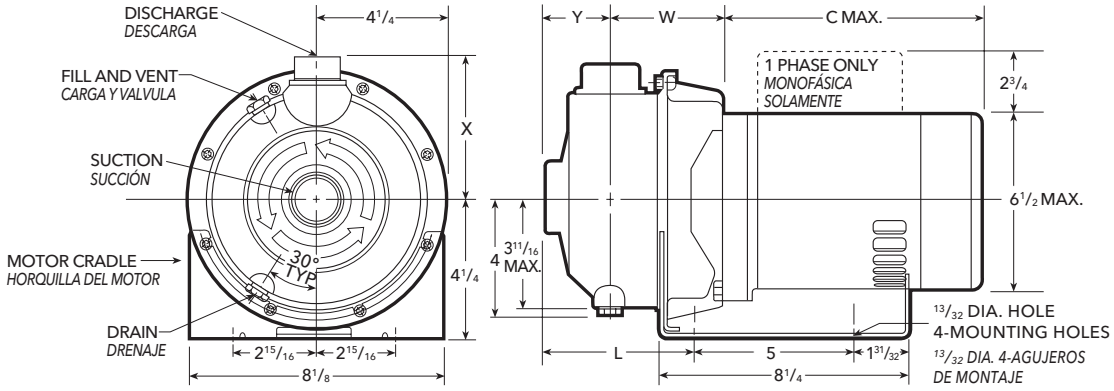
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón*		
									56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM				C Max.	Wt. Max., *Peso Máx.*
	Single Phase, *Monofásicos*		Three Phase, *Trifásicos*			
	ODP	TEFC	ODP	TEFC		
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	–	–	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	–	5	18 1/8	112

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

INSTRUCTION MANUAL
IM013R10



Model NPE/NPE-F

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

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Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Dealer: _____

Dealer Phone No.: _____

Date of Purchase: _____

Date of Installation: _____

Current Readings at Startup:

1 Ø	3 Ø	L1-2	L2-3	L3-1
Amps: _____	Amps: _____	_____	_____	_____
Volts: _____	Volts: _____	_____	_____	_____

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.

This is a **SAFETY ALERT SYMBOL.** When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

⚠ DANGER Warns of hazards that **WILL** cause serious personal injury, death or major property damage.

⚠ WARNING Warns of hazards that **CAN** cause serious personal injury, death or major property damage.

⚠ CAUTION Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

⚠WARNING



Hazardous fluids can cause fire, burns or death.

UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. IMPORTANT:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

⚠ CAUTION **Always disconnect electrical power when handling pump or controls.**

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	250° F (120° C)
Pressure:	125 PSI
Starts Per Hour:	20, evenly distributed

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. INSTALLATION:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

⚠ CAUTION **Never draw piping into place by forcing the pump suction and discharge connections.**

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units

2.2.1. Units may be installed horizontally, inclined or vertically.

⚠ CAUTION **Do not install with motor below pump. Any leakage or condensation will affect the motor.**

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.

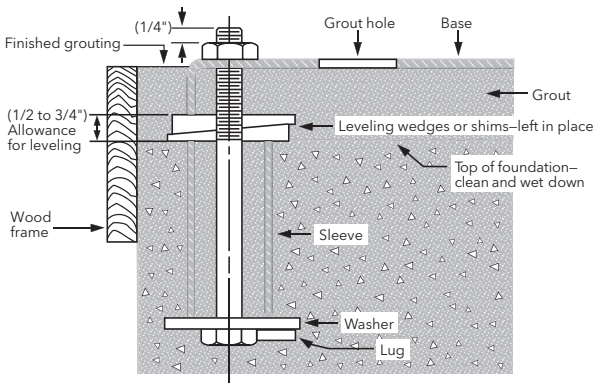


Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. SUCTION PIPING:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

⚠CAUTION **Do not use suction isolation valve to throttle pump.**

3.5. Installation with pump above source of supply

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

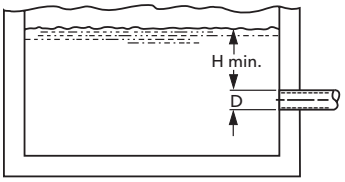


Figure 2

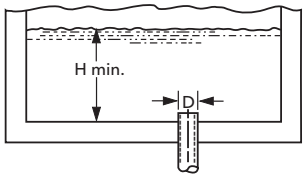


Figure 3

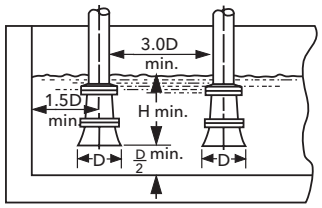


Figure 4

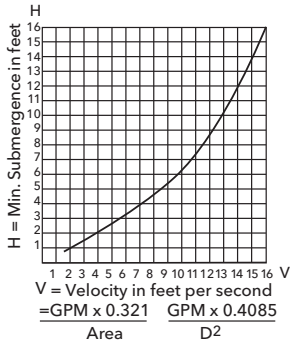


Figure 5

4. DISCHARGE PIPING:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.

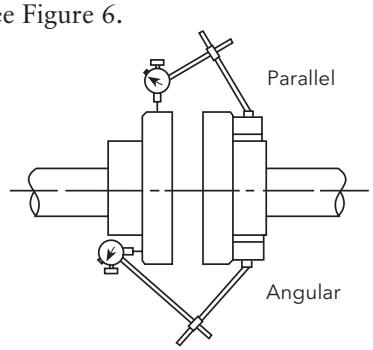


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

⚠CAUTION Always recheck both alignments after making any adjustment.

6. ROTATION:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. OPERATION:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

⚠CAUTION Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. MAINTENANCE:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

⚠CAUTION Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

⚠CAUTION Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 and 168).

10. REASSEMBLY:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame.

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end.

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

⚠CAUTION **Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.**

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. TROUBLE SHOOTING CHART:

MOTOR NOT RUNNING:
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

NPE STANDARD REPAIR PARTS LIST

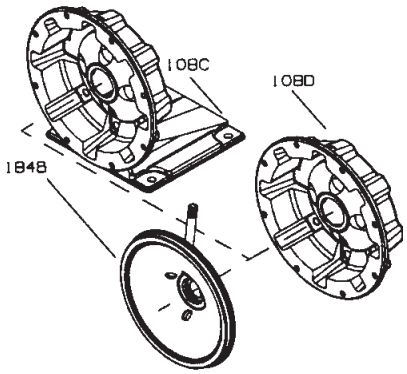
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and flush	
108D	Motor adapter less foot with flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton (standard)
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton (standard)
		EPR
		BUNA
513	O-Ring, casing	Viton (standard)
		EPR
		BUNA

MECHANICAL SEAL APPLICATION CHART

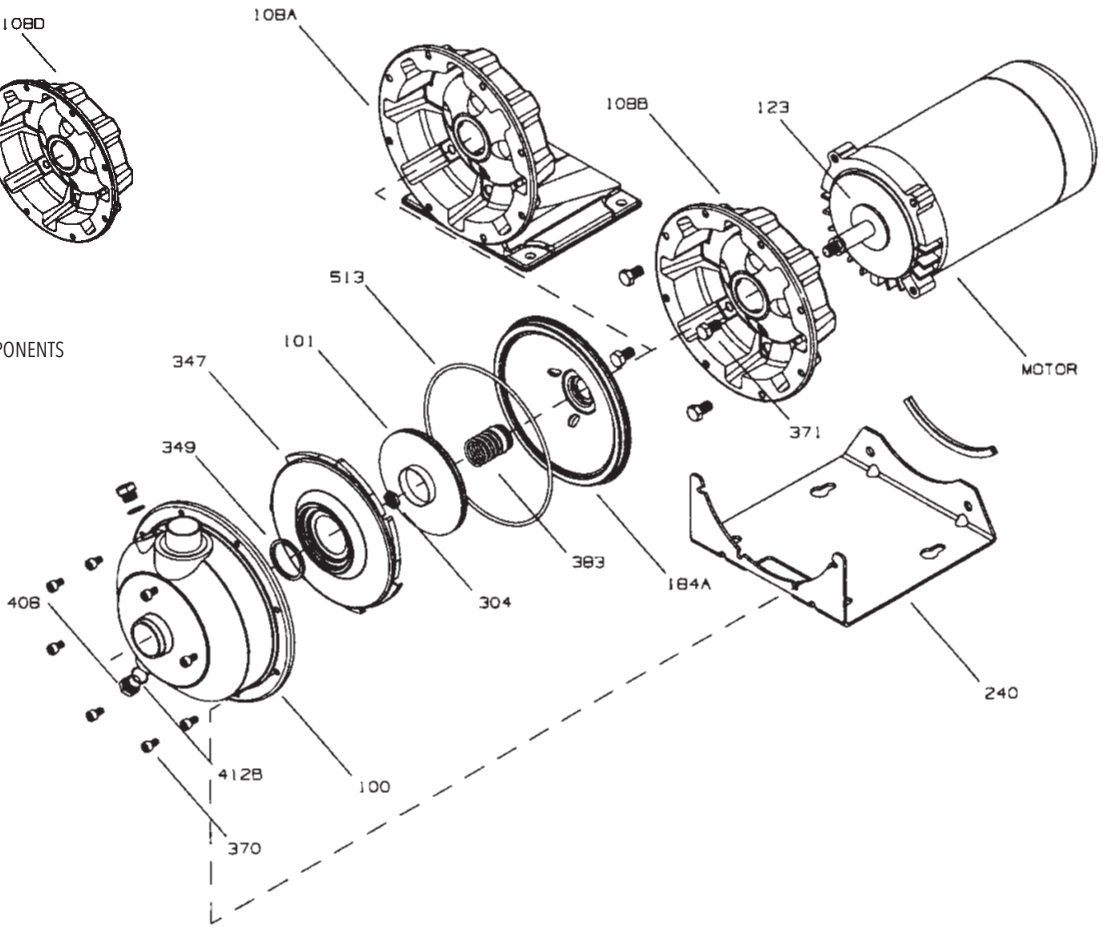
Item 383 Mechanical Seal (⅝" seal)				
Rotary	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

NOTE: Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



COMMERCIAL WARRANTY

For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or twelve (12) months from the date of shipment (which date of shipment shall not be greater than eighteen (18) months after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

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Let's Solve Water

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Declaration of Conformity

We at,
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declare that the following products: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS comply with Machine Directive 06/42/EC. This equipment is intended to be incorporated with machinery covered by this directive, but must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the actual provisions of the directive.

Declaración de Conformidad

Nosotros en
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declaramos que los siguientes productos: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS cumplen con las Directivas para Maquinarias 06/42/EC. Este equipo ha sido diseñado para ser incorporado a la maquinaria cubierta por esta directiva pero no debe ponerse en funcionamiento hasta que se declare que la maquinaria en la que será incorporado cumple con las disposiciones reales de la directiva.

Déclaration de Conformité

Nous, à
Goulds Water Technology, Xylem Inc.
1 Goulds Drive
Auburn, NY, U.S.A. 13021,
déclarons que les produits NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB et LBS sont conformes à la directive 06/42/EC (législation relative aux machines). Ils sont destinés à être intégrés dans la machinerie faisant l'objet de ladite directive, mais ne doivent pas être mis en service tant que la machinerie en question ne sera pas déclarée conforme aux stipulations de la directive.

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NPE/NPE-F REPAIR PARTS



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NPE END SUCTION

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NOTE:
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS.

(3) Mechanical Seal upgrades as noted on page 3.

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F R

CASING ROTATION, OPTIONAL
R = 3 o'clock L = 9 o'clock B = 6 o'clock
Note: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

SEAL VENT/FLUSH OPTION

MECHANICAL SEAL and O-RING
4 = Pre-Engineered Standard. For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (⅝" seal)						
Seal Code	**Rotary**	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**	**Casing O-Ring**
2	Carbon	Sil-Carbide	EPR	316 SS	10K18	EPR
4			Viton		10K55	Viton
5	Sil-Carbide		EPR		10K81	EPR
6			Viton		10K62	Viton

IMPELLER OPTION CODE . . . NO ADDER REQUIRED
For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.
Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	1 x 1¼-6	**1¼ x 1½-6**	**1½ x 2-6**
	Diameter	**Diameter**	**Diameter**
K		6⅛	
G		5 15/16	5⅜
H		5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	

Note: Not recommended for operation beyond printed H-Q curve.

For critical application conditions, consult factory.

Note: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with factory on non-cataloged numbers.

Note: Impeller diameter is measured at the vane. The overall diameter of the shroud may be greater.

DRIVER
1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

HP RATING
C = ½ HP F = 1½ HP J = 5 HP
D = ¾ HP G = 2 HP
E = 1 HP H = 3 HP

DRIVER: HERTZ/POLE/RPM
1 = 60 HZ, 2 pole, 3500 RPM
2 = 60 HZ, 4 pole, 1750 RPM
3 = 60 HZ, 6 pole, 1150 RPM
4 = 50 HZ, 2 pole, 2900 RPM
5 = 50 HZ, 4 pole, 1450 RPM

MATERIAL
ST = Stainless Steel

PUMP SIZE
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

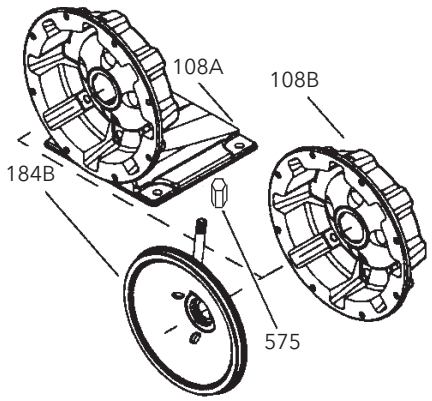
For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QUANTITY
100	Casing	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller	AISI 316L SS	See Impeller chart on page 6			1
108A	Motor adapter with foot*	AISI 316L SS	1L80			1
108B	Motor adapter less foot*	AISI 316L SS	1L87			1
123	Deflector	BUNA-N	5K7			1
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush	AISI 316L SS	1L333			1
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 3			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

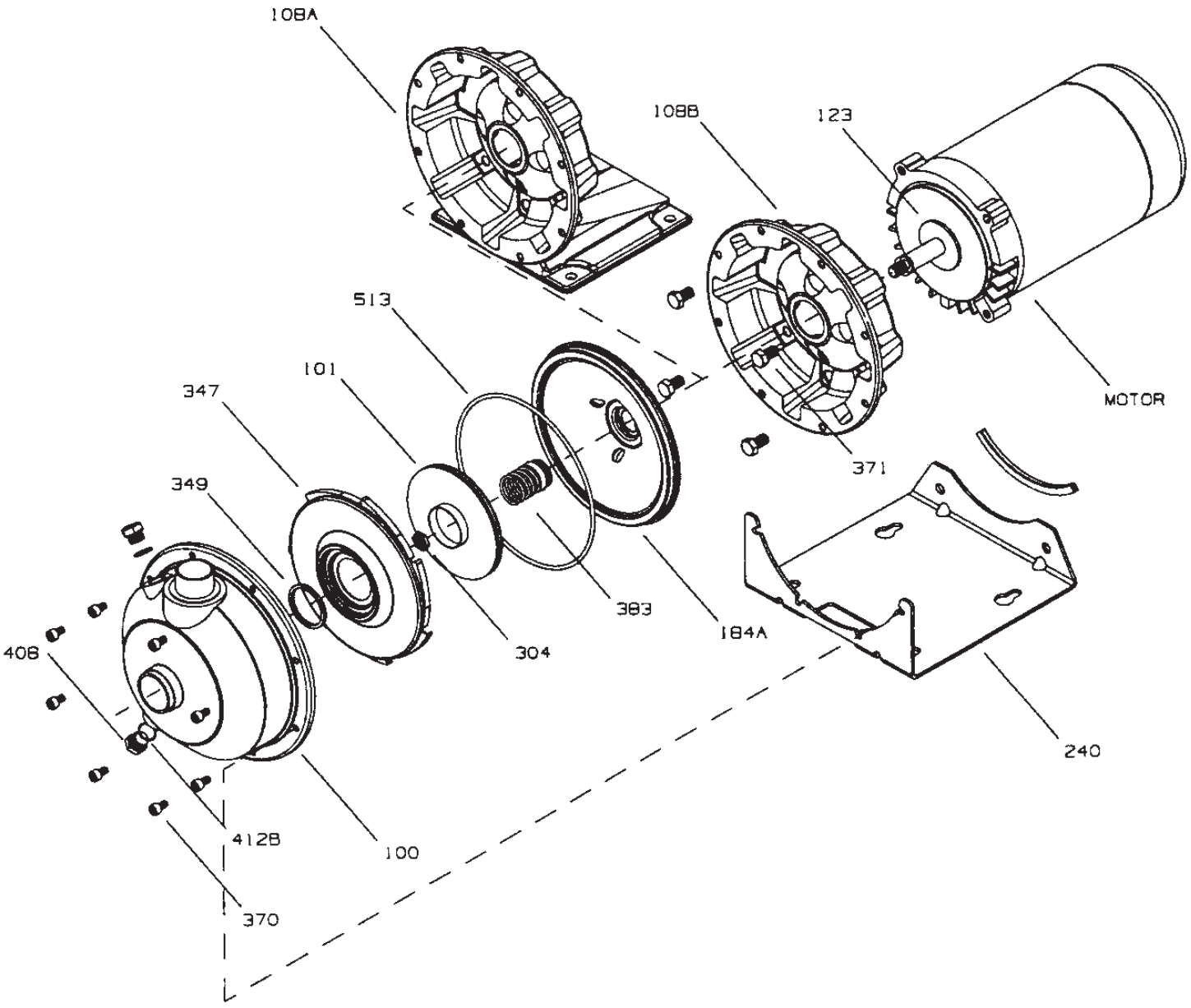
** Flush access hole provided.*

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS



NOTE:
Close-coupled units using motors ½ – 1 HP (TEFC and ODP) will use footed motor adapter as standard.
Close-coupled units using motors 1½ – 3 HP (TEFC and ODP) will use footless motor adapter as standard.
Close-coupled units using motors 5 HP and all X-Proof will have a foot attached to the motor.

NOTE:
Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power Frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x 1¼-6		1¼ x 1½-6		1½ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			6 1/8	2K1221		
G			5 15/16	2K1206	5 3/8	2K1209
H			5 1/2	2K1205	5	2K1208
A	6 1/8	2K1203	5 1/4	2K1216	4 3/4	2K1220
B	5 3/4	2K1202	5 1/16	2K1204	4 5/8	2K1207
C	5 3/16	2K1201	4 7/8	2K1215	4 3/8	2K1219
D	4 3/4	2K1200	4 5/8	2K1214	4 1/16	2K1218
E	4 7/16	2K1199	4 1/4	2K1213	3 5/8	2K1217
F	4 1/16	2K1211	3 7/8	2K1212		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST	2ST		3ST
			ODP/TEFC	ODP/TEFC		ODP/TEFC
½	C	Repair #	2K1199			
		Dia.	4 7/16			
		Imp. Code	E			
¾	D	Repair #	2K1200	2K1212		
		Dia.	4 3/4	3 7/8		
		Imp. Code	D	F		
1	E	Repair #	2K1201	2K1213		2K1217
		Dia.	5 3/16	4 1/4		3 5/8
		Imp.Code	C	E		E
1½	F	Repair #	2K1202	2K1214		2K1218
		Dia.	5 3/4	4 5/8		4 1/16
		Imp. Code	B	D		D
2	G	Repair #	2K1203	2K1215		2K1219
		Dia.	6 1/8	4 7/8		4 3/8
		Imp. Code	A	C		C
3	H	Repair #	2K1203	2K1216		2K1220
		Dia.	6 1/8	5 1/4		4 3/4
		Imp. Code	A	A		A
5	J	Repair #		2K1206	2K1221	2K1209
		Dia.		5 15/16	6 1/8	5 3/8
		Imp. Code		G	K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST		2ST		3ST	
			ODP	TEFC/EXP	ODP	TEFC/EXP	ODP	TEFC/EXP
½	C	Repair #	2K1199	2K1211				
		Dia.	4 7/16	4 1/16				
		Imp. Code	E	F				
¾	D	Repair #	2K1200	2K1199	2K1212			
		Dia.	4 3/4	4 7/16	3 7/8			
		Imp. Code	D	E	F			
1	E	Repair #	2K1201	2K1200	2K1213	2K1212	2K1217	
		Dia.	5 3/16	4 3/4	4 1/4	3 7/8	3 5/8	
		Imp. Code	C	D	E	F	E	
1½	F	Repair #	2K1202	2K1201	2K1214	2K1213	2K1218	2K1217
		Dia.	5 3/4	5 3/16	4 5/8	4 1/4	4 1/16	3 5/8
		Imp. Code	B	C	D	E	D	E
2	G	Repair #	2K1203	2K1202	2K1215	2K1214	2K1219	2K1218
		Dia.	6 1/8	5 3/4	4 7/8	4 5/8	4 3/8	4 1/16
		Imp. Code	A	B	C	D	C	D
3	H	Repair #	2K1203	2K1203	2K1216	2K1204	2K1220	2K1207
		Dia.	6 1/8	6 1/8	5 1/4	5 1/16	4 3/4	4 5/8
		Imp. Code	A	A	A	B	A	B
5	J	Repair #			2K1206 / 2K1221		2K1209	
		Dia.			5 15/16 / 6 1/8		5 3/8	
		Imp. Code			G / K		G	

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821S	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821S	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821S	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821S	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854S	26.8/13.4	36	E08821S	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854S	14.0	40	E09821S	11.89	44			
5	E10754S	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873S	2.6/1.3	19	E04876S	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873S	3.4/1.7	19	E05876S	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873S	4.2/2.1	22	E06876S	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878S	5.8/2.9	25	E07876S	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874S	6.9/3.3	39	E08876S	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874S	7.2/3.6	31	E09876S	7.6/3.8	37			
5	E10774S	7.2/14.4	50	E10876S	6.2/12.4	48			

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

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2) a leading global water technology company.

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www.gouldswatertechnology.com

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HFP

FX-201

QA INSPECTION SHEET

TANK MODEL #: H4R3X170FL-XP MFG ORDER #: 64993

INVENTORY CONTROL #: 12714 #2 SERIAL #: 10020

Q. A. CHECKPOINT #1 INSPECTION

- ✓ CLOSURE HARDWARE CORRECT
- ✓ INLET/OUTLET FLANGE CORRECT
- ✓ 1/4" NPT GAUGE PORT THREADS CORRECT
- ✓ DRAIN PORT THREADS CORRECT
- ✓ VENT PORT THREADS CORRECT
- ✓ CARTRIDGE BTM SEAL DIAMETER & WELD CORRECT
- ✓ STANDPIPE ALIGNMENT CORRECT
- ✓ CLOSURE O-RING & SEAT FREE OF DEFECTS
- ✓ DIMENSIONS PER BLUEPRINT

CHECKED BY: CM DATE: 12-17-14

Q. A. CHECKPOINT #2 FINAL ASSMBLY & PACKAGING

- ✓ STANDPIPE THREADS SEALED & TIGHT
- ✓ I&O MANUAL ATTACHED
- ✓ MODEL/SERIAL # DECAL & INLET/OUTLET LABELS CORRECT
- ✓ PLUG/HANDLE PACKAGED INSIDE HOUSING
- ✓ CLOSURE HARDWARE TIGHTENED
- ✓ PALLET & CRATE CORRECT & LABELED CORRECT

CHECKED BY: CM DATE: 9-1-15

CORRECTIVE ACTONS LOG:

QA RELEASE FOR SHIPMENT BY: CM DATE: 9-1-15

HFP

FX-202

QA INSPECTION SHEET

TANK MODEL #: HYR3X170FL-XP **MFG ORDER #:** 64380

INVENTORY CONTROL #: 91514 #4 **SERIAL #:** 10022

Q. A. CHECKPOINT #1 INSPECTION

- ✓ CLOSURE HARDWARE CORRECT
- ✓ INLET/OUTLET FLANGE CORRECT
- ✓ 1/4" NPT GAUGE PORT THREADS CORRECT
- ✓ DRAIN PORT THREADS CORRECT
- ✓ VENT PORT THREADS CORRECT
- ✓ CARTRIDGE BTM SEAL DIAMETER & WELD CORRECT
- ✓ STANDPIPE ALIGNMENT CORRECT
- ✓ CLOSURE O-RING & SEAT FREE OF DEFECTS
- ✓ DIMENSIONS PER BLUEPRINT

CHECKED BY: JLH DATE: 9-15-14

Q. A. CHECKPOINT #2 FINAL ASSMBLY & PACKAGING

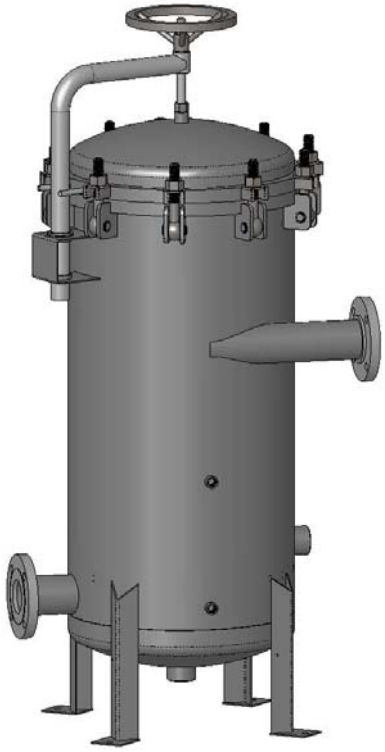
- ✓ STANDPIPE THREADS SEALED & TIGHT
- ✓ I&O MANUAL ATTACHED
- ✓ MODEL/SERIAL # DECAL & INLET/OUTLET LABELS CORRECT
- ✓ PLUG/HANDLE PACKAGED INSIDE HOUSING
- ✓ CLOSURE HARDWARE TIGHTENED
- ✓ PALLET & CRATE CORRECT & LABELED CORRECT

CHECKED BY: [signature] DATE: 10-7-15

CORRECTIVE ACTONS LOG:

QA RELEASE FOR SHIPMENT BY: [signature] DATE: 10-7-15

PRODUCT SPECIFICATION
Harmsco® Model #: HUR 3X170FL-XP



Description: Tangential Entry, Up-Flow Cartridge Filter Housing with; Swing Bolt Closure, Davit Cover Lift, and Flanged Connections.

Details:

1. Stainless steel construction, wetted metallic components are 304/304L ASTM A-240.
2. Electro-polish finish.
3. Swing bolt style housing closure. Swing bolts are SS alloy per ASTM A-193 B7.
4. NSF Certified using Genuine Harmsco® Hurricane® replacement filter cartridges.*
5. Tangential inlet and the integral inner-can, create a centrifugal flow that induces pre-filtration by heavy particulate separation.
6. Patented "Up-Flow" design that;
   a. Self purges housing of air.
   b. Eliminates by-pass contamination during servicing.
   c. Improves efficiency by creating an even flow distribution across filtering media.
7. Strong, durable, built to ASME Design Standards.
8. Utilizes three (3) Genuine Harmsco® Hurricane® HC/170 series filter cartridges. *
9. Inlet & Outlet are NPS 3 Flanges ANSI/ASME B16.5 Class 150
10. Drains (Qty 2) are 1-1/2" Female NPT (FPT) Couplings, Class 1000
11. Vent is 1/2" Female NPT (FPT) Coupling, Class 1000
12. Gauge Ports (Qty 2) are 1/2" Female NPT (FPT) Couplings, Class 1000
13. Closure Gasket is EPDM 70 Durometer O-ring.
14. Pressure Rating - 150 P.S.I.G.
15. Temperature Rating – Up to 140°F
    Note: Higher temperatures are possible, check cartridge specifications. **
16. Flow Rate – 450 GPM Maximum.
    See Pressure Drop vs. Flow Rate Curve, page 2.
17. One person can perform maintenance.

Requirements:

Floor Load:	Dry weight = 435 lbs. Volume = 61 US gallons x 8.337 lbs./US gallon (water) = 509 lbs. Total weight = 435 + 509 = 944 lbs. (housing + water) Floor contact area = .292 ft² Floor Load = 944 lbs. divided by .292 ft² = **3,250 pounds per square foot** (approx.) Note: Piping shall conform to all applicable codes and be independently supported. If floor strength is suspect, use appropriate measures to adequately distribute load.
Floor Space:	**4.5 ft²** (does not include Cover/Davit swing position), See Installation Diagram, page 3.
Service Height:	98-1/2", See Installation Diagram, page 3.
Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided.

Recommended Spare Parts:
Closure Gasket O-ring: PN 363-E
Set of 3 Harmsco® Hurricane® HC/170 replacement cartridges

* The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges in this filter housing voids certifications by NSF International.
** Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.
Notice: The information contained in this publication is considered accurate, and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest, most up to date, specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. End users should perform their own tests to determine suitability for each application.

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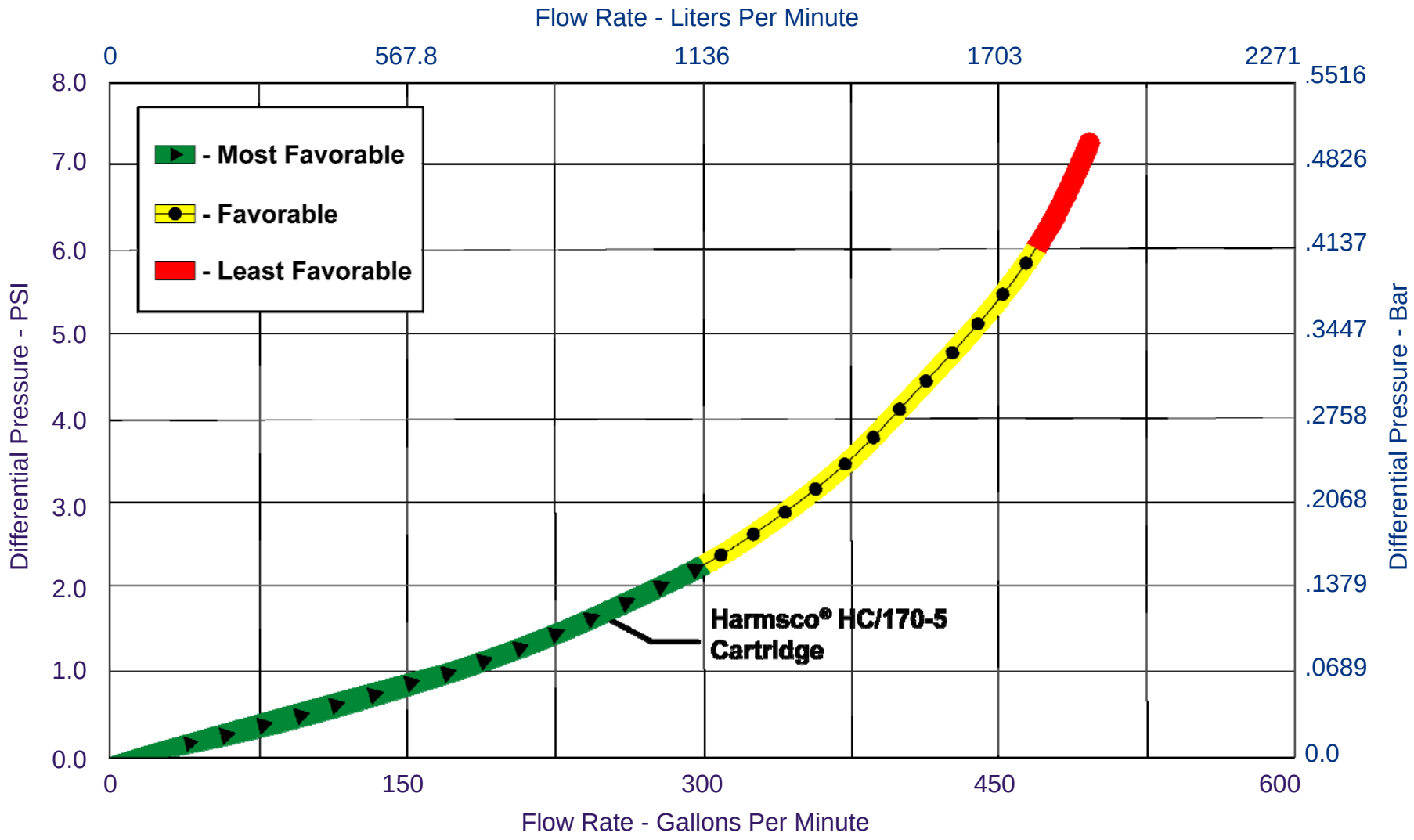
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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 3X170FL-XP

Hurricane® HC/170-5 Cartridges, Qty 3; with clean water.

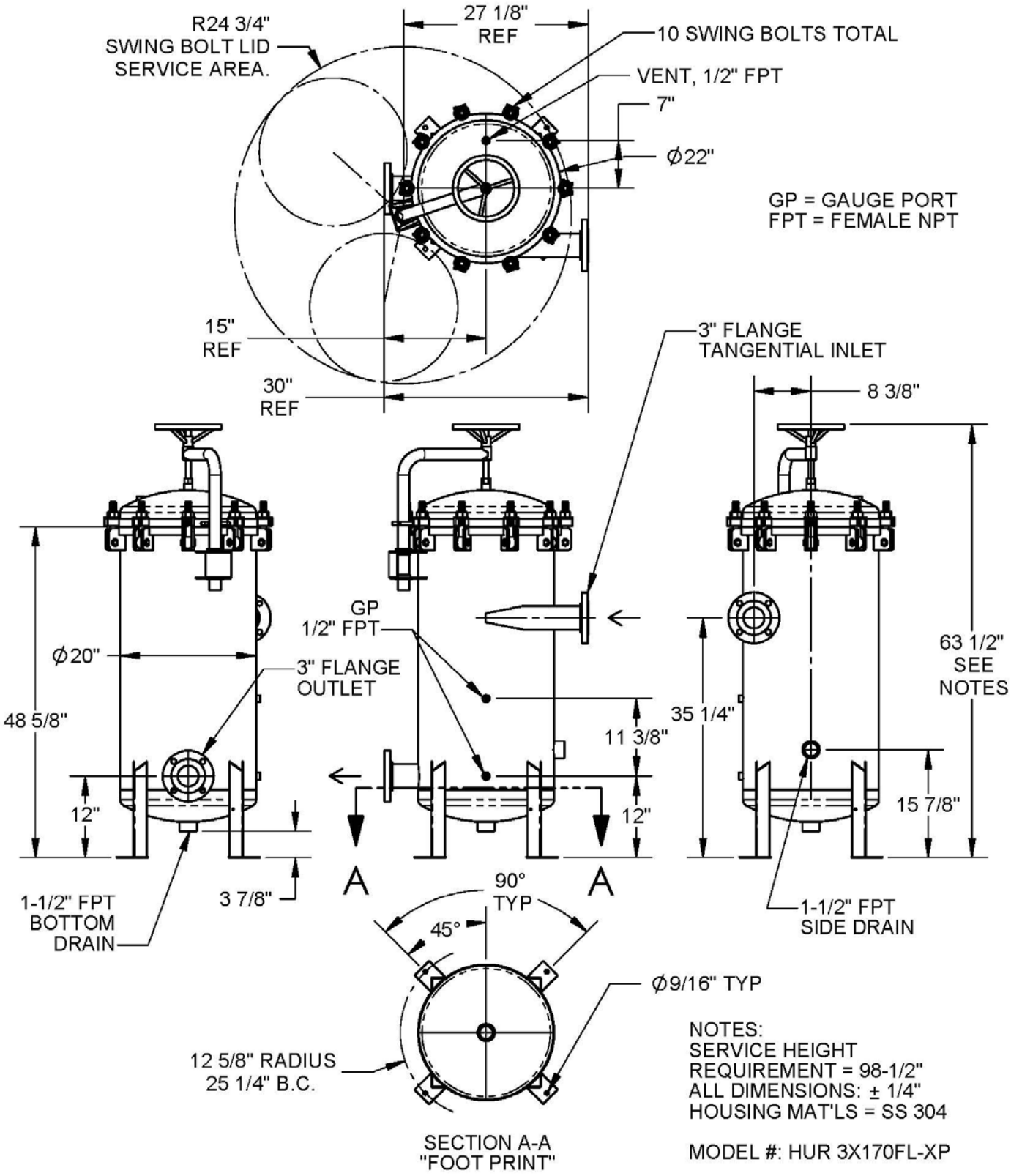


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Harmsco® Filtration Products
Installation Diagram
Hurricane® 3X170FL-XP Swing Bolt Housing



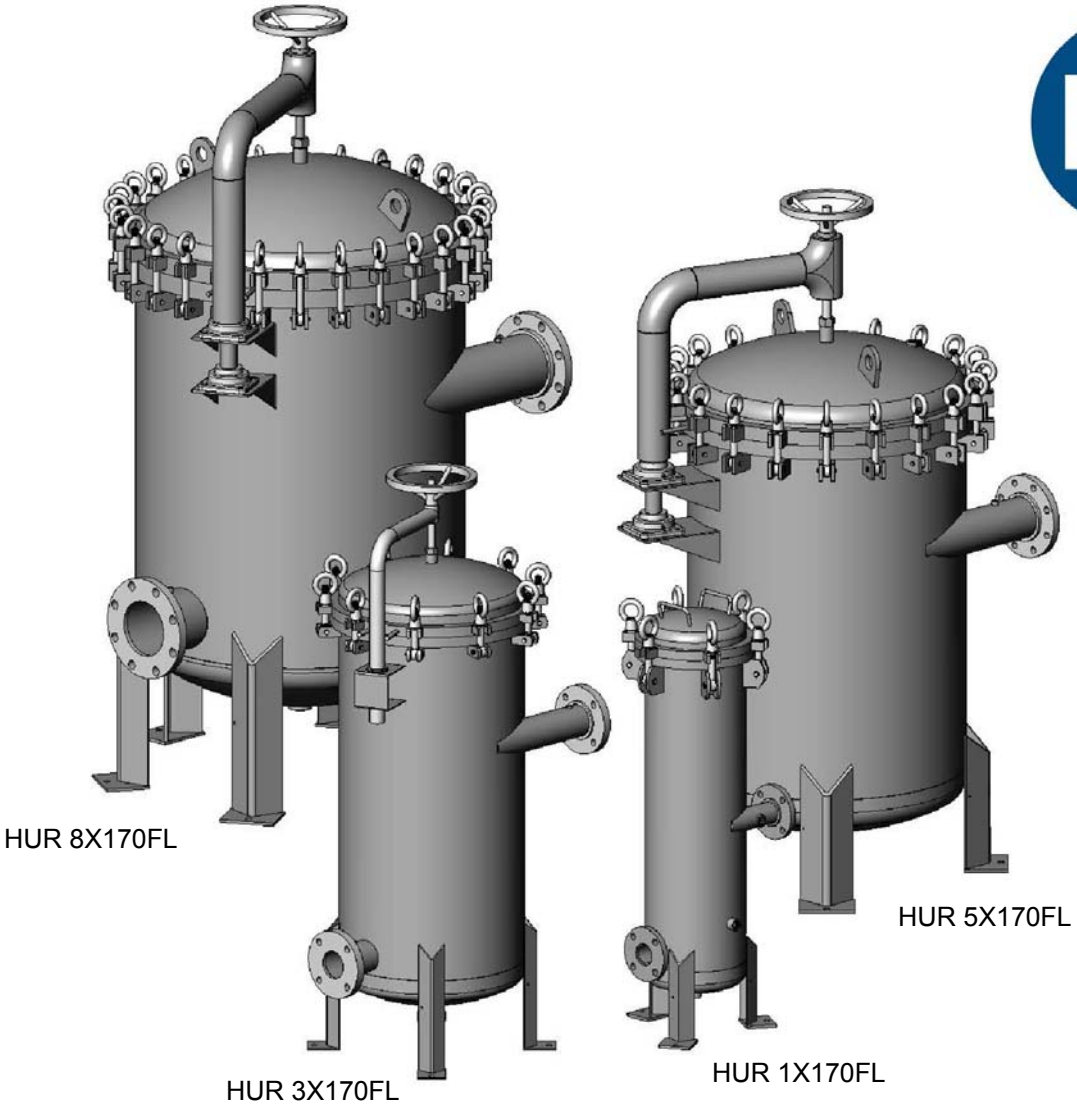
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HARMSCO® Hurricane®
Swing Bolt Water Filters
Models: HUR 1X170FL, HUR 3X170FL
HUR 5X170FL, & HUR 8X170FL

INSTALLATION AND OPERATION MANUAL



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HARMSCO® Hurricane®
Swing Bolt Water Filters

INTRODUCTION

The Harmsco® Hurricane® Swing Bolt Water Filter is a water filtration device that utilizes the Harmsco® Hurricane® HC/170 size cartridge filter in various quantities from one per housing (HUR 1X170FL) to 8 per housing (HUR 8X170FL).

The Hurricane® HC/170 cartridges are available in many micron ratings, styles and materials of construction. High temperature cartridges are also available. Consult the Harmsco® Product Catalog (www.harmsco.com) or a Sales Representative for more details.

All of the Harmsco® Hurricane® Swing Bolt housings; **HUR 1X170FL**, **HUR 3X170FL**, **HUR5X170FL** & **HUR 8X170FL** are equipped with pipe flanges on both the inlet and the outlet, & cartridge lifting handle(s) (part # 362-L). All models are NSF Certified per Standard 61 when used with Genuine Harmsco® Hurricane® HC/170 cartridges.

The Harmsco® Hurricane® Swing Bolt Water Filter is designed as a strong economical filter that continuously improves the water quality with minimal maintenance.

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HARMSCO® Hurricane®
Swing Bolt Water Filters
INSTALLATION & OPERATION MANUAL

Safety Precautions:

Before using and installing this product or its components please read this entire manual. Failure to do so could result in serious personal injury or damage to the equipment and assembled components.

This product and all of its components MUST NOT be installed or used in any manner other than that which is specified in this manual.

! WARNINGS !

1. **Seek qualified assistance for installation. Piping shall conform to all applicable codes and be independently supported.**
2. **Do not install the unit where a temperature of 32° F or lower can occur. Damage caused by freezing shall void all warranties.**
3. **The unit shall be properly bonded in accordance with all applicable codes. A grounding lug is provided.**
4. **After unit is installed, flush (through outlet) to drain for 10 minutes at recommended flow rates prior to use.**
5. **Always isolate unit and relieve pressure before servicing.**
6. **Utilizes Genuine Harmsco® Hurricane® HC/170 filter cartridges, available in many micron ratings and styles.**
   The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges will void certifications by NSF International.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844. Other patents pending.

Notice: The information contained in this publication is considered accurate and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest and most up to date specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication.

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Swing Bolt Water Filters

REQUIREMENTS

- Only qualified personnel are to perform the installation.
- Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.
- Install shut off valves on both the inlet and the outlet to isolate unit while servicing.

RECOMMENDATIONS

- Plumb drains with appropriate valves to reduce service time.
- Include a by-pass with shut off valves between the inlet and outlet. See installation Block Diagram on page 7.
- Install appropriate pressure gauges into the gauge ports provided. Model HUR1X170FL outlet pressure gauge is to be installed in-line and in close proximity to the outlet flange.
- Install plug or appropriate valve into the vent port provided.
- Lubricate Swing Bolt Assemblies (all models) & Davit Assemblies (HUR 3X170FL, HUR 5X170FL & HUR 8X170FL) using Food Grade grease with PTFE and NSF rated H1 only.
- Replace cartridge(s) when certain conditions exist.
  For example: 1. Differential pressure is greater than 30 psi.
  2. Quality of water is unacceptable.
  3. Flow rate has diminished.
  4. Every 6 months
- **Spare Parts:**

  1. Sufficient supply of replacement cartridges.
     Note: Harmsco® Hurricane® HC/170 filter cartridges available include: Activated Carbon, High Temperature, SureSafe™, Poly-Mesh, Poly-Pleat™ & more.
     Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

  2. Housing O-ring Seal:

Model #	Part #		
	EPDM (std)	BunaN	Viton
HUR 1X170FL	361-E	361-B	361-V
HUR 3X170FL	363-E	363-B	363-V
HUR 5X170FL	365-E	365-B	365-V
HUR 8X170FL	368-E	368-B	368-V

  3. Optional: Cartridge Lifting Handle, Part #362-L



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HARMSCO® Hurricane®
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INSTALLATION/SET-UP

The following instructions & diagrams show the Harmsco® Hurricane® Swing Bolt Water Filter housing with typical plumbing hook-up requirements. All steps of the installation are to be performed by qualified personnel.

1. Always adhere to state and local plumbing codes and requirements for design and installation.
2. Mount and secure housing using the holes at the base of the legs - see Installation Diagrams, pages 8-11.
   Models HUR 5X170FL & HUR 8X170FL have two lifting lugs welded onto the lid for positioning of the housing. Swing bolts must be engaged and the housing must be empty prior to using the lifting lugs.
3. Bond the filter housing utilizing the grounding lug on the leg.
   - must be performed by a qualified electrician.
4. Install incoming water supply with shut off valve to flange marked "Inlet".
5. Install return line with shut off valve to flange marked “Outlet”.
6. Install plugs or valves in drain lines into the FPT couplings located at the bottom center and side of housing.
7. Install plugs or pressure gauges into the gauge ports.
8. Install plug or valve into the vent port.
9. Refer to Specifications, Installation Block Diagram & Installation Diagrams for more details, pages 6-11.

Notes:

- Shut-off valves shall be installed on inlet and outlet to isolate the filter when servicing.
- To protect against electrolysis, all filters shall be bonded.
  Failure to properly bond the filter will void all warranties.
- Valves, plugs and pressure gauges are not provided.
- Use gaskets, sealants and/or expansion/vibration coupling materials appropriate for the application.
- Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.
- For cartridge replacement, see pgs. 12 - 18, 24.
- For models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL, make sure sufficient space is available to rotate lid away from housing allowing access to all cartridges.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

SPECIFICATIONS

Specification	Model			
	HUR 1X170FL	HUR 3X170FL	HUR 5X170FL	HUR 8X170FL
Cartridge Quantity[1]	1	3	5	8
Recommended Flow Rate, gal/min	105	315	525	840
Max. Flow Rate, gal/min	150	450	750	1200
Pressure Rating, P.S.I.G. Max. *	150 *	150 *	150 *	150 *
Height, inches	48"	64"	74"	84"
Service Height, inches	77"	98-1/2"	98-1/2"	104-1/2"
Housing Diameter	11"	20"	30"	35-3/8"
Inlet/Outlet[2]	2" Flange	3" Flange	4" Flange	6" Flange
Height of Inlet, inches	23-5/8"	35-1/4"	38"	44-1/4"
Height of Outlet, inches	9 3/4	12"	14-1/8"	20-1/2"
Drain (Qty 2, Female)	3/4" NPT	1-1/2" NPT	1-1/2" NPT	1-1/2" NPT
Weight, Dry	150 lbs.	420 lbs.	1,100 lbs.	1,600 lbs.
Weight, Wet	284 lbs.	929 lbs.	2,284 lbs.	3,535 lbs.
Floor Contact Area	.188 ft²	.292 ft²	.776 ft²	1.164 ft²
Floor Load (approx.)[2,3]	1,515 lbs/ft²	3,200 lbs/ft²	3,000 lbs/ft²	3,100 lbs/ft²
Floor Space[4]	1.6 ft²	4.5 ft²	8.5 ft²	14.0 ft²

Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided on the leg.
Housing Material:	Stainless Steel Construction. All wetted metallic components are ASTM A-240
Finish:	Electro-polish
O-ring Material:	EPDM is standard. Buna-N & Viton are available
Temperature Rating:	Up to 140°F, Note: Higher temperatures are possible, check cartridge specifications and contact a Harmsco® sales engineer.

* Models with -HP suffix 200 P.S.I.G. Max.

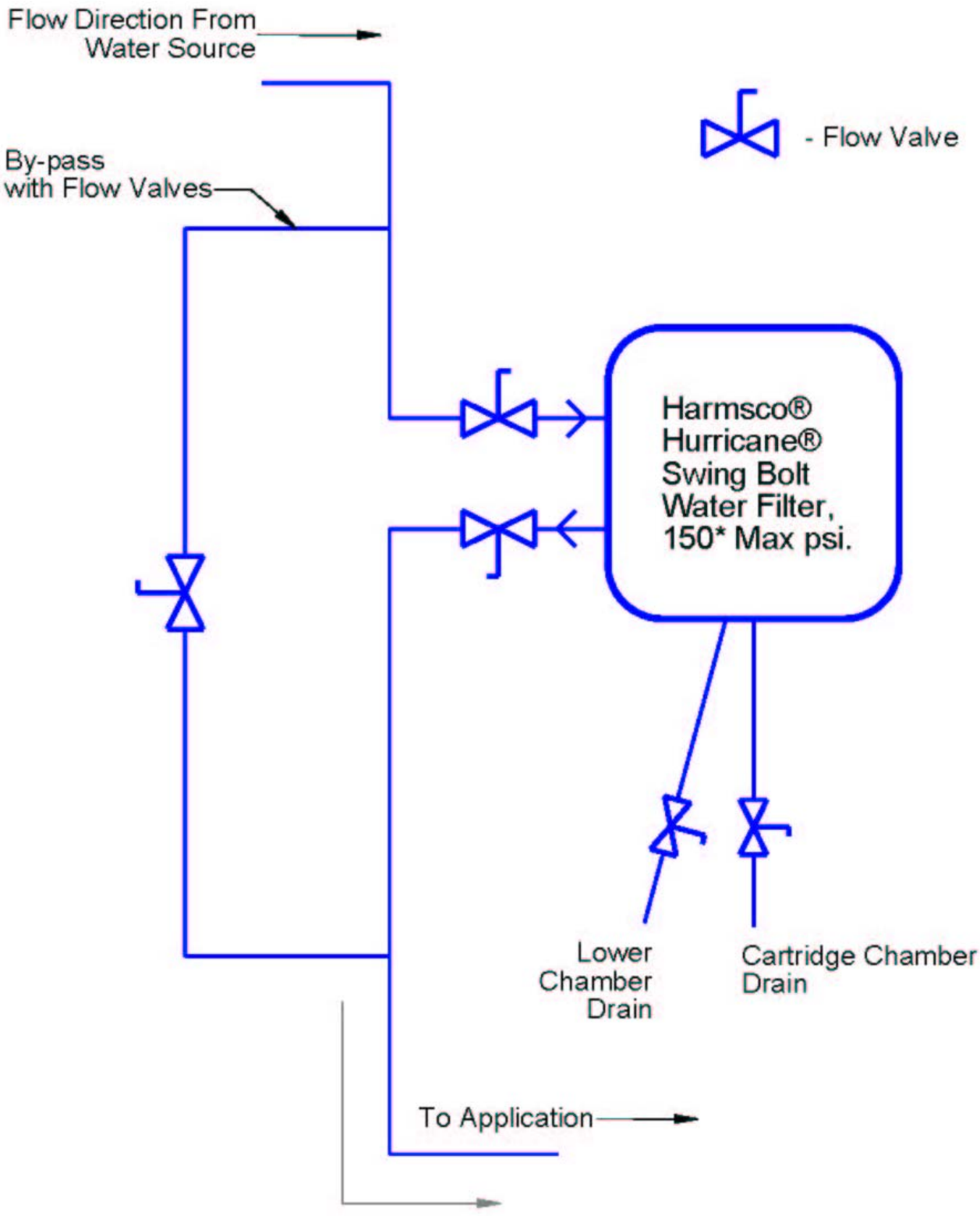
Notes:

1. Utilizes Genuine Harmsco® Hurricane® HC/170 cartridges.
   - HC/170 cartridge filters are available in many micron ratings and styles.
   - Activated carbon and several high temperature cartridges are also available.
   - The use of cartridges other than Genuine Harmsco® Hurricane® HC/170 filter cartridges will void certifications by NSF International.
2. Piping shall conform to all applicable codes and be independently supported.
3. If floor strength is suspect, use appropriate measures to adequately distribute load.
4. Does not include Cover/Davit swing position for models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL.

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Swing Bolt Water Filters

Installation Block Diagram

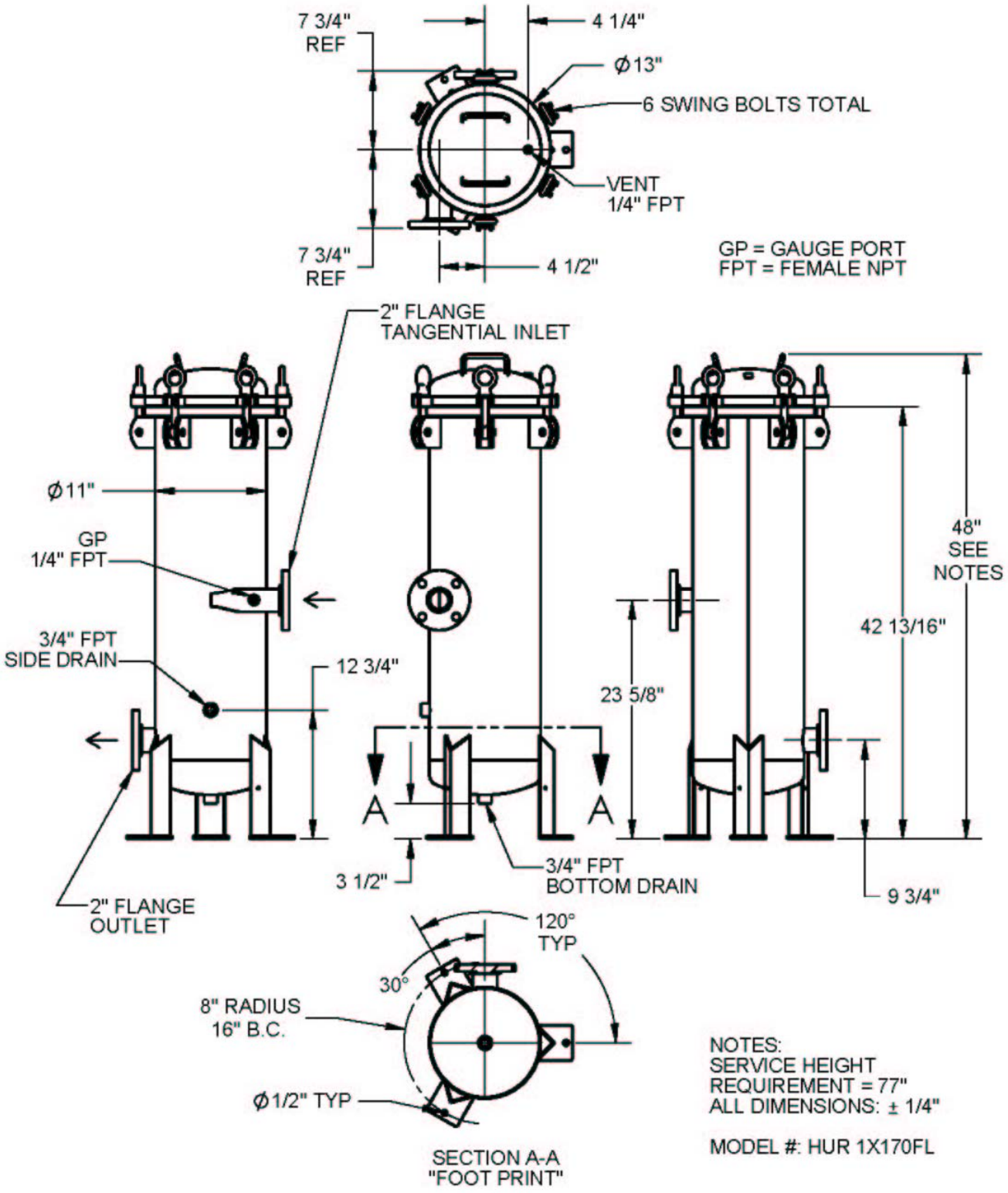


* Models with –HP suffix = 200 psi.

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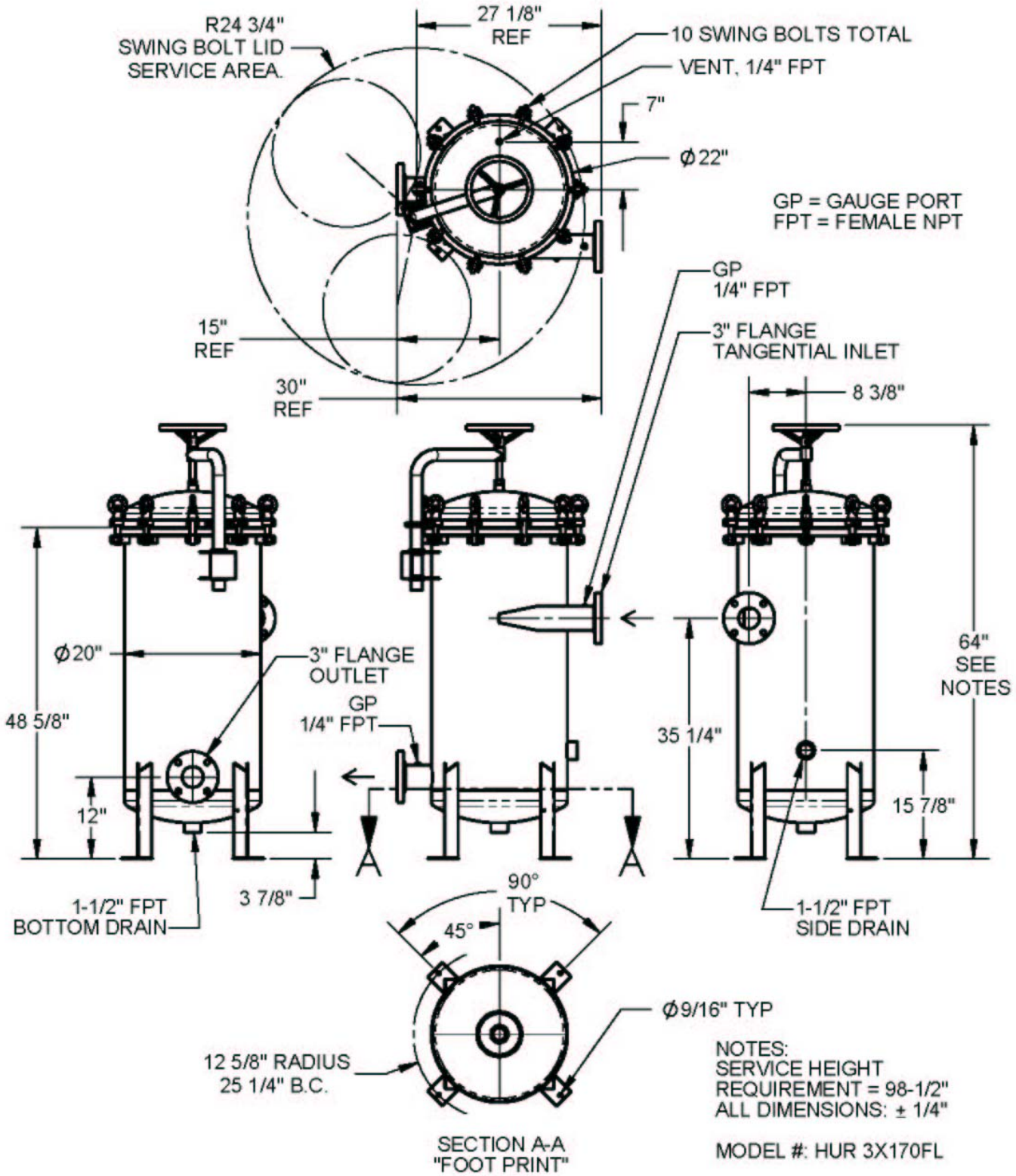
Installation Diagram
Model HUR 1X170FL



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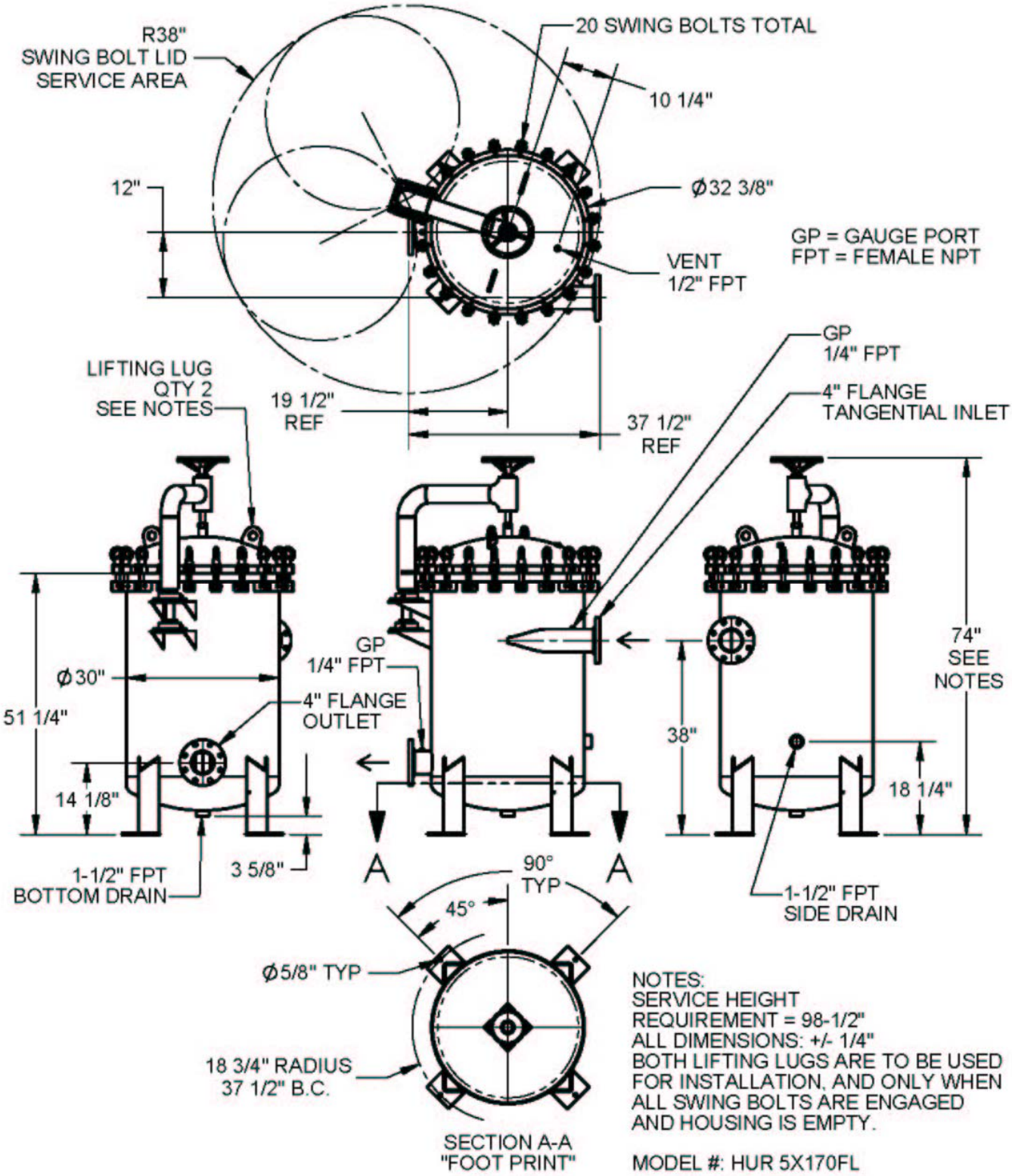
Installation Diagram
Model HUR 3X170FL



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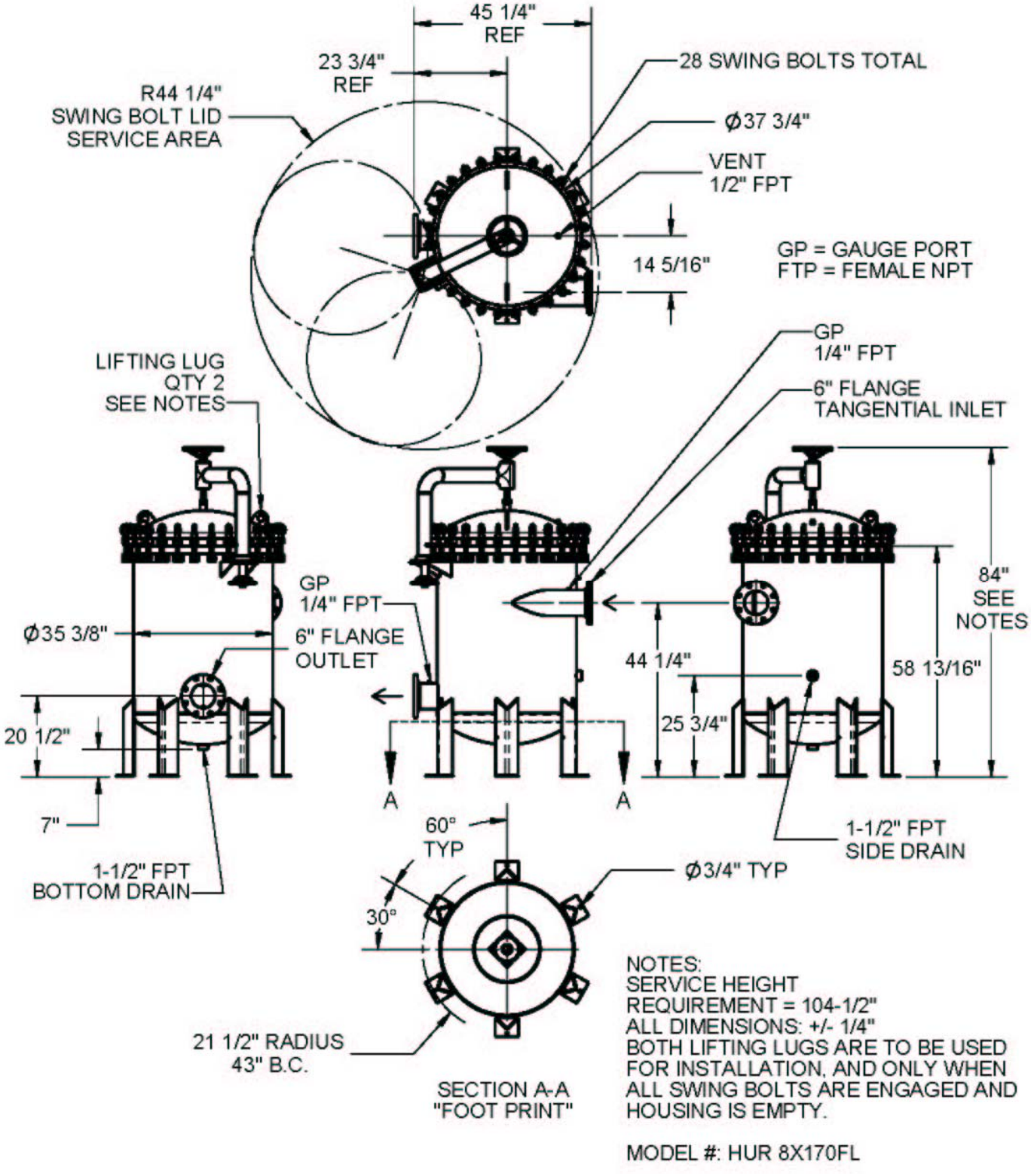
Installation Diagram
Model HUR 5X170FL



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Installation Diagram
Model HUR 8X170FL

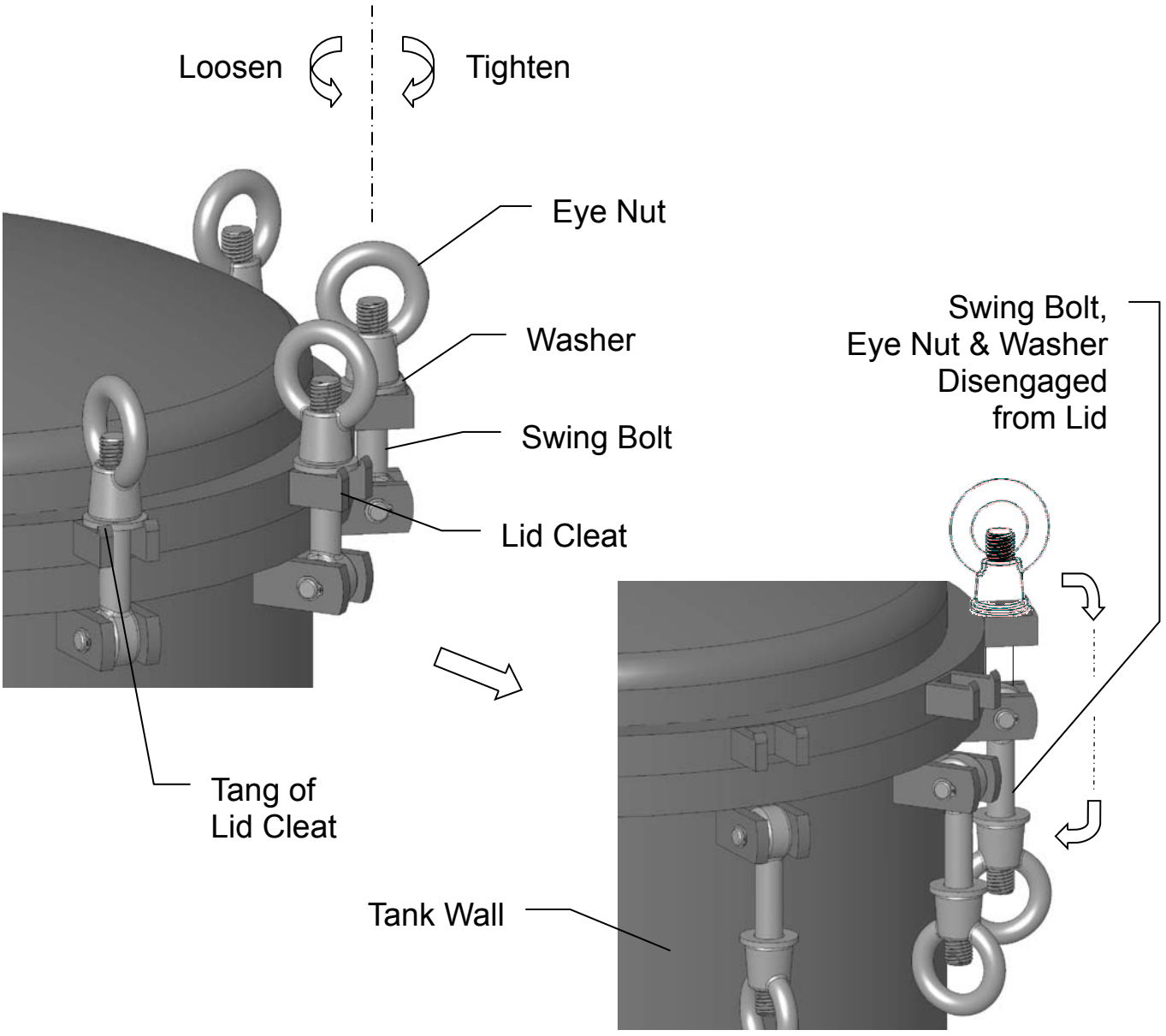


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Swing Bolt Water Filters

CARTRIDGE REPLACEMENT

1. Isolate unit from all water sources (close I/O lines) and relieve pressure to housing by first opening the housing's "Bottom Drain" and let drain completely. See Installation Diagrams (pgs. 8-11). This will protect the cartridges (installed) from experiencing a reverse flow that could cause damage.
2. Open Side Drain and let housing drain completely.
3. Loosen all Eye Nuts of Swing Bolts by 1/2 turn increments counter-clockwise to gradually step down load applied to swing bolts. Repeat process as needed.
4. Fully loosen Eye Nuts but do not remove from Swing Bolt. Lift Washer above Tangs in Lid Cleats and allow Swing Bolt to rotate downward along the side of the housing's Tank Wall.



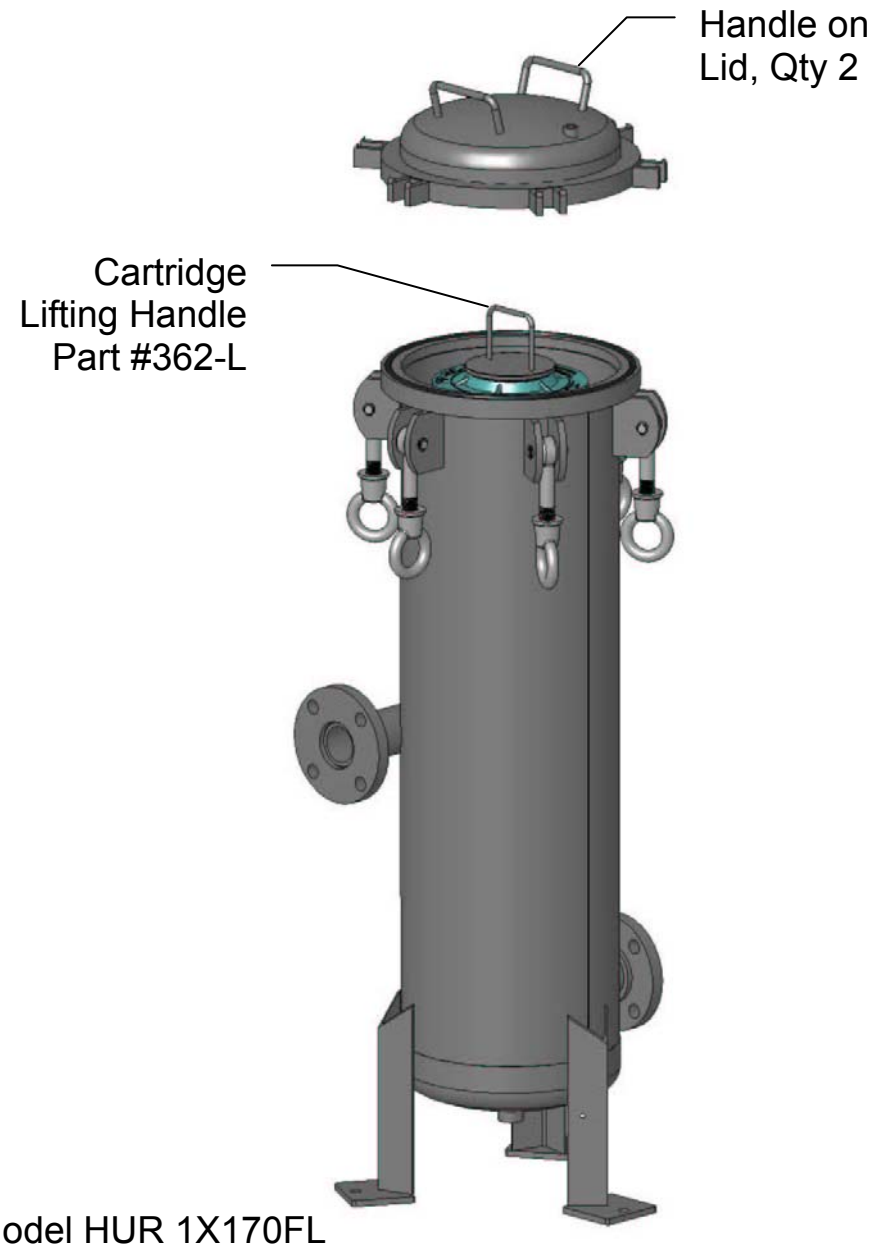
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CARTRIDGE REPLACEMENT cont.

5. When all of the Swing Bolt hardware is disengaged, the Lid can be removed.

5 a. For Model HUR 1X170FL the Handles on the Lid are used to raise and remove the Lid.

Note: The Lid must be raised sufficiently to clear the Cartridge Lifting Handle prior to removal.



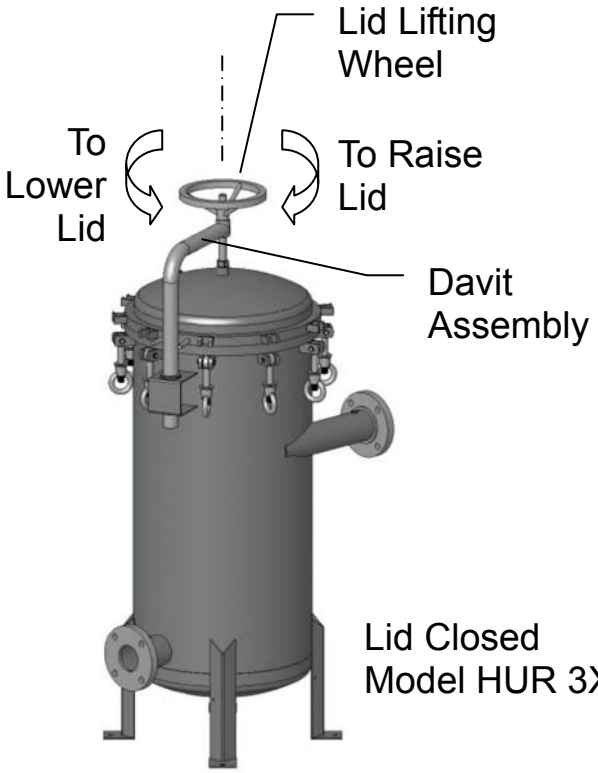
Model HUR 1X170FL

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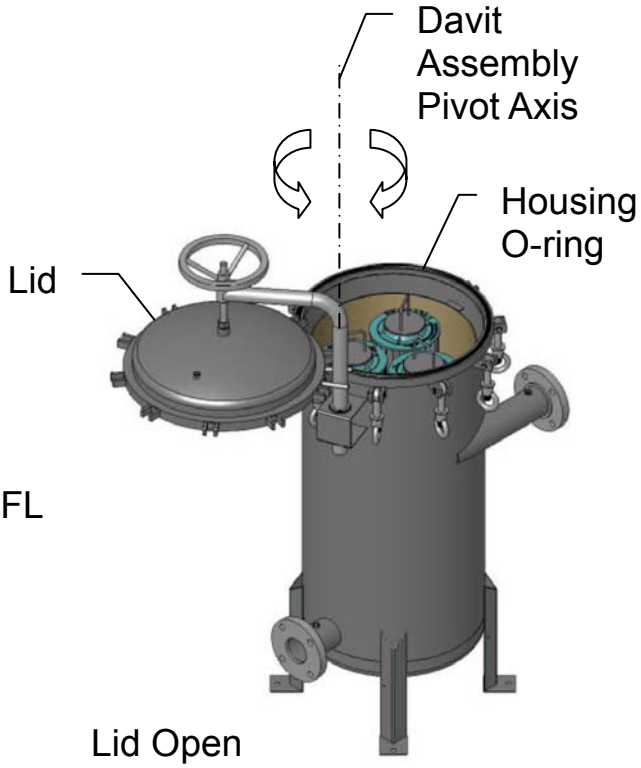
CARTRIDGE REPLACEMENT cont.

5 b. Models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL all have a Davit Assembly and Lid Lifting Wheel to raise and lower the Lid. To raise Lid, turn Lid Lifting Wheel clockwise. To lower Lid, turn Wheel counter-clockwise.
Note: Housing O-ring may stick to Lid. To prevent this, it is suggested to raise the Lid about 1/8” inch and move the Lid/Davit Assembly slightly sideways to free the O-ring from Lid while keeping the O-ring in its housing channel.
Continue raising Lid approximately 1” to clear housing. Swing Lid and Davit Assembly until cartridge compartment is fully exposed.

Caution: The Lid should be secured when servicing.



Lid Closed
Model HUR 3X170FL



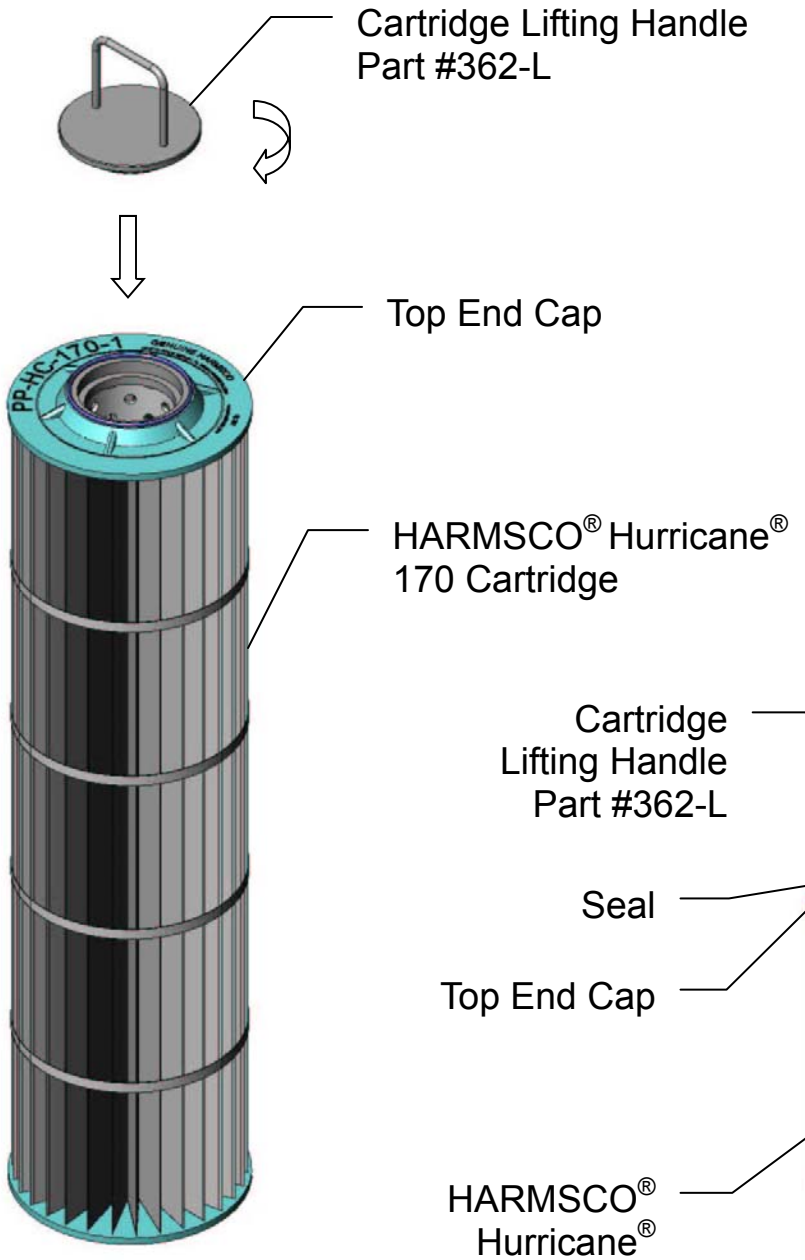
Lid Open
Model HUR 3X170FL

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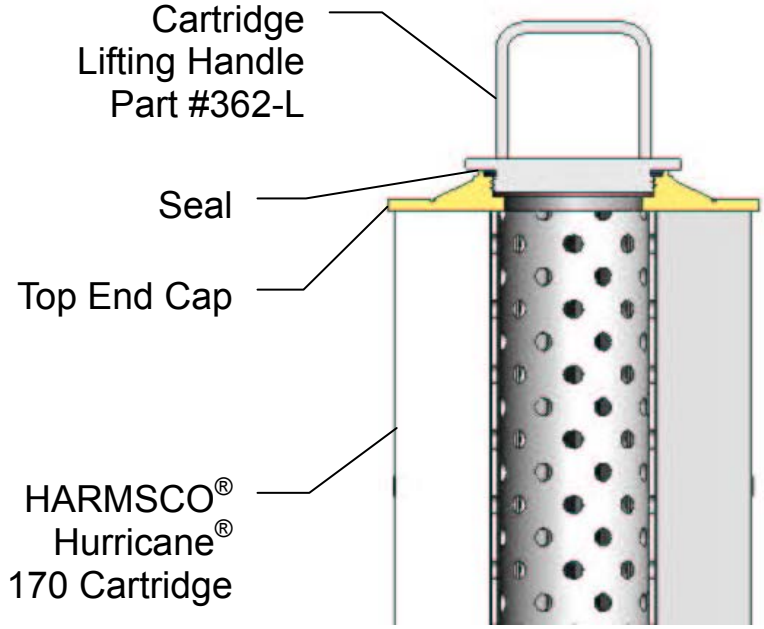
HARMSCO® Hurricane®
Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.

6. Install Cartridge Handle(s), part #362-L, to Cartridge(s). Tighten securely to seal with Top End Cap to prevent by-passing of the Cartridge.



Exploded View



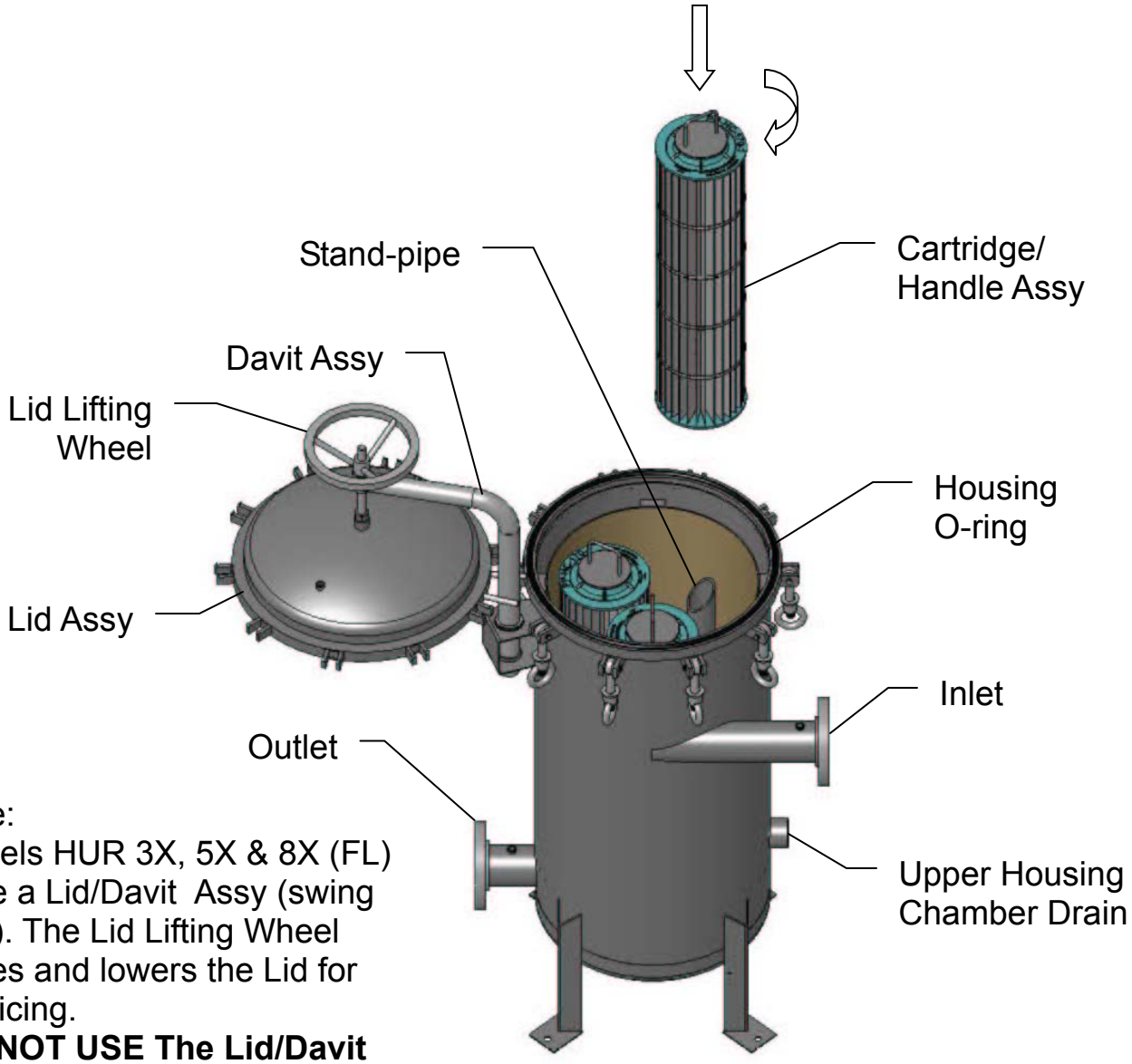
Partial Sectional View

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Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.

7. With swing bolts disengaged and lid removed, install Cartridge/Handle assembly(s) onto Stand-pipe(s). Position Cartridge/Handle assembly downward until Cartridge's Bottom End Cap contacts the housing's Tube Sheet. The Cartridge's Bottom End Cap will seal with the Stand-pipe Coupling to prevent by-passing. A clockwise rotating motion will help to position the Cartridge while engaging the Stand-pipe Coupling. Confirm all Cartridge/Handle assemblies are fully installed with all Cartridge Bottom End Caps contacting the housing's Tube Sheet, see illustrations on page 17.



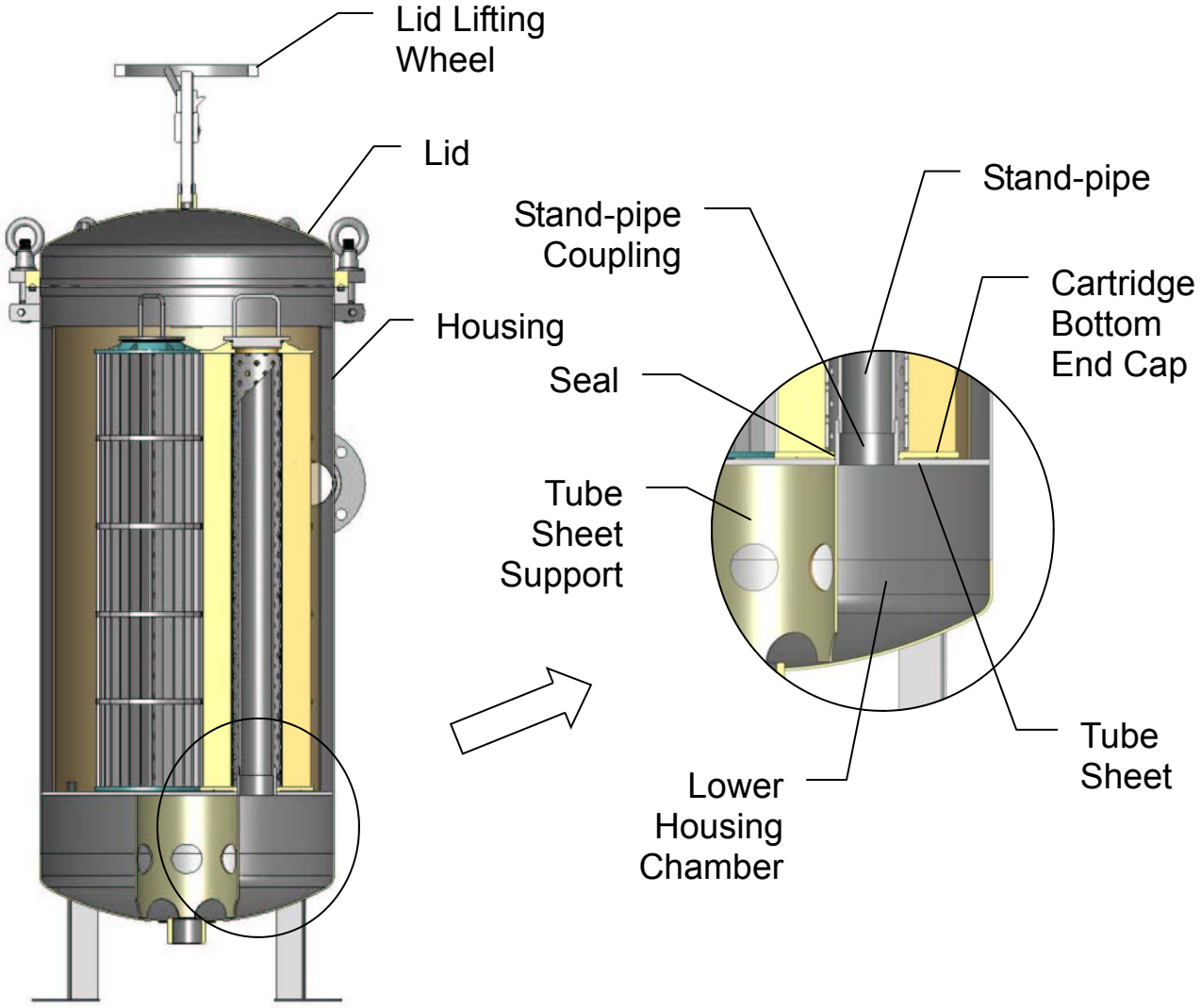
Model HUR 3X170FL

Note:
Models HUR 3X, 5X & 8X (FL) have a Lid/Davit Assy (swing arm). The Lid Lifting Wheel raises and lowers the Lid for servicing.
DO NOT USE The Lid/Davit Assy to raise the Lid while swing bolts are engaged.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.



Section View
Model HUR 3X170FL

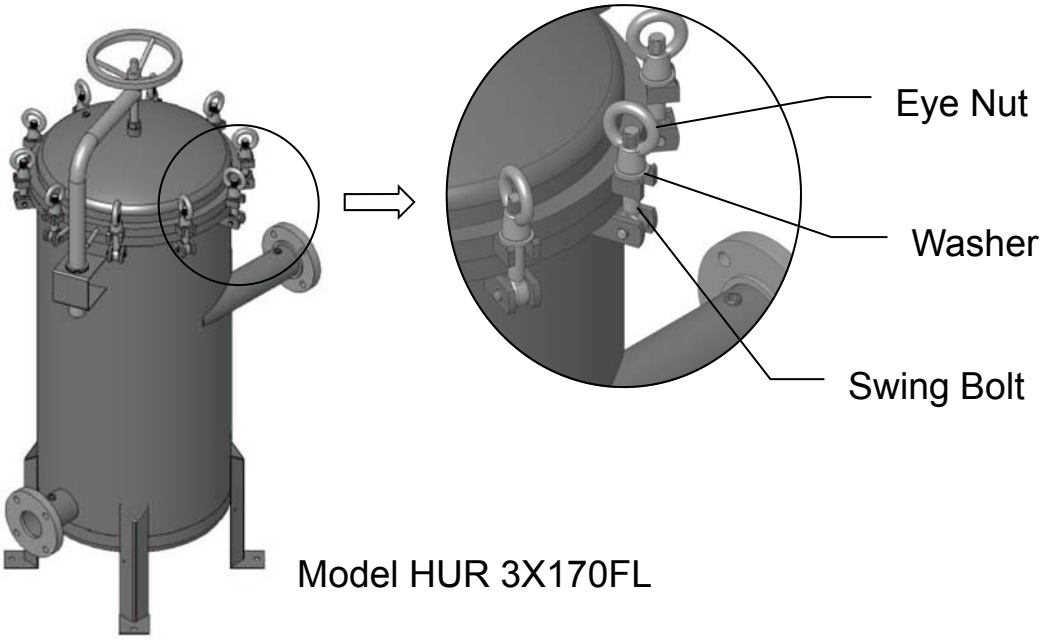
8. Inspect Housing O-ring and make sure that it is free from cracks and debris.
9. Clean Housing and Lid O-ring mating surfaces.
10. Place Housing O-ring into channel of Housing.
11. Return Lid to closure position and maintain alignment of Lid on Housing. Lower lid onto Housing O-ring. Make sure O-ring stays in the channel of the Housing. Do not allow tilting or cocking of Lid on the O-ring.

Note: The Lid/Davit Assembly is NOT to be carrying any load from the Lid at this time.

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CARTRIDGE REPLACEMENT cont.

12. Return all Swing Bolts, Eye Nuts, & Washers to their closure position.
13. Tighten all Eye Nuts by hand in a “star/criss-cross” pattern several times until all Eye Nuts are uniformly tight. Make sure Lid position and alignment to Housing is maintained.



Model HUR 3X170FL

14. Start the flow of water by first opening the inlet valve and allow the housing to completely fill, then, open the outlet valve.
15. Flush unit at recommended flow rate for 10 minutes prior to use. Inspect closure for any leaks. If a leak is observed, **Isolate and Remove Pressure in Housing,** then repeat steps 8 through 15.

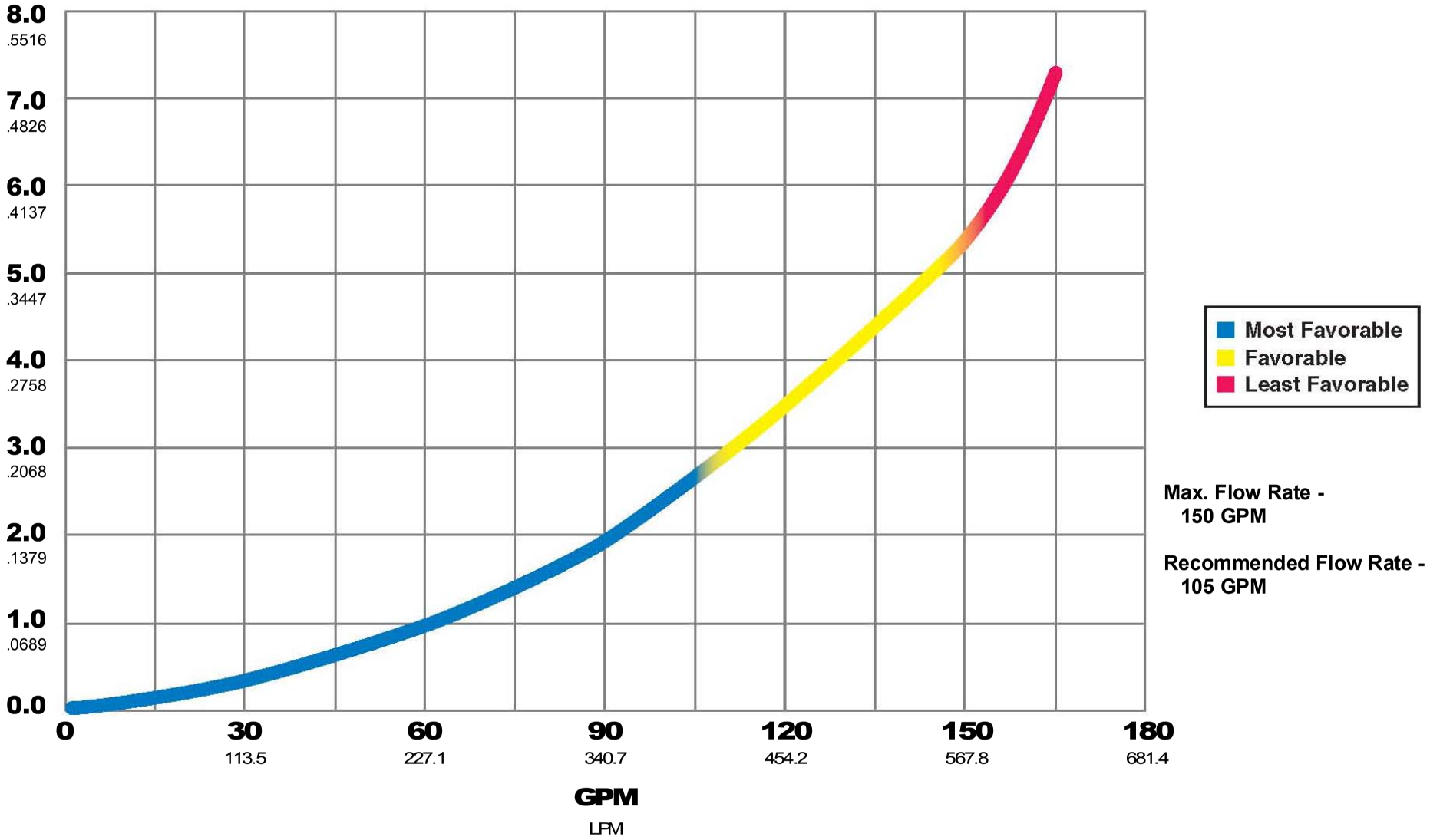
The Harmsco® Swing Bolt Water Filter is now operational.

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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 1X170FL
Hurricane® HC/170-20 Cartridge
Qty 1; with clean water.



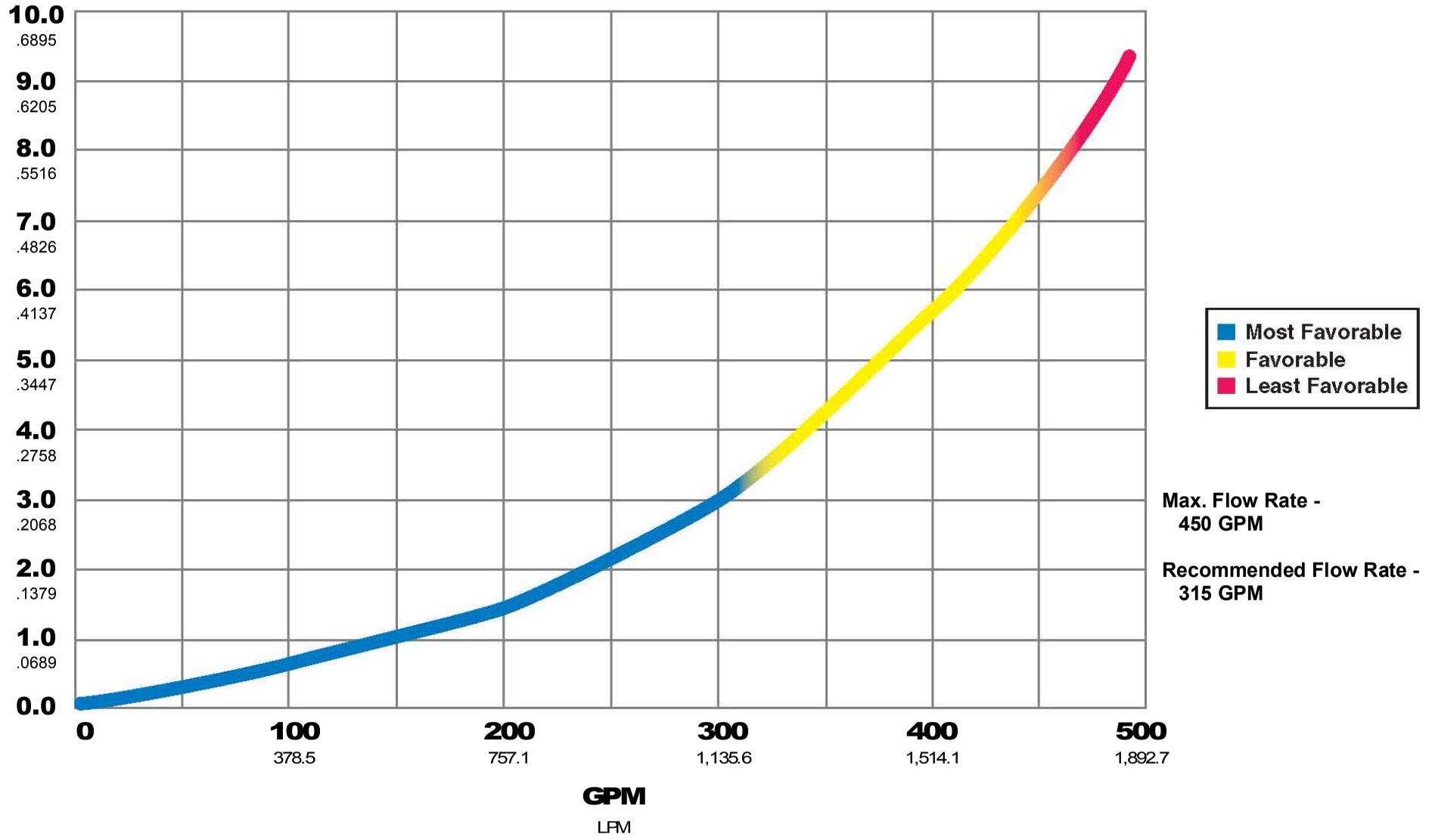
Max. Flow Rate -
150 GPM

Recommended Flow Rate -
105 GPM

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Pressure Drop vs. Flow Rate Curve

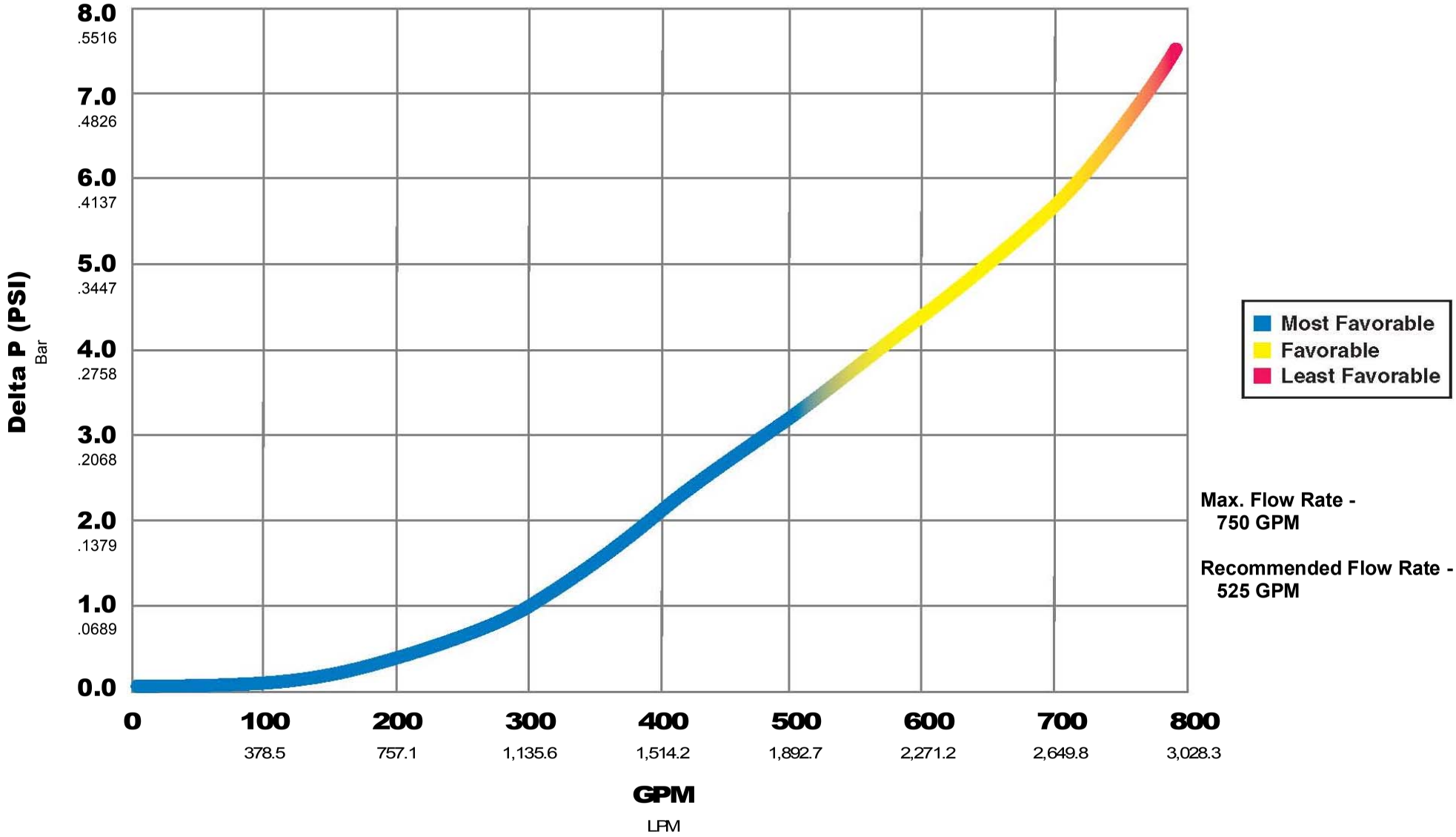
Harmsco® HUR 3X170FL
Hurricane® HC/170-20 Cartridges
Qty 3; with clean water.



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Pressure Drop vs. Flow Rate Curve

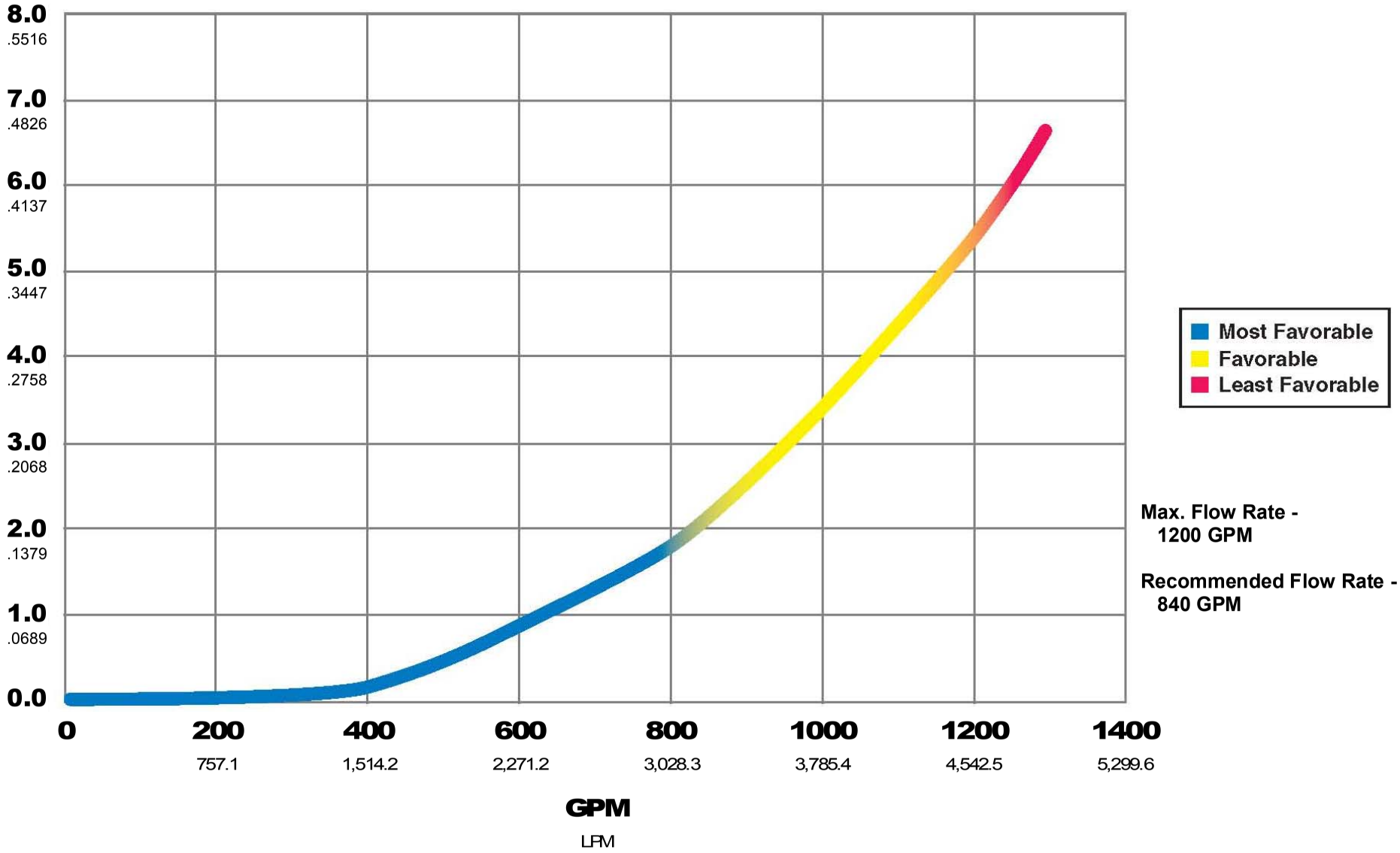
Harmsco® HUR 5X170FL
Hurricane® HC/170-20 Cartridges
Qty 5; with clean water.



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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 8X170FL
Hurricane® HC/170-20 Cartridges
Qty 8; with clean water.



HARMSCO® Hurricane®
Swing Bolt Water Filters

Filter Cartridge Cleaning Instructions:

For Filter Housings With Swing Bolt Closure.

*** * NOTICE * ***

THE FOLLOWING INSTRUCTIONS MUST BE READ AND FOLLOWED PRIOR TO USE.

Harmsco® Hurricane® cartridges are made of Polyester Plus™, a proprietary blend of polyester fibers, which can be cleaned, and re-used, in most applications and micron ratings. For best results, follow the directions described below.

Harmsco® is not held liable for determining cartridge cleaning applications and/or cleaning procedures implemented.

When Cartridge Cleaning is Possible:

Clean cartridge when pressure differential is 12 psi above start-up differential.

Normal Cleaning Procedure: Cartridge Cleaning in Aqueous Applications. For best results, clean cartridges with pressure nozzle using standard hose. Direct spray at an angle to remove particulate.

Special Cleaning Procedures:
For oils, soak cartridge in a solution of tri-sodium phosphate or equivalent detergent (two lbs. to ten gallons of water). Soak for up to 12 hours. Rinse thoroughly.

For organic matter, algae, use tri-sodium phosphate solution as described above, plus 1 pint of liquid chlorine. Soak cartridge for one hour, or until filter surface is not slippery. Rinse thoroughly.

For calcium mineral deposits, follow directions for oils described above, then soak cartridge for ten minutes in a solution of one part muriatic acid to twenty parts of water. Rinse thoroughly.

Non-cleanable Applications:

Replace cartridge when pressure differential is 30 psi above start-up differential, or when flow has diminished to an unacceptable level.

Generally, it is not possible to clean filter cartridges when filtering petroleum base liquids, cyst reduction applications, toxic substances, and 1 micron or smaller rating.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

Cartridge Replacement Instructions (Quick Reference):

For Filter Housings With Swing Bolt Closure.

*** * NOTICE * ***

THE FOLLOWING INSTRUCTIONS MUST BE READ AND FOLLOWED PRIOR TO USE.

1. **Always Isolate And Remove Pressure From Housing Before Servicing.** Housing is to be shut off and drained of fluid by first opening the lower drain.
2. Open filter housing by turning Eye Nuts counter-clockwise, disengaging Swing Bolts, and removing Lid. Take out used cartridge(s) and remove cartridge lifting handle(s).
3. Remove new cartridge(s) from packaging and make sure center cores are clear of all obstructions, dessicants and shipping materials.
4. Install cartridge lifting handle(s) into cartridge(s).
5. Insert Cartridge(s) into housing and onto Stand-pipe(s), cartridge(s) is(are) to contact Tube Sheet of housing.
6. Position housing O-ring seal in groove of housing.
7. Position Lid onto housing and properly align on O-ring before applying Swing Bolts. Do not allow tilting or cocking of Lid on the O-ring.
8. Close filter housing by tightening Eye Nuts clockwise by hand. Use a “star/criss-cross” pattern several times to tighten all of the Eye Nuts uniformly tight.
9. Open inlet valve and allow fluid to fill housing.
10. Open outlet valve.
11. Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.

Should a leak appear at the housing O-ring, isolate and relieve pressure and repeat steps 6 through 11. Always isolate and remove pressure from housing before servicing any part of filter.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.

Harmsco® Filtration Products

With Patented Up-Flow Filtration Technology

www.harmsco.com

(561) 848-9628

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Harmsco Inc. Industrial Filters Limited Warranty

1. Harmsco, Inc. warrants its line of Industrial Filters to be free of defects in material and workmanship for a period of one year from the date of installation.
2. The warranty for Industrial Filters ordered with special coatings is limited only to the recoating of the defective parts due to failure in materials or workmanship for one year from date of installation.
3. This warranty does not cover any equipment purchased for use in applications in which the product is not suited. It is the responsibility of the buyer to determine if a product is suitable for a particular application.
4. **THIS WARRANTY EXCLUDES THE FOLLOWING:**
   - **A.** Any fresh water unit installed for salt water use.
   - **B.** Damage caused by improper installation, operation or care.
   - **C.** Chemical attack.
   - **D.** Modification or alteration by other than Harmsco employees.
   - **E.** Rubber type parts and normal wear items i.e. "O" rings, rim gaskets, wing-nuts, pipe caps, holding rods.
   - **F.** Any costs of labor or expenses expended in the removal and/or installation of unit, or any surrounding device.
   - **G.** Damage caused by galvanic or electrolytic attack.
   - **H.** Altering or removing the Harmsco, Inc. information label.
   - **I.** Any unit not grounded.
5. Service under this warranty is to be provided by the distributor who sold the unit to the user. If the distributor is unable to provide warranty service, contact:

Harmsco, Inc., P.O. Box 14066
North Palm Beach, Florida, 33408, U.S.A.
Phone: (561) 848-9628 • Fax: (561) 845-2474

A Returned Goods Authorization (RGA) number must be received from the above office and placed on all shipments to and correspondence with Harmsco, Inc. Please be prepared with the following information: **1.** Model number and serial number. **2.** Date of installation. **3.** Name of installer **4.** Nature of problem. **5.** Your address and telephone number.

****NOTICE****

Some of the information contained in this publication has been obtained from outside sources and is considered accurate. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. For this reason, we do not assume any liability for the accuracy or completeness of the data in this publication. End users should perform their own tests to determine suitability for each application.

Available from:

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Toll Free: (800) 327-3248
Fax: (561) 845-2474
Local: (561) 848-9628
E-mail: sales@harmsco.com

MADE IN U.S.A.

Harmsco® Filtration Products

P.O. Box 14066, North Palm Beach, Florida 33408

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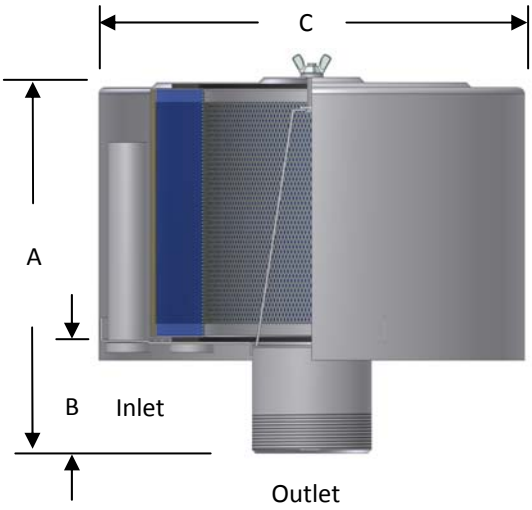
Compact Filter Silencers
FS Series 1/2” - 6” MPT, Flange





Features

- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tubes are positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish & powder coated weatherhood



Technical Specifications

- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H2O over initial Δ P
- Pressure drop graphs available upon request
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

Options

- 1/8” tap holes available for 3” and larger connections
- Pressure drop indicator (See page 3-11)
- Various media for different environments
- Stainless steel construction
- Epoxy coated finish
- Special connections
- Side Access Silencer Filters (LQB Series) for space restricted enclosures (select models)

Tidbit: Charlie Solberg Sr. “Senior” designed our first filter silencer in 1966. The FS-15 size filter was created for small air compressors.

www.solbergmfg.com • sales@solbergmfg.com • Sales: 630.773.1363 • Fax: 630.773.0727

Outlet Connections

MPT Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	B	C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
1/2"	10	FS-15-050	FS-14-050	4	1 1/2	6	1	2	15	14	35
3/4"	25	FS-15-075	FS-14-075	4	1 1/2	6	2	2	15	14	35
1"	35	FS-15-100	FS-14-100	4	1 1/2	6	3	2	15	14	35
1"	55	FS-19P-100	FS-18P-100	6 5/8	1 5/8	6	3	3	19P	18P	100
1 1/4"	70	FS-19P-125	FS-18P-125	6 5/8	1 5/8	6	5	3	19P	18P	100
1 1/2"	85	FS-19P-150	FS-18P-150	6 5/8	1 5/8	6	5	4	19P	18P	100
2"	135	FS-31P-200	FS-30P-200	7 1/4	2 1/4	10	5	8	31P	30P	195
2"	135	FS-231P-200	FS-230P-200	12 1/4	2 1/4	10	5	14	231P	230P	300
2 1/2"	195	FS-31P-250	FS-30P-250	7 1/2	2 1/2	10	5	8	31P	31P	195
2 1/2"	195	FS-231P-250	FS-230P-250	12 1/2	2 1/2	10	9	15	231P	230P	300
3"	300	FS-231P-300	FS-230P-300	13	3	10	9	15	231P	230P	300
3"	300	FS-235P-300	FS-234P-300	13	3	16	9	29	235P	234P	570
3"	300	FS-275P-300	FS-274P-300	13	3	16	9	33	275P	274P	1100
4"	520	FS-235P-400	FS-234P-400	14	4	16	9	30	235P	234P	570
4"	520	FS-275P-400	FS-274P-400	14	4	16	9	34	275P	274P	1100
5"	800	FS-245P-500	FS-244P-500	14	4	16	14	33	245P	244P	880
5"	800	FS-275P-500	FS-274P-500	14	4	16	14	36	275P	274P	1100
6"	1100	FS-275P-600	FS-274P-600	15	5	16	18	38	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

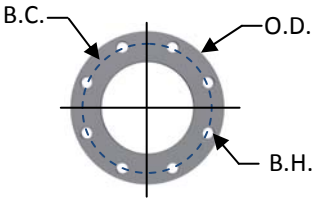
Flange Outlet Connections

Flange Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	B	C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
4"	520	FS-235P-400F	FS-234P-400F	14	4	16	9	33	235P	234P	570
4"	520	FS-275P-400F	FS-274P-400F	14	4	16	9	39	275P	274P	1100
5"	800	FS-245P-500F	FS-244P-500F	14	4	16	14	38	245P	244P	880
5"	800	FS-275P-500F	FS-274P-500F	14	4	16	14	41	275P	274P	1100
6"	1100	FS-275P-600F	FS-274P-600F	15	5	16	18	42	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

125/150# Pattern Flg	Dimensions - inches O.D.	B.C.	B.H.	No. of Holes	Flange Thickness
4"	9	7 1/2	0.75	8	0.38
5"	10	8 1/2	0.88	8	0.38
6"	11	9 1/2	0.88	8	0.38



O.D.: Outside Dimension
B.C.: Bolt Circle
B.H.: Bolt Hole

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

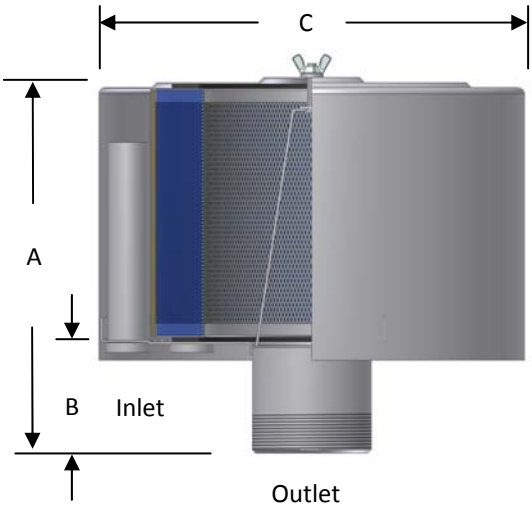
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3/4"	25	FS-15-075	FS-14-075	4	1 1/2	6	2	2	15	14	35
1"	35	FS-15-100	FS-14-100	4	1 1/2	6	3	2	15	14	35
1"	55	FS-19P-100	FS-18P-100	6 5/8	1 5/8	6	3	3	19P	18P	100
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2 1/2"	195	FS-31P-250	FS-30P-250	7 1/2	2 1/2	10	5	8	31P	31P	195
2 1/2"	195	FS-231P-250	FS-230P-250	12 1/2	2 1/2	10	9	15	231P	230P	300
3"	300	FS-231P-300	FS-230P-300	13	3	10	9	15	231P	230P	300
3"	300	FS-235P-300	FS-234P-300	13	3	16	9	29	235P	234P	570
3"	300	FS-275P-300	FS-274P-300	13	3	16	9	33	275P	274P	1100
4"	520	FS-235P-400	FS-234P-400	14	4	16	9	30	235P	234P	570
4"	520	FS-275P-400	FS-274P-400	14	4	16	9	34	275P	274P	1100
5"	800	FS-245P-500	FS-244P-500	14	4	16	14	33	245P	244P	880
5"	800	FS-275P-500	FS-274P-500	14	4	16	14	36	275P	274P	1100
6"	1100	FS-275P-600	FS-274P-600	15	5	16	18	38	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

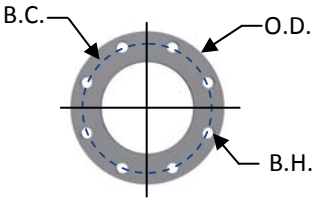
Flange Outlet Connections

Flange Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	B	C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
4"	520	FS-235P-400F	FS-234P-400F	14	4	16	9	33	235P	234P	570
4"	520	FS-275P-400F	FS-274P-400F	14	4	16	9	39	275P	274P	1100
5"	800	FS-245P-500F	FS-244P-500F	14	4	16	14	38	245P	244P	880
5"	800	FS-275P-500F	FS-274P-500F	14	4	16	14	41	275P	274P	1100
6"	1100	FS-275P-600F	FS-274P-600F	15	5	16	18	42	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

125/150# Pattern Flg	Dimensions - inches O.D.	B.C.	B.H.	No. of Holes	Flange Thickness
4"	9	7 1/2	0.75	8	0.38
5"	10	8 1/2	0.88	8	0.38
6"	11	9 1/2	0.88	8	0.38



O.D.: Outside Dimension
B.C.: Bolt Circle
B.H.: Bolt Hole

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.



Compact Filter Silencers
FS Series ½” – 6” MPT

www.solbergmfg.com

Note: Please read the maintenance instructions given by the OEM for the machinery first. The OEM's manual should be adhered to in order to protect the equipment. Solberg Manufacturing, Inc has made every effort to make sure that these instructions are accurate but is not responsible for any typos, slight variations or for human errors that may occur.

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Maintenance Manual

Compact Filter Silencers

FS Series ½" – 6" MPT

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**For Further Information Please Call: 630-773-1363*

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SOLBERG

Section A

INTRODUCTION

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet air filters.

WARNING

This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the inlet air filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will meet your application requirements.

Section B

GENERAL INFORMATION

1. Identification of Solberg Inlet Air Filters.

All Solberg inlet air filters should have an identification label/nameplate that gives the following information:

Assembly Model #
Replacement Element #

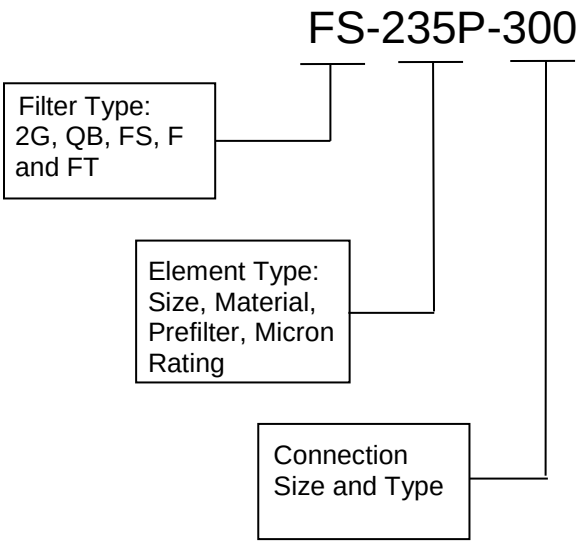
(The exception is OEM supplied units. In this case, please enter the OEM part numbers below.)
Fill in the actual nameplate data from your new Solberg inlet filter(s):

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No.	Filter Model Number	Replacement Element	Initial Delta P Readings
1			
2			
3			
4			
5			

Table 1

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'FS' design filter with a 235 element with prefilter and 3" MPT connection size:



2. Filtration Rules of Thumb

General: For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

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Rule of Thumb #1: Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

Rule of Thumb #2: Always ask or specify a filter based on a micron rating ***with filtration efficiencies***. As an example, stating a requirement for a 1-micron filter is misleading because no efficiency rating has been specified. A 1-micron filter at 95% efficiency may be less efficient than a 5-micron filter at 99% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99% filtration efficiency at 5 microns is required.

Rule of Thumb #3: Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.

Filtration Efficiency Requirements (99%+ efficiency)	**Environmental Conditions**	**Air to Media Ratio**	
Industrial Grade 2-micron **Paper**	Industrial Duty (clean, office/warehouse-like)	30 CFM/ft^2	(51m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	15 CFM/ft^2	(25.5m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	10 CFM/ft^2	(17m^3/h)/cm^2
Industrial Grade 5-micron **Polyester**	Industrial Duty (clean, office/warehouse-like)	50 CFM/ft^2	(85m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	40 CFM/ft^2	(68m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	25 CFM/ft^2	(42.5m^3/h)/cm^2
Industrial Grade 1-micron **Polyester**	Severe Duty (Foundry, Construction-like)	10 CFM/ft^2	(17m^3/h)/cm^2
Industrial Grade 0.3-micron **HEPA** Glass @ 99.97% Efficiency	Industrial Duty (Pre-filtered Applications)	10 CFM/ft^2	(17m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	7 CFM/ft^2	(12m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	5 CFM/ft^2	(8.5m^3/h)/cm^2

Table 2

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Rule of Thumb #4: Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" / 250-280mm H_2O over the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200m^3/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Max Airflow	
1/2"	10 CFM	17m^3/h	2 ½"	195 CFM	332m^3/h
3/4"	20 CFM	34m^3/h	3"	300 CFM	510m^3/h
1"	35 CFM	60m^3/h	4"	520 CFM	884m^3/h
1 ¼"	60 CFM	102m^3/h	5"	800 CFM	1360m^3/h
1 ½"	80 CFM	136m^3/h	6"	1,100 CFM	1870m^3/h
2"	135 CFM	230m^3/h			

Table 3 **Note: This information is for general use only. A qualified engineer must properly design each system.*

3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C
Filter Change-Out Differential: 10" to 15" / 250-380mm H_2O Over Initial Delta P

Media	Micron Rating
Standard Paper	99+% @ 2 micron
Standard Polyester	99+% @ 5 micron
"S" Series Wire Mesh	Epoxy Coated Wire Mesh
"Z" Series Polyester	99+% @ 1 micron
"HE" Series HEPA	99.97% @ 0.3 microns
"U" Series Polyester	99+% @ 25 micron
"W" Series Polyester	99+% @ 100 micron
"S2" Series	Stainless Steel Wire Mesh
"AC" & "ACP" Series	N/A
"Y" Series Polypropylene	99+% @ 5 micron

Table 4

Temperature Range: -15° to 385°F / -26° to 196°C
Filter Change-Out Differential**:** 10" to 15"/ 250-380mm H_2O Over Initial Delta P

Media	Micron Rating
"MX" & "MXD" Series – Nomex Cloth	99+% @ 5 micron

Table 5

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4. **Element Cleaning - Inlet Filtration**

Solberg elements should be cleaned or replaced, once the pressure drop reaches 15 to 20-inches water column (380 - 500mm WC) above the initial pressure drop of the installation.

The decision to clean the element rather than replace it is left to the discretion of the operator. Any damage which results from by-pass or additional pressure drop created by element cleaning is the sole responsibility of the operator.

WARNING

The overall performance of a filter element is altered once cleaned.

The initial pressure drop after cleaning will be greater than the original, clean pressure drop of the element.

After each subsequent cleaning, the initial pressure drop will continue to increase.

Under all circumstances, the initial pressure drop of the element needs to be maintained at less than 20-inches water column (500mm WC).

Cleaned elements that exceed 20-inches water column (500mm WC) at start-up should be replaced with new elements.

With many types of equipment, the maximum pressure drop allowed will be dictated by the ability of the equipment to perform to its rated capacity. Under all circumstances, the operator should avoid exceeding the manufacturer's recommended maximum pressure drop for their specific equipment.

A. ***Polyester Element***: The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element should be dry before reinstallation. The element should be replaced after a maximum of three cleanings.
B. ***Paper Element***: The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.

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C. ***Polyurethane Prefilter***: The prefilter may be washed as a sponge or replaced to give the element a longer service life.
D. ***Epoxy Coated Wire Mesh and Stainless Steel Wire Mesh Elements***: Cleaning instructions similar to polyester, except mild solvents may be used.
E. ***Activated Carbon Element***: Not cleanable
F. ***Polypropylene Element***: Cleaning instructions similar to polyester
G. ***Nomex Cloth Element***: Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wing nuts and washers can be supplied upon request.

Section C

PROCEDURES

1. Installation.

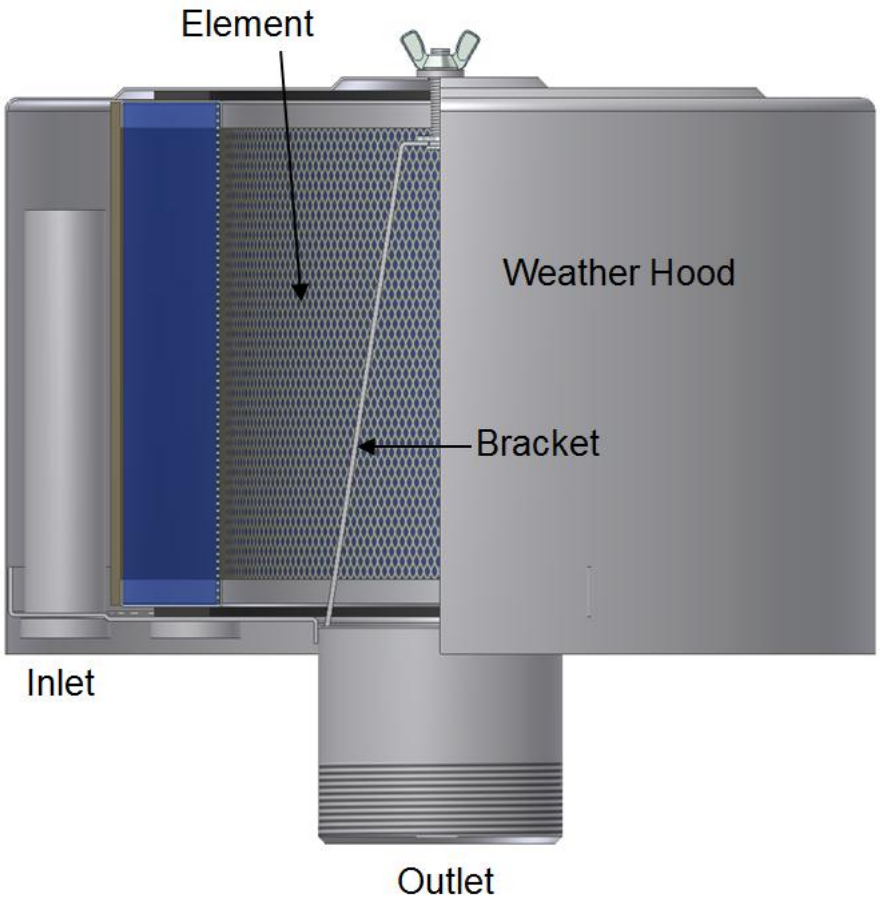


Figure C.1: Housing Terms

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A. Maximum operating temperature for most Solberg inlet air filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers. High temperature products are available.

B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on the inlet and outlet ports.

C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

2. Disconnecting canister top from canister base.

Remove weather hood by loosening wing nut and lifting off.

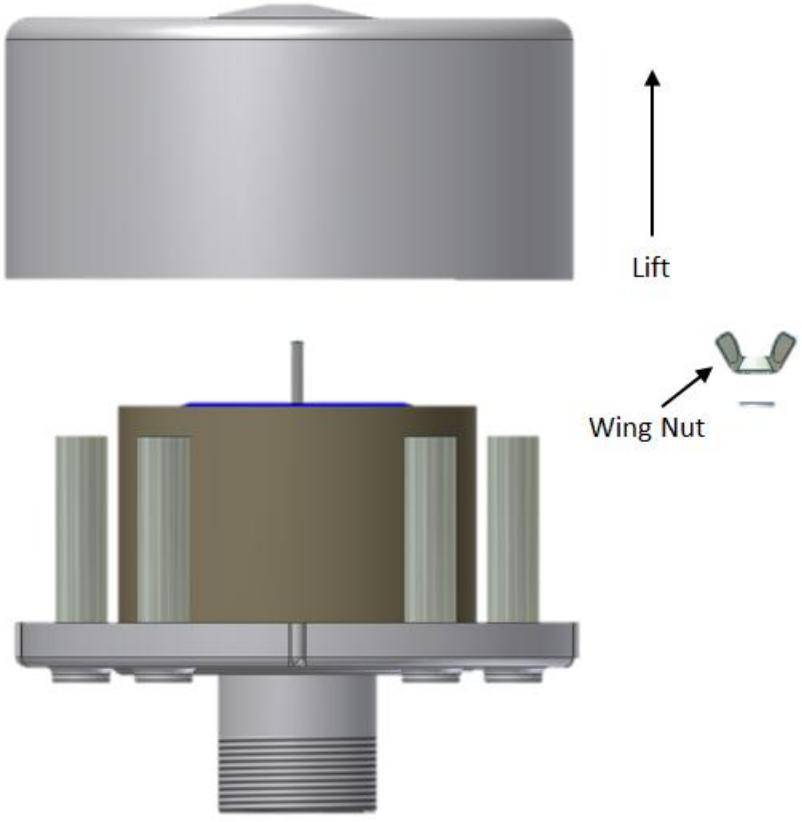


Figure C.2.1: Weather hood removal.

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3. Removing element for service/maintenance.

A. Carefully lift element off of the internal bracket and housing base.

B. Clean sealing surfaces of housing and element endcaps so that they are free of dirt or any other particulate.

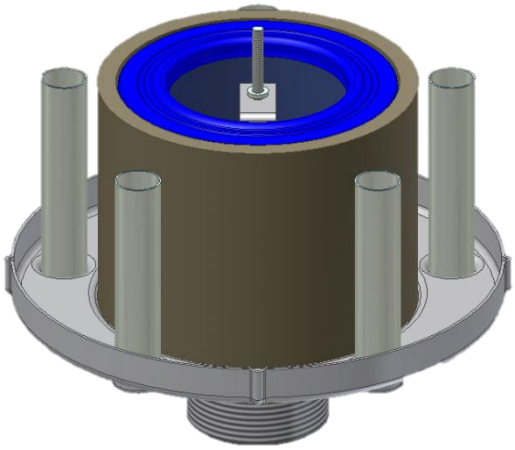


Figure C.3.1: Element sitting in housing base.

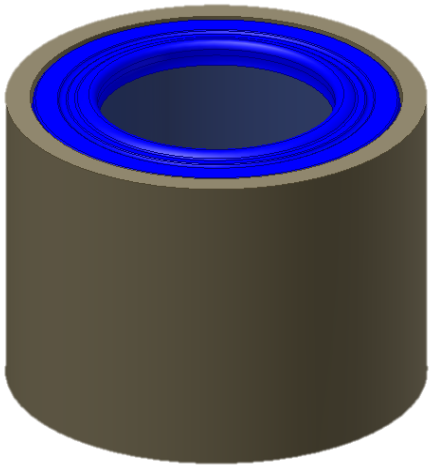


Figure C.3.2: Element with pre-filter.

C. Clean sealing surfaces of housing and element so that they are free of dirt or any other particulate.

WARNING

Failure to comply with these instructions may result in system or equipment contamination.

4. Securing Element.

Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces. See Figure C.3.1. With multiple element stacks place elements in line with base element and ensure elements seat properly.

WARNING

Defective installation may cause system or pump contamination. Use only genuine Solberg replacement parts.

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5. **Securing canister top to canister base.**

   A. Make sure all surfaces are free from dust and other particulate.

   B. Place weather hood over housing base and element. Feed threaded rod into corresponding bolt hole and tighten. Note: Do NOT over tighten!



Figure C.5.1: Weather hood and wing nut in secured position.

6. **Equipment Startup.**

   A. Be sure to read the instructions on installation or element replacement as listed above before starting equipment.

WARNING

If at any time the operator is unable to verify the integrity of the element or any housing feature, the factory or a regional representative should be contacted prior to start-up.

   B. Please check the listed steps prior to startup.

      1. Check element to make sure it is seated properly on element base or sealing surface.

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WARNING

Failure to seat the element properly may result in contaminant by-pass resulting in damage to equipment.

2. Check weather hood is installed correctly onto housing.

WARNING

If the air flow is reversed through a Solberg filter unit, be sure to check the element and housing internals for damage. Failure to do so may result in damage to equipment.

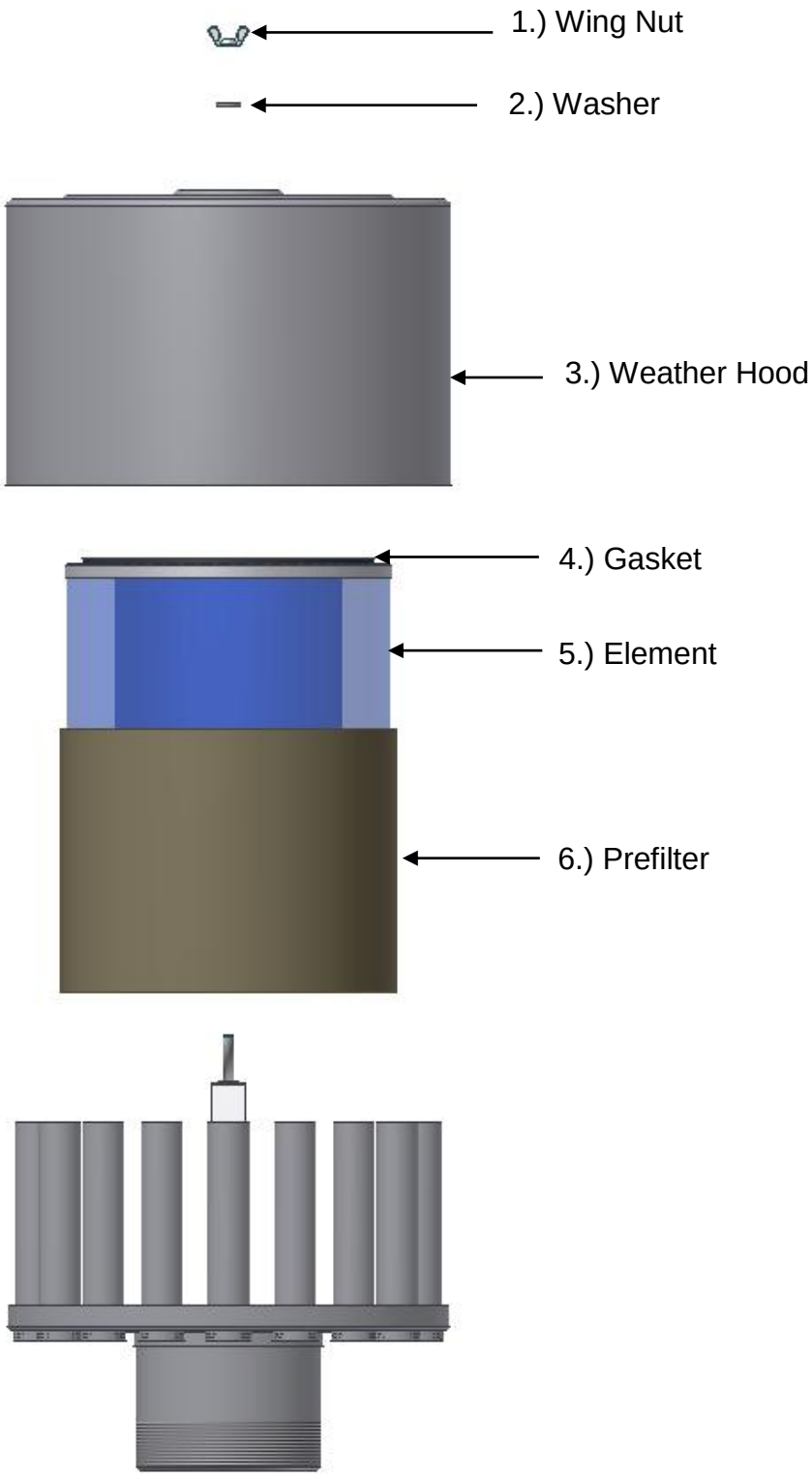
3. Be sure all fasteners and hardware have been tightened.

Section D

MAINTENANCE RECOMMENDATIONS

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10” to 15” / 250-380mm H^2O above drop above the initial reading. Refer to page 4 for initial values.
2. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.
3. Operate only when a proper seal exists.

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Compact Filter Silencer Available Replacement Parts

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Available Replacement Part by Product Number						
Product #	**Element****	**Prefilter**	**Gasket**	**Weather Hood**	**Washer**	**Wing Nut**
FS-14P-XXX	14	9010200	N/A	1050300+01	5040200	5030500
FS-15P-XXX	15	9010200	N/A	1050300+01	5040200	5030500
FS-18P-XXX	18	9010400	N/A	1050500+01	5040200	5030500
FS-19P-XXX	19	9010400	N/A	1050500+01	5040200	5030500
FS-30P-XXX	30	9010500	N/A	1050900+01	5040200	5030500
FS-31P-XXX	31	9010500	N/A	1050900+01	5040200	5030500
FS-230P-XXX	230	9010700	N/A	1051000+01	5020150	5030600
FS-231P-XXX	231	9010700	N/A	1051000+01	5020150	5030600
FS-234P-XXX	234	9010800	N/A	1051200+01	5020150	5030600
FS-235P-XXX	235	9010800	N/A	1051200+01	5020150	5030600
FS-244P-XXX	244	9010900	N/A	1051200+01	5020150	5030600
FS-245P-XXX	245	9010900	9110100	1051200+01	5020150	5030600
FS-274P-XXX	274	9011000	9110200	1051200+01	5020150	5030600
FS-275P-XXX	275	9011000	9110200	1051200+01	5020150	5030600

**Note: *Even element numbers are Paper elements and odd element numbers are Polyester elements.*

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QED Air Stripper Model ver. 2.0

12/22/2015

Site Data

Name: KWB
e-mail: kbindas@nes-inc.biz
Project: t2t3t5 -uaf >>650>>
Units: English
Altitude: 22 ft
Air Temp: 55 F
Flow: 50 gpm
Water Temp: 55 F
Stripper: EZ-Tray 12.x - Click for details
Stripper Air Flow: 650 cfm
Stripper Max Flow: 120 gpm

Water Results

Contaminant	Influent (ppb)	Target (ppb)	4-Tray Results (ppb)	4-Tray %Removal	6-Tray Results (ppb)	6-Tray %Removal
1,2,4-trimethylbenzene	1	0	< 1	100.000	< 1	100.000
1,2-dichlorobenzene	5.2	0	< 1	100.000	< 1	100.000
1,2-dichloroethane	1300	0	63.0	95.154	17.0	98.692
1,3-dichlorobenzene	2.1	0	< 1	100.000	< 1	100.000
1,4-dichlorobenzene	1.6	0	< 1	100.000	< 1	100.000
benzene	800	0	1.4	99.825	< 1	100.000
chlorobenzene	2100	0	6.6	99.686	< 1	100.000
chloroethylene	240	0	< 1	100.000	< 1	100.000
vinyl chloride (chloroethylene)	40	0	< 1	100.000	< 1	100.000

Air Results

Contaminant	4-Tray (ppmV)	4-Tray (lb/hr)	6-Tray (ppmV)	6-Tray (lb/hr)
1,2,4-trimethylbenzene	0.0020	0.00002	0.0020	0.00003
1,2-dichlorobenzene	0.0084	0.00013	0.0085	0.00013
1,2-dichloroethane	3.0158	0.03097	3.1278	0.03212
1,3-dichlorobenzene	0.0034	0.00005	0.0034	0.00005
1,4-dichlorobenzene	0.0026	0.00004	0.0026	0.00004
benzene	2.4666	0.01999	2.4707	0.02003
chlorobenzene	4.4870	0.05241	4.5003	0.05257
chloroethylene	0.9264	0.00601	0.9264	0.00601
vinyl chloride (chloroethylene)	0.1544	0.00100	0.1544	0.00100

Fractional Tray Results

Contaminant	Influent (ppb)	2-Tray Results (ppb)	3-Tray Results (ppb)	4-Tray Results (ppb)	5-Tray Results (ppb)	6-Tray Results (ppb)
1,2,4-trimethylbenzene	1	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	5.2	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	1300	247.6	123.2	63.0	32.6	17.0

1,3-dichlorobenzene	2.1	< 1	< 1	< 1	< 1	< 1
1,4-dichlorobenzene	1.6	< 1	< 1	< 1	< 1	< 1
benzene	800	32.0	6.6	1.4	< 1	< 1
chlorobenzene	2100	112.3	27.2	6.6	1.6	< 1
chloroethylene	240	1.5	< 1	< 1	< 1	< 1
vinyl chloride (chloroethylene)	40	< 1	< 1	< 1	< 1	< 1

Fractional Tray Air Results - ppmV

Contaminant	2-Tray (ppmV)	3-Tray (ppmV)	4-Tray (ppmV)	5-Tray (ppmV)	6-Tray (ppmV)
1,2,4-trimethylbenzene	0.0019	0.0020	0.0020	0.0020	0.0020
1,2-dichlorobenzene	0.0077	0.0083	0.0084	0.0085	0.0085
1,2-dichloroethane	2.5658	2.8690	3.0158	3.0897	3.1278
1,3-dichlorobenzene	0.0032	0.0034	0.0034	0.0034	0.0034
1,4-dichlorobenzene	0.0023	0.0025	0.0026	0.0026	0.0026
benzene	2.3722	2.4504	2.4666	2.4700	2.4707
chlorobenzene	4.2605	4.4428	4.4870	4.4977	4.5003
chloroethylene	0.9206	0.9260	0.9264	0.9264	0.9264
vinyl chloride (chloroethylene)	0.1534	0.1543	0.1544	0.1544	0.1544

Fractional Tray Air Results - (lb/hr)

Contaminant	2-Tray (lb/hr)	3-Tray (lb/hr)	4-Tray (lb/hr)	5-Tray (lb/hr)	6-Tray (lb/hr)
1,2,4-trimethylbenzene	0.00002	0.00002	0.00002	0.00003	0.00003
1,2-dichlorobenzene	0.00012	0.00013	0.00013	0.00013	0.00013
1,2-dichloroethane	0.02635	0.02946	0.03097	0.03173	0.03212
1,3-dichlorobenzene	0.00005	0.00005	0.00005	0.00005	0.00005
1,4-dichlorobenzene	0.00004	0.00004	0.00004	0.00004	0.00004
benzene	0.01923	0.01986	0.01999	0.02002	0.02003
chlorobenzene	0.04976	0.05189	0.05241	0.05254	0.05257
chloroethylene	0.00597	0.00601	0.00601	0.00601	0.00601
vinyl chloride (chloroethylene)	0.00100	0.00100	0.00100	0.00100	0.00100

Warnings

Warning: User request of fractional tray results.

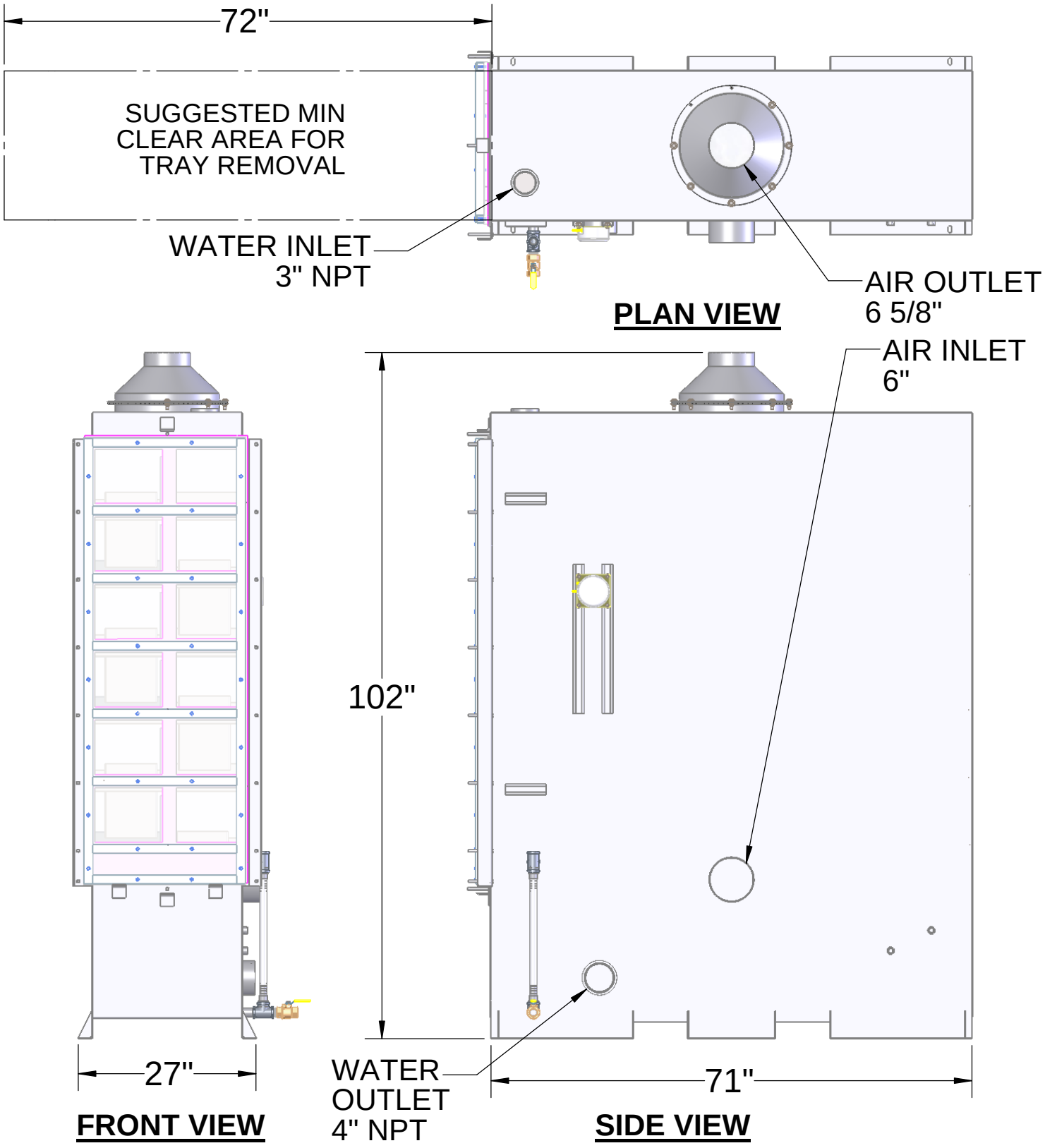
Warning: User entered air flow. Use with caution - blower air flow should stay within 20 percent of recommended flow.

Notes

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PH-> 1-800-624-2026 or 1-734-995-2547, FX-> 1-734-995-1170. E-mail->info@qedenv.com. WEB->www.qedenv.com.

The QED modeler estimates unit performance for the listed contaminants. ***Results assume -***



EZ-12.6SS (AIR STRIPPER ONLY)

FOR MORE SPECIFICATIONS CLICK ON:

http://www.qedenv.com/Products/Airstrippers_VOC_Removal/Air_Stripper_Specifications/

NOT TO SCALE

NOT FOR CONSTRUCTION, FOR REFERENCE ONLY

ENGINEERING DATA SHEET 1
AIR STRIPPER (REMOVABLE TRAY)

GENERAL PRODUCT DATA

Model No.	Max. Flow (GPM)	Dry Weight (lbs)	Oper. Weight (lbs)	Area required Dimension (“DxWxH)	Trays per tier (no x lbs)	Active Area (sq ft)	Nom. air flow (cfm)	*Oper. Clearance (inches)
4.4	1-50	630	985	29 x 27 x 82	4 x 29	2.8	210	27
4.6	1-50	780	1,219	29 x 27 x 102	6 x 29	2.8	210	27
6.4	1-65	790	1,285	37 x 27 x 82	4 x 40	3.8	320	35
6.6	1-65	978	1,591	37 x 27 x 102	6 x 40	3.8	320	35
8.4	1-75	955	1,580	49 x 27 x 82	4 x 50	5.6	420	47
8.6	1-75	1,182	1,956	49 x 27 x 102	6 x 50	5.6	420	47
12.4	1-120	1,165	2,105	73 x 27 x 82	4 x 60	8.8	600	71
12.6	1-120	1,442	2,606	73 x 27 x 102	6 x 60	8.8	600	71
16.4	1-150	1,625	2,870	49 x 52 x 84	8 x 50	11.1	850	47
16.6	1-150	2,011	3,553	49 x 52 x 104	12 x 50	11.1	850	47
24.4	1-250	2,100	3,980	73 x 52 x 84	8 x 60	17.5	1300	72
24.6	1-250	2,599	4,926	73 x 52 x 104	12 x 60	17.5	1300	72
36.4	1-375	3,200	6,085	73 x 100 x 104	12 x 60	26.25	1900	72
36.6	1-375	3,900	7,532	73 x 100 x 124	18 x 60	26.25	1900	72
48.4	1-500	5,000	12,500	73 x 120 x 104	16 x 60	35	2600	72
48.6	1-500	5,500	13,000	73 x 120 x 124	24 x 60	35	2600	72
72.4	1-750	6,400	14,600	146 x 100 x 104	24 x 60	52.5	3800	2x72
72.6	1-750	7,800	15,100	146 x 120 x 124	36 x 60	52.5	3800	2x72
96.4	1-1000	11,000	25,000	146 x 124 x 104	32 x 60	70	5200	2x72
96.6	1-1000	11,500	30,000	146 x 124 x 124	48 x 60	70	5200	2x72

* Additional clearance required for tray removal. Models 96 and 72 need tray removal clearance at front and back. One side requires space for piping, blower, appurtenances, etc. (depends on design layout).

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INSTALLATION DATA

Model	+Water Inlet (“FNPT)	+Water Outlet (“FNPT)	Air Inlet (“OD pipe)	*Exhaust Stack Size (inches)	Water drain (“FNPT)	#Max. back pressure (“H_2O)
4.4	2	3	4.63	6.63	1	10
4.6	2	3	4.63	6.63	1	5
6.4	3	3	4.63	6.63	1	10
6.6	3	3	4.63	6.63	1	5
8.4	3	4	4.63	6.63	1	10
8.6	3	4	4.63	6.63	1	5
12.4	4	4	6.63	6.63	1	10
12.6	4	4	6.63	6.63	1	5
16.4	4	4	6.63	8.63	1	10
16.6	4	4	6.63	8.63	1	5
24.4	4	6	8 flange	8.63	1	10
24.6	4	6	8 flange	8.63	1	5
36.4	8	6	10 flange	12 flange	1	5
36.6	8	6	10 flange	12 flange	1	5
48.4	8	8	10 flange	12 flange	1	5
48.6	8	8	10 flange	12 flange	1	5
72.4	8	10	12 flange	16 flange	1	5
72.6	8	10	12 flange	16 flange	1	5
96.4	8	10	12 flange	16 flange	1	5
96.6	8	10	12 flange	16 flange	1	5

+ Models 36.X and larger use flange inlet and outlet connections
* Minimum recommended nominal diameter of exhaust stack, if added
# Maximum clean-tray exhaust back-pressure allowed without auxiliary blower

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QED Environmental Systems

EZ-Tray Air Stripper

Patent No. 5518668



System Operation & Maintenance Manual

P/N 95167 *5/5/15*

QED Environmental Systems

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Service Department Phone & Special Precautions

Thank you for relying on QED Environmental Systems to handle your water treatment needs. After reading the Operation and Maintenance Manual, if you have any questions regarding the startup or operation of your system, please contact the ***QED Service and Repair Department at 1-800-624-2026.***

PLEASE NOTE!

Read the QED Operation and Maintenance Manual First!
The manual will assist you in equipment hookups, installation, startup, maintenance, and troubleshooting.

It is Important That a Qualified, Licensed Electrician Perform All Electrical/Wiring Installation Work.
Please see “Equipment Set-Up” in the Operating Instructions section of this manual.

Follow the Manufacturers Instructions
All the mechanical equipment that was supplied with your air stripper system should include the respective manufacturer’s instruction manual for each piece of equipment.The documentation will either be found with the actual piece of equipment (if shipped loose) or found within a QED Operation and Maintenance manual that includes all relevant manufacturers’ instruction sheets.

Follow Safe Work Practices
Be sure to follow all associated safety practices.

Note for drinking water applications
Prior to shipping preparation, QED has sprayed the interior surfaces of this EZ Tray stripper with dilute chlorinated water. It is the responsibility of the customer (system operator) to carry out any final cleaning and disinfection procedures prior to using the stripper for drinking water production.

Warning!
Air discharge and demister assembly is NOT designed to support discharge stack piping. Discharge stack must be supported by other means.

EZ-Tray™ systems are fabricated from rugged stainless steel. Each system is pre-assembled and factory tested before shipment to your site. EZ-Tray™ low profile air strippers are built to meet site and project specifications, which can include a number of standard or optional pieces of equipment. Depending upon the specifics of your order, the equipment described in this manual may or may not be included with your system configuration. Please refer to your sales order for the equipment that should be included with your system. Equipment information will be found either within this O&M manual or in separate documentation provided in addition to this manual.

Air Pressure Gauge (Standard)
The standard pressure gauge reads the differential pressure between the sump pressure and atmospheric pressure, in inches of water column (" wc). The gauge is connected to the system via tubing that is attached to a pressure port on the air stripper sump. The air tubing from the sump leads to the "high" pressure port on the gauge. The "low" pressure port is left open to the atmosphere.

Demister (Standard)
A demister pad is installed beneath the air discharge stack located on the top cover of the unit. The purpose of the demister pad is to remove entrained water droplets that would have blown through the discharge stack. It is possible, though unlikely, that the demister pad may become plugged or fouled. If this occurs the demister pad is easily removed. Disconnect the vent line, take off the demister cap, and remove the demister. The demister pad can be cleaned with a pressure washer or replaced with a new one.

Gaskets (Standard)
Various gaskets are used in the EZ-Tray™ air stripper units. One gasket is installed in the air discharge stack flange, one gasket is used to form an air tight seal between the front hatch and aeration trays, and a felt gasket is located on the underside of each aeration tray and a gasket is used under each downcomer flange. Through the course of regular maintenance, these gaskets will eventually wear and will not seal effectively. When the gaskets are ripped, worn, or do not seal properly, these gaskets should be replaced. Contact QED for replacement gaskets and adhesive. *Please contact QED prior to making any gasket repairs or adjustments.*

Sight Tube (Standard)
The sight tube provides a means of easily viewing the water level in the sump tank.

Blower
The blowers on the EZ-Tray™ low profile air stripper units are typically cast aluminum type B spark resistant, direct drive @ 3450 rpm, with motor options of TEFC or EXP. Each blower is selected to meet the proper air flow requirements (cfm) at the anticipated working pressures (inches of water column) of each system.

It is critical that the blower damper be opened wide enough to provide the unit with the designated minimum flow. If the damper is opened too wide, however, high air flow can cause water entrainment, with water droplets caught up in the airstream and sent out of the air stripper discharge stack.

It is also critical that water does not enter the blower housing while the blower is in operation; this will damage your blower and void the warranty. The high water level alarm switch prevents this from happening. Make sure it is installed correctly. If not installed by QED, it is recommended that the blower piping be of an inverted-U design,capable of collecting water within the blower piping and minimizing the potential for blower flooding. Please refer to **Figure 3** for a typical blower piping configuration.

If water does accumulate in the blower, it must be removed from the blower housing before continuing operation. A small drain hole may be drilled and plugged on the bottom side of the blower housing to provide a means of discharging any water that may accumulate. Remove the plug temporarily to drain any water or take off the front panel of the fan housing and remove the water.

When starting the unit for the first time, check that the blower wheel is rotating in the direction of the arrow on the blower housing. If you hear the blower wheel rubbing or any odd sounds, shut down the system immediately and call QED.

Damper

The standard QED blowers normally have a damper on the discharge side of the blower. The damper is used to make adjustments to the air flow rate (cubic feet per minute) of your system. The air flow rate is increased by opening the damper, and decreased by closing the damper.

Use the damper to adjust the sump pressure to its proper operating value. By adjusting the sump pressure, the proper operating air flow through the air stripper will be achieved. Follow the instructions given in the earlier “Air Pressure Gauge” section to obtain the correct sump operating pressure. Using an air flow meter and an air pressure gauge together is desirable for confirming air flow and sump pressure, especially when attempting to troubleshoot any problems encountered with the air stripper operation. It is also recommended that you keep a log book of pressure readings so you can determine the frequency of cleaning required to minimize system fouling.

Air Blower Silencer

The air blower silencer reduces the dynamic noise level of the blower. The size of the silencer and the type of connection used to mount it is dictated by the size of the blower and the choice of options. If a silencer is purchased through QED, they are typically shipped loose, for customer installation. The silencer can be mounted either horizontally or vertically (through the use of an elbow) must be properly supported to avoid over-stressing the blower housing. Silencers exposed to high wind velocities must be properly secured.

Air Flow Meter

The air flow meter measures the amount of air flowing through the system. If it is a pitot tube-type, two air tubes lead from the air piping to a meter/gauge. To operate effectively, the pitot tube must be located a minimum required distance upstream and downstream from elbows, valves, etc. Refer to manufacturer’s installation instructions for proper installation procedures.

The air flow meter typically gives readings in feet per minute (FPM), which is then multiplied by the cross sectional area, (square feet), of the vent line to give cubic feet per minute (CFM). As stated in the damper section, the air flow meter is needed to make damper adjustments, especially after initial start-up.

Control Panel

The control panel serves two basic functions required for the safe operation of the system. The first is to provide the required electrical safety components for each motor (blowers and pumps) per NEC standards. These components consist of fuses,motor starters, and overload relays.

The second function is to provide the required process safety alarm components. The alarm circuit monitors the low air pressure switch and the high water level alarm switch. If either of these alarms occur, the alarm contacts will shut off the incoming water source (feed or well pumps) if the appropriate connections have been made. A qualified, licensed electrician should perform any and all electrical connections.

Control Panel Intrinsically Safe Components

EZ-Tray™ low profile air stripper systems that process potentially explosive concentrations of vapors require intrinsically safe (IS) signals to all electrical components housed in non-explosion proof enclosures. The IS signal does not have enough energy to ignite the concentration of any NEC classified explosive vapor. Typical components that need IS signals are the float switches and well probes. Determination of when IS signals are required is generally the responsibility of the ground water remediation engineer who has placed the order for a system. A qualified,licensed electrician should perform any and all electrical connections.

Water Flow Indicators and Totalizers

The digital water flow indicator, typically installed in the incoming process water line or shipped loose, reads the rate of flow (GPM) and the totalized flow (gallons). The flow meters are selected to exceed the maximum flow of your system while providing a wide working range. The digital face plate is battery operated and intrinsically safe. The mechanical components of the meter consists of a “turbine style” rotor which spins around a shaft that is axial to the flow of water.

The standard “nutating disc” meters have a totalizing function only. They operate on the positive-displacement principle, where the flow of water through the meter moves a disc which in turn rotates a magnet. Every magnet rotation corresponds to a fixed volume of fluid which is then added to the summed total of flow.

Feed and Discharge Pumps

Any transfer pumps included in the air stripper order have been selected by our engineering staff to meet all known flow and pressure requirements. The standard pumps are typically stainless steel centrifugal-type with motor options of EXP or TEFC. The standard pumps are not self-priming; they must be primed before starting by filling either the discharge port or the priming port with clean water until the entire pump chamber is full. The pipe/hose leading into the pump should also be full of water. Install throttle valves on the discharge lines for adjusting water flow rate. The valve should be throttled back until the motor draws “full-load amps” (refer to the current rating on the nameplate).

Warning: *If the pump is running wide open and it is not pumping against the required head, the pump will cavitate and adversely affect pump performance and pump life.*

Centrifugal transfer pumps used by QED typically must be throttled back if they are not pumping against the required head. Before initial system startup, double check the pump rotation. A pump shaft rotating in the wrong direction could spin off the pump impeller and cause serious damage to the pump. Pumps operating in the wrong rotation will show poor performance. Systems using pumps should have the flow rates tuned so that the discharge is keeping up with the feed pump.

High Water Level Alarm Switch

The high water level alarm switch is one of the two alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start-up. Please see the “Special Precautions” at the beginning of the “Equipment Setup” section for more information. The purpose of the high water level alarm switch is to prevent water from flooding the blower by shutting off the incoming contaminated water once it has reached a designated level. The high water level switch will send an alarm signal when it is approximately 3½ inches above the coupling from which its cord emerges.

Line Sampling Ports

The line sampling ports provide a quick and easy means to take a water sample of both incoming contaminated water and outgoing clean water. The sampling ports are the ball valves located on both the inlet and outlet piping. When starting the unit for the first time, double check that the valves on the sample ports are closed.

When taking a water sample, open the valve and let the water flow for at least 1 minute prior to taking the sample. This purges the sample port of any stagnant water. When purging the sample port on the contaminated water line, make sure the contaminated water is collected in some sort of storage container and then properly dispose of the water after sampling.

Low Air Pressure Alarm Switch

The low air pressure alarm switch is one of the two alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start up. Please see the “Special Precautions” at the beginning of “The Equipment Setup” section for more information. The low air pressure alarm switch monitors the blower for continuous water treatment.

Should the blower fail, the low air pressure switch should be wired to shut off all incoming water. It, like the air pressure gauge, is connected to the system via an air hose which is attached to a pressure port on the sump tank. The air hose is connected to the "high" pressure port on the switch. The "low" pressure port is open to the atmosphere. Periodically inspect and remove any water which may have accumulated in the tubing. The presence of water can affect proper switch operation.

Test the switch, at initial start up, by removing the air hose from the pressure port on the sump tank once the system is in full operation. This should set the system into an alarm condition and shut off the incoming contaminated water.

Main Disconnect Switch

The main disconnect switch removes power from the EZ-Tray™ low profile air stripper. A disconnect is required by the National Electric Code (NEC) and must be installed. Some control panels, not supplied by QED, contain an internal disconnect or circuit breaker to remove power. Disconnects supplied by QED are external to the control panel, providing flexibility in situations where a site already contains a disconnect for the air stripper system. A qualified, licensed electrician should perform any and all electrical connections.

Intermittent Operation

Some systems are ordered with the intermittent operation option. EZ-Tray™ low profile air stripper systems can be designed to run intermittently when continuous blower operation is a concern. When the feed water is flowing into the system, the blower will be in operation and the outlet pump (if provided) will maintain proper sump tank levels. When the feed water is shut down, the blower will run for an additional period of time to treat the water that had previously entered the air stripper before shutting down. When the feed water is restored, the blower will start up to treat the new incoming water. The benefits of intermittent operation are lower operating costs, better control of noise, and longer motor life.

Water Temperature Gauge

The temperature gauges can be installed on both the inlet and outlet piping. The water temperature represents an important factor when estimating the system's performance since it directly effects removal efficiency. Temperature gauges provided by QED typically have a range of 0-140º F.

Water Pressure Gauge

Water pressure gauges can be installed on both the inlet and outlet water lines. The gauges can be used to determine the water pressures entering and exiting the system. Excessively high readings could signal that something in your system is plugged. Large fluctuations in the pressure readings could be a sign that the water flow rate is varying.

Special Precautions!

Use a Licensed, Qualified Electrician for Any and All Electrical/Wiring Work, and Always Use Proper Work Safety Practices!

Follow All Applicable Codes
The plumbing and electrical installations must be performed by qualified personnel. All installations must be done in accordance with local, state and national codes.

Install Adequate Supports on Piping and Ductwork
The external process piping that will connect into and from the QED equipment should be properly supported to minimize stresses and vibration from non-QED equipment. The QED equipment is not designed to support the process water and air lines without proper structural support.

Do Not Run Free Product, Oil or Grease Through the Air Stripper
Free product will contaminate the unit by coating the side walls with a film of free-product. Air strippers are not designed to treat free product, oil, grease, or any other type of immiscible phase.

Equipment Setup Steps

Depending upon how the system was ordered, some of the following instructions may not apply.

Setup Step 1. Secure/Mount the Equipment
For shipping purposes, the EZ-Tray™ unit may come either already skid-mounted or the equipment shipped loose. If shipped loose, locate the equipment as required and firmly secure to the floor, base, etc.

Setup Step 2. Install the Blower Piping
If the blower is not already pre-piped on a QED skid, install the blower piping to connect the blower outlet to the air inlet nozzle on the air stripper sump. Refer to **Figure 3** for an example of a blower piping configuration.

Setup Step 3. Level the EZ-Tray™ Unit
Level the EZ-Tray™ unit. This is a critical step in the proper assembly and installation of the equipment. The aeration trays must be level for proper operation.

Setup Step 4. Install Discharge Piping, either gravity-discharge or pump-discharge.

Install the Gravity Discharge Pipe (For Gravity Discharge Units Only)
Refer to the outlet piping drawing in **Figure 4** to assemble the piping kit and vacuum breaker. Customers providing their own gravity discharge piping must ensure that proper water sump levels are maintained during operation. It is essential that the piping be mounted vertically and that it be properly supported. Install outlet piping from the pump's discharge port. Use proper pipe sealant, PVC cement, and proper plumbing practices and techniques as necessary.

Caution: *The vertical height of the piping should not be changed from that provided in the kit unless air stripper conditions have changed dramatically from the originally-specified flows. The piping kit includes flexible couplings to allow easy vertical height adjustment, should it be necessary.*

Install the Pump Discharge Pipe (For Pump Discharge Units Only)
For a unit with a discharge pump that has not come mounted to a QED skid, install the water line from the air stripper sump to the pump inlet. If customer has purchased a QED pump kit, the components will be found in a separate box. Install outlet piping from the pump's discharge port. Use proper pipe sealant, PVC cement, and proper plumbing practices and techniques as necessary.

Prime the pump. Allow the inlet line and pump chamber to fill completely.

Setup Step 5. Install the Sump Drain Valve and the Sight Tube
(if not already installed at the factory). Make sure all fittings and hose clamps are tight and secure.

Setup Step 6. Connect the Water Lines
Connect the process water lines to the inlet and discharge piping. *Firmly support the process water lines to prevent excessive stress on the piping. The piping is not designed to support the weight of the customer's process water lines.*

Use proper pipe sealant, PVC cement, and proper plumbing practices and techniques as necessary.

Setup Step 7. Connect the Tubing Between Pressure Gauges, Pressure Switch(es), and Air Stripper Sump
Connect the air line tubing from the hose barb located on the top of the sight tube to the high pressure ports on both the air pressure gauge and the air pressure switch(es). Keep the low pressure ports open to the atmosphere (remove plugs or caps).

Setup Step 8. Install Air Discharge Stack
Install any necessary extension to the air stripper air discharge stack as necessary.

Caution: *Any added extension should have an inner diameter at least as large as the air stripper stack.*

Connect the stack extension to the exhaust stack using a flexible rubber coupling or other suitable means. Support the extension independently of the air stripper so that it can be easily disconnected if the demister element must be removed for maintenance purposes, and to prevent damage to top of air stripper housing.

Setup Step 9. Wire the Electrical Components
Have a qualified, licensed electrician wire up the electrical components in compliance with local, state, and national codes.

IMPORTANT! *Make sure the safety interlocks are connected properly!*

To avoid damage to the blower and flooding of the equipment with contaminated feed water, install the high water level and low air pressure interlock switches. If the water level in the sump tank rises beyond the maximum level water could flood the blower. This will destroy the blower and void the warranty. The high water level interlock switch will shut off the feed water pump in an emergency situation. The low air pressure interlock switch will shut off the feed water pump in the event of a blower failure. This reduces the risk of having untreated water passing through the air stripper.

If QED is supplying the control panel, refer to the appropriate wiring diagrams.

Setup Step 10. Install Optional Items

Refer to manufacturers' installation instructions for all equipment and properly support all equipment in an appropriate manner. This also applies to the optional air stripper blower silencer which requires support to avoid overstressing the air stripper blower housing.

Please refer to **Figures 1 and 2** at the end of this manual for a general drawing of an E-Z Tray air stripper and its aeration tray. Upon completion of the equipment set-up procedure, mechanical and electrical installation (including float switches, air pressure switches, etc.), proceed as follows:

Startup Step 1. Turn Off Electrical Components Using the Site's Appropriate "Lock-Out" Procedure. Close Drain and Sample Valves.
Check that all electrical components associated with the unit are turned off,and all drain and sample valves are closed.

Startup Step 2. *IMPORTANT!* Fill the Inlet Chambers with Clean Water.
Each downcomer (**see Figures 1 and 2**) must be sealed by having its end immersed in the seal pot water of the tray below it. Failure to do so may create a situation where not enough back pressure is provided upon blower startup, causing the blower motor overload to trip.

Startup Step 3. *IMPORTANT!* Fill the Sump Tank with One Foot of CleanWater.
On initial start-up, the sump tank must be filled with clean water to a height of about one foot. The sump tank can be filled by taking off the front hatch and filling the sump directly or by disconnecting the water inlet piping and using a hose applied through the water inlet connection. The water level should be seen in the sight tube.

Startup Step 4. Power May Now Be Supplied to the System.

Startup Step 5. *IMPORTANT!* Check the Blower Rotation (*IMPORTANT* for proper air stripper operation)
Check the blower rotation by momentarily turning the Hand-Off-Auto (HOA) Switch to the "Hand" position ("bumping" the motor). Verify that the fan turns in the direction of the arrow on the blower casing. If rotation is incorrect:

1. Have a licensed electrician correct the wiring per manufacturer's instructions.

2. Check and correct the rotation of the other motor(s) in the system. *(This is a common oversight and very often is the reason for inadequate blower operation. If the blower is not providing the expected air flow or backpressure, please double-check this step).*

Startup Step 6. Connect A Clean Water Line To The Air Stripper Inlet. Trial-run Air Stripper System Using Clean Feed Water At The Expected Flow Rate.
Start the QED Air Stripper System by closing the Blower Damper and Placing the Appropriate HOA Switches in the "Auto" Position. Carefully open the damper to achieve the desired tray pressure or air flow rate at the anticipated water flow rate for the system.

Blower throttling is not always possible at unattended and/or intermittent operation sites when the system restarts. Our testing shows that the new seal pots maintain seal water for up to 10 minutes once they are filled. If your system frequently shuts down for longer than 10 minutes, or you've experienced water blow off on start-up, we've created plastic insert pans that sit in the seal pots and ensure that the pot will maintain its water seal.

QED's recommendation is to use the pans on systems that operate intermittently and/or systems where an operator is not present on start up to throttle the blower at the beginning until the seal pots have filled. Reference **Figure 2**.

Startup Step 7. Monitor the Trial Run and Adjust the System Accordingly.
The following items should be monitored as water builds up on each tray:

1. Proper sump pressure. This may require 15-30 minutes for the water to reach the proper depth on each tray. Once the blower has reached its operational speed and water flow is steady, the blower can be throttled to adjust air flow to optimal conditions. QED wet-tests every EZ-Tray unit for proper sump pressures at the customer's expected water flow rates for "clean tray" and "fouled tray" conditions. These values are normally printed on a label and affixed to the side of the air stripper. Adjustments should be made first by referring to these wet-test pressure values. If no values are given, refer to the table below. The values are estimates, and vary depending upon the influent water flow rates. The table assumes there is no additional pressure from equipment downstream of the air stack. If down stream equipment adds back pressure, these values may not be accurate.

	Typical Sump Operating Pressures (Approximate*)
1 Tray System	4-6" wc
2 Tray System	8-12" wc
3 Tray System	12-18" wc
4 Tray System	16-24" wc
5 Tray System	20-30" wc
6 Tray System	24-36" wc

IT IS RECOMMENDED THAT A BOOSTER BLOWER BE USED IF IT IS EXPECTED THAT THE COMBINED PRESSURE LOSS OF THE QED AIR STRIPPER AND ANY DOWN STREAM EQUIPMENT EXCEEDS 40" WC.

Be careful when making damper adjustments—fouling of the system over time will affect the air flow rate. A "fouled" system will have lower air flow at the same sump pressure reading than a clean system. A severely fouled air stripper will not produce the minimum air flow the system requires for proper performance. The blower damper should therefore be adjusted to the proper sump pressure after the trays have been properly cleaned. Refer to the "Equipment Maintenance Instructions" for proper cleaning procedures.

2. Check for any leaks and correct.

Note: *If the blower overload trips, the system will shut down. This overload may indicate that the damper needs to be parially* closed. Reset the overload and try to start the system again.

Once **Step 7** is successfully completed, turn HOA switches to "Off" and proceed to **Step 8**.

Startup Step 8. Replace the Clean Water Feed Line with the Contaminated or Process Feed Line.
Install the inlet piping according to proper plumbing practices. Use proper pipe sealant and PVC cement where necessary.

Startup Step 9. Initiate Full Operation.
Switch all air stripper system HOA switches to “Auto”.

Please Note: The blower damper should now already be in its proper position to provide the desired air flow for the system’s anticipated influent water flow rate; however, the air flow through the air stripper upon initiating “full operation” will be greater until water builds up on the trays. If this increased air flow is a concern, it is advised to close the damper slightly to throttle the air flow until the water has built up to its final height on each tray.

Startup Step 10. Inspect and Record Unit's Operation Data
Inspect the unit's operation at regular intervals and take pertinent instrument readings. Record readings and performance data in an operations log book.

Startup Step 11. Set the Throttle Valve on Discharge Pump
Units with a discharge pump are supplied with a throttle valve. The valve should be set so that the pump matches the influent flow rate without cavitation and draws no more than the rated full load amps stamped on the pump motor.

Installation and Start-up Checklist

Please follow the procedures below during installation and start-up to confirm that your E-Z Tray air stripper is installed and begins proper operation during start-up. If the QED air stripper is integrated as part of an equipment package sold by a third-party, please refer to operating guides, control logic and equipment cut-sheets as provided by the manufacturer.

Installation task:	DATE:	CHECKED BY:

1) Inspect air stripper for any defects or damage _____
   i. Shell
   ii. Trays
   iii. Gaskets
   iv. Site tube
   v. Door
   vi. Demister cone / demister element
   vii. Magnahelic gauge

2) Verify that air stripper skids are installed / anchored on level surface _____

3) Confirm electrical supply (voltage, phase) defined in approval _____

4) Confirm rotation of blower / pump motors _____

Start-up task / checklist

Task

1) Verify system conforms with recommended installation guidelines _____

2) Confirm trays / down-comers are properly installed in air stripper _____

3) "Prime" air stripper sump with fresh water _____

4) Confirm air stripper door knobs are tightened to recommended torque _____

5) Confirm ball valve on sump drain is closed _____

6) Confirm all plumbing connections are tight / sealed _____

7) "Bump" blower motor & confirm proper rotation _____

8) Confirm motor rotation & prime for discharge pumps (if included) _____

9) Set blower throttle to “1/4” open _____

10) Initiate liquid flow _____

11) Allow tray levels to fill with water _____

12) Start pressure blower (must come up to speed) _____

13) Verify froth level (water / air mixture) on trays (4 – 6” maximum) _____

14) Verify differential pressure across air stripper sump _____

a. ~24” WC during clean start-up (open blower throttle to proper operating pressure)
b. ~36” WC when fouling

15) Measure liquid level in sump from site tube _____

16) Confirm absence of air / water bypassing on trays _____

Please contact QED Environmental Systems (1-800-684-2026) if you have any questions regarding air stripper start-up or proper operating conditions. Please refer to the identification number on the unit when contacting for assistance.

System Shutdown Procedure

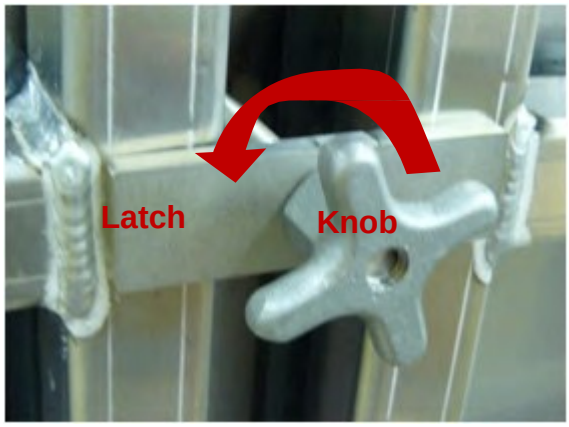
Shutdown Step 1. Shut Water Off
Shut off the water feed to the system.

Shutdown Step 2. Wait 5 Minutes Before Blower Shut Off
Wait 5 minutes to allow the water in the aeration trays to be completely treated, then shut off the blower.

Shutdown Step 3. Shut Power Off
Shut off power at the main disconnected switch if more than a temporary shutdown is anticipated.

Caution: *If proper shutdown procedures are not followed contaminated water will drain into the sump and contaminate the water that has collected in the sump. Allow the blower to run the additional 5 minutes after the feed water is shut off.*

Tray Removal (for strippers with hinged doors)



1. Loosen the door knobs by turning them counterclockwise.



2. Remove the knobs and latches from the bolts above and below the door.



3. Loosen the side knobs until the latches can be rotated to the vertical position. The knobs and latches can be left in place on the two outside door sides. The knobs and latches must be completely removed from all of the door sides in the middle of the stripper.
Swing the hinged doors open to gain access to the trays.

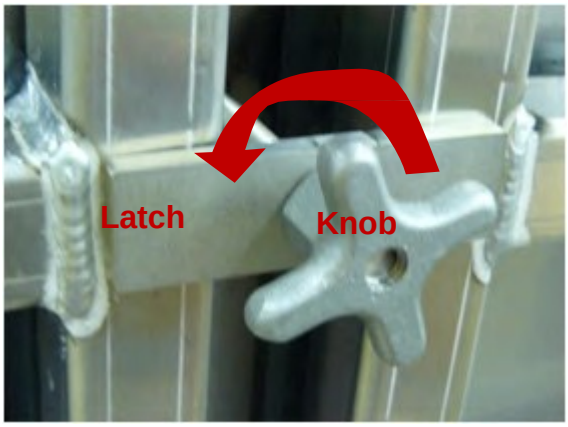


4. Remove the trays starting with the top tray and working down. Each downcomer will need to be raised to allow enough clearance to slide the tray out. The downcomer will need to be completely removed on the bottom-most tray. If “seal pots” (shallow black plastic pots) are being used at the base of the downcomers, gently raise the front end of the “seal pot” to pour the water out of it prior to sliding the tray out. Emptying the “seal pots” prevents water from splashing onto personnel.



5. Pull the tray straight out and remove it for cleaning. QED can provide specialty tools that make tray removal easier. After cleaning the trays and the other internal surfaces of the stripper, replace everything in reverse order.

Tray Removal (for strippers without hinged doors)



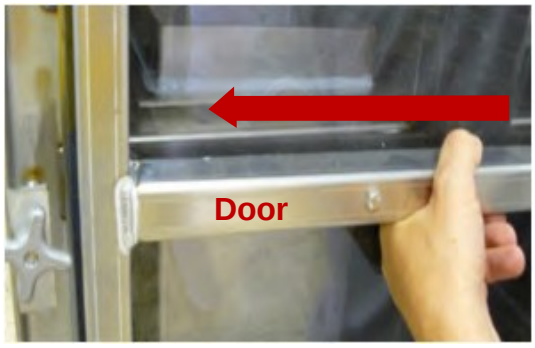
1. Loosen the door knobs by turning them counterclockwise.



2. Remove the knobs and latches from the bolts above and below the door.



3. Loosen the knobs on the sides of the door until the latches can be rotated to the vertical position.



4. Slide the door slightly to the left, turn it on an angle and remove the door by pulling it outward. The knobs may need to be turned to the “X” position to provide enough clearance for door removal.



5. Remove the trays starting with the top tray and working down. Each downcomer will need to be raised to allow enough clearance to slide the tray out. The downcomer will need to be completely removed on the bottom-most tray. If “seal pots” (shallow black plastic pots) are being used at the base of the downcomers, gently raise the front end of the “seal pot” to pour the water out of it prior to sliding the tray out. Emptying the “seal pots” prevents water from splashing onto personnel.



6. Pull the tray straight out and remove it for cleaning.
QED can provide specialty tools that make tray removal easier.
After cleaning the trays and the other internal surfaces of the stripper, replace everything in reverse order.

Tray and Downcomer Weights

Standard Trays	Tray Only (Lbs.)	Tray with Short Downcomer (Lbs.)	Tray with Bottom Downcomer (Lbs.)
4 Series	19	24	30
6 Series	24	30.5	37.5
8 Series	32	38.5	45.5
12 Series	46.5	54.5	63.5
16 Series	32	38.5	45.5
24 Series	46.5	54.5	63.5
36 Series	46.5	54.5	63.5
48 Series	46.5	54.5	63.5
72 Series	46.5	54.5	63.5
96 Series	46.5	54.5	63.5

Split Trays

12 Series Front	27	35	44
12 Series Back	25		

Downcomers

4 Down	5
4 Down Bottom	11
6 Down	6.5
6 Down Bottom	13.5
12 Down	8
12 Down Bottom	17

This information describes how to clean the QED EZ-Tray™ Air Stripper unit. Please refer to the manufacturer's instructions for maintenance on the non-air stripper equipment.

Tray Fouling
With normal operation of the air stripper, the sump pressure will typically increase over time. This typically indicates that the air stripper trays are becoming fouled. If this occurs, shut down the system. Remove the door and visually inspect for signs of fouling and clean the air stripper as outlined in the "Maintenance" section of this manual. Occasionally inspect the pressure gauge tubing for water build up. Water trapped in the air tubing could produce an erroneous reading. A pinch clamp is provided on the tubing and should be closed when no one is at the site in order to prevent potential condensate accumulation. Condensation buildup will ruin the pressure gauge.

Dealing with High Mineral Concentrations
Minerals, dissolved in high concentrations, tend to precipitate out of ground water during aeration processes. These minerals form insoluble deposits commonly referred to as "fouling". Deposits from iron-rich or mineral-rich feed water can be reduced by pre-treating it with sequestering agents or possibly other types of technologies. There are a number of sequestering suppliers that should be able to offer recommendations or suggestions. The recommended cleaning procedure is pressure-washing. Follow the instructions detailed below.

Cleaning the Air Stripper

Recommended cleaning equipment:

Pressure Washer with Washer Wand
2 GPM minimum flow at 900 PSI maximum. Equipment rental companies can usually supply such a unit on a daily rental basis.

Clean Water Supply
Clean water supply with a capacity of at least 2 GPM at 20 PSI, connected to the pressure washer by means of an ordinary garden hose.

Cleaning the Unit.
The QED air stripper is designed for easy cleaning. Trays can either be removed for cleaning or left in the unit and cleaned. Another option would be for the customer to purchase a spare set of trays which would allow maintenance personnel to replace the fouled trays with clean trays and reduce air stripper down time and allow the maintenance personnel to clean the trays at their convenience.

Cleaning Step 1. Turn Off Equipment, Perform Electrical "Lockout"Procedure
Turn off the feed water supply and all associated electrical equipment.

Cleaning Step 2. Provide for Waste Disposal
Make provisions for disposing of the sludge and waste generated during cleaning.

Cleaning Step 3. Remove Front Cover(s). Either remove the traysfrom the air stripper unit or leave them in for cleaning.

Cleaning Step 4. Turn On Water and Pressure Washer
Turn on the water supply to the pressure washer. Then, turn on the pressure washer itself. Wear protective goggles while spraying.

Cleaning Step 5. Insert Wand into Air Stripper
(This step is for cleaning trays while they remain in the air stripper unit. If trays have been removed for cleaning, skip step 5 and proceed to step 6.)

Insert the wand all the way into the door opening. Point the spray nozzle up towards the bottom of the lowest tray.

Cleaning Step 6. Clean Bottom Side of Tray
Holding the wand tightly, pull the trigger to start the pressurized water flow. Expect the wand to kick back as flow starts. Move the wand side to side at a rate of about 1" per second. Be sure to cover the entire tray bottom area. The tray holes must be cleaned of all deposits. Periodically stop the cleaning operation and inspect the cleaned area. The area is clean when there are no deposits around the aeration holes.

Cleaning Step 7. Clean Top Side of Tray
Move the wand to the top side of the tray. Continue spraying with the nozzle pointed down onto the top surface of the tray. Also clean the downcomer and sealpot areas. Remove all visible deposits from the tray baffles and the walls of the unit. Inspect the cleaned area for deposits.

Cleaning Step 8. Repeat for all Trays
Repeat the procedure for all trays, working up to the top-most tray.

Cleaning Step 9. Spray the Ceiling and Walls of the Air Stripper.
Cleaning the walls and ceiling are not necessarily required for proper air stripper operation.

Cleaning Step 10. Rinse
After the cleaning operation is finished, rinse the ceiling, trays, baffles,and walls with the pressure washer. Work down from the top down to the sump tank. Make sure the surfaces are clean and the holes are not blocked by loosened debris.

Cleaning Step 11. Check the Demister Pad and Replace as Necessary
Inspect the demister pad and clean as needed. Use the pressure sprayer to remove debris, deposits and gummy residues sometimes found on the demister pad. Demister pads that are excessively plugged should be replaced.

Cleaning Step 12. Inspect the Air Stripper
Visually inspect the air stripper box for the following:

1. Gasket integrity
2. Inspect the air stripper for any damage and repair as necessary.
3. Aeration tray integrity. Inspect trays for structural damage.
4. Inspect the internal piping (typically PVC piping) and replace as necessary.

E-Z Tray Air Stripper Cleaning Solutions

While pressure washing is often effective at removing scales and other solids from around stripper tray sieve holes, sometimes the scale is tightly adhered and requires a chemical solution to soften and/or re-dissolve the solids. Care needs to be exercised in selecting cleaning chemicals to avoid damage to the stripper metal enclosure.

General Precautions – Use adequate personal protection and recommended procedures when handling cleaning chemicals (eye shields, gloves of appropriate resistance, vented area, etc.)

Citric Acid – QED's general recommendation is the use of a dilute citric acid solution for scale cleaning. Dilute citric acid can be used with the standard 304 stainless steel used in the E-Z Tray systems and additionally with both 316 stainless steel and marine grade aluminum versions. Citric is also safe to use with the HDPE E-Z Stacker.

Citric acid can be purchased in power or granular form and is added to water to create a cleaning solution. A solution of 20-30% can be made by using the following weight to volume guide –

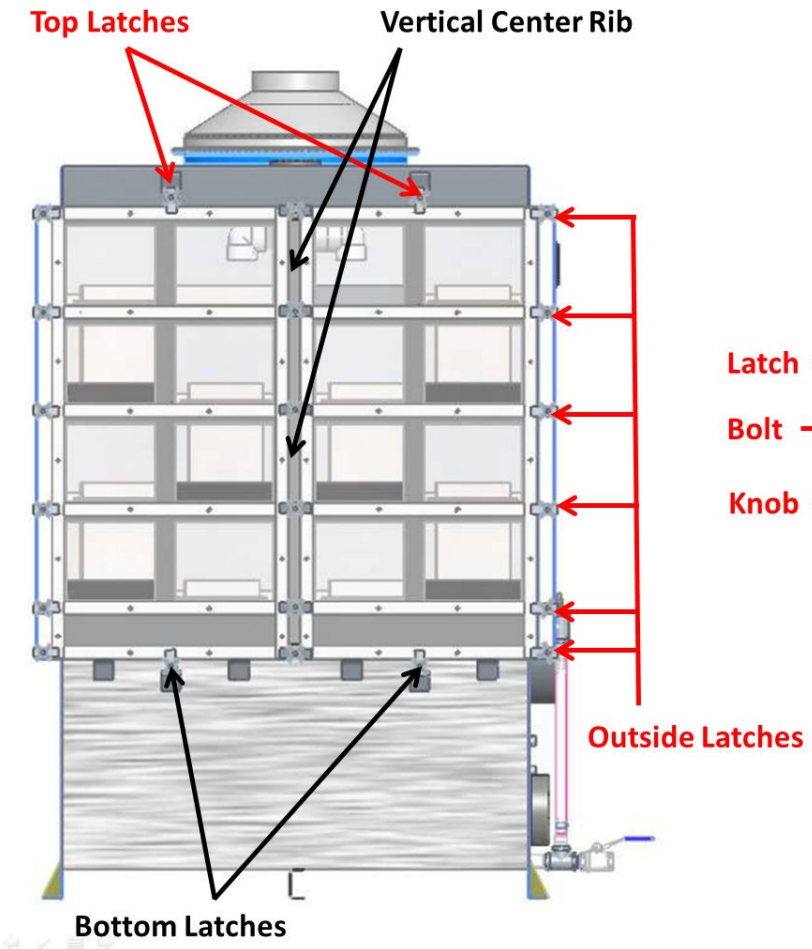
Citric Solution	Ratio (gm/ml)	Ratio (lbs/gal)
20%	250 gm / 1000ml	2 lbs / 1gal
30%	430 gm / 1000ml	3.6 lbs / 1gal

Other Acids – For more aggressive scales stronger acid solutions may be tested. The following is a general guide for dilute solutions in the 10-20% range. It is suggested that a small area be tested with the acid solution to evaluate effectiveness and observe any impacts on the stripper materials. **Do not use hydrochloric (muriatic) acid on stainless steel.**

304 stainless steel (standard E-Z Tray) – Solutions of nitric or phosphoric acid can be used.
316 stainless steel – Solutions of nitric, phosphoric or sulfuric acid can be used.
Marine grade aluminum – Solutions of phosphoric acid can be used.
HDPE (E-Z Stacker) – Solutions of nitric, phosphoric or sulfuric acid can be used.

Tightening the Doors After Cleaning

1. Apply a dab of PTFE grease to the ends of each bolt. Verify that the knobs spin freely on the bolts.
2. Position the top and bottom latches, and lightly tighten the knobs. This takes most of the "bow" out of the door and sets the door position.
3. Position the latches, and lightly tighten the knobs on the vertical center rib, working from bottom to top.
4. Position the outside latches, and lightly tighten the outside knobs, working from bottom to top.
5. Repeat the tightening sequences in steps 2-4 above until adequate sealing pressure is achieved (15 to 25 ft-lbs of torque).





Problem 1. Blower Won't Start or Run

No Power to Blower
Check that all switches are in "ON" or "AUTO" position.

Position main disconnect switch to "ON" position. Turn control switches to"ON" or "AUTO".

Blown Fuse
Check to see if fuses are okay. Check fuses in main disconnect switch and in control panel.

If blown, replace with fuse of same size and rating.

Overload Relay Trips
Locate reset button on blower overload relay. Push reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, loose wire connections, inadequate ventilation, bearings are bad.

Tubing to Pressure Switch Plugged with Water or Debris
Remove tubing from pressure switch and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Blower Wheel Jammed Against Side of Housing
TURN OFF ALL power to the system. Try to spin wheel by hand. Wheel should rotate freely. See blower manual for more details. Call QED.

Problem 2. Discharge Pump Won't Shut Off

Suction or Discharge Piping for Pump is Clogged
Check water flow from discharge pipe. Piping should be clean inside. Look for narrowing caused by scale or iron accumulation.

Remove piping, inspect and clean or replace as necessary.

Float Switch in Tank is Stuck in Down Position
Look into sump and check that all floats are free moving and floating on the water.

Clean all deposits from float. Replace float as necessary.

Normal Operation - Water Level in Sump is Okay
Pump will stop when water level reaches pre-determined height in tank (low level).

Allow water level to decrease until pump turns off.
Let water level reach pre-determined lower level, which will cause discharge pump to turn off.

Problem 3. Discharge Pump Won't Start or Run

No Power to Pump
Check that all switches are in "ON" or "AUTO" position.

Position main disconnect switch to "ON" position. Turn control switches to "ON" or "AUTO".

Blown Fuse
Check to see if fuses are okay. Check fuses in main disconnect switch and in control panel.

If blown, replace with fuse of same size and rating.

Overload Relay Trips
Locate reset button on pump contactor overload relay.

Push reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, inadequate ventilation, obstruction in piping, bearings are bad.

Normal Operation - Water Level in Sump is Okay
Pump will start when water level reaches pre-determined height in tank.

Allow water level to increase until pump turns on. Be sure pump switch is in "Auto" position.

Let water level reach pre-determined upper level, which will cause discharge pump to turn on.

Level Switch in Tank is Wired Incorrectly in Control Panel
Check wiring circuit against diagram. See that all connections are tight and no short circuits exist because of worn insulation, crossed wires, etc.

Rewire any incorrect circuits. Tighten connections, replace defective wires.

Impeller, Seal or Bearing Damaged
TURN OFF POWER. Try to turn impeller by hand.

If impeller won't turn, remove housing and locate source of binding, or obstruction.

Problem 4. Low Air Pressure in Stripper Tank

Blower Damper Closed
Visually check position of damper near discharge of blower.

Open damper to get proper reading on pressure gauge. Firmly tighten screws.

Motor Rotation Backwards
Watch rotation of blower wheel at slow speed.

Reconnect for proper rotation as per motor diagram.

Gravity Discharge Trap Installed Incorrectly
Tray should be positioned vertically.

Install discharge trap per outlet plumbing drawings provided in **Figure 4**.

Inlet Chamber (Sealpot) in each Tray is Not Full of Water
Follow inlet chambers fill up procedures above in Initial Start Up.

Front Cover not in Place
Front cover must be secured during operation.

Tubing to Pressure Gauge Plugged with Water or Debris
Remove tubing from pressure gauge and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Debris Blocking Blower Intake
Look at blower intake. Remove any accumulated debris.

Normal Operation in Automatic Mode
When inlet pump starts, blowers will start, air pressure will rise to operational level.

No action necessary.

Problem 5. High Pressure in Stripper

Air Exhaust Piping is Restricted
Check vent piping for obstructions. Check that vent pipe diameter does not decrease.

Vent piping diameter must be the same as the outlet vent diameter on the cover.

Air Holes in Bottom of Trays are Plugged
Remove front cover and visually inspect holes.

For iron fouling, clean out unit with a 1000 PSI pressure washer. For scaling, scrape or tap scale from all surfaces, then use a pressure washer to open holes. Consider using sequestering agent or other technology to reduce scaling.

Demister Pad is Plugged
Inspect the bottom of the demister pad in the cover. Clean and/or replace as necessary.

Problem 6. Water Won't Flow Into Unit

Inlet/Well Pump Functioning Properly
Allow water level to rise in well pump, which will turn on inlet pump to system.

No action necessary.

Tank Air Pressure is Low. System is in Alarm Condition
Read tank air pressure from pressure gauge. System should be in alarm condition if pressure is below about 2 inches w.c.

Check that blower is operating properly.

Inlet Piping is Plugged
Remove inlet piping and inspect for debris and buildup.

Clean or replace clogged parts.

Problem 7. Iron Fouling is a Problem

Iron Precipitates Out of Water When Treated with an Air Stripper Causing Iron Build Up in Unit
Remove the front door(s) and inspect inside of tray for buildup/fouling.

Clean out unit with 1000 PSI pressure washer on routine basis.

Pretreat incoming water using sequestering agents or other appropriate technology.

Treatment Equipment Warranty

QED Environmental Systems Inc. (QED) warrants to the original purchaser of its products that, subject to the limitations and conditions provided below, the products, materials and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in materials and workmanship. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

QED warrants the equipment components of its manufacture for a period of one (1) year from date of delivery. Our sole obligation during this warranty will be to repair or replace (at our option) the defective components. We are not responsible for consequential damages. Labor costs are not included.

Purchaser's exclusive remedy for breach of said warranty shall be as follows: if, and only if, QED is notified in writing within the applicable warranty period of the existence of any such defects in the said products, and QED upon examination of any such defects, shall find the same to be within the term of and covered by the warranty running from QED to Purchaser, QED will, at its option, as soon as reasonably possible, replace or repair any such product, without charge to Purchaser. If QED for any reason, cannot repair a product covered hereby within four (4) weeks after receipt of the original Purchaser's notification of a warranty claim, then QED's sole responsibility shall be, at its option, either to replace the defective product with a comparable new unit at no charge to the Purchaser, or to refund the full purchase price. In no event shall such allegedly defective products be returned to QED without its consent, and QED's obligations of repair, replacement or refund are conditioned upon the Purchaser's return of the defective product to QED.

IN NO EVENT SHALL QED ENVIRONMENTAL SYSTEMS INC. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF SAID WARRANTY.

The foregoing warranty does not apply to major subassemblies and other equipment, accessories, and other parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties supplied by their respective manufacturers. In the event of failure of any such product or accessory, QED will give assistance to Purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY, and of any other obligations or liabilities on the part of QED, and QED neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products, materials and/or workmanship.

It is understood and agreed that QED shall in no event be liable for incidental or consequential damages resulting from its breach of any of the terms of this agreement, nor for special damages, nor for improper selection of any product described or referred to for a particular application.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use, or exposure to chemical or physical environment beyond the designated limits of materials and construction will also void this warranty.

Treatment Equipment Warranty

The equipment is warranted to perform as specified under the conditions specified here and within the air stripper model or QED will make the necessary changes at no cost to the owner. Some restrictions apply. Requirements for warranty consideration include, (but are not limited to):

1. Current operating conditions do not differ from the previously-modeled conditions.
2. The system should be cleaned regularly to maintain system performance.
3. The equipment is installed, operated and maintained according to QED's instruction or non-QED manufactured subassembly manufacturer's instructions.
4. Air stripper influent air is not "dirty" (does not contain VOC's, etc.).
5. No surfactants, oils, greases, immiscible phases or other Henry's constant altering water additions present in the water.
6. Each influent contaminant does not exceed 25% of its maximum solubility under modeled conditions.

QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the consent of QED. If any product covered hereby is actually defective within the terms of this warranty, Purchaser must contact QED for determination of warranty coverage. If the return of a component is determined to be necessary, QED will authorize the return of the component, at owner's expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts and labor as authorized by owner hereunder shall be borne by the Purchaser.

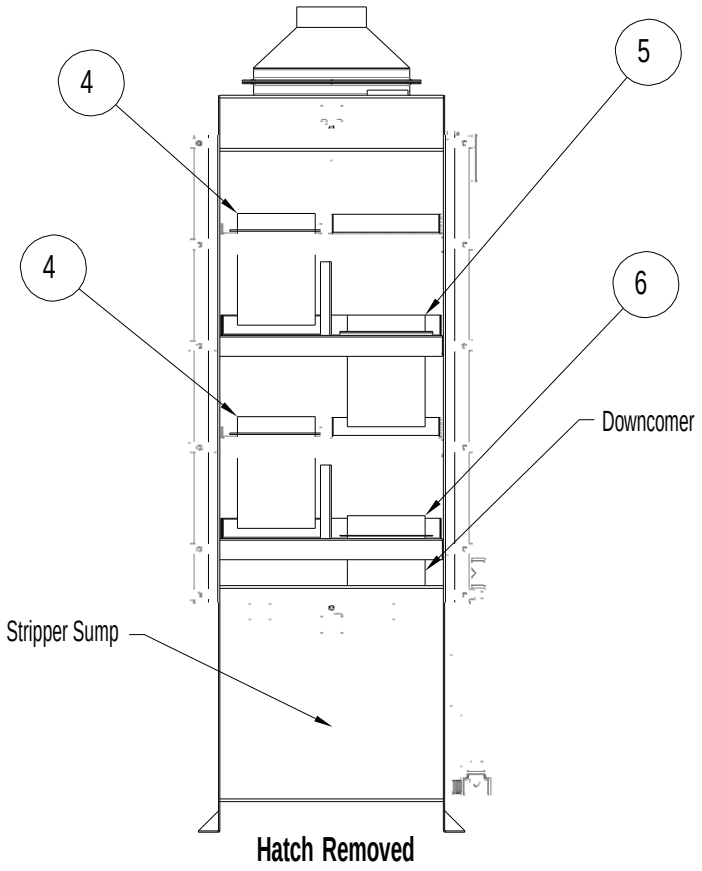
In the event of air stripper performance issues, QED may require customer to conduct a variety of troubleshooting steps. These include, but are not limited to, modifying operational parameters, cleaning air stripper system, modifying (temporarily or permanently) process piping, and obtaining reasonable and necessary influent/effluent samples. These steps are the responsibility of the customer and will be conducted by customer prior to consideration by QED for a site visit. These steps and the associated costs incurred are the responsibility of the customer, regardless of future action. Should customer request a site visit by QED or accept a site visit offer by a QED-trained technician, the visit and associated costs: a) will be the responsibility of the customer at $750/day, plus travel, lodging, and meals, if the visit finds improper sampling, process piping installation, or equipment operation inconsistent with QED's Operation and Maintenance Manual; or b) will be the responsibility of QED if the visit finds QED responsible for the performance issue(s) raised.

The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department of QED and:

1. Identify the product or system involved by job number or QED order number.
2. Specifying where, when, and from whom the product was purchased.
3. Describing the nature of the defect or malfunction covered by this warranty.
4. If applicable, send the malfunctioning component, after receiving a Return Authorization Code (RAC) Number from the QED Service Department, to:

QED Environmental Systems Inc.
2355 Bishop Circle West
Dexter, MI 48130
Attn: RAC Number
(RAC provided by QED Service Dept.)

Figure 1 General Drawing of E-Z Tray Air Stripper



ITEM NO.	Description	QTY.
1	EZ TRAY AIR STRIPPER	1
2	DEMISTER HOUSING	1
3	SIGHT TUBE	1
4	TRAY L.H.	2
5	TRAY R.H.	1
6	TRAY R.H. BOTTOM	1
7	GAUGE MAGNEHELIC	1

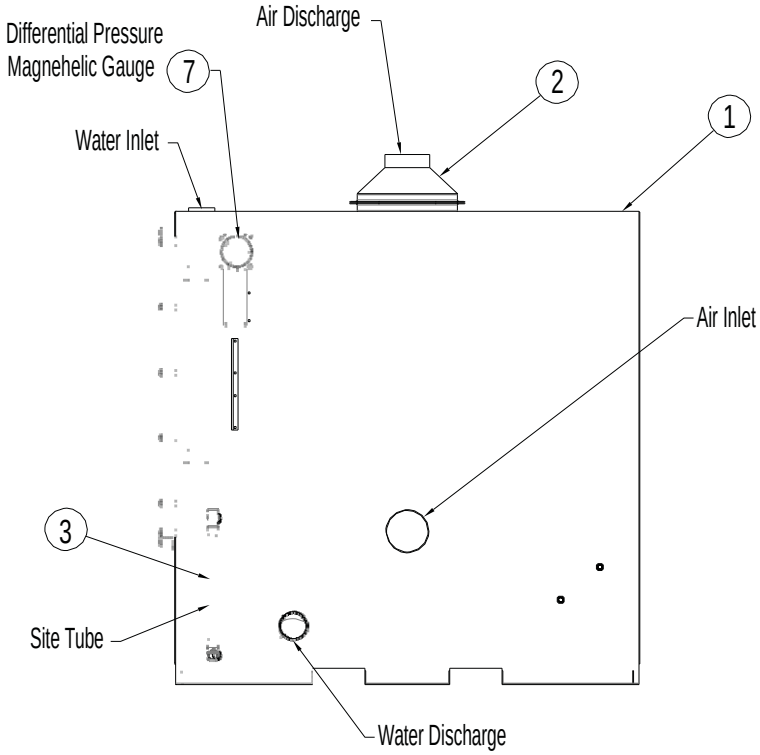
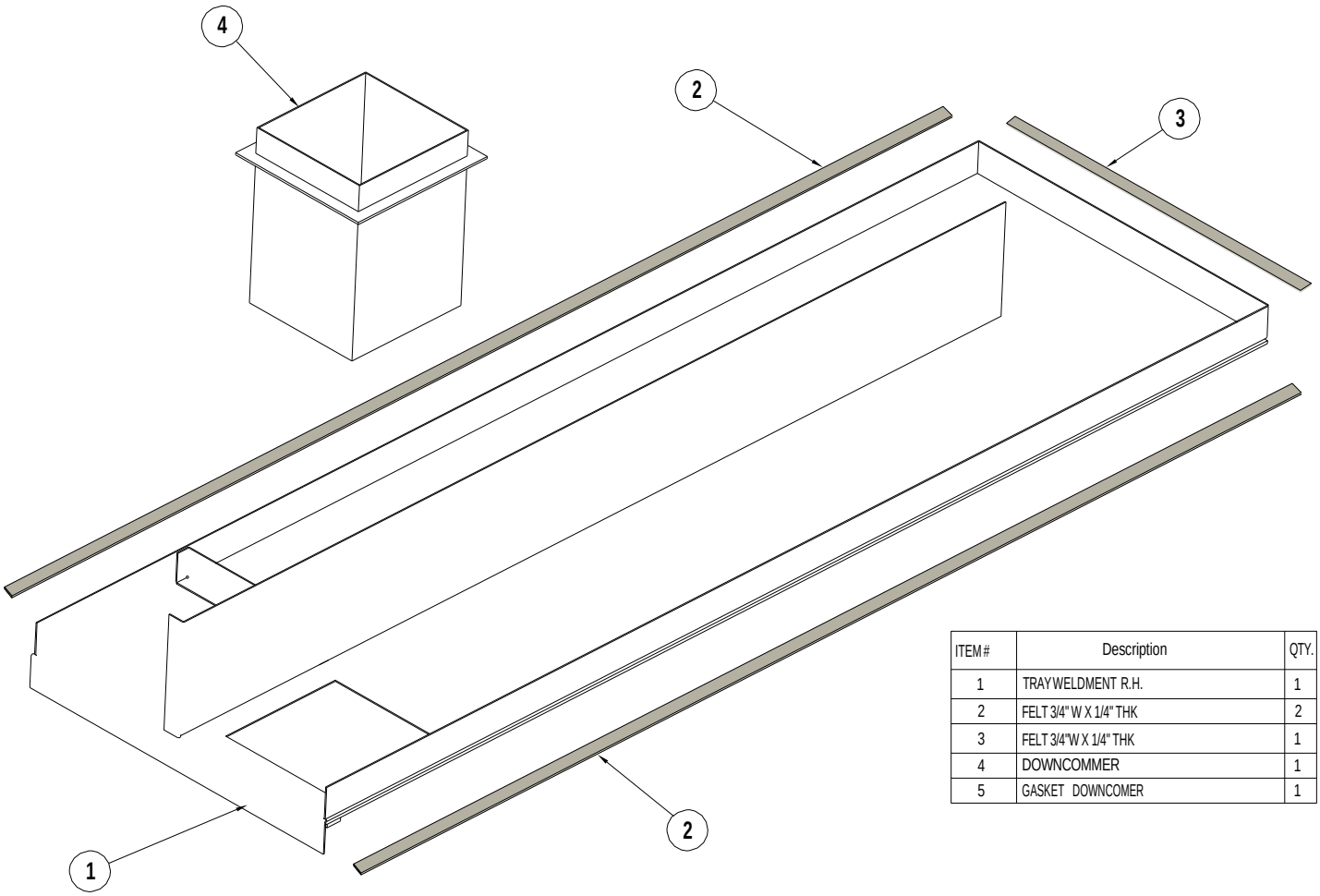


Figure 2 Typical Tray Assembly



ITEM #	Description	QTY.
1	TRAY WELDMENT R.H.	1
2	FELT 3/4" W X 1/4" THK	2
3	FELT 3/4"W X 1/4" THK	1
4	DOWNCOMMER	1
5	GASKET DOWNCOMER	1

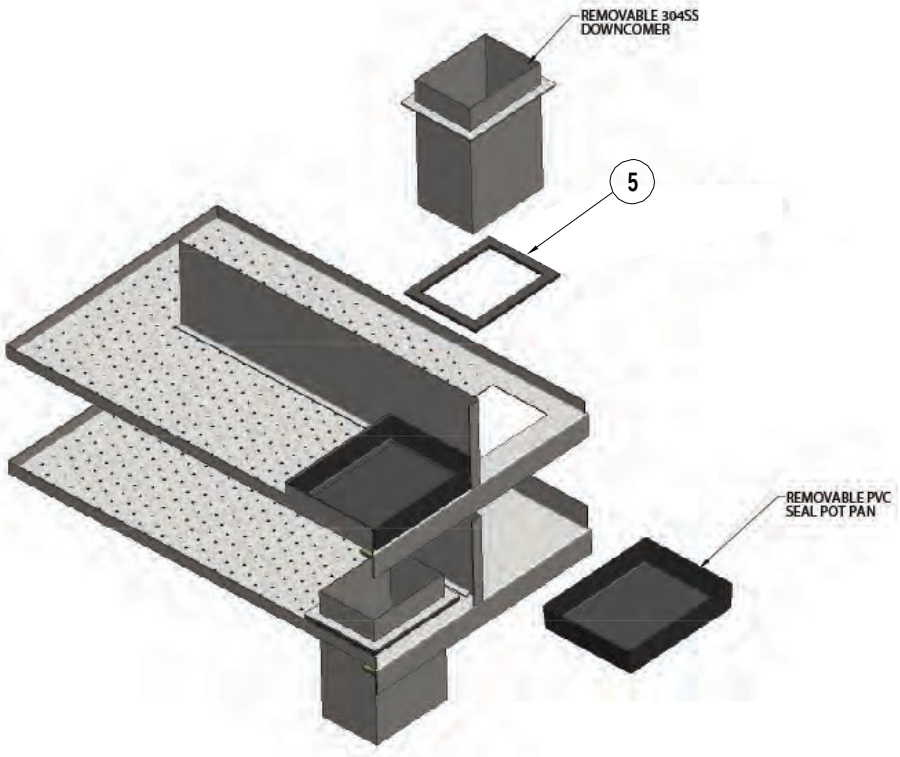


Figure 3 Typical Blower Piping

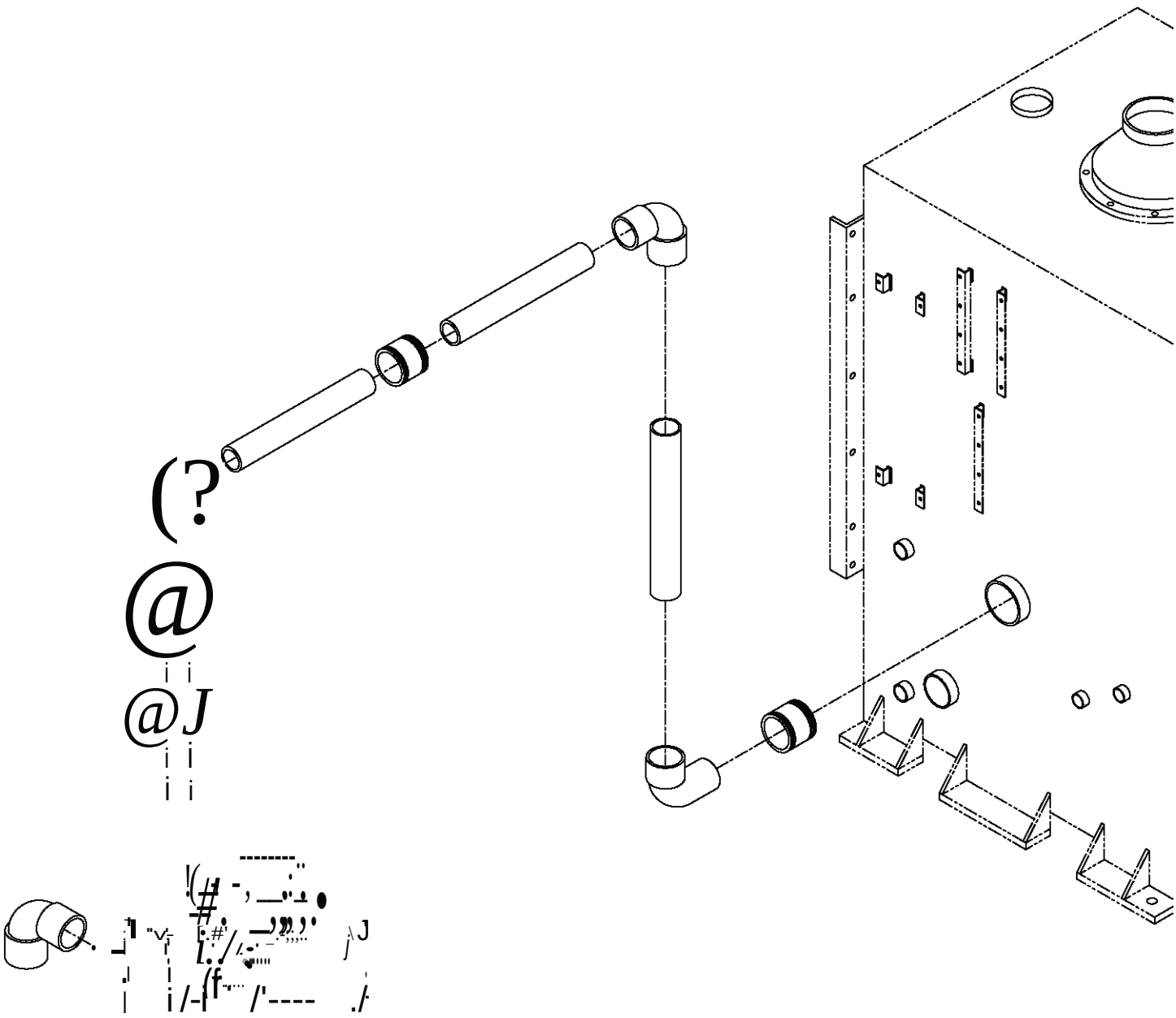
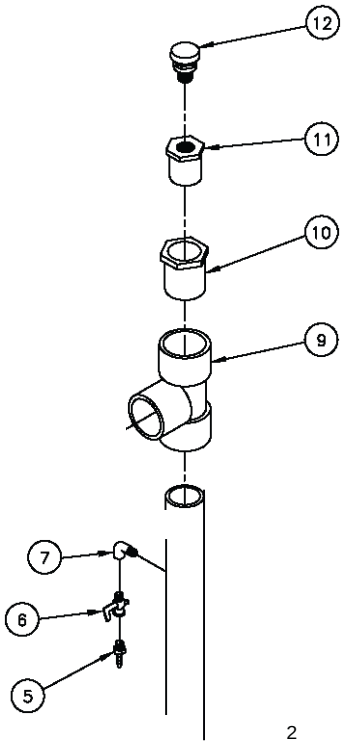


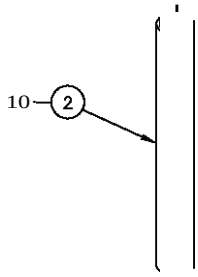
Figure 4 Typical Gravity Discharge Piping

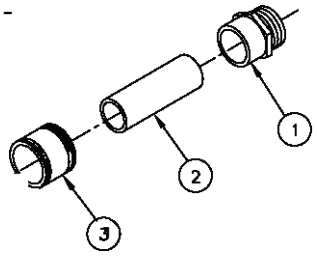
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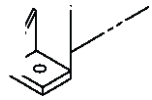
1. CENTER LINE OF WATER OUT (ITEM 1) TO CENTER LINE OF DRAIN CONNECTOR (ITEM 9) TO BE 27" – 6 TIRAY
   1B" – 4 TIRAY

(DIMENSIONS ARE APPROXIMATE--REQUIRES SOME ADJUSTMENT AS NECESSARY BASED UPON SUMP PRESSURES AND WATER FLOWS ASSUMES STANDARD OPERATING CONDITIONS.)









Jo

ITEM	QTY	DESCRIPTION	PART fj
12	1	BREAKER VACUUM RELIEF 1/2"	
11	1	BUSHING, SPI X THD PVC SCH BO	
10	1	BUSHING, REDUCER SPI. X SOC.	
9	1	TEE, SOCKET PVC SCH BO	
B			
7	1	ELBOW, STREET 1/B" FPT BRASS	
6	1	COCK, SHUTOFF 1/B"MPT X 1/B"FPT BRASS	
5	1	BARB, 1/B"MPT X 3/16" BARB	
4	1	ELBOW, 90 DEGREE PVC SCH 80 SOCKET	
3	2	FERNCO, FLEXIBLE PVC	
2	TBD	PIPE, PVC SCH 80	
1	1	ADAPTER, PVC SCH BO	

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EZ-TRAY (2U)

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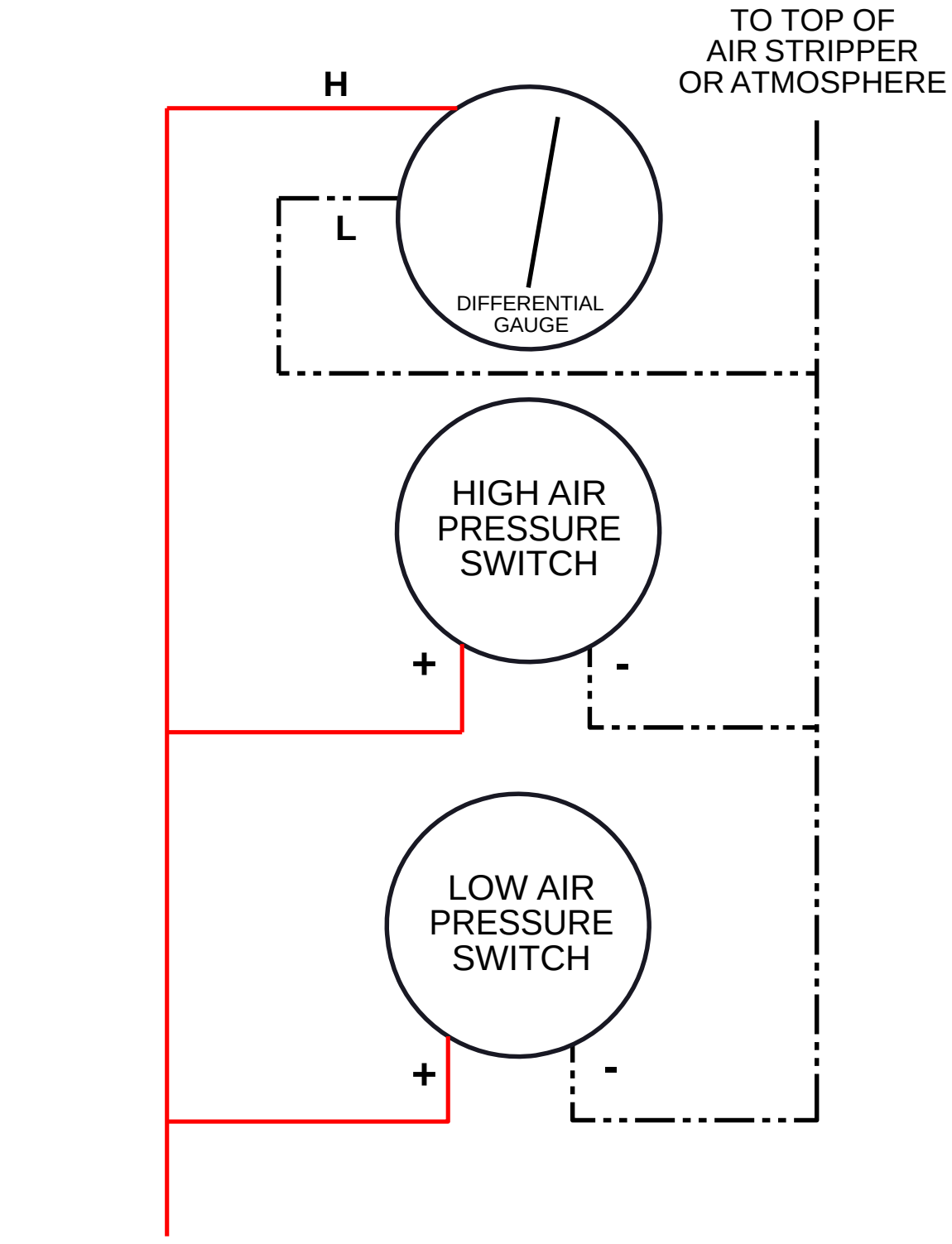
EN'IIRDNMENTAL SYSIEMS INC.
6155 JACKSON ROAD, ANN ARBOR, 1.11.

TITLE
GRAVITY DRAIN ASSEMBLY /BOM/KIT

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SCALE N.T.S. I HET 1 a; 1

Figure 5 Gauge/Pressure Switch Diagram



AIR STRIPPER GAUGE AND PRESSURE SWITCH CONNECTION DIAGRAM (Optional)

QED Environmental Systems

E Z Tray

Removable Tray Air Strippers

Delatching Tool (PIN 807201)

he Tray Delatcher is a very useful tool to use to loosen e trays from their supports. To do this follow these mple steps:

Use proper personal protective equipment, such as gloves and safety glasses

Open the access hatches (doors) to gain access to the tray areas





Grasp the Tray Delatcher Tool on the long side with both hands.



4. Position the Tray Delatcher Tool under the outer edge of the tray.

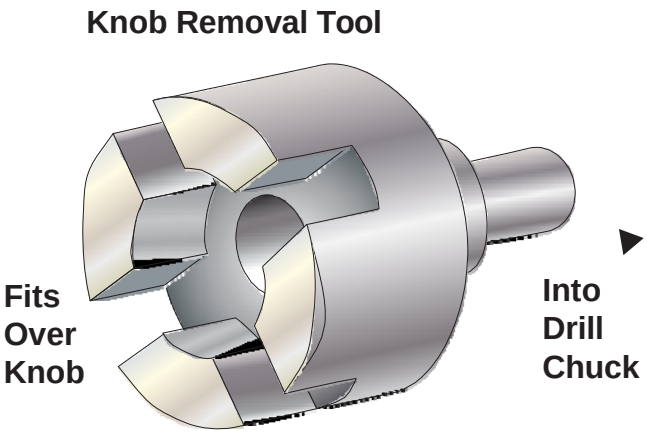


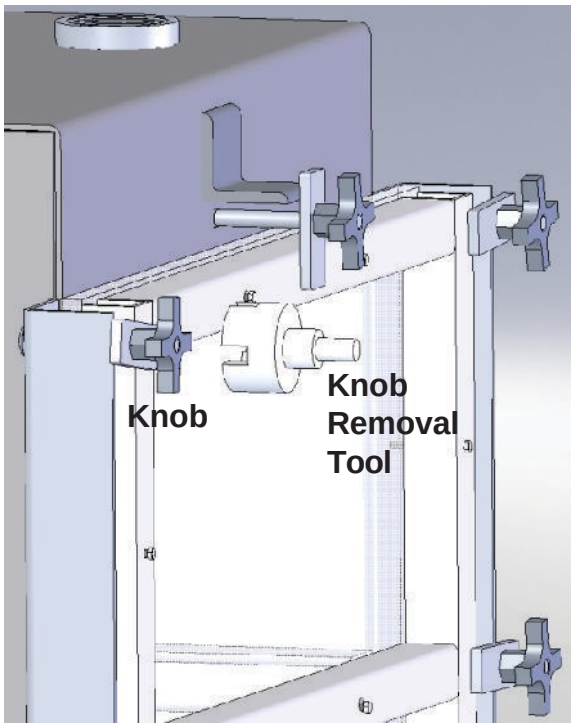
Firmly push down on the Tray Delatcher Tool.



6. The tray will loosen and move outward toward the hatch (door) opening.

Operation Instructions and Safe Use Tips





KNOB REMOVAL:

1. Use a power drill with reverse settings and preferably use one that has variable speeds and adjustable torque settings.
2. Keep in mind that drive tools such as these have a lot of power and torque. Refer to, understand, and follow all safety precautions and operating instructins of such power tools prior to use.
3. Install Knob Removal Tool in appropriate drill chuck and tighten securely.
4. Set torque setting on highest setting (if equipped).
5. Set rotation of drill to counterclockwise rotation.
6. Place tool over each knob, being certain that the tool is squarely on the knob.
7. Begin by operating drill as you normally would and spin off each knob. Work from the bottom of each access door up, and leave one knob at the top of each access door on so that the door will not fall off suddenly.
8. If stuck or stubborn knobs cannot be loosened using this method, use a wrench first and loosen slightly. If rust or corrosion is present or suspected, spray each knob /stud with a light penetrating oil first and let set for some time prior to removal.

KNOB INSTALLATION:

1. Be sure all knobs are started on each stud by hand prior to using tool.
2. Set drill to clockwise rotation.
3. Set torque setting (if equipped) to approximately 50% of maximum torque.
4. Using the same tool, alternate from side to side, top to bottom, and diagonally to provide even sealing pressure across entire door surface. Be careful not to over tighten any knob, which could cause damage to the access door and /or damage (strip) the internal threads of the Knob.
5. If knobs are not tight enough to provide adequate sealing pressure, increase torque setting of drill slightly to add tightening torque and repeat as necessary If knobs are still not tight enough at maximum drill torque, use a wrench to tighten.



Pull out the front tray while slightly lifting up on e downcomer (of the tray being removed} in der for the downcomer to clear the seal pot pan ea of the tray below.





3. Remove downcomer and then fully remove the front tray and set aside.

6. Firmly pull on Tray Remover handle and pull rear tray out towards front of Air Stripper access door / hatch opening.

7. Set Tray Remover Tool aside and pull towards you to remove each rear tray.

Appendix A:

Supplementary Materials for NSF/ANSI 61 Certified Air Strippers

Please note: Refer to the following materials if your E-Z Tray air stripper was purchased as NSF/ANSI 61 certified.

Air Stripper Disinfection

This E-Z Tray air stripper unit has been disinfected prior to shipping. A dilute solution of chlorine bleach is sprayed onto the interior surfaces of the unit, then the hatch, flanges, and pipe connections are sealed. In this procedure, the surface of the trays, the bottoms of the trays, the walls of the air stripper shell and the sump are sprayed with the disinfectant solution. This solution is permitted to stay in contact with the surface post application to permit adequate disinfection time.

This process is completed to mitigate the risk of any microbiological contaminant encountered during the fabrication process. The disinfectant solution is added at a concentration of – 1.5 oz. of chlorine bleach to 14 gallons of water.

While this procedure is completed prior to shipping the unit, it is recommended that a similar procedure be completed prior to start-up, especially if the interior of the unit is accessed during system assembly.

Post Cleaning Disinfection

After cleaning and maintenance is completed on the air stripper unit, the air stripper should be disinfected prior to being placed back into operation. A similar disinfectant solution and procedure as described above should be used to complete this task.

Recommended practices:

- Interior surface area of air stripper shell (walls, sump, roof) should be contacted with disinfectant
- Trays can be disinfected prior to storage (tray rack should also be contacted w/ disinfectant)
- Final disinfection should be completed with trays ***installed*** into air stripper
- Both top & bottom sides of trays should be contacted with disinfectant
- Sealpot pans should be disinfected
- Interior surface of doors should be disinfected prior to sealing
- Interior surfaces of gravity discharge vessel should be disinfected prior to re-starting system

Manufacturer's Spare Parts for NSF Certified Air Strippers

Part Number	Description
810011	DOOR 4 HIGH
810012	DOOR 6 HGH
810017	GASKET DOOR (req. 1 810050 per gasket)
810018	GASKET DEMISTER 24
810019	GASKET DEMISTER 36 & 48
810020	GASKET DEMISTER 72 & 96
810021	GASKET AIR INLET 36 & 48
810022	GASKET AIR INLET 72 & 96
810023	GASKET WATER CLEAN OUT COVER
810024	BARB HOSE 1/4" NPT X 3/16" T 304SS
810025	GASKET TRAY FELT (req. 2 810050 per roll)
810026	GASKET DOWNCOMER
810027	KNOB DOOR
810032	PAN SEAL POT
810041	DEMISTER 24
810042	DEMISTER 36 & 48
840043	DEMISTER 72 & 96
810049	TUBING 1"
810050	CAULK DOW 832

Please note: Components listed above are specific to NSF approved air strippers. Please contact QED Environmental systems with model information when requesting consumable parts. QED representatives will assist you in determining necessary quantities, as well as parts availability.

TECHNICAL BROCHURE
BNPE R2



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F R

Casing Rotation, Optional
R = 3 o'clock L = 9 o'clock
B = 6 o'clock
NOTE: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

Rotación de la cubierta, opcional
R = 3 hora L = 9 hora
B = 6 hora
NOTA: *Rotación cuando está visto del extremo de la succión de la bomba. La posición estándar de la descarga es las 12.*

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	Pump Size, *Tamaño de la bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

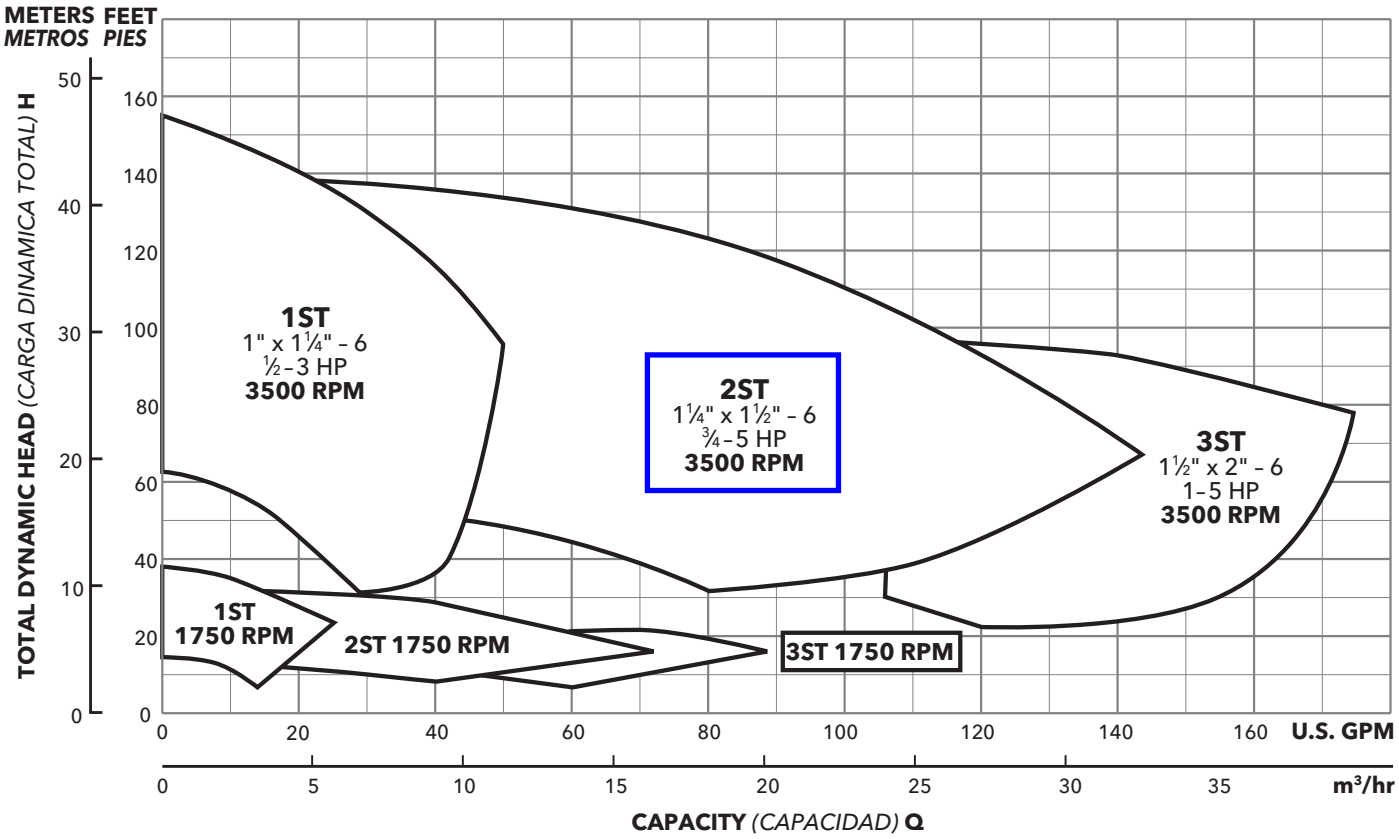
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

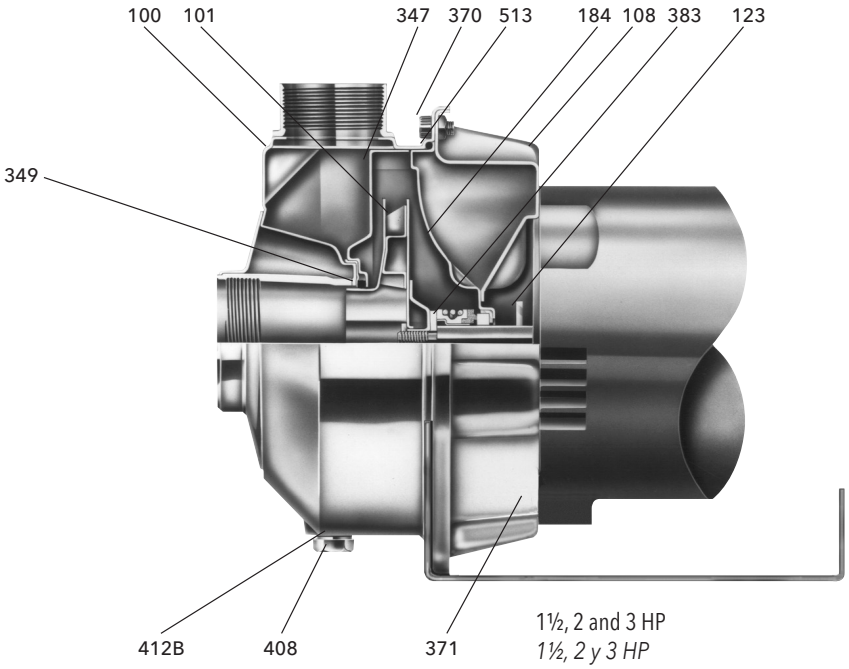
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

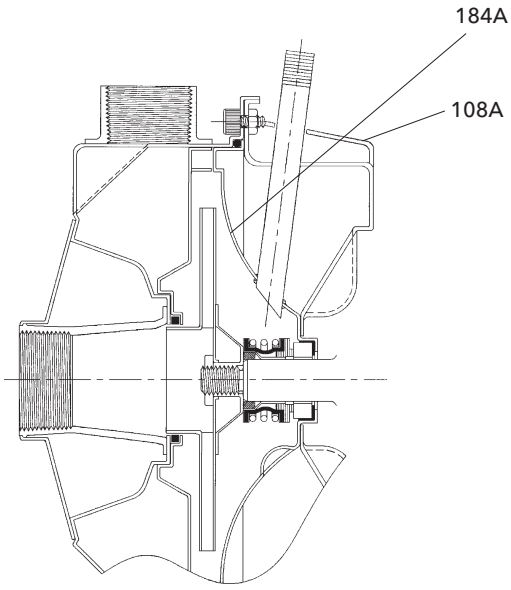
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

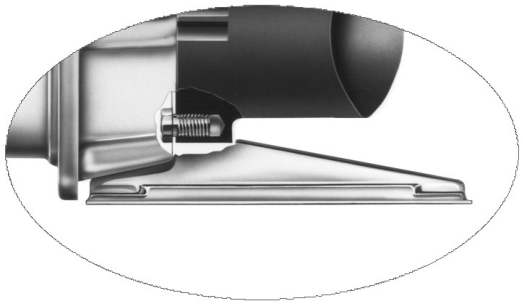


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370 *able*	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxid-*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408 *able*	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxid-*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

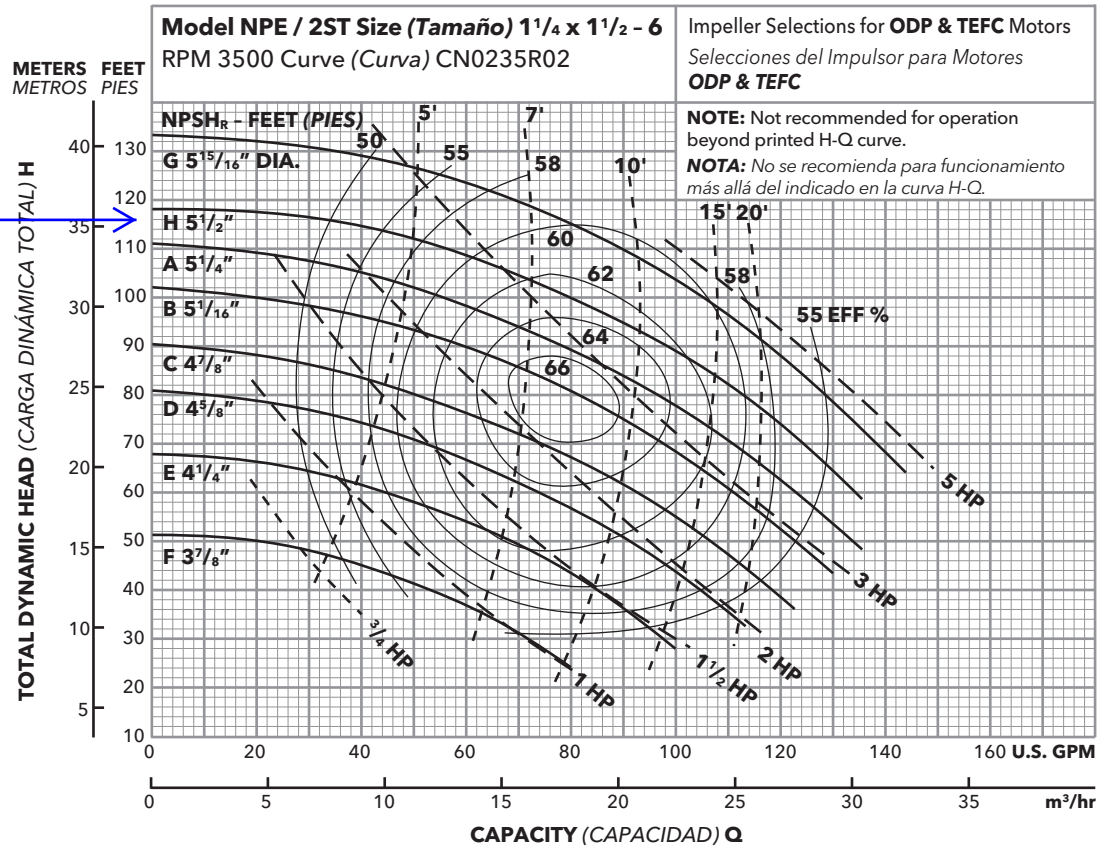


½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

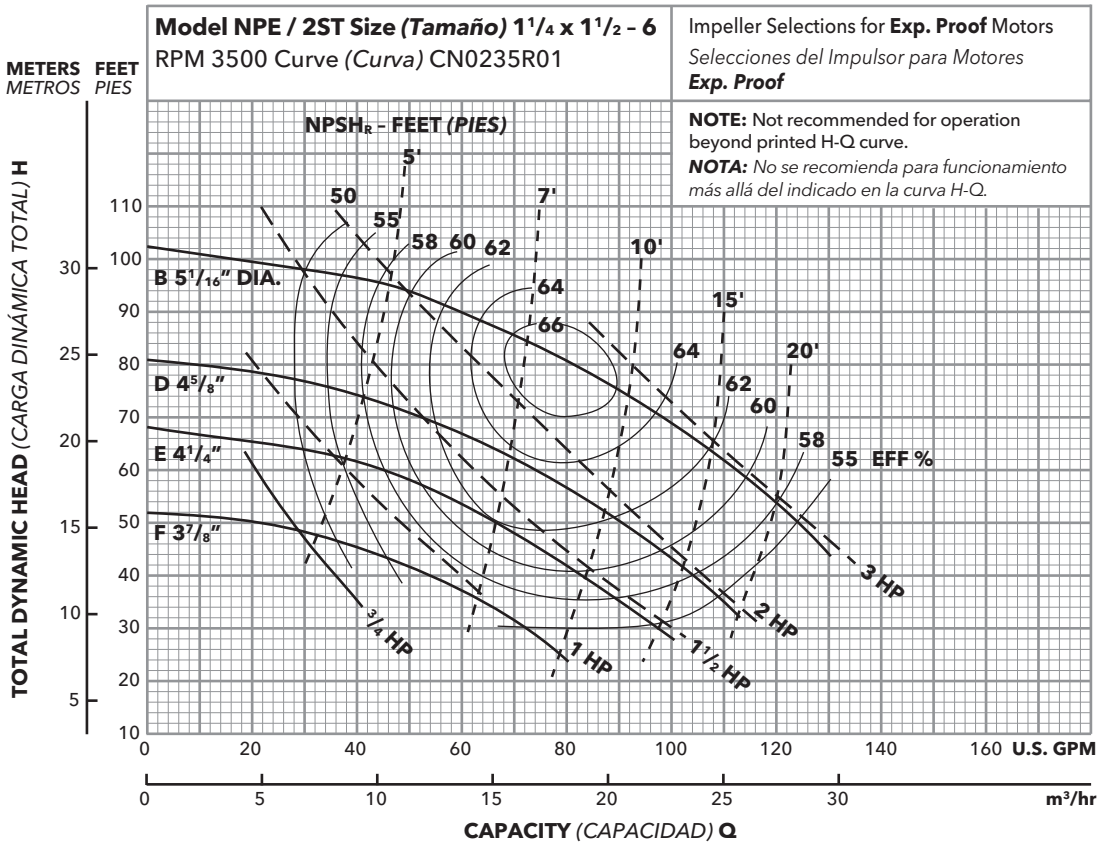
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	¾	3 7/8"
E	1	4 1/4
D	1½	4 5/8
C	2	4 7/8
B	3	5 1/16
A	3	5 1/4
H	5	5 1/2
G	5	5 15/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*



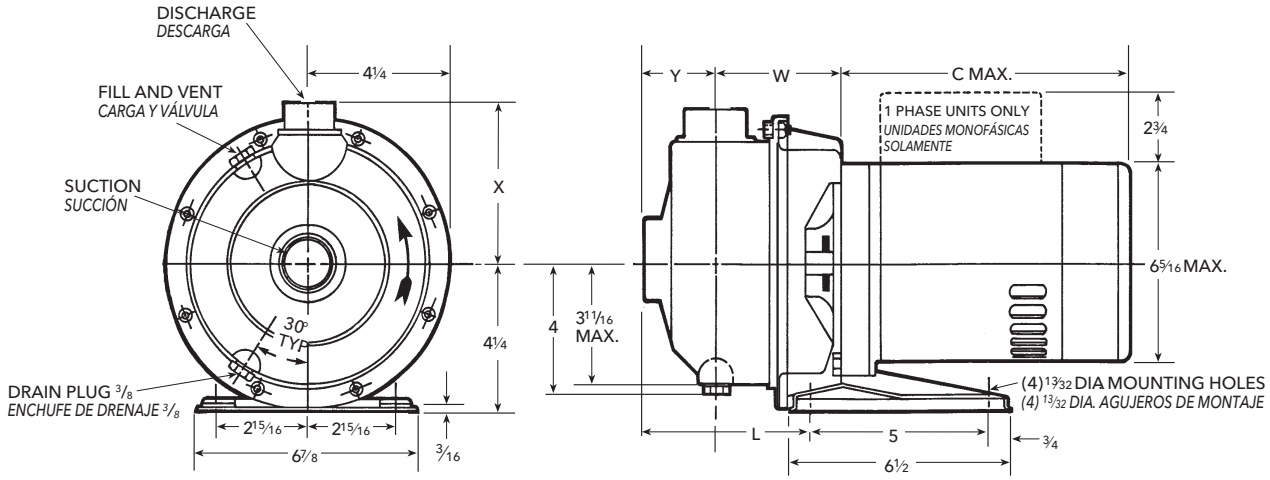
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	1	3 7/8"
E	1½	4 1/4
D	2	4 5/8
B	3	5 1/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

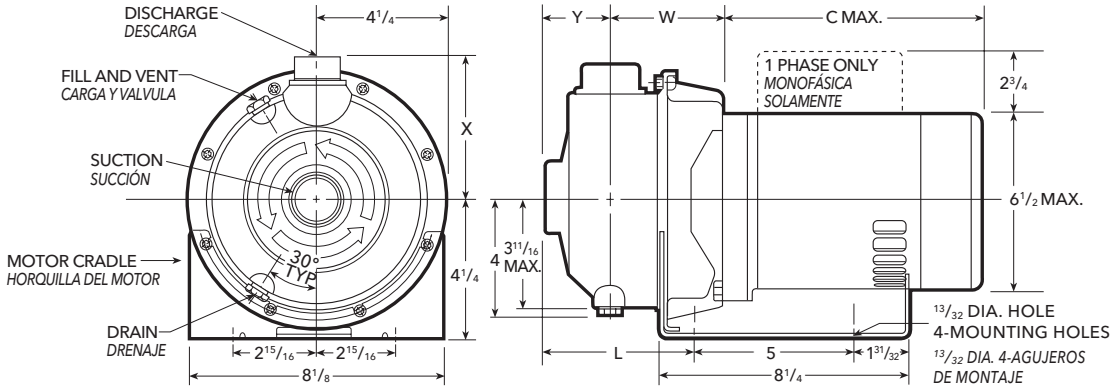
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón*		
									56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM				C Max.	Wt. Max., *Peso Máx.*
	Single Phase, *Monofásicos*		Three Phase, *Trifásicos*			
	ODP	TEFC	ODP	TEFC		
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	–	–	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	–	5	18 1/8	112

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

INSTRUCTION MANUAL
IM013R10



Model NPE/NPE-F

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

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Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Dealer: _____

Dealer Phone No.: _____

Date of Purchase: _____

Date of Installation: _____

Current Readings at Startup:

1 Ø	3 Ø	L1-2	L2-3	L3-1
Amps: _____	Amps: _____	_____	_____	_____
Volts: _____	Volts: _____	_____	_____	_____

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.

This is a **SAFETY ALERT SYMBOL.** When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

⚠ DANGER Warns of hazards that **WILL** cause serious personal injury, death or major property damage.

⚠ WARNING Warns of hazards that **CAN** cause serious personal injury, death or major property damage.

⚠ CAUTION Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

⚠WARNING



Hazardous fluids can cause fire, burns or death.

UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. IMPORTANT:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

⚠ CAUTION **Always disconnect electrical power when handling pump or controls.**

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	250° F (120° C)
Pressure:	125 PSI
Starts Per Hour:	20, evenly distributed

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. INSTALLATION:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

⚠ CAUTION **Never draw piping into place by forcing the pump suction and discharge connections.**

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units

2.2.1. Units may be installed horizontally, inclined or vertically.

⚠ CAUTION **Do not install with motor below pump. Any leakage or condensation will affect the motor.**

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.

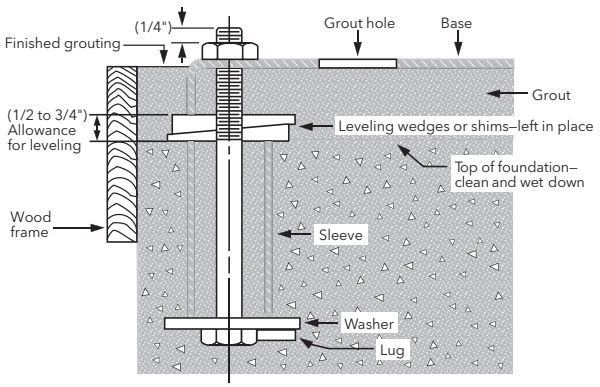


Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. SUCTION PIPING:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

⚠CAUTION **Do not use suction isolation valve to throttle pump.**

3.5. Installation with pump above source of supply

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

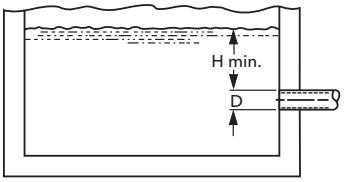


Figure 2

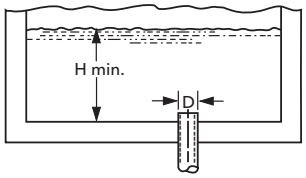


Figure 3

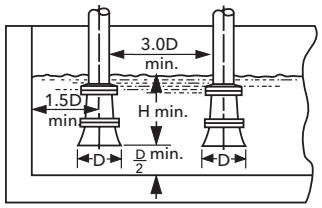


Figure 4

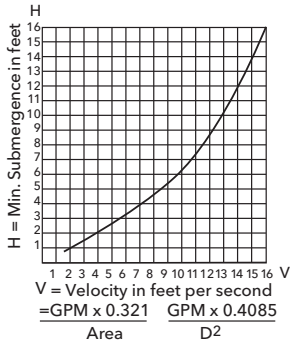


Figure 5

4. DISCHARGE PIPING:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.

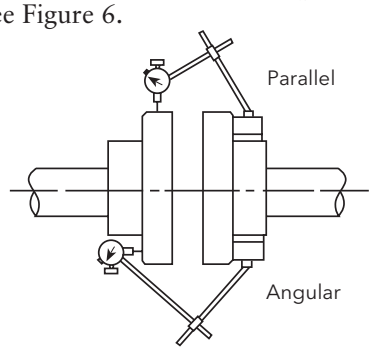


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

⚠CAUTION Always recheck both alignments after making any adjustment.

6. ROTATION:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. OPERATION:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

⚠CAUTION Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. MAINTENANCE:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

⚠CAUTION Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

⚠CAUTION Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 and 168).

10. REASSEMBLY:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame.

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end.

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

⚠CAUTION **Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.**

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. TROUBLE SHOOTING CHART:

MOTOR NOT RUNNING:
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

NPE STANDARD REPAIR PARTS LIST

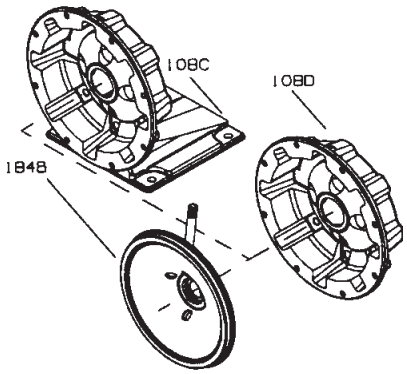
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and flush	
108D	Motor adapter less foot with flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton (standard)
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton (standard)
		EPR
		BUNA
513	O-Ring, casing	Viton (standard)
		EPR
		BUNA

MECHANICAL SEAL APPLICATION CHART

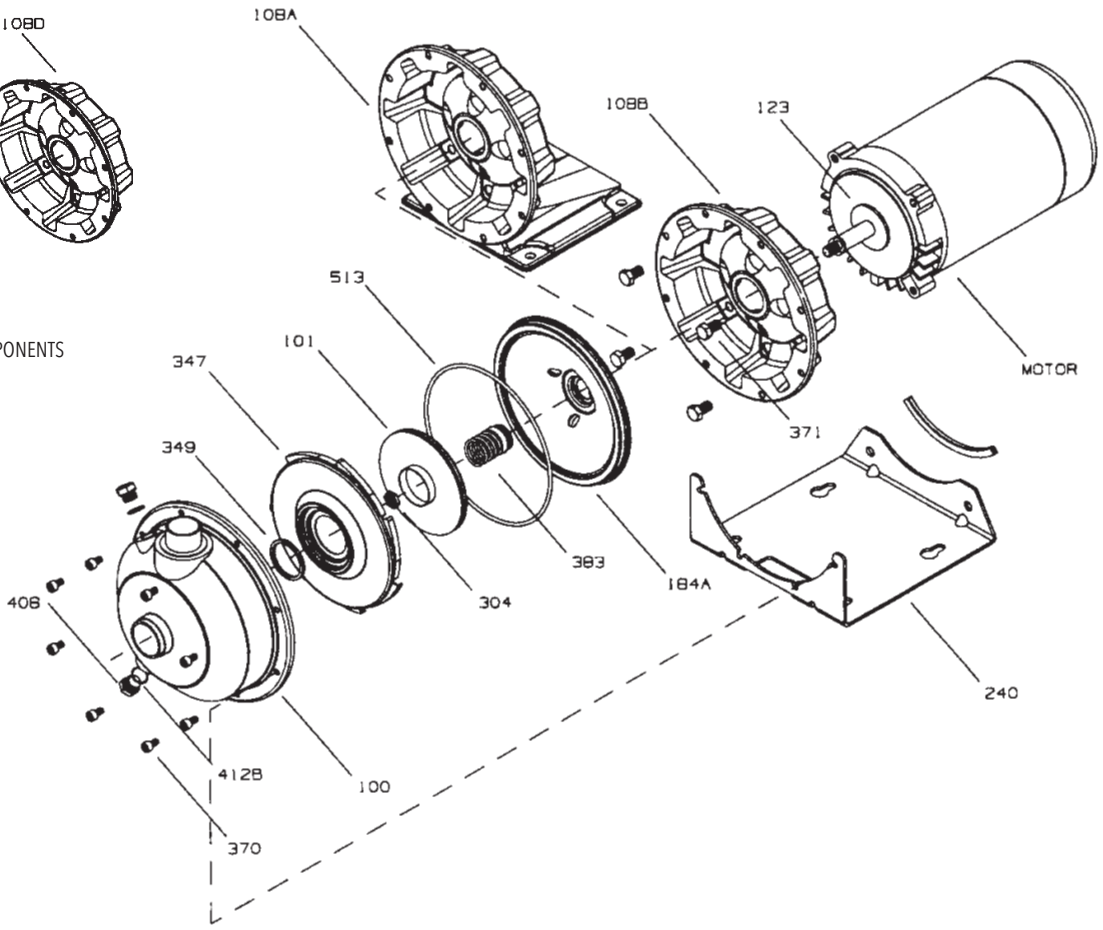
Item 383 Mechanical Seal (⅝" seal)				
Rotary	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

NOTE: Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



COMMERCIAL WARRANTY

For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or twelve (12) months from the date of shipment (which date of shipment shall not be greater than eighteen (18) months after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

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xylem
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Declaration of Conformity

We at,
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declare that the following products: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS comply with Machine Directive 06/42/EC. This equipment is intended to be incorporated with machinery covered by this directive, but must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the actual provisions of the directive.

Declaración de Conformidad

Nosotros en
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declaramos que los siguientes productos: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS cumplen con las Directivas para Maquinarias 06/42/EC. Este equipo ha sido diseñado para ser incorporado a la maquinaria cubierta por esta directiva pero no debe ponerse en funcionamiento hasta que se declare que la maquinaria en la que será incorporado cumple con las disposiciones reales de la directiva.

Déclaration de Conformité

Nous, à
Goulds Water Technology, Xylem Inc.
1 Goulds Drive
Auburn, NY, U.S.A. 13021,
déclarons que les produits NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB et LBS sont conformes à la directive 06/42/EC (législation relative aux machines). Ils sont destinés à être intégrés dans la machinerie faisant l'objet de ladite directive, mais ne doivent pas être mis en service tant que la machinerie en question ne sera pas déclarée conforme aux stipulations de la directive.

xylem
Let's Solve Water

Xylem Inc.
2881 East Bayard Street Ext., Suite A
Seneca Falls, NY 13148
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www.goulds watertechnology.com

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NPE/NPE-F REPAIR PARTS



GOULDS
WATER TECHNOLOGY
a xylem brand

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NOTE:
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS.

(3) Mechanical Seal upgrades as noted on page 3.

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F R

CASING ROTATION, OPTIONAL
R = 3 o'clock L = 9 o'clock B = 6 o'clock
Note: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

SEAL VENT/FLUSH OPTION

MECHANICAL SEAL and O-RING
4 = Pre-Engineered Standard. For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (⅝" seal)						
Seal Code	**Rotary**	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**	**Casing O-Ring**
2	Carbon	Sil-Carbide	EPR	316 SS	10K18	EPR
4			Viton		10K55	Viton
5	Sil-Carbide		EPR		10K81	EPR
6			Viton		10K62	Viton

IMPELLER OPTION CODE . . . NO ADDER REQUIRED
For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.
Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	1 x 1¼-6	**1¼ x 1½-6**	**1½ x 2-6**
	Diameter	**Diameter**	**Diameter**
K		6⅛	
G		5 15/16	5⅜
H		5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	

Note: Not recommended for operation beyond printed H-Q curve.

For critical application conditions, consult factory.

Note: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with factory on non-cataloged numbers.

Note: Impeller diameter is measured at the vane. The overall diameter of the shroud may be greater.

DRIVER
1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

HP RATING
C = ½ HP F = 1½ HP J = 5 HP
D = ¾ HP G = 2 HP
E = 1 HP H = 3 HP

DRIVER: HERTZ/POLE/RPM
1 = 60 HZ, 2 pole, 3500 RPM
2 = 60 HZ, 4 pole, 1750 RPM
3 = 60 HZ, 6 pole, 1150 RPM
4 = 50 HZ, 2 pole, 2900 RPM
5 = 50 HZ, 4 pole, 1450 RPM

MATERIAL
ST = Stainless Steel

PUMP SIZE
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

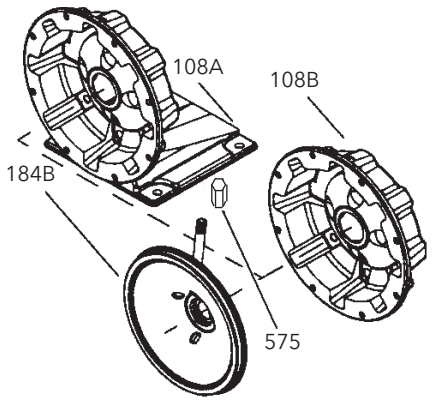
For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QUANTITY
100	Casing	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller	AISI 316L SS	See Impeller chart on page 6			1
108A	Motor adapter with foot*	AISI 316L SS	1L80			1
108B	Motor adapter less foot*	AISI 316L SS	1L87			1
123	Deflector	BUNA-N	5K7			1
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush	AISI 316L SS	1L333			1
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 3			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

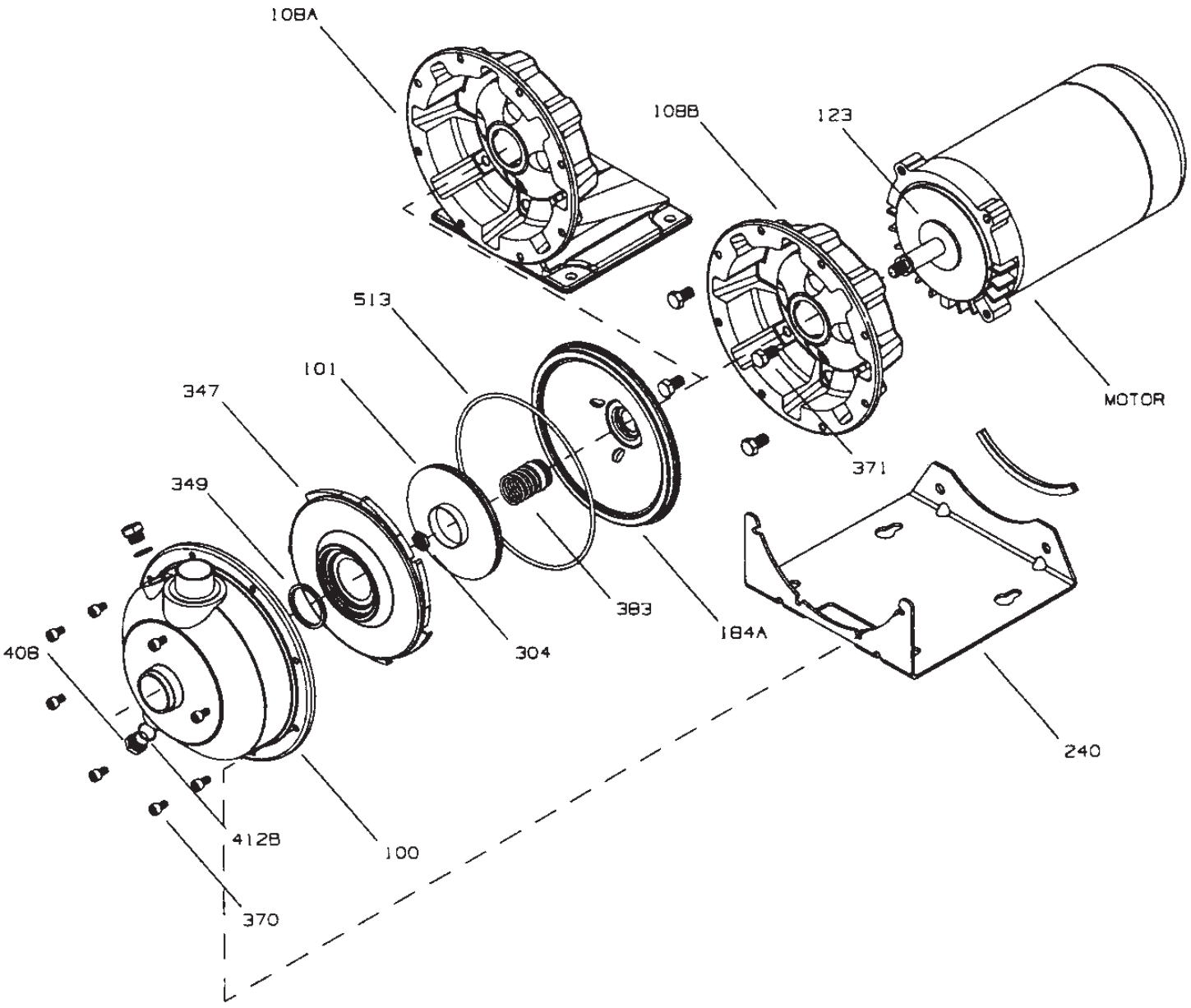
** Flush access hole provided.*

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS



NOTE:
Close-coupled units using motors ½ – 1 HP (TEFC and ODP) will use footed motor adapter as standard.
Close-coupled units using motors 1½ – 3 HP (TEFC and ODP) will use footless motor adapter as standard.
Close-coupled units using motors 5 HP and all X-Proof will have a foot attached to the motor.

NOTE:
Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power Frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x 1¼-6		1¼ x 1½-6		1½ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			6 1/8	2K1221		
G			5 15/16	2K1206	5 3/8	2K1209
H			5 1/2	2K1205	5	2K1208
A	6 1/8	2K1203	5 1/4	2K1216	4 3/4	2K1220
B	5 3/4	2K1202	5 1/16	2K1204	4 5/8	2K1207
C	5 3/16	2K1201	4 7/8	2K1215	4 3/8	2K1219
D	4 3/4	2K1200	4 5/8	2K1214	4 1/16	2K1218
E	4 7/16	2K1199	4 1/4	2K1213	3 5/8	2K1217
F	4 1/16	2K1211	3 7/8	2K1212		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST	2ST		3ST
			ODP/TEFC	ODP/TEFC		ODP/TEFC
½	C	Repair #	2K1199			
		Dia.	4 7/16			
		Imp. Code	E			
¾	D	Repair #	2K1200	2K1212		
		Dia.	4 3/4	3 7/8		
		Imp. Code	D	F		
1	E	Repair #	2K1201	2K1213		2K1217
		Dia.	5 3/16	4 1/4		3 5/8
		Imp.Code	C	E		E
1½	F	Repair #	2K1202	2K1214		2K1218
		Dia.	5 3/4	4 5/8		4 1/16
		Imp. Code	B	D		D
2	G	Repair #	2K1203	2K1215		2K1219
		Dia.	6 1/8	4 7/8		4 3/8
		Imp. Code	A	C		C
3	H	Repair #	2K1203	2K1216		2K1220
		Dia.	6 1/8	5 1/4		4 3/4
		Imp. Code	A	A		A
5	J	Repair #		2K1206	2K1221	2K1209
		Dia.		5 15/16	6 1/8	5 3/8
		Imp. Code		G	K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST		2ST		3ST	
			ODP	TEFC/EXP	ODP	TEFC/EXP	ODP	TEFC/EXP
½	C	Repair #	2K1199	2K1211				
		Dia.	4 7/16	4 1/16				
		Imp. Code	E	F				
¾	D	Repair #	2K1200	2K1199	2K1212			
		Dia.	4 3/4	4 7/16	3 7/8			
		Imp. Code	D	E	F			
1	E	Repair #	2K1201	2K1200	2K1213	2K1212	2K1217	
		Dia.	5 3/16	4 3/4	4 1/4	3 7/8	3 5/8	
		Imp. Code	C	D	E	F	E	
1½	F	Repair #	2K1202	2K1201	2K1214	2K1213	2K1218	2K1217
		Dia.	5 3/4	5 3/16	4 5/8	4 1/4	4 1/16	3 5/8
		Imp. Code	B	C	D	E	D	E
2	G	Repair #	2K1203	2K1202	2K1215	2K1214	2K1219	2K1218
		Dia.	6 1/8	5 3/4	4 7/8	4 5/8	4 3/8	4 1/16
		Imp. Code	A	B	C	D	C	D
3	H	Repair #	2K1203	2K1203	2K1216	2K1204	2K1220	2K1207
		Dia.	6 1/8	6 1/8	5 1/4	5 1/16	4 3/4	4 5/8
		Imp. Code	A	A	A	B	A	B
5	J	Repair #			2K1206 / 2K1221		2K1209	
		Dia.			5 15/16 / 6 1/8		5 3/8	
		Imp. Code			G / K		G	

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821S	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821S	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821S	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821S	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854S	26.8/13.4	36	E08821S	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854S	14.0	40	E09821S	11.89	44			
5	E10754S	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873S	2.6/1.3	19	E04876S	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873S	3.4/1.7	19	E05876S	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873S	4.2/2.1	22	E06876S	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878S	5.8/2.9	25	E07876S	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874S	6.9/3.3	39	E08876S	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874S	7.2/3.6	31	E09876S	7.6/3.8	37			
5	E10774S	7.2/14.4	50	E10876S	6.2/12.4	48			

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com

xylem
Let's Solve Water

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FPZ BLOWER TECHNOLOGY

SCL K07 / K08 / K09 / K10 / K11 / K12

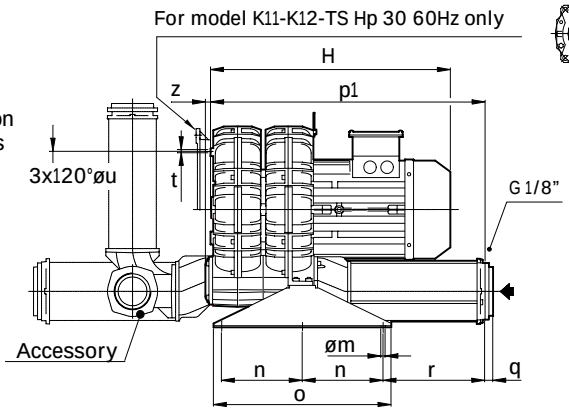
TS SERIES

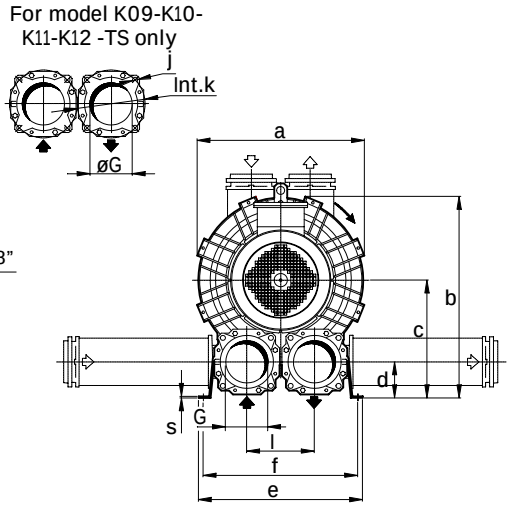
SN 1826-12

TECHNICAL CHARACTERISTICS
- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - cURus motor
- G1/8" female thread on both suction and discharge silencer port flanges

OPTIONS
- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES
- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors





Dimensions in inches.
Dimension for reference only.

Model	a	b	c	d	e	f	G	l	j	k	m	n	o	p1	q	r	s	t	u	z
K07-TS	16.69	20.91	12.56	3.86	18.43	17.24	4"NPT	7.17	-	-	0.51	984	21.65	31.57	0.98	11.77	0.20	M8	11.61	0.63
K08-TS	18.03	21.57	12.56	3.86	18.82	17.64	4"NPT	7.17	-	-	0.51	9.84	21.65	31.57	0.98	11.77	0.20	M8	12.20	0.63
K09-TS	19.37	24.02	14.37	4.4	20.00	18.82	5.12	8.27	M16	8.27	0.51	9.84	21.65	33.46	-	12.40	0.20	M8	14.17	0.63
K10-TS	20.31	24.53	14.37	4.41	20.00	18.82	5.12	8.27	M16	8.27	0.51	9.84	21.65	33.46	-	12.40	0.20	M8	14.17	0.63
K11-TS	21.26	25.59	14.96	4.17	21.26	20.08	5.12	8.98	M16	8.27	0.51	9.84	21.65	34.25	-	12.60	0.20	M8	15.35	0.63
K12-TS	21.57	25.66	14.96	4.17	21.26	20.08	5.12	8.98	M16	8.27	0.51	9.84	21.65	34.37	-	12.60	0.20	M8	15.35	0.63

Model	Maximum flow cfm		Installed power Hp		Maximum differential pressure Δp (In Hg)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	Inches	Lbs
K07-TS	588	487	7 ½	7 ½	2.6	3.5	84.5	82.5	23.76	197.31
			10	10	4.4	5.2	84.8	82.8	23.76	206.13
			15	15	8.1	8.9	85.4	83.4	24.55	223.77
K08-TS	715	592	7 ½	7 ½	1.3	2.2	80.9	78.9	23.76	205.47
			10	10	2.7	3.7	81.2	79.2	23.76	214.29
			15	15	5.5	6.4	82.9	80.9	24.55	231.92
K09-TS	941	780	20	20	5.9	6.6	84.1	82.1	29.92	350.53
			25	25	8.1	8.8	86.1	84.1	30.79	383.60
K10-TS	1093	906	20	20	4.8	5.5	89.4	87.4	29.92	354.94
			25	25	5.9	7.0	89.7	87.7	30.79	388.01
K11-TS	1254	1039	25	25	3.7	5.0	90.7	88.7	31.38	429.02
			30 (2)	30 (2)	5.1	6.6	91.3	89.3	31.38	434.53
K12-TS	1410	1168	30 (2)	30 (2)	3.3	5.9	91.9	89.9	31.50	436.75

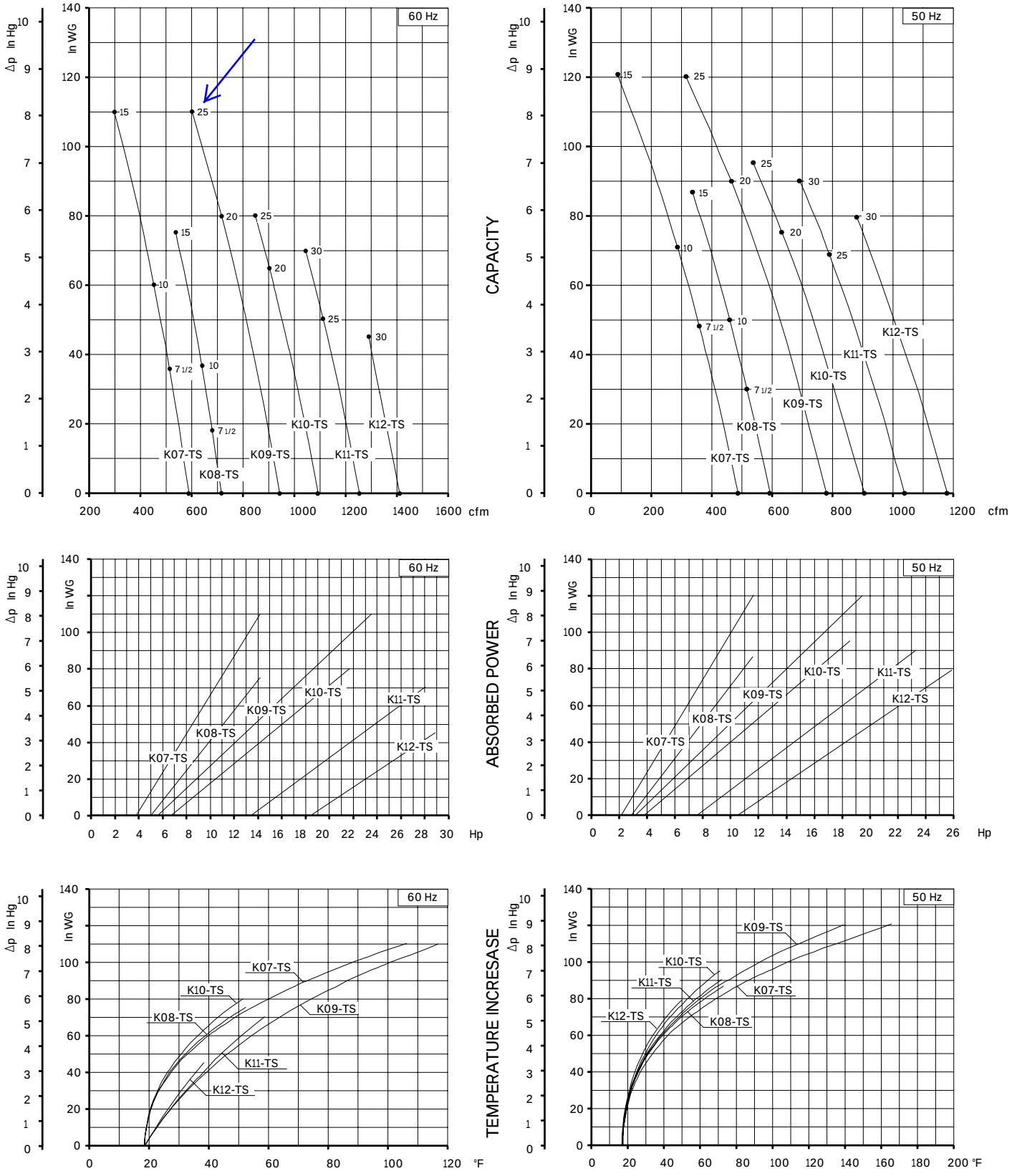
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(2) K11-K12-TS Hp 30 vertical assembly only.

- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

SCL K07 / K08 / K09 / K10 / K11 / K12

TS SERIES

SN 1826-12



Curves refer to air at 68° F temperature, measured at inlet port and 29.92 In Hg atmospheric backpressure (abs).
Values for flow, power consumption and temperature rise: +/-10% tolerance.
Data subject to change without notice.

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www.fpz.com

CE

COMPRESSORI - ASPIRATORI A CANALE LATERALE	**ISTRUZIONI I**
LATERAL CHANNEL BLOWERS – EXHAUSTERS	**INSTRUCTIONS GB**
COMPRESSEURS - ASPIRATEURS A CANAL LATERAL	**INSTRUCTIONS F**
SEITENKANALVERDICHTER - VAKUUMPUMPEN BAUREIHE	**BETRIEBSANLEITUNG D**
COMPRESORES - ASPIRADORES DE CANAL LATERAL	**INSTRUCCIONES E**

LEGGERE ATTENTAMENTE TUTTE LE ISTRUZIONI E CONSERVARLE I

PLEASE READ CAREFULLY ALL INSTRUCTIONS AND KEEP THEM FOR FUTURE REFERENCE GB

LIRE ATTENTIVEMENT TOUTES LES INSTRUCTIONS ET LES CONSERVER F

ALLE ANLEITUNGEN SIND SORGFÄLTIG ZU LESEN UND AUFZUBEWAHREN! D

SIRVASE LEER CUIDADOSAMENTE TODAS LAS INSTRUCCIONES Y CONSERVARLAS PARA FUTURA REFERENCIA E

SN 1975-3

SCL K07 / K08 / K09 / K10 / K11 / K12
TS - MOR



AZIENDA CON SISTEMA DI GESTIONE PER LA QUALITÀ CERTIFICATO DA DNV
=UNI EN ISO 9001:2000=

DICHIARAZIONE DI CONFORMITÁ ALLA DIRETTIVA MACCHINE
DECLARATION OF CONFORMITY TO THE MACHINERY DIRECTIVE

Unità tipo - *Unit type*

SCL K07-TS MOR	**SCL K09-TS MOR**	**SCL K11-TS MOR**
SCL K08-TS MOR	**SCL K10-TS MOR**	**SCL K12-TS MOR**

1. L'unità è in conformità con:
   - DIRETTIVA MACCHINE CE 2006/42;
   - DIRETTIVA COMPATIBILITA' ELETTROMAGNETICA (EMC) CE 2004/108;
   - DIRETTIVA BASSA TENSIONE 2006/95/CE;

   È tuttavia vietata la messa in servizio prima che la macchina in cui sarà incorporata sia dichiarata conforme con le citate Direttive.
2. Sottoposta a collaudo funzionale è risultata conforme alle caratteristiche richieste.
3. Il Fascicolo tecnico elaborato secondo Allegato VII della direttiva CE 2006/42 viene conservato presso la sede della società FPZ SpA a Concorezzo (MB), via F.lli Cervi 16.

1. *The unit conforms to the:*
   - *MACHINERY DIRECTIVE CE 2006/42;*
   - *ELECTROMAGNETIC COMPATIBILITY (EMC) DIRECTIVE CE 2004/108;*
   - *LOW VOLTAGE DIRECTIVE 2006/95/CE;*

   Nevertheless it is forbidden to put the unit in service before the machine in which will be incorporated is declared in conformity with the above Directives.
2. *The unit has been tested and meets its operating performances.*
3. *FPZ SpA in Concorezzo (ITALY), Via F.lli Cervi 16, store the Technical Files developed according Annex VII of Machinery Directive CE 2006/42*

Concorezzo (MB), *data 19.04.2010*

Amministratore Delegato
Managing Director

Sergio Ferigo

Direttore Tecnico
Technical Manager

Luis Sagastegui

DATI CARATTERISTICI I
PERFORMANCE TABLE GB
CARACTÉRISTIQUES TECHNIQUES F
LEISTUNGDATEN D
DATOS CARACTERISTICOS E

SI - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	kW		**hPa** (mbar)		**Lp / Lw** (1) **dB (A)**		**Ps** max A	**M**
	50 Hz *2900 min^{-1}*	*60 Hz* *3500 min^{-1}*	*50 Hz* *2900 min^{-1}*	*60 Hz* *3500 min^{-1}*	*50 Hz* *2900 min^{-1}*	*60 Hz* *3500 min^{-1}*	**MPa** (bar)	**kg**
SCL K07-TS	**5.5**	**6.3**	**- 150 / + 150**	**- 110 / + 110**	**81.9**	**83.9**	**0.28 (2.8)**	**88.0**
	7.5	**8.7**	**- 225 / + 225**	**- 200 / + 200**	**82.2**	**84.2**	**0.28 (2.8)**	**93.0**
	9.2	**10.6**	**- 275 / + 275**	**- 250 / + 250**	**82.5**	**84.5**	**0.28 (2.8)**	**102.5**
	11.0	**12.7**	**- 300 / + 350**	**- 300 / + 300**	**82.8**	**84.8**	**0.28 (2.8)**	**103.5**
	-	**17.4**	**- / -**	**- 350 / + 450**	**-**	**85.1**	**0.28 (2.8)**	**109.5**
SCL K08-TS	**5.5**	**6.3**	**- 100 / + 100**	**- 60 / + 60**	**78.8**	**80.8**	**0.28 (2.8)**	**91.5**
	7.5	**8.7**	**- 160 / + 160**	**- 120 / + 120**	**78.9**	**80.9**	**0.28 (2.8)**	**96.5**
	9.2	**10.6**	**- 210 / + 210**	**- 170 / + 170**	**80.1**	**82.1**	**0.28 (2.8)**	**106.0**
	11.0	**12.7**	**- 260 / + 260**	**- 220 / + 220**	**81.3**	**83.3**	**0.28 (2.8)**	**107.0**
	15.0	**17.4**	**- 325 / + 380**	**- 325 / + 325**	**82.5**	**84.5**	**0.28 (2.8)**	**113.0**
SCL K09-TS	**9.2**	**10.6**	**- 145 / + 145**	**- 110 / + 110**	**79.0**	**81.0**	**0.28 (2.8)**	**116.0**
	11.0	**12.7**	**- 190 / + 190**	**- 150 / + 150**	**81.0**	**83.0**	**0.28 (2.8)**	**117.0**
	15.0	**17.4**	**- 270 / + 270**	**- 240 / + 240**	**83.0**	**85.0**	**0.28 (2.8)**	**128.0**
	18.5	**21.5**	**- 325 / + 360**	**- 275 / + 275**	**85.0**	**87.0**	**0.28 (2.8)**	**158.0**
SCL K10-TS	**11.0**	**12.7**	**- 160 / + 160**	**- 125 / + 125**	**85.8**	**87.8**	**0.28 (2.8)**	**122.0**
	15.0	**17.4**	**- 225 / + 225**	**- 180 / + 180**	**86.1**	**88.1**	**0.28 (2.8)**	**133.0**
	18.5	**21.5**	**- 275 / + 275**	**- 260 / + 260**	**86.4**	**88.4**	**0.28 (2.8)**	**163.0**
SCL K11-TS	**11.0**	**-**	**- 100 / + 100**	**- / -**	**86.0**	**-**	**0.28 (2.8)**	**135.0**
	15.0	**17.4**	**- 160 / + 160**	**- 105 / + 105**	**86.7**	**88.7**	**0.28 (2.8)**	**146.0**
	18.5	**21.5**	**- 220 / + 220**	**- 165 / + 165**	**87.4**	**89.4**	**0.28 (2.8)**	**176.0**
	22.0	**25.5**	**- 275 / + 275**	**- 220 / + 220**	**88.0**	**90.0**	**0.28 (2.8)**	**186.5**
SCL K12-TS	**18.5**	**-**	**- 150 / + 150**	**-**	**88.0**	**-**	**0.28 (2.8)**	**175.0**
	22.0	**25.5**	**- 200 / + 200**	**- 140 / + 140**	**88.6**	**90.6**	**0.28 (2.8)**	**185.5**

(1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, según la Normativa ISO 3744.

DATI CARATTERISTICI I
PERFORMANCE TABLE GB
CARACTÉRISTIQUES TECHNIQUES F
LEISTUNGDATEN D
DATOS CARACTERISTICOS E

US - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	Hp		**In Hg / In WG**		**Lp / Lw** (1) **dB (A)**		**Ps** max	**M**
	60 Hz *3500 rpm*	*50 Hz* *2900 rpm*	*60 Hz* *3500 rpm*	*50 Hz* *2900 rpm*	*60 Hz* *3500 rpm*	*50 Hz* *2900 rpm*	**In Hg**	**Lbs**
SCL K07- TS	**7 ½**	**7 ½**	**- 2.6 / + 36**	**- 3.5 / + 48**	**84.5**	**82.5**	**82.7**	**197.31**
	10	**10**	**- 4.4 / + 60**	**- 5.2 / + 71**	**84.8**	**82.8**	**82.7**	**206.13**
	15	**15**	**- 8.1 / + 110**	**- 8.9 / + 121**	**85.4**	**83.4**	**82.7**	**223.77**
SCL K08-TS	**7 ½**	**7 ½**	**- 1.3 / + 18**	**- 2.2 / + 30**	**80.9**	**78.9**	**82.7**	**205.47**
	10	**10**	**- 2.7 / + 37**	**- 3.7 / + 50**	**81.2**	**79.2**	**82.7**	**214.29**
	15	**15**	**- 5.5 / + 75**	**- 6.4 / + 87**	**83.3**	**81.3**	**82.7**	**231.92**
SCL K09-TS	**15**	**15**	**- 3.8 / + 52**	**- 4.5 / + 62**	**83.0**	**81.0**	**82.7**	**270.06**
	20	**20**	**- 5.9 / + 80**	**- 6.6 / + 90**	**85.0**	**83.0**	**82.7**	**350.53**
	25	**25**	**- 8.1 / + 110**	**- 8.8 / + 120**	**87.0**	**85.0**	**82.7**	**383.60**
SCL K10-TS	**15**	**15**	**- 3.0 / + 41**	**- 3.6 / + 51**	**89.1**	**87.1**	**82.7**	**274.47**
	20	**20**	**- 4.8 / + 65**	**- 5.5 / + 75**	**89.4**	**87.4**	**82.7**	**354.94**
	25	**25**	**- 5.9 / + 80**	**- 7.0 / + 95**	**89.7**	**87.7**	**82.7**	**388.01**
SCL K11-TS	**25**	**25**	**- 3.7 / + 50**	**- 5.0 / + 69**	**90.7**	**88.7**	**82.7**	**429.02**
	30	**30**	**- 5.1 / + 70**	**- 6.6 / + 90**	**91.3**	**89.3**	**82.7**	**434.53**
SCL K12-TS	**30**	**30**	**- 3.3 / + 45**	**- 5.9 / + 80**	**91.9**	**89.9**	**82.7**	**436.75**

(1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, seg+ún la Normativa ISO 3744.

1 SAFETY STANDARDS

This operating manual:

- Applies to “K” series side channel compressors/suction pumps in an “MOR” single block version.
- Contains instructions for transporting, installation, commissioning, operating, storing, and maintenance of “K” series side channel compressors/suction pumps in an “MOR” format.
- Must be read carefully and understood fully before doing any work using the unit.
- Must be complied with fully.
- Must be to hand at all times at the workstation at which the unit is used.

Failure to comply with the safety standards may result in serious injury to people – even with fatal consequences – as well as damage to materials and the environment.

1.1 NOTES FOR THE USER’S SAFETY

The safety standards referred to in this operating manual are marked by a danger symbol. Next to this symbol there is wording indicating the seriousness of the danger. You are kindly requested to fully comply with the procedures described in order to avoid any danger to people or property!



This **Danger** symbol indicates dangers that may result in **injury to people** with consequences including **death or serious injury** if the necessary precautions are not taken.

The term “**WARNING**” indicates dangers that may result in **damage to property**.

“**USER’S NOTES**” are intended to allow the unit to be used in the best way to achieve best performance, in safety and respecting the environment.

1.2 GENERAL SAFETY WARNINGS

WARNING!

The “K” series of side channel compressors / suction pumps in an “MOR” format are designed and built for use in industrial plants are fitted with three-phase electric motors of an asynchronous bipolar type, in compliance with IEC 34-1.



Any use other than the intended use of the unit may cause serious injury and even death!

- The unit may only be started:
  In conformity with the use, transport, and handling purposes indicated in “INTENDED USE”.
  According to the values indicated in the “CHARACTERISTIC DATA” table on page 3/4.
- All transportation, assembly, installation, starting up, and maintenance operations are only to be carried out by qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.



When the unit us working there is a danger of injury due to shearing, crushing, entanglement, and burns!

Transportation, assembly, installation, starting up, and maintenance operations are to be carried out wearing adequate **personal protective clothing** (protective gloves and safety glasses, safety shoes, and a hardhat).

Do not wear loose-fitting garments, long laces, or other items that may get entangled in the machine.

Long hair must be gathered up.



Electrical danger!

Inappropriate behaviour may result in serious injury and even death!

Work on electrical equipment (installation and maintenance) is only to be done by qualified, authorised electricians!

Before starting to work on the unit or plant, the following precautions must be taken:

Switch off the mains power supply.

Adopt measures to prevent it being switched on again.

Only open the terminal board box after checking that the power is off altogether!



Danger due to rotating components (cooling fan for the electric motor, impeller, and shaft): Cutting or shearing of limbs, entanglement or trapping of hair or clothing.

Danger due to excess pressure and vacuum: Sudden ejection of process fluids (injury to the skin and eyes), and sudden sucking in of hair and clothing!

Danger due to process fluids that come out and cause burns!

- The unit may only be started and operated under the following conditions:

  The unit must be fully assembled and whole (not damaged).

  Piping must be connected to the silencers using fixings, connections, pipes, pipe fittings, and tanks that are watertight and sufficiently strong to withstand the pressures that develop.

  Connections to the suction and delivery silencers must not be closed, clogged, or dirty.

  Regularly check that the seatings for fixings, connections, piping, pipe fittings, and tanks are firmly secured!
- Before starting maintenance work on the unit, the following safety precautions must be taken:

  Put the unit out of order and ensure that it cannot be switched on again.

  Put a sign on the plant’s controls and on the control units that reads: “DANGER! Maintenance work on the compressor / suction pump in progress! Do not switch on!”

  Wait until the unit has stopped completely, that is, until the impeller has stopped rotating.

  Allow the unit to cool down!

  Make sure that there is no pressure or vacuum in the unit or in the piping to be disconnected.

  Make sure that no fluid can flow out of the unit and/or plant!



Danger due to rotating impeller: Cutting or shearing of limbs!

The impeller can be accessed while it is rotating by opening the suction and delivery silencers!

Never put your hands or any item into these openings.

Fit the suction and/or delivery silencers with additional silencers or additional pipes sufficiently long to prevent access to the impeller.

Danger due to burns caused by contact with hot surfaces on the unit!

When operating in compliance with the values indicated in the “CHARACTERISTIC DATA” table on page 3/4 the compressors / suction pumps can reach high surface temperatures of up to 160°C (+320°F).

Fit the unit with adequate protection against the risks of involuntary contact with hot surfaces.

Do not touch the unit’s surfaces on purpose when it is running!

Before doing any work after having switched off the unit, allow it to cool!

Danger resulting from the impeller seizing due to the performance values being exceeded: Vacuum and/or pressure exceeding the declared values!

Do not allow the unit to operate with the suction and/or delivery openings obscured for any reason.

Install a safety valve that can prevent excessive vacuum and/or pressure, and that makes it possible to comply with the values indicated among the “CHARACTERISTIC DATA” given on page 3/4 of this manual.

In order to limit the formation of layers of dust on the surfaces, which may compromise natural exchanging of heat between the unit and the environment, regularly clean and remove all dust using suitable equipment.

Suction and/or delivery piping must not be dirty or clogged!

If any anomalous noises are heard, which may be a warning that the impeller is about to seize, switch off the unit and move away from it immediately.

Danger due to the impeller seizing due to use in an unsuitable place and/or due to conveying fluids that are not suitable: Unsuitable ambient and suction temperatures!

Check that the ambient and suction temperatures for the gas conveyed are between: -15°C (+5°F) and +40°C (+104 °F).

Check that good ventilation is provided for the unit.

Use a filter on the suction side with a maximum filtration of 25 µm, which will make it possible to limit the entry of any solids into the unit, thereby avoiding possible breakage of the impeller blades, making the fragments projected out of the delivery opening dangerous!

During installation and when the unit is running, check for load losses due to the use of this filter: The maximum load loss allowed is 30 mbar. This value must be subtracted from the maximum admissible pressure indicated in the “CHARACTERISTIC DATA” table on page 3/4 of this manual.

If any anomalous noises are heard, which may be a warning that the impeller is about to seize, switch off the unit and move away from it immediately.

1.3 RESIDUAL RISKS

Danger due to rotating components: Cooling fan for the electric motor!

There is an immediate danger of hair and clothing becoming entangled in the cooling fan in the electric motor’s cowling via the cowling itself!

Protective steps to be taken:

Do not wear loose-fitting garments, long laces, or other items that may get entangled in the machine.

Long hair must be gathered up.

Danger due to hot surfaces – up to 160°C (+320°F)!

Under operating conditions there is a possibility of burns due to contact with the unit’s surfaces.

Protective steps to be taken:

Fit the unit with adequate protection against the risks of involuntary contact with hot surfaces.

Do not touch the unit’s surfaces on purpose when it is running!

Before starting with any work, wait for the unit to cool down after switching it off!

Danger due to noise emitted by the unit!

When the compressors / suction pumps are running they emit noise that may exceed 80 dB(A)!

Protective steps to be taken:

Mark the area around the unit using warning signs.

Wear personal protective equipment for hearing.

If necessary, fit additional silencers on the suction and/or delivery silencers.

From time to time use noise tests to check the efficiency of the soundproofing panels in the suction and delivery silencers. The reference values are indicated in the “CHARACTERISTIC DATA” table on page 3/4 of this manual.

2 INTENDED USE

The “K” series of side channel compressors / suction pumps in an “MOR” format are made to generate vacuums and pressures, and for conveying air and gas that is not explosive, not inflammable, not poisonous, and not aggressive, for continuous operation in a non-explosive environment.

The “K” series of side channel compressors / suction pumps in an “MOR” format are designed and built for use in industrial plants are fitted with three-phase electric motors of an asynchronous bipolar type, in compliance with IEC 34-1.

2.1 REASONABLY FORESEEABLE INCORRECT USE

Any use other than the intended use of the unit may cause serious injury and even death!

Failure to comply with the prohibitions / obligations indicated may result in technical faults, damage to the plant, or injury!

Danger of very serious injury!

THE FOLLOWING ARE STRICTLY FORBIDDEN:

- Using the unit in non-industrial installations, unless all the necessary precautions or protective measures have been taken (e.g. protection against contact to safeguard children).
- Using the unit in places in which there are explosive dust and/or gas or where these may form.
- Sucking up and conveying explosive, inflammable, aggressive, corrosive, and/or harmful fluids.
- Using the unit under conditions that differ from those indicated in the “CHARACTERISTIC DATA” table on page 3/4.
- Using the unit without having installed a suction filter.
- Operating with the suction and/or delivery openings closed.

- Making modifications to the unit or transforming it, or making repairs or doing maintenance based on your own initiative. Maintenance works are only to be carried out as described in this operating manual by qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.
- Starting the unit up again after a fault, unless it has been repaired by qualified personnel.

THE FOLLOWING ARE OBLIGATORY:

- Doing maintenance work as indicated in chapter 6.
- Carrying out preliminary and periodic checks as indicated in the "STARTING UP" chapter.

3 STORAGE AND TRANSPORT



Danger due to loads that fall over or fall down!

Heavy loads that fall over or down may cause crushing, resulting in injuries to people and even death!

Do not put loads on top of the packing.



Danger due to lifting heavy loads!

Heavy loads that fall over or down may cause crushing, resulting in injuries to people and even death!

Before undertaking handling operations (lifting, moving, transporting, and putting down) look at the unit's mass (M) shown in the "CHARACTERISTIC DATA" table on page 3/4 and determine the best way to work in maximum safety.

In this regard all the prevention measures must be applied, including any local and/or specific regulations that make it possible to carry out the handling operations:

Using qualified personnel that have specific skills and adequate training.

With the help of suitable equipment.

Organising the work in such a way that it poses the least risk possible and is done under safe, healthy, conditions.

Using safe, stable support surfaces.

Use of suitable working clothes and adequate personal protective equipment (protective gloves and safety glasses, safety shoes and a hardhat).

Working in an area with sufficient space, even floors, no obstructions.

Avoiding impacts, jolting, and shaking.

Units with a mass that exceeds 25 kg (55 lbs) are fitted with lugs to be used for handling.

WARNING!

Lifting the unit is any way other than that indicated is strictly forbidden. Use the lug provided on the blower unit or motor.

Store in a dry place, keeping the packing if possible. Do not remove the covers over the openings.

4 INSTALLATION

4.1 SCL K COMPRESSOR – SUCTION PUMP



Any use other than the intended use of the unit may cause serious injury and even death!

- This operating manual:

  MUST be read carefully and understood fully before doing any work using the unit.

  MUST be complied with fully.

  MUST be to hand at all times at the workstation at which the unit is used.

- Remember that installation operations are only to be carried out by qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.



Danger due to a lack of a clear view of the place in which the unit is installed!

Make sure that the unit installed is always under control when doing anything in the installation area.

The controls must be positioned in such a way as to be able to see the unit installed.

Danger of very serious injury!

WARNING!

If the flow rate has to be reduced, use a draw-off valve rather than throttling back the suction or delivery lines.

4.1.1 WORKING CONDITIONS

The "K" series of side channel compressors / suction pumps in an "MOR" format are made to generate vacuums and pressures, and for conveying air and gas that is not explosive, not inflammable, not poisonous, and not aggressive, for continuous operation in a non-explosive environment.

If installed outdoors, protect the unit against exposure to sunlight.

The maximum pressure differentials allowed are indicated in the "CHARACTERISTIC DATA" table on page 3 of this manual and must never be exceeded. Only the following conditions are valid:

As a compressor:
Gas intake temperature 20°C (+68°F) and atmospheric pressure 1013 mbar (abs) (29,92 in Hg) measured at the suction opening.

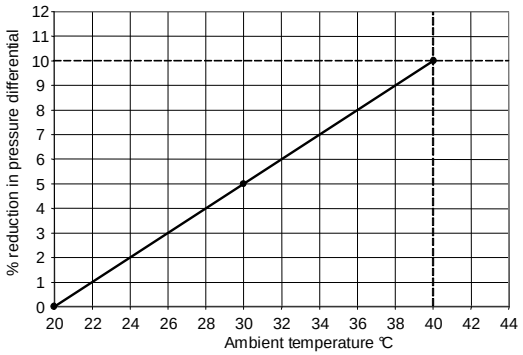
As a suction pump:
Gas intake temperature 20°C (+68°F) measured at the suction opening and atmospheric back pressure 1013 mbar (abs) (29,92 in Hg).

The ambient temperature and the intake temperature of the gas conveyed is allowed within the -15°C (+5°F) to + 40 °C (+104°F) range, with the following provisions:

- If the ambient temperature is +30°C (+86°F) **reduce** the maximum pressure differentials indicated in the "CHARACTERISTIC DATA" table on page 3/4 by 5%.

- If the ambient temperature is +40°C (+104°F) **reduce** the maximum pressure differentials indicated in the "CHARACTERISTIC DATA" table on page 3/4 by 10%.

The graph to be used to reduce the maximum pressure differentials when the ambient temperature is between +21°C (+70°F) and +40°C (+104°F) is given below.



4.1.2 INSTALLATION CONDITIONS

It is important that this unit be installed at an altitude not exceeding 1000 m above sea level. For installations at higher altitudes, contact FPZ for assistance.

The support surfaces for the unit must be flat, strong, stable, and as level as possible.

It is important that the unit be installed on a structure that does not transmit significant vibrations to the same.

Under all conditions, do not install units on structures that can transmit or amplify noise (tanks, steel plating, etc.).

The unit must always be installed using anti-vibration supports.

Danger due to vibrations!

Regularly check that the points at which the unit is fixed to the support structure are tight.

Excess vibration of the unit can cause damage to balance, resulting in injury to people and even death!

The unit must be installed in such a way that the motor's ventilation is not impeded by obstacles put in the immediate vicinity.
To this end a minimum gap must be kept between the motor's fan guard and any other structure of at least 50 mm.

WARNING!

To guarantee that the unit is well ventilated after installation, proceed as follows:
The air intake on the motor's fan guard must be kept free.

Air affected by other systems must NOT be sucked in again!

If the unit is installed in a closed space, guarantee a good flow of cooling air by using an extractor / fan and correct air intake for cooling the motor.

Any use other than the intended use of the unit may cause serious injury and even death!

To avoid overloading due to pressure fluctuations, fit a safety valve on the suction pipe if used as a suction pump and on the delivery pipe if used as a compressor.

Danger due to foreign bodies and dirt getting into the unit!

Any foreign bodies, even very small in size, getting into the unit causes serious damage and probable breakage of the impeller, and a danger that broken bits may be projected outwards!

Foreign bodies include: Dust, sand, lime scale, impurities in the pipes, cutting or threading burrs, welding drops or slag, metal burrs or residue of sealing products used when connecting up the pipework.

Protect the suction pipe using a suitable filter with a maximum degree if filtration of 25µm and a maximum load loss of ΔP=20mbar.

Replace filters regularly!

WARNING!

Size piping and choose accessories that cause the minimum load losses, and so:

Do not fit pipes of a diameter smaller than that of the machine's openings.

When installing a number of machines in parallel, size the manifold and main line accordingly.

Do not use elbows, but large radius bends.

Do not fit valves with a passage smaller than the nominal size and non-return valves with a spring-loaded shutter (the non-return valve that causes the smallest load loss is one with a lightened shutter).

When using for oxygenation, choose diffusers with a low passage resistance (low load loss) and do not forget that the spark plugs and porous sieves increase load losses over time due to gradual clogging.

WARNING!

Avoid the possibility of water stagnating, especially when installing the unit with its axis vertical.

See the INSTALLATION DIAGRAMS in chapter 8.

4.1.3 HORIZONTAL INSTALLATION

The unit is ready for installation in a horizontal position, suitably fixed to the foot/feet.

The foot has fixing holes. Use all the holes and suitable bolt types.

See point 4.1.2 for the INSTALLATION CONDITIONS.

Remove the covers over the openings before checking the direction of rotation and before final connection.

WARNING!

Check the direction of rotation in the motor.

(See point 4.2.3 ROTATION DIRECTION)

When connecting the unit cabin to the ducting, do so using the flanges on the silencer housings and form suitable connections using flexible hoses. Avoid rigid connections that may impose loads and give rise to harmful vibrations.

Fit the flanges on the silencer housings complete with gaskets again, and tighten.

4.1.4 INSTRUCTIONS FOR REPOSITIONING THE SILENCER HOUSINGS

Danger due to rotating components: Impeller!

There may be a danger of shearing due to the impeller rotating even when the machine is switched off, if it is started manually.

Suitable working clothes and personal protective equipment must therefore be used.

The SCL K-TS series is designed to provide maximum flexibility in positioning the silencer housings, to allow for various installation configurations.

The blower comes with the silencers positioned as shown in fig.1.

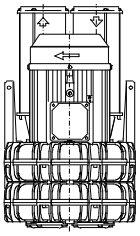


fig. 1

If this layout has to be modified, proceed to identify the layout of the silencer housings required.
The possible solutions are shown in fig 2, fig 3, and fig 4 below.

fig 2

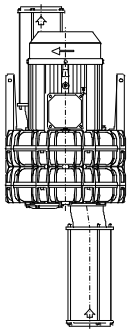
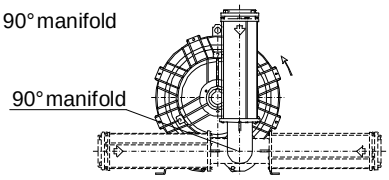


fig 2 with 90° manifold



---

fig 3

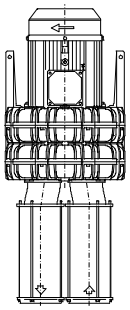


fig 3 with 90° manifolds

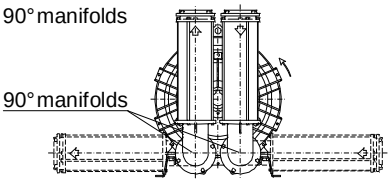


fig 4

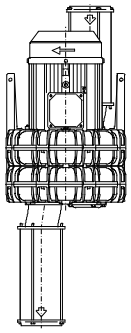
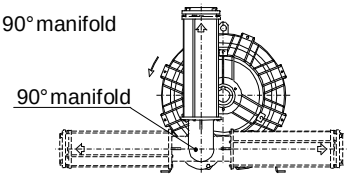


fig 4 with 90° manifold



Position the unit in a horizontal position with the feet on a flat, stable surface.

4.1.4.1 INSTRUCTIONS FOR SCL K07-TS / K08-TS

Disassembling the silencer housing: (see figure below)

- Remove the (904) screws, taking away the (706) manifold and the (424) gasket.

Fitting the blank (730) flange: (see figure below)

- Remove the (909) screws and the (730) flange with the (427) O-Ring.

Reassemble by proceeding in reverse order-do not forget the (424) and (427) gaskets.

4.1.4.2 INSTRUCTIONS FOR SCL K09-TS / K10-TS / K11-TS

Disassembling the silencer housing: (see figure below)

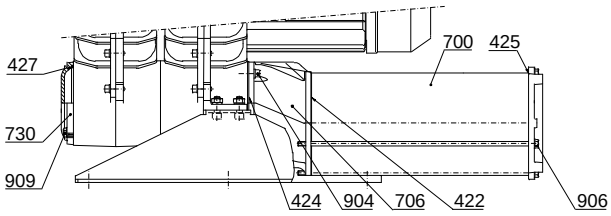
- Remove the (906) bolts
- Take away the silencer housing from the unit, along with (422) gasket
- Remove the (904) screws, taking away the (706) manifold and the (424) gasket

Fitting the blank (730) flange: (see figure below)

- Remove the (909) screws and the (730) flange with the (427) O-Ring.

Reassemble by proceeding in reverse order-do not forget the (422), (424) and (427) gaskets

If needed, reconstruct (425) seal using Loctite 5970 or similar, after cleaning the sealing surfaces of any existing sealant.



4.1.4.3 USING THE (accessory) CK TYPE 90° MANIFOLD KIT

The CK type 90° manifold kit comprises:

N°1 manifold
N°1 (422) gasket and
N°4 M8x25 UNI 5739 screws

To assemble the 90° manifold proceed as follows:

- Remove the silencer housing as described before.
- Put the gasket between the manifold (706) and the 90° manifold, and tighten the M8x25 UNI 5739 bolts.
- Assemble the silencer housing, following the instructions in reverse order and not forgetting (424) and (427) gasket.

4.1.5 VERTICAL INSTALLATION ON THE COVER

For installing in a vertical position, fit the anti-vibration supports supplied with the unit on the cover, and then fix the whole structure to the support.

See point 4.1.2 for the INSTALLATION CONDITIONS.



Any use other than the intended use of the unit may cause serious injury and even death!

When installing vertically DO NOT use the foot supplied with the unit as this is only suitable for horizontal installations.

Remove the covers over the openings before checking the direction of rotation and before final connection.

NOTE FOR THE USER

A foot for fitting the unit in a vertical position on the cover is available as an accessory.

The foot has fixing holes. Use all the holes and suitable bolt types.

WARNING!

Check the direction of rotation in the motor.

(See point 4.2.1 ROTATION DIRECTION)

When connecting the unit cabin to the ducting, do so using the flanges on the silencer housings and form suitable connections using flexible hoses. Avoid rigid connections that may impose loads and give rise to harmful vibrations.

Fit the flanges on the silencer housings complete with gaskets again, and tighten.

4.2 ELECTRIC MOTOR



Electrical danger!

- Inappropriate behaviour may result in serious injury and even death!
- Work on electrical equipment (installation and maintenance) is only to be done by qualified, authorised electricians!
- Before starting to work on the unit or plant, the following precautions must be taken:

  Make sure that the line is NOT switched on.

  Adopt measures to prevent it being switched on again.

  Only open the terminal board box after checking that the power is off altogether!
- The terminal board box must not contain:

  Foreign bodies

  Impurities

  Moisture.

Close the cover on the terminal board box and seal the openings in the cable glands in order to prevent dust, water, and moisture to penetrate.

Check the seals periodically.

- Should you touch a defective unit there may be a danger of electric shock!

  Fit a motor trip-switch.

  Have the unit's electrical system checked by an electrician on a regular basis.

The electric motor is sized to work at an ambient temperature between -15°C (+5°F) and +40°C (+104°F), and a maximum altitude of 1000 m above sea level.

Under other conditions the motor cannot be used at full load and so difficulties may arise for starting.

WARNING!

A maximum of n° 6 evenly distributed starts per hour, is allowed.

Failure to comply with this may seriously damage the unit.

4.2.1 CONNECTION

WARNING!

Connecting the motor incorrectly may seriously damage the unit.

The power supply for the motor and any auxiliary equipment must be provided using cables of suitable section to avoid abnormal overheating and great voltage drops.

Check that the details on the nameplate are compatible with the line voltage and frequency.

A voltage tolerance of ±10% compared to the nominal value is admissible.

Connect the motor's earth cable to the relevant terminal marked with this symbol ⏚ always before connecting to the mains supply and check the dispersion capacity.

The earth cable can be recognised by its colour (yellow/green).

This connection to the main supply must be formed as shown in the wiring diagram contained in the terminal board box.

Use the cable gland openings to allow power supply cables to pass into the terminal board box.

Proceed to tighten the power supply cables, taking the section of the electrical cables into account each time.

The terminal boards for the electrical connections must be tightened properly to avoid high contact resistances and resulting overheating.

Check that the insulation gaps between the various conductors are kept in the air and between surfaces, as indicated in the standards.

All the screws used to close the terminal board must be tightened properly. Damaged screws must be replaced immediately, using screws of the same or better quality.

The connection must guarantee:

- Long-lasting safety.
- That no wire ends are sticking out.

Fuses do not constitute protection for the motor, but merely protect against short-circuits.

Size the fuses according to the peak currents, especially when using direct starting.

Protection with a (thermal or amperometric) trip switches is essential to deal with risks of overloading, a loss of one phase in the mains supply, excessive voltage fluctuations, or the rotor getting stuck.

Set the motor trip switch using the current value shown on the nameplate as a maximum.

4.2.2 INVERTER POWERED ELECTRIC MOTOR

WARNING!

A maximum of n° 6 evenly distributed starts per hour, is allowed.

Failure to comply with this may seriously damage the unit.

WARNING!

The unit's nominal pressure or vacuum characteristics for service at mains frequency cannot be maintained if the unit is powered via an inverter.

If an inverter is used for the power supply the installer is responsible for the checks and any steps necessary to comply with the immunity and emission limits laid down by the standards.

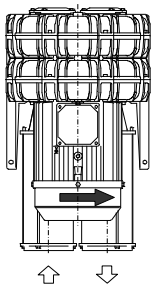
When using the unit with a motor powered via an inverter, follow the wiring instructions supplied by the inverter manufacturer carefully.

WARNING!

The performance of the unit powered via an inverter is shown in the relevant tables that can be requested from FPZ's assistance service.

4.2.3 ROTATION DIRECTION

The SCL K compressors – suction pumps must be used with the rotation direction shown by the arrow on the fan guard for the electric motor (see figure below).



To check the direction of rotation, switch on the motor very briefly. If the rotation direction is incorrect, switch the position of two of the three power supply conductors on the terminals.

5 STARTING UP

Any use other than the intended use of the unit may cause serious injury and even death!

The unit may only be started:

After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" and "INSTALLATION").

In conformity with the purposes laid down under "INTENDED USE".

According to the values indicated in the "CHARACTERISTIC DATA" table on page 3/4.

Danger due to rotating components (electric motor fan, impeller, and shaft): Cutting or shearing of limbs, entanglement or trapping of hair or clothing!

Danger due to excess pressure or vacuum: Sudden ejection of process fluids (injury to the skin and eyes), and sudden sucking in of hair and clothing!

Danger due to process fluids that come out and cause burns!

Danger due to burns caused by contact with hot surfaces on the unit!

Electrical danger!

Danger due to the impeller seizing due to use in an unsuitable place and/or due to conveying fluids that are not suitable: Unsuitable ambient and suction temperatures!

Danger resulting from the impeller seizing due to the performance values being exceeded: Vacuum and/or pressure exceeding the declared values and/or openings closed!

Danger due to noise emitted by the unit!

- CHECK THAT ALL THE SAFETY GUARDS HAVE BEEN FITTED CORRECTLY.

WARNING!

A maximum of n° 6 evenly distributed starts per hour, is allowed.

Failure to comply with this may seriously damage the unit.

5.1 PRELIMINARY CHECKS

Before finally starting up, carry out the following preliminary checks:

- If a lot of time has passed since the unit was last started up, check its condition and check for and if necessary remove dust deposited on the external surfaces.
- Deactivate/open any closing elements on the piping (closing valves, solenoid valves, etc.) before starting the unit.

  Do not allow the unit to be started and operate with the suction and/or delivery openings obscured for any reason!
- Check that the ambient and suction temperatures for the gas conveyed are between: -15°C (+5°F) and +40°C (+104°F).
- Check the rotation direction as indicated previously in the "INSTALLATION" chapter.
- Check that the setting for the motor trip switch corresponds to the motor's nominal current shown on the nameplate.
- Check that the safety valve is working correctly.

5.2 OPERATION

Having carried out all the preliminary checks, you can start with final starting of the unit.

Start the unit by switching on the power supply to the electric motor.

Check the operating pressure or vacuum and compare them to the values indicated in the "CHARACTERISTIC DATA" table on page 3/4. Load losses on the pipes are often underestimated but are determining factors for the operating pressure differential.

Measure the motor's absorption and check against the nameplate value.

Any use other than the intended use of the unit may cause serious injury and even death!

The unit may only be used:

- After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" and "INSTALLATION").
- In conformity with the purposes laid down under "INTENDED USE".
- According to the values indicated in the "CHARACTERISTIC DATA" table on page 3/4.

5.2.1 ROUTINE CHECKS

It is important that the units be checked routinely while running by qualified personnel, using inspections to avoid faults that may cause damage directly or indirectly.

When the unit is running, routinely carry out the following checks:

- Delivery temperature
- Operating pressure and/or vacuum
- Electric motor current absorption
- Vibrations
- State of the filter and related load loss.

Variations in normal working conditions (increases in power absorbed, anomalous noise, vibrations, excess overheating of the service fluid) indicate that the unit is not working correctly.

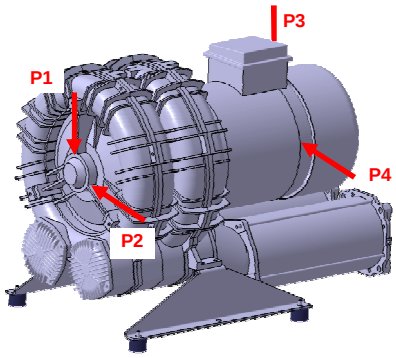
Also compare the values measured with those indicated in the "CHARACTERISTIC DATA" table on page 3/4.

See chapter 9 "TROUBLESHOOTING" for preventing possible breakage or faults.

Measuring vibrations

Measurements to determine vibration speed [mm/s] must be carried out using an electronic vibration meter at the points indicated below (see the figure below).

- **Points P1** and **P2 (front bearing):** The vibration meter must be put on the cover near the bearing seating, and the highest value must be recorded.
- **Points P3** and **P4 (back bearing):** The vibration meter must be put on the electric motor casing near the bearing seating (not on the fan guard), and the highest value must be recorded.



The results must be evaluated by comparing the maximum speed value measured with the limits laid down for the zones (A, B) shown in the table below, in compliance with ISO 14694.

Effective vibration speed value [mm/s]	***Class I*** (≤ 15kW)
1.8	***A***
4.5	***B***

Effective vibration speed value [mm/s]	***Class II*** (> 15kW)
2.8	***A***
7.1	***B***

Legend:

Machine classification:

Class I = SCL with electric motor power ≤ 15 kW
Class II = SCL with electric motor power > 15 kW

Evaluation zones:

Zone A = SCL with vibrations within this zone are considered acceptable for long-term service.

Zone B = SCL with vibrations within this zone are considered unsuitable for continuous long-term service. Under these conditions the machine can be operated for a limited period, until the opportunity arises for suitable corrective work to be done.

Danger resulting from the impeller seizing due to excessive vibrations!

Vibration values exceeding zone B (table of effective vibration speed values) are considered NOT admissible and may cause damage to the machine and resulting serious injury and even death!

- If any anomalous noises and/or vibrations are detected, these may be a warning that the impeller is about to seize, switch off the unit and move away from it immediately.

When the unit is stopped, routinely carry out the following checks:

- Dust deposits: Check and , if necessary, use suitable equipment to remove deposits on the external surfaces of the unit that may impede correct heat exchanging.
- Suction filter: Every 8-10 days check and if necessary clean or replace the filter cartridge. In very dusty environments, change the filter more frequently. A dirty cartridge creates extensive resistance at the suction, resulting in an increase in: the pressure differential, the power absorbed, and the operating temperature. The load loss must not exceed 30 mbar.

Electrical danger!

- Before doing anything else, make sure that the power supply is NOT switched on.

Danger due to burns caused by contact with hot surfaces on the unit!

When operating the compressors / suction pumps can reach high surface temperatures of up to 160°C (+320°F).

- Before starting with any work, wait for the unit to cool down after switching it off!

6 MAINTENANCE

Any use other than the intended use of the unit may cause serious injury and even death!

Maintenance may only be carried out on the unit:

If the maintenance instructions, parts list, and section/exploded view of the relevant unit are available.

After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" "STORAGE AND TRANSPORT" and "INSTALLATION").

In conformity with the purposes laid down under "INTENDED USE".

By qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.

Danger due to burns caused by contact with hot surfaces on the unit!

When operating the compressors / suction pumps can reach high surface temperatures of up to 160°C (+320°F).

- Before starting with any work, wait for the unit to cool down after switching it off!

Electrical danger!

- Before doing anything else, make sure that the power supply is NOT switched on.

Any use other than the intended use of the unit may cause serious injury and even death!

The user is not authorised to make repairs or do maintenance work that involves restoring seized surfaces.

In these cases contact FPZ's assistance service or an authorised dealer.

After seizing the components involved may undergo deformation that makes the components unsuitable for being used again. Seized components must be analysed by FPZ before being reused or replaced.

- **Using unsuitable components may cause the impeller blades to break, giving rise to dangerous ejected fragments.**

Danger due to rotating components: Impeller!

There may be a danger of shearing due to the impeller rotating even when the machine is switched off, if it is started manually.

- **Suitable working clothes and personal protective equipment must therefore be used.**

6.1 INTERNAL CLEANING

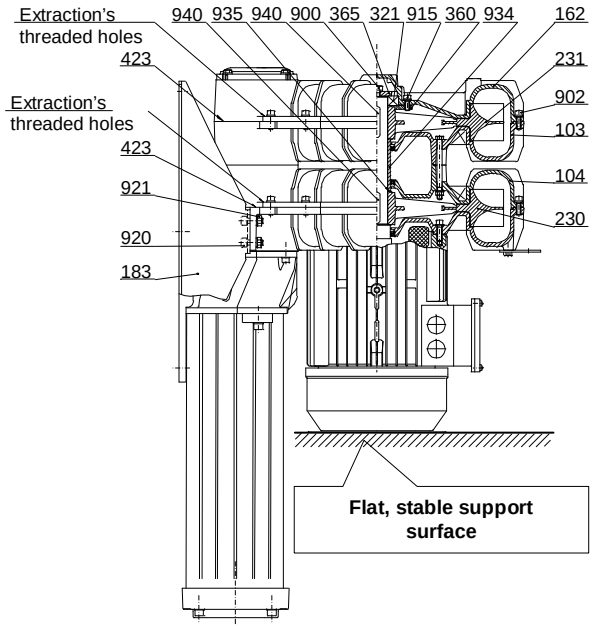
Should it be necessary to clean the inside of the unit, proceed as follows:

6.1.1 INSTRUCTIONS FOR K07-TS / K08-TS

1. Position the unit in a vertical position with the fan guard cowling on a flat, stable surface.
2. Remove the (183) mounting feet by removing (920) screws and (921) nuts.
3. Remove (915) and (902) screws in order from the (162) cover.
4. Remove the (162) cover by using the two threaded holes placed on cover itself.
5. Remove the (900) screw and (365) washer.
6. Remove the (321) bearing and (360) bearing cover working through the extractor.
7. Remove the (231) impeller through the extractor if necessary and (940) key.
8. Remove (902) screws from the (104) intermediate cover.
9. Remove components (103) and (104) and place them together, by using the two threaded holes placed on (104) intermediate cover.
10. Remove the (934) spacer.
11. Remove the (935) shims-be careful not to misplace.
12. Remove the (230) impeller through the extractor if necessary and (940) key.

Clean and reassemble following the instructions in reverse order, and forming the (423) seal using Loctite 5970 or a similar product after having carefully cleaned the surfaces previously sealed.

It's important not to reverse the position of the (230) and (231) impellers.

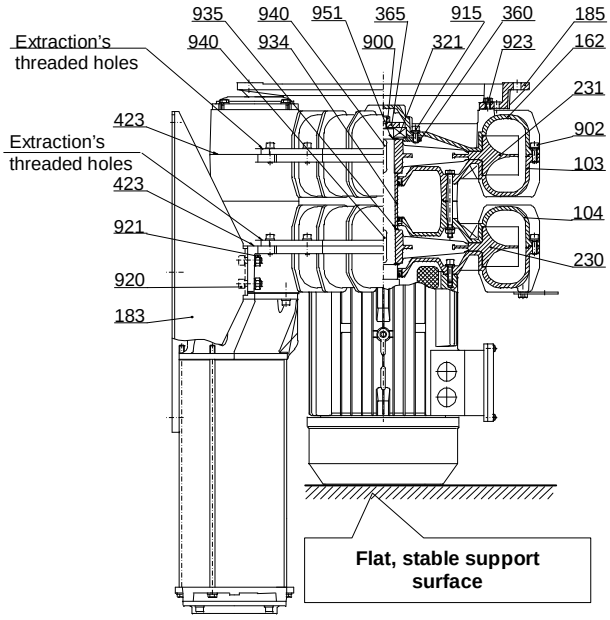


6.1.2 INSTRUCTIONS FOR K09-TS / K10-TS / K11-TS

1. Position the unit in a vertical position with the fan guard cowling on a flat, stable surface.
2. If present, remove the (185) mounting feet by removing (923) screws.
3. Remove the (183) mounting feet by removing (920) screws and (921) nuts.
4. Remove (915) and (902) screws in order from the (162) cover.
5. Remove the (162) cover by using the two threaded holes placed on cover itself.
6. Remove the (900) screw and (365) washer.
7. Remove the (321) bearing and (360) bearing cover working through the extractor.
8. Remove the (951) spacer ring.
9. Remove the (231) impeller through the extractor if necessary and (940) key.
10. Remove (902) screws from the (104) intermediate cover.
11. Remove components (103) and (104) and place them together, by using the two threaded holes placed on (104) intermediate cover.
12. Remove the (934) spacer.
13. Remove the (935) shims-be careful not to misplace.
14. Remove the (230) impeller through the extractor if necessary and (940) key.

Clean and reassemble following the instructions in reverse order, and forming the (423) seal using Loctite 5970 or a similar product after having carefully cleaned the surfaces previously sealed.

It's important not to reverse the position of the (230) and (231) impellers.

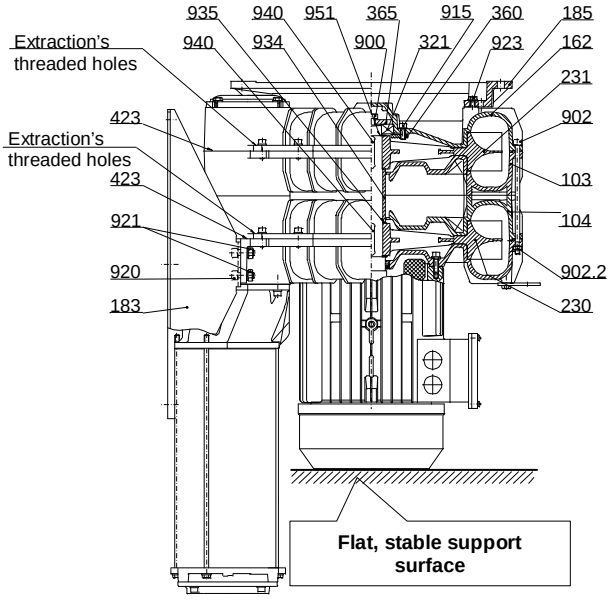


6.1.3 INSTRUCTIONS FOR K12-TS

1. Position the unit in a vertical position with the fan guard cowling on a flat, stable surface.
2. If present, remove the (185) mounting feet by removing (923) screws.
3. Remove the (183) mounting feet by removing (920) screws and (921) nuts.
4. Remove the (915) screws.
5. Remove the (902.2) nuts.
6. Remove (902) screws from the (162) cover.
7. Remove the (162) cover by using the two threaded holes placed on cover itself.
8. Remove the (900) screw and (365) washer.
9. Remove the (321) bearing and (360) bearing cover working through the extractor.
10. Remove the (951) spacer ring.
11. Remove the (231) impeller through the extractor if necessary and (940) key.
12. Remove components (103) and (104) and place them together, by using the two threaded holes placed on (104) intermediate cover.
13. Remove the (934) spacer.
14. Remove the (935) shims-be careful not to misplace.
15. Remove the (230) impeller through the extractor if necessary and (940) key.

Clean and reassemble following the instructions in reverse order, and forming the (423) seal using Loctite 5970 or a similar product after having carefully cleaned the surfaces previously sealed.

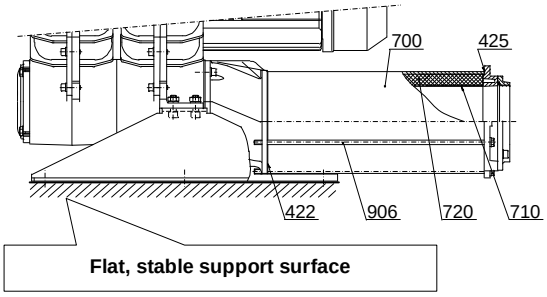
It's important not to reverse the position of the (230) and (231) impellers



6.2 REPLACEMENT SOUND-ABSORBING PANELS

If needed, replace the foam sound-absorbing panels, proceed as follows

1. Position the unit in a horizontal position with its foot on a flat, stable surface.
2. Remove the bolts (906).
3. Remove the silencers (700) from the unit, being careful not to lose the gaskets (422).
4. Remove the soundproofing (720) from the silencer housings.
5. Retrieve the support mesh (710).
6. Replace and reassemble-proceeding in reverse order, remembering to include the (422) gaskets.



6.3 LIFESPAN OF BEARINGS

Under normal operating conditions (values shown in CHARACTERISTIC DATA – page 3/4) the machine's bearings have to be replaced after a maximum of 25,000 working hours or not more than 4 years.

Any use other than the intended use of the unit may cause serious injury and even death!

The bearings may only be replaced:

If the instructions, parts list, and section/exploded view of the relevant unit are available.

After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" "STORAGE AND TRANSPORT" and "INSTALLATION").

In conformity with the purposes laid down under "INTENDED USE".

By qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.

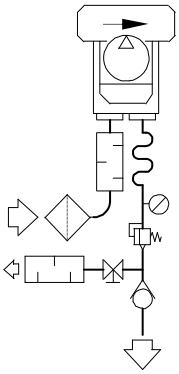
7 COMMERCIAL CONDITIONS

All undertakings, agreements, or legal relations are governed by the relevant sales contract. These are in no way limited by the contents of this manual.

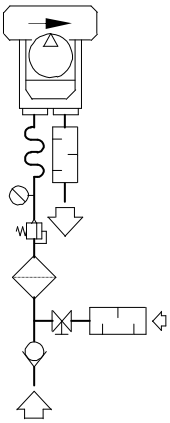
The quality of the materials and workmanship is guaranteed, as indicated in the general sales conditions. Guarantees are regulated by the general conditions of sale

8. INSTALLATION DIAGRAMS

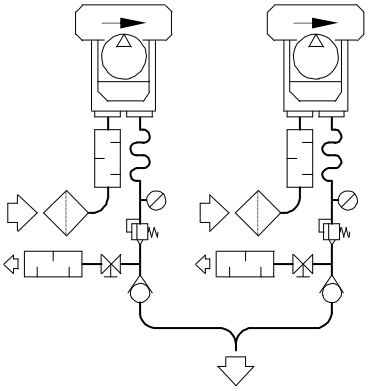
8.1 PRESSURE SERVICE



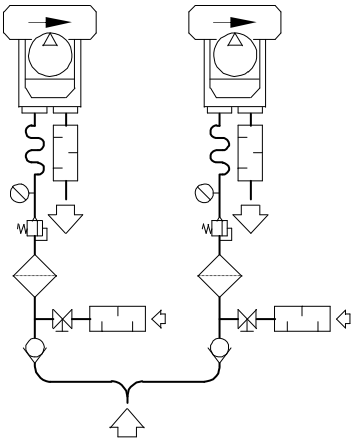
8.3 VACUUM SERVICE



8.2 PARALLEL PRESSURE SERVICE



8.4 PARALLEL VACUUM SERVICE



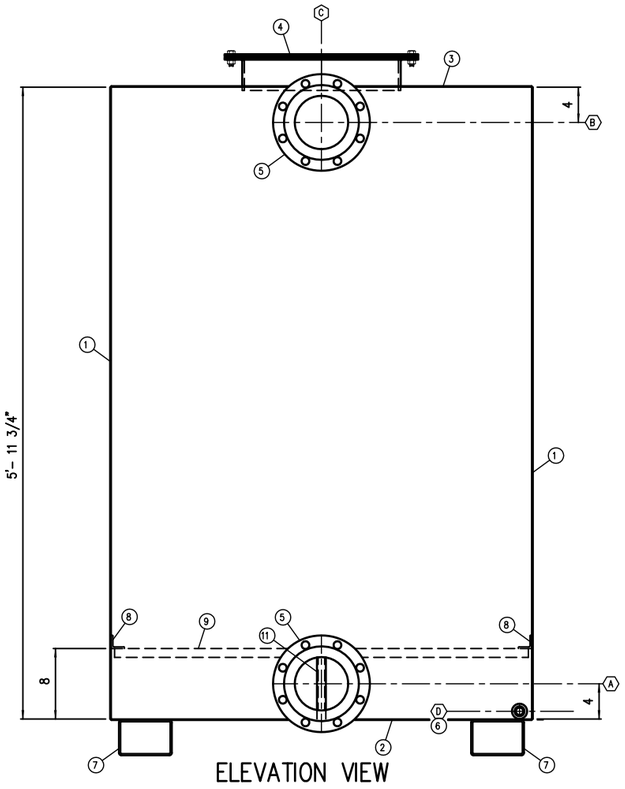
8.5 LIST ACCESSORIES

Item		Denomination	Item		Denomination
1		Filter – Inline filter	5		Safety valve
(2)		Silencer	6		Non return valve
3		Flexible coupling	7		Valve
4		Pressure – Vacuum gauge	(x) IF NECESSARY		

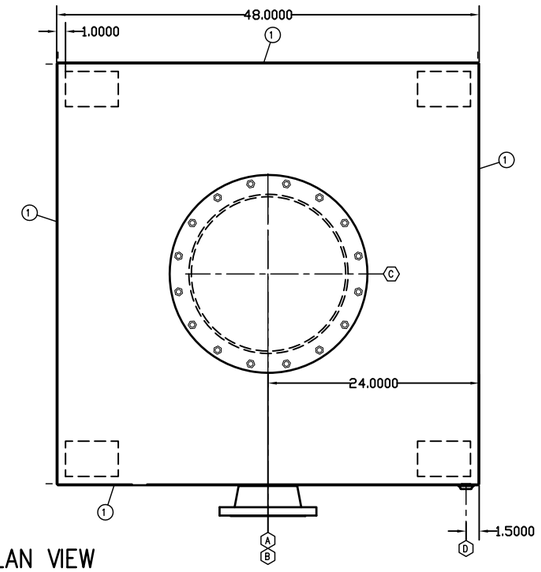
9 TROUBLESHOOTING

Problem	Cause	Solution
The unit does not start	Electrical wiring incorrect	Get the operator to check the electrical connection against the wiring diagram contained in the terminal board box.
	Power supply voltage unsuitable	Check that the power supply voltage, measured at the motor's terminals, is within +/- 10% of the nominal voltage.
	The impeller is stuck	Get the operator to repair the unit
No or insufficient air flow	The suction filter is clogged	Get the operator to clean or replace the cartridge
	Frequency wrong (for units powered via an inverter)	Correct the frequency
	Profile of the impeller blades modified (due to deposits on the profile)	Get the operator to clean the impeller, check if it is worn and, if necessary, replace it.
No or insufficient pressure differential	Incorrect rotation direction	Get the operator to invert the rotation direction by switching two of the electrical power supply conductors.
	Leaks in the plant	Identify the leak and seal
Current absorption exceeding the admissible value	Electrical wiring incorrect	Get the operator to check the electrical connection against the wiring diagram contained in the terminal board box.
	Drop in mains supply voltage	Get the operator to reinstate the power supply voltage at the terminals at the admissible values
	The suction filter is clogged	Get the operator to clean or replace the cartridge
	The unit has accumulated deposits inside	Get the operator to clean the inside of the unit
	The unit is operating at a pressure and/or vacuum that exceeds the admissible value	Adjust the system and/or the regulating valve to lower pressure differentials.
High delivery air temperature	The unit is operating at a pressure and/or vacuum that exceeds the admissible value	Adjust the system and/or the regulating valve to lower pressure differentials.
	The suction filter is clogged	Get the operator to clean or replace the cartridge
	The unit has accumulated deposits inside	Get the operator to clean the inside of the unit
	Suction and/or delivery piping obstructed.	Get the operator to remove any obstructions
	Suction air temperature exceeds 40°C (+104°F)	Use heat exchangers to reduce the suction air temperature
Anomalous noise	The soundproofing is damaged	Get the operator to replace the soundproofing
	The impeller scrapes against the casing. - The unit is operating at a pressure and/or vacuum that exceeds the admissible value	Reduce the pressure differentials in the plant
	- Reduction of assembly play due to internal deposits (dust, impurities in the pipes, process residues, etc.)	Get the operator to clean the inside of the plant
	Bearing worn	Get the operator to replace the bearing
	Unit's installation position unsuitable	Do not fit structures (tanks, steel plating, etc.) on the unit that can transmit or amplify noise
Abnormal vibrations	The impeller is damaged	Get the operator to replace the impeller
	The impeller has accumulated deposits	e uniGet the operator to clean the inside of th t
	Unit fixing without anti-vibration supports	Get the operator to fix the unit with anti-vibration supports
	Rigid connection to the plant	Get the operator to fit flexible hoses between the unit and the piping
	Bearing on the blower or motor side defective	Get the operator to replace the bearing
Leaks in the unit	Defective silencer gaskets	Get the operator to clean or replace the gaskets
	Defective cover gaskets	Get the operator to clean or replace the gaskets

The term "operator" means: A qualified person appointed to install, operate, set, clean, repair or move a unit or to carry out maintenance work on it.



ELEVATION VIEW



PLAN VIEW

SCHEDULE OF OPENINGS

MARK	SIZE	QTY	RATING	TYPE	DESCRIPTION	INT PROJ	WELD DETAIL	A	B	C
A	6"	1	150#	RFWN	INLET					
B	6"	1	150#	RFWN	OUTLET					
C	16"	1	N/A	FF CMPRG	MANWAY c/w BLIND	9/16"	15	1/8		
D	1/2"	1	FNPT	WLD FLG	DRAIN	SEE WLD DTL	17			
E										
F										
G										
H										
J										
K										
L										
M										
N										
P										
Q										
R										
S										

DESIGN DATA

Registration	NOT APPLICABLE	Year Built	2001
Construction	NOT APPLICABLE	Serial No.	00-____
Design Pressure	3 PSIG	Capacity (Vol.)	96 cu. ft.
Design Temperature	350 Deg F	Shipping Wt. (Empty)	830 POUNDS
External Pressure	NOT APPLICABLE	Wt. full of water	_____ POUNDS
Min. Des. Metal Temp	-20 Deg F AT 3 PSIG	Gaskets	NEOPRENE
MAWP (New & Cold)	3 PSIG	Studs & Nuts	MILD STEEL (ZINC PLATED)
MAWP (Hot & Corr'd)	3 PSIG	Internal Surface Prep	INTERNAL POWER CLEAN
Hydro Test Pressure	N / A	External Surface Prep	EXTERNAL POWER CLEAN
Corrosion Allowance	NONE	Internal Coating	SERIES 120 POTAPOX PLUS 5-8 mils DFT
Radiography	NONE	External Coating	MAB PLYMASTIC (Lt GRAY) 5-7 mils DFT

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Tetrasolv Filtration
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CUSTOMER: Stock

PROJECT: Stock

GENERAL ASSEMBLY LAYOUT - ELEVATION AND ORIENTATION

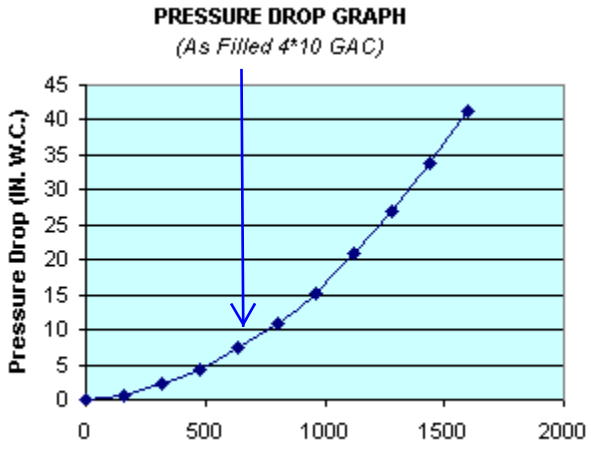
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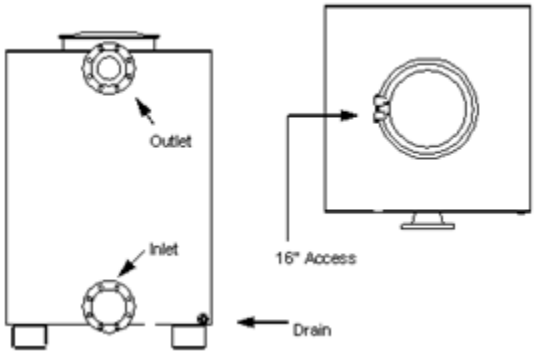
MODEL VF-2000 FILTER 48" x 48" x 6'- 0" SEAM - SEAM

DWN BY	CHK'D BY	APP'D BY	DATE	SCALE	JOB No.	DRAWING No.	REV
DB (TF)	TB (TF)	EP (TF)	JAN 29/01	1 1/2" = 1'-0"	xxxxxxx	VF2000-STD	0

VF-2000

Low Pressure Drop Vapor Phase Filter





VF-2000 SPECIFICATIONS			
Overall Height	6'8"	Vessel/Internal Piping Materials	Polypropylene
Footprint	4' x 4'	Internal Coating	Polyamide (2-Part) Epoxy Resin
Inlet / Outlet (150# FLNG)	6"	External Coating	Epoxy Mastic (Light Grey)
Drain / Vent (FNPT)	1/2"	Maximum Pressure / Temp	3 PSIG / 250° F
GAC Fill (lbs)	2000	Cross Sectional Bed Area	16 FT^2
Shipping / Operational Weight (lbs)	2,650/3,200	Bed Depth/Volume	4.5 FT / 71 FT^3

Operation & Maintenance Manual

VFD ● VFV ● VF ● VR SERIES

Tetrasolv Filtration Vapor Filters

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

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1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat vapor. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

The most common application utilizes activated carbon as the adsorption media. Typically vapor which contains low levels of organic contaminants flows upward through the column of activated carbon where the larger organic molecules adhere to the porous structure of the activated carbon granules. This adsorption begins at the bottom of the “bed” and continues upward as the original adsorptive area becomes saturated.

Complete saturation of the carbon is dependent upon many factors such as contaminant levels, temperature, compounds being adsorbed, humidity, etc. Typically a carbon isotherm has been run on the influent stream to determine the expected rate of consumption of the activated carbon media. When monitoring has determined discharge air no longer meets discharge requirements the carbon will have to be removed and replaced ***(refer to section 5.0)***.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system. If you have any questions please contact Tetrasolv Filtration at the number listed below or support@tetrasolv.com.

- ***WARNING: Where system pressure may exceed design pressure we strongly recommend the use of a relief device. Exceeding the maximum pressure of the filter could result in catastrophic failure***

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of the vessel.

- Always adhere to "lockout/tagout" procedures when servicing the system.

- Wear appropriate safety equipment when operating system.

♦ ***WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.***

♦ ***WARNING: High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehydes, organic acids and sulphur may cause severe temperature rises.***

- Understand the potential hazards of the stream being treated by the system. The activated carbon may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the carbon may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

♦ ***WARNING: Failure to follow the procedures outlined below can result in catastrophic damage to the system.***

Crane Lift - If a crane lift is to be used we recommend the following method. A "spreader" equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

3.3 Inspection

Perform the following inspections after un-loading the system. Note any discrepancies and contact TetraSolv immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.

- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.

- If the filters are shipped without carbon visually inspect the interior of the vessel for damaged internals.

- Inspect the carbon discharge, drain and vent valves for damage

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it's maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped

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loose with the system.

The outlet piping if connected to a stack or vent should be designed to prevent the introduction of water or debris into the adsorber piping. Discharge piping should be sized equal to or greater than the diameter of the system piping or back pressure could occur creating excess pressure drop on the system.

Flowrates greater than 60 cfm / sq ft can produce bed fluidization in vapor phase filters. When this occurs carbon granules can be lifted and propelled out of the carbon bed in up-flow applications. In extreme cases large amounts of carbon can be expelled. If the system will be operating near or greater than the amount stated above please contact Tetrasolv for recommendations.

Carbon filters can be manifold in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

Vapor conditions such as high humidity and high temperature (> 125º F) can cause inefficient adsorbtion to occur. If these conditions exist contact Tetrasolv for support. Also, any free water or product and debris should be eliminated with a knockout filter prior to the vapor stream entering the system. Many other vapor issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

4.0 OPERATION

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.

4.3 Monitoring

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate media breakdown or presence of high moisture. Rapid increase in pressure drop could indicate adsorber failure.

Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

5.0 ADSORBER SERVICING

The Adsorber may be serviced on-site using a vacuum removal method. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber be checked thoroughly and any minor maintenance conducted.

5.1 Carbon Loading - Bulk Bag

- ***WARNING - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.***

Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasping it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

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5.2 Carbon Loading - Vacuum Method

In this method dry-activated carbon will be loaded into to the adsorbers using a vacuum rig. To add the carbon to the filters use the following method:

WARNING: Due to the low vacuum rating of the VF series adsorbers (< 60" H_20) only experienced change-out personnel should attempt this method of re-filling. Exceeding the recommend vacuum rating could lead to failure of the superstructure of the vessel.

1. Connect a 3" vacuum source to the auxiliary connection of the adsorber to be filled.

2. Install a 16" bolted transfer lid onto the manway opening of the adsorber to be filled.

3. Turn on the vacuum and check for good flow of air through the adsorber. Connect the fill line to the transfer lid and lead enough hose to reach the fresh carbon source (Note: This should be as short of a distance as possible).

4. Begin vacuuming carbon into the adsorber. It is important to note that the loading method is actually conveying and not true vacuum. The hose should contain 1/3 air with the carbon. Closely view the adsorber being filled. If the adsorber is collasping in excessively take less carbon and more air. This is something from experience and cannot be adequately explained here.

5. When transfer is complete the transfer lid should be removed and the carbon in the adsorber should be leveled out to insure even pressure drop across the bed.

6. Close the manway and turn the adsorber back on.

> ***Note: When the system if first started up small amounts of fines may be present in the discharge stream. This is normal and should discontinue within a short period of time.***

6.0 MAINTENANCE

6.1 Extended Shutdown

If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

Monitor the system closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

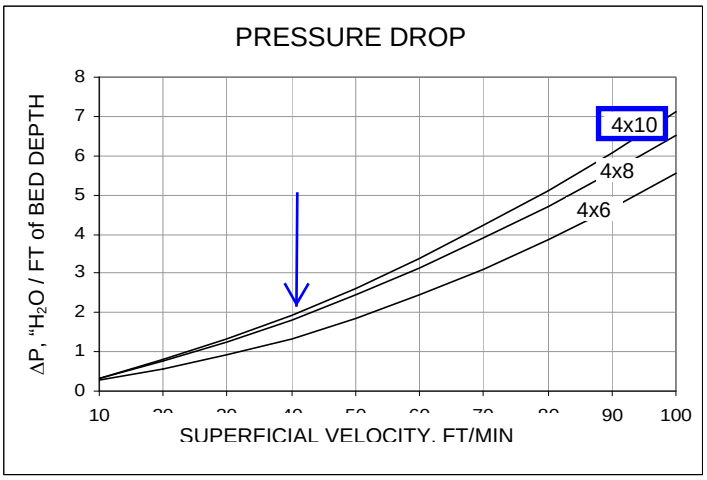
Carbon Filtration Systems, Inc.

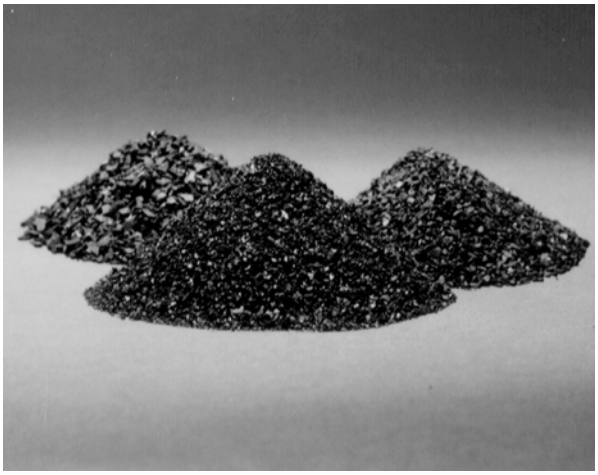
PRODUCT BULLETIN

COC-A 60

Vapor Phase, Coconut Shell Carbon

COC-A 60 is a highly active Granular Activated Carbon (GAC) manufactured via high temperature steam activation from selected grades of coconut shell and designed for use in a wide variety of air purification and vapor phase applications. Available in industry standard 4x6, 4x8 and 4x10 mesh sizes, these high quality carbons provide extraordinary surface area, fine pore structure, high density and superior hardness.





TYPICAL PHYSICAL PROPERTIES / SPECIFICATIONS

Iodine Number, mg/gm.	1150 - 1250
CCl_4 Activity, Min. (ASTM D-3467)	60
Apparent Density (ASTM D-2854), gm/cc	0.45 - 0.48
lb/ft^3	28 - 30
Hardness, Min. (ASTM D-3802)	98
U.S. Standard Sieve Size	4 x 6, 4 x 8, 4 x 10
Larger than No. 4, Max.	5%
Smaller than No. 6, 8, or 10, Max	5%
Total Surface Area (BET), m^2/gm	1150 - 1250
Ash, Max (ASTM D-2866)	3%
Moisture, Max. (ASTM D-2867)	2%

STANDARD PACKAGING:

55lb or 27.5lb POLYLINED POLYPROPYLENE BAGS. 200lb FIBER DRUMS. 1100lb SUPERSACKS.

This information is offered solely for your consideration and verification. It has been gathered from reference materials and/or test procedures and is believed to be true and accurate. None of this information shall constitute a warranty or representation, expressed or implied for which we assume legal responsibility or that the information or goods is fit for any particular use either alone or in combination with other goods or processes.

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Truth or Consequences, NM 87901
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jbarbour@tetrasolv.com

HS-600

6% potassium permanganate impregnated media. The number one method for removing acid gasses and other air born pollutants.

The Environmental Remediation Heavyweight

HS-600 is a major breakthrough in oxidation of acid gases, fumes and odors. HS-600, a unique molecular sieve impregnated with potassium permanganate, was created in our laboratories to oxidize gaseous pollutants such as hydrogen sulfide, sulfur dioxide, formaldehyde, ethylene, mercaptans, and various aldehydes and alcohols.

The potassium permanganate impregnated media shall have no less than 3.6 pounds of potassium permanganate per cubic foot, a bulk density of no less than 60 pounds per cubic foot, a moisture content of 12-15% by weight and shall not dust. The media shall have an irregular particle size of 4 x 8 mesh.

The performance characteristics of the air filtration media shall meet or exceed a service life of no less than 72 hours for breakthrough of hydrogen sulfide at the following test conditions:

Media Bed Volume: 76.00 cubic centimeters
Bed Configuration: 2.54 cm (id) x 15.00 cm
Flow Rate: 3000 (+/- 100) ml/minute
Relative Humidity: 70%
Challenge Gas: hydrogen sulfide
Challenge Gas Concentration: 10 (+/- 0.25) PPM

Removes

- Vinyl Chloride, DCE, TCE, PCE, Ethyl Mercaptan, Methyl Mercaptan
- Penta Mercaptan, Propylene Glycol, Chloroethane

HFP

FX-401,

QA INSPECTION SHEET

TANK MODEL #: HHR 3X 170 FL -XP MFG ORDER #: 64780

INVENTORY CONTROL #: 111214#5 SERIAL #: 10023

Q. A. CHECKPOINT #1 INSPECTION

- ✓ CLOSURE HARDWARE CORRECT
- ✓ INLET/OUTLET FLANGE CORRECT
- ✓ 1/4" NPT GAUGE PORT THREADS CORRECT
- ✓ DRAIN PORT THREADS CORRECT
- ✓ VENT PORT THREADS CORRECT
- ✓ CARTRIDGE BTM SEAL DIAMETER & WELD CORRECT
- ✓ STANDPIPE ALIGNMENT CORRECT
- ✓ CLOSURE O-RING & SEAT FREE OF DEFECTS
- ✓ DIMENSIONS PER BLUEPRINT

CHECKED BY: [signature] DATE: 11-12-14

Q. A. CHECKPOINT #2 FINAL ASSMBLY & PACKAGING

- ✓ STANDPIPE THREADS SEALED & TIGHT
- ✓ I&O MANUAL ATTACHED
- ✓ MODEL/SERIAL # DECAL & INLET/OUTLET LABELS CORRECT
- ✓ PLUG/HANDLE PACKAGED INSIDE HOUSING
- ✓ CLOSURE HARDWARE TIGHTENED
- ✓ PALLET & CRATE CORRECT & LABELED CORRECT

CHECKED BY: [signature] DATE: 10-7-15

CORRECTIVE ACTONS LOG:

QA RELEASE FOR SHIPMENT BY: [signature] DATE: 10-7-15

HFP

FX-402

QA INSPECTION SHEET

TANK MODEL #: HUB3X170FL-XP MFG ORDER #: 64993

INVENTORY CONTROL #: 121714 #2 SERIAL #: 10019

Q. A. CHECKPOINT #1 INSPECTION

- ✓ CLOSURE HARDWARE CORRECT
- ✓ INLET/OUTLET FLANGE CORRECT
- ✓ 1/4" NPT GAUGE PORT THREADS CORRECT
- ✓ DRAIN PORT THREADS CORRECT
- VENT PORT THREADS CORRECT
- ✓ CARTRIDGE BTM SEAL DIAMETER & WELD CORRECT
- ✓ STANDPIPE ALIGNMENT CORRECT
- ✓ CLOSURE O-RING & SEAT FREE OF DEFECTS
- ✓ DIMENSIONS PER BLUEPRINT

CHECKED BY: CM DATE: 12-17-14

Q. A. CHECKPOINT #2 FINAL ASSMBLY & PACKAGING

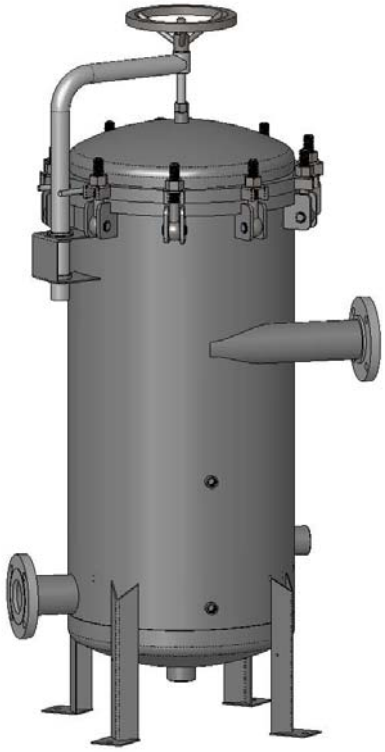
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- ✓ MODEL/SERIAL # DECAL & INLET/OUTLET LABELS CORRECT
- ✓ PLUG/HANDLE PACKAGED INSIDE HOUSING
- ✓ CLOSURE HARDWARE TIGHTENED
- ✓ PALLET & CRATE CORRECT & LABELED CORRECT

CHECKED BY: CM DATE: 9-1-15

CORRECTIVE ACTONS LOG:

QA RELEASE FOR SHIPMENT BY: CM DATE: 9-1-15

PRODUCT SPECIFICATION
Harmsco® Model #: HUR 3X170FL-XP



Description: Tangential Entry, Up-Flow Cartridge Filter Housing with; Swing Bolt Closure, Davit Cover Lift, and Flanged Connections.

Details:

1. Stainless steel construction, wetted metallic components are 304/304L ASTM A-240.
2. Electro-polish finish.
3. Swing bolt style housing closure. Swing bolts are SS alloy per ASTM A-193 B7.
4. NSF Certified using Genuine Harmsco® Hurricane® replacement filter cartridges.*
5. Tangential inlet and the integral inner-can, create a centrifugal flow that induces pre-filtration by heavy particulate separation.
6. Patented "Up-Flow" design that;
   a. Self purges housing of air.
   b. Eliminates by-pass contamination during servicing.
   c. Improves efficiency by creating an even flow distribution across filtering media.
7. Strong, durable, built to ASME Design Standards.
8. Utilizes three (3) Genuine Harmsco® Hurricane® HC/170 series filter cartridges. *
9. Inlet & Outlet are NPS 3 Flanges ANSI/ASME B16.5 Class 150
10. Drains (Qty 2) are 1-1/2" Female NPT (FPT) Couplings, Class 1000
11. Vent is 1/2" Female NPT (FPT) Coupling, Class 1000
12. Gauge Ports (Qty 2) are 1/2" Female NPT (FPT) Couplings, Class 1000
13. Closure Gasket is EPDM 70 Durometer O-ring.
14. Pressure Rating - 150 P.S.I.G.
15. Temperature Rating – Up to 140°F
    Note: Higher temperatures are possible, check cartridge specifications. **
16. Flow Rate – 450 GPM Maximum.
    See Pressure Drop vs. Flow Rate Curve, page 2.
17. One person can perform maintenance.

Requirements:

Floor Load:	Dry weight = 435 lbs. Volume = 61 US gallons x 8.337 lbs./US gallon (water) = 509 lbs. Total weight = 435 + 509 = 944 lbs. (housing + water) Floor contact area = .292 ft² Floor Load = 944 lbs. divided by .292 ft² = **3,250 pounds per square foot** (approx.) Note: Piping shall conform to all applicable codes and be independently supported. If floor strength is suspect, use appropriate measures to adequately distribute load.
Floor Space:	**4.5 ft²** (does not include Cover/Davit swing position), See Installation Diagram, page 3.
Service Height:	98-1/2", See Installation Diagram, page 3.
Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided.

Recommended Spare Parts:
Closure Gasket O-ring: PN 363-E
Set of 3 Harmsco® Hurricane® HC/170 replacement cartridges

* The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges in this filter housing voids certifications by NSF International.
** Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.
Notice: The information contained in this publication is considered accurate, and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest, most up to date, specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. End users should perform their own tests to determine suitability for each application.

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Revised: 12-5-14
File Name: SPECIFICATION HUR 3X170FL-XP (pg. 1 of 3)

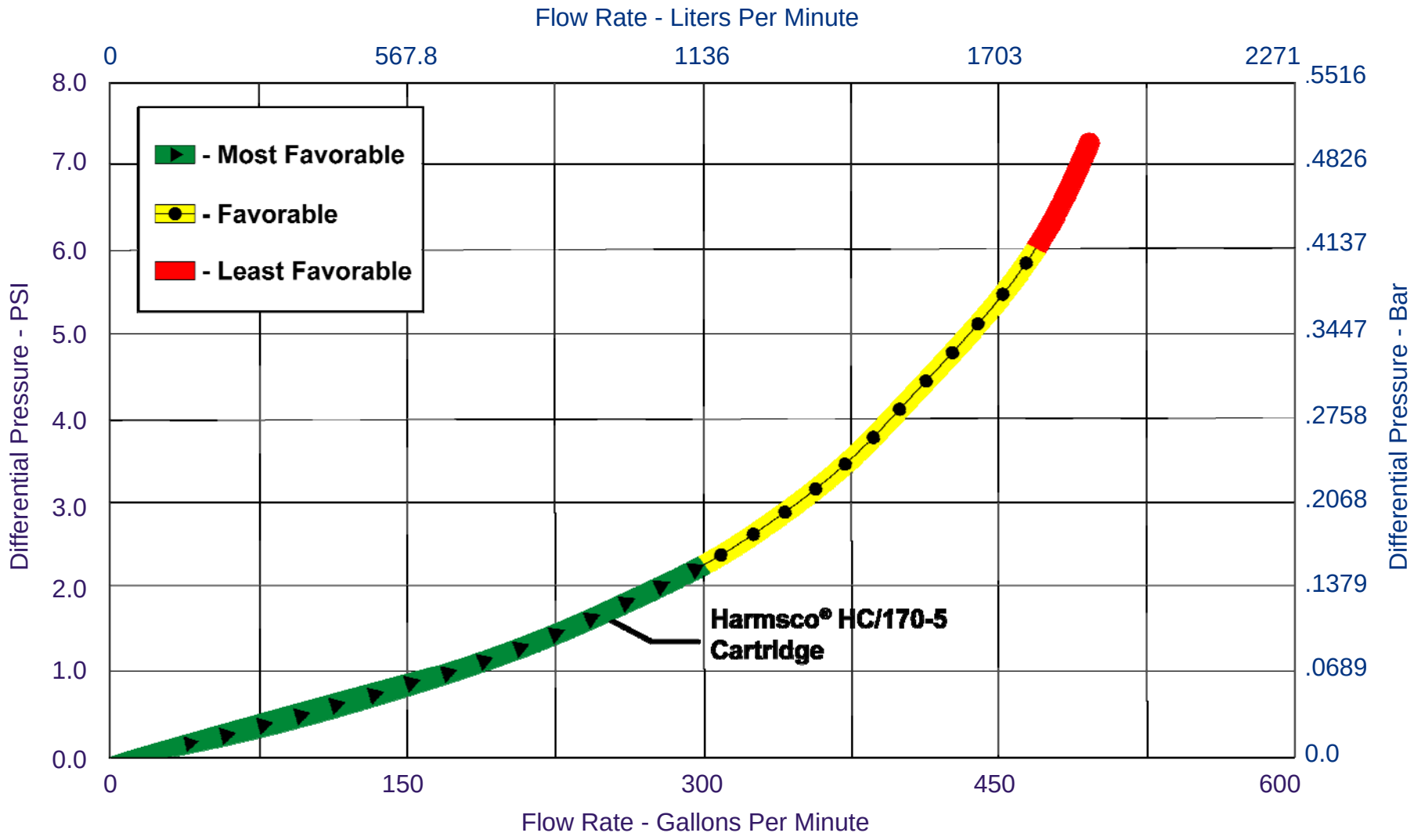
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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 3X170FL-XP

Hurricane® HC/170-5 Cartridges, Qty 3; with clean water.

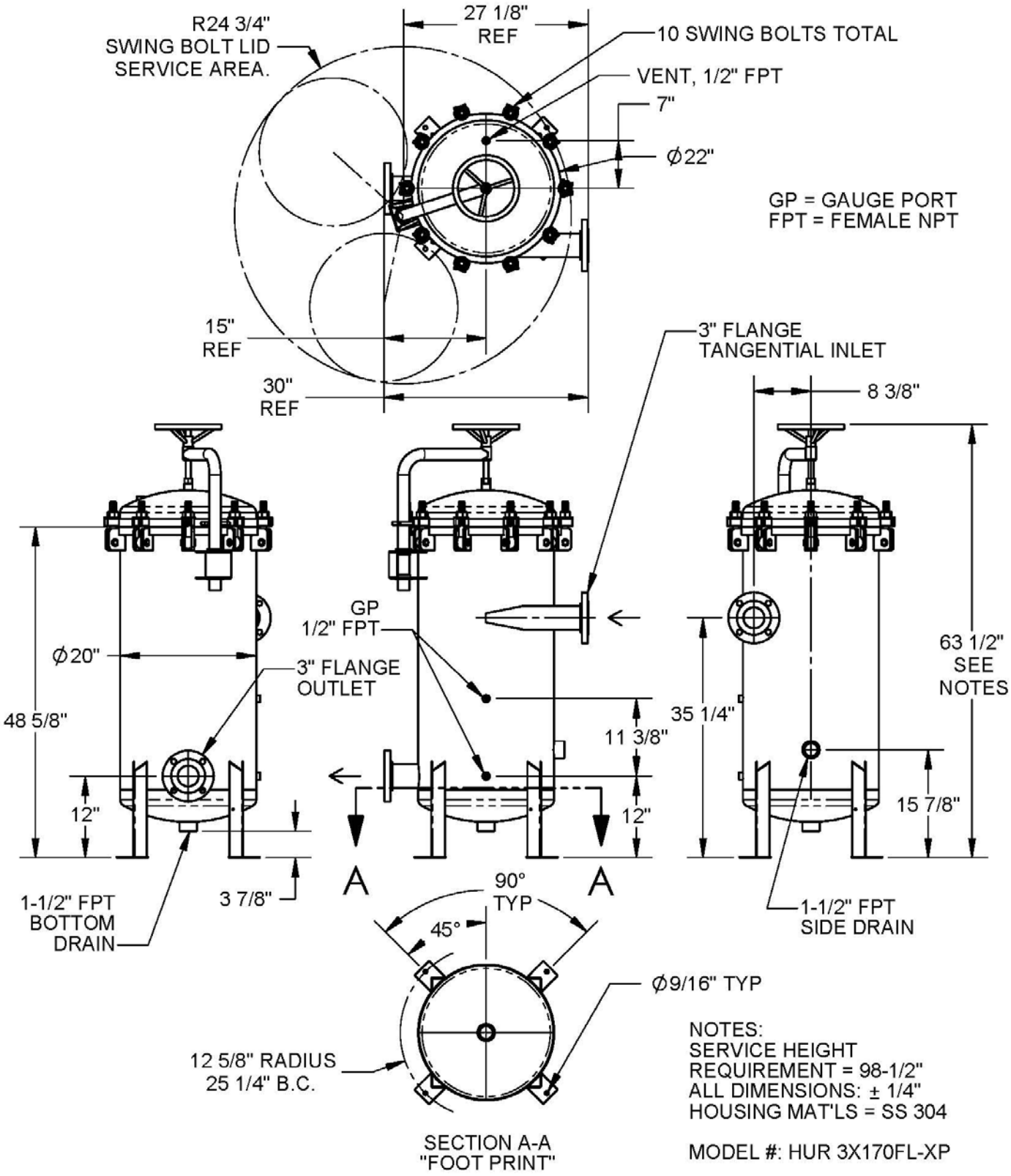


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Installation Diagram
Hurricane® 3X170FL-XP Swing Bolt Housing



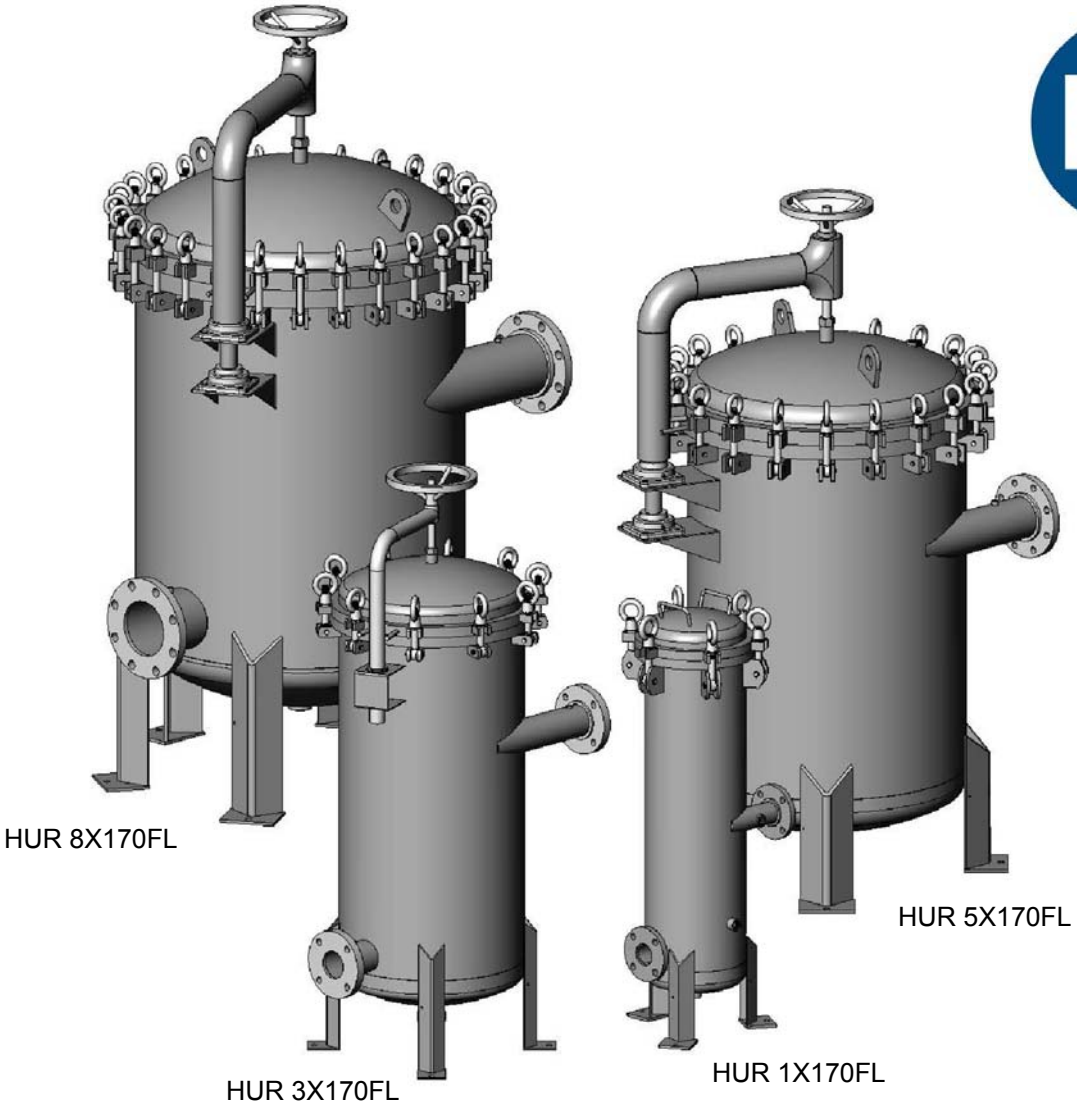
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HARMSCO® Hurricane®
Swing Bolt Water Filters
Models: HUR 1X170FL, HUR 3X170FL
HUR 5X170FL, & HUR 8X170FL

INSTALLATION AND OPERATION MANUAL



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1243-HP, MANUAL - HUR FL
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HARMSCO® Hurricane®
Swing Bolt Water Filters

INTRODUCTION

The Harmsco® Hurricane® Swing Bolt Water Filter is a water filtration device that utilizes the Harmsco® Hurricane® HC/170 size cartridge filter in various quantities from one per housing (HUR 1X170FL) to 8 per housing (HUR 8X170FL).

The Hurricane® HC/170 cartridges are available in many micron ratings, styles and materials of construction. High temperature cartridges are also available. Consult the Harmsco® Product Catalog (www.harmsco.com) or a Sales Representative for more details.

All of the Harmsco® Hurricane® Swing Bolt housings; **HUR 1X170FL**, **HUR 3X170FL**, **HUR5X170FL** & **HUR 8X170FL** are equipped with pipe flanges on both the inlet and the outlet, & cartridge lifting handle(s) (part # 362-L). All models are NSF Certified per Standard 61 when used with Genuine Harmsco® Hurricane® HC/170 cartridges.

The Harmsco® Hurricane® Swing Bolt Water Filter is designed as a strong economical filter that continuously improves the water quality with minimal maintenance.

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HARMSCO® Hurricane®
Swing Bolt Water Filters
INSTALLATION & OPERATION MANUAL

Safety Precautions:

Before using and installing this product or its components please read this entire manual. Failure to do so could result in serious personal injury or damage to the equipment and assembled components.

This product and all of its components MUST NOT be installed or used in any manner other than that which is specified in this manual.

! WARNINGS !

1. **Seek qualified assistance for installation. Piping shall conform to all applicable codes and be independently supported.**
2. **Do not install the unit where a temperature of 32° F or lower can occur. Damage caused by freezing shall void all warranties.**
3. **The unit shall be properly bonded in accordance with all applicable codes. A grounding lug is provided.**
4. **After unit is installed, flush (through outlet) to drain for 10 minutes at recommended flow rates prior to use.**
5. **Always isolate unit and relieve pressure before servicing.**
6. **Utilizes Genuine Harmsco® Hurricane® HC/170 filter cartridges, available in many micron ratings and styles.**
   The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges will void certifications by NSF International.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844. Other patents pending.

Notice: The information contained in this publication is considered accurate and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest and most up to date specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

REQUIREMENTS

- Only qualified personnel are to perform the installation.
- Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.
- Install shut off valves on both the inlet and the outlet to isolate unit while servicing.

RECOMMENDATIONS

- Plumb drains with appropriate valves to reduce service time.
- Include a by-pass with shut off valves between the inlet and outlet. See installation Block Diagram on page 7.
- Install appropriate pressure gauges into the gauge ports provided. Model HUR1X170FL outlet pressure gauge is to be installed in-line and in close proximity to the outlet flange.
- Install plug or appropriate valve into the vent port provided.
- Lubricate Swing Bolt Assemblies (all models) & Davit Assemblies (HUR 3X170FL, HUR 5X170FL & HUR 8X170FL) using Food Grade grease with PTFE and NSF rated H1 only.
- Replace cartridge(s) when certain conditions exist.
  For example: 1. Differential pressure is greater than 30 psi.
  2. Quality of water is unacceptable.
  3. Flow rate has diminished.
  4. Every 6 months
- **Spare Parts:**

  1. Sufficient supply of replacement cartridges.
     Note: Harmsco® Hurricane® HC/170 filter cartridges available include: Activated Carbon, High Temperature, SureSafe™, Poly-Mesh, Poly-Pleat™ & more.
     Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

  2. Housing O-ring Seal:

Model #	Part #		
	EPDM (std)	BunaN	Viton
HUR 1X170FL	361-E	361-B	361-V
HUR 3X170FL	363-E	363-B	363-V
HUR 5X170FL	365-E	365-B	365-V
HUR 8X170FL	368-E	368-B	368-V

  3. Optional: Cartridge Lifting Handle, Part #362-L



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HARMSCO® Hurricane®
Swing Bolt Water Filters

INSTALLATION/SET-UP

The following instructions & diagrams show the Harmsco® Hurricane® Swing Bolt Water Filter housing with typical plumbing hook-up requirements. All steps of the installation are to be performed by qualified personnel.

1. Always adhere to state and local plumbing codes and requirements for design and installation.
2. Mount and secure housing using the holes at the base of the legs - see Installation Diagrams, pages 8-11.
   Models HUR 5X170FL & HUR 8X170FL have two lifting lugs welded onto the lid for positioning of the housing. Swing bolts must be engaged and the housing must be empty prior to using the lifting lugs.
3. Bond the filter housing utilizing the grounding lug on the leg.
   - must be performed by a qualified electrician.
4. Install incoming water supply with shut off valve to flange marked "Inlet".
5. Install return line with shut off valve to flange marked “Outlet”.
6. Install plugs or valves in drain lines into the FPT couplings located at the bottom center and side of housing.
7. Install plugs or pressure gauges into the gauge ports.
8. Install plug or valve into the vent port.
9. Refer to Specifications, Installation Block Diagram & Installation Diagrams for more details, pages 6-11.

Notes:

- Shut-off valves shall be installed on inlet and outlet to isolate the filter when servicing.
- To protect against electrolysis, all filters shall be bonded.
  Failure to properly bond the filter will void all warranties.
- Valves, plugs and pressure gauges are not provided.
- Use gaskets, sealants and/or expansion/vibration coupling materials appropriate for the application.
- Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.
- For cartridge replacement, see pgs. 12 - 18, 24.
- For models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL, make sure sufficient space is available to rotate lid away from housing allowing access to all cartridges.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

SPECIFICATIONS

Specification	Model			
	HUR 1X170FL	HUR 3X170FL	HUR 5X170FL	HUR 8X170FL
Cartridge Quantity[1]	1	3	5	8
Recommended Flow Rate, gal/min	105	315	525	840
Max. Flow Rate, gal/min	150	450	750	1200
Pressure Rating, P.S.I.G. Max. *	150 *	150 *	150 *	150 *
Height, inches	48"	64"	74"	84"
Service Height, inches	77"	98-1/2"	98-1/2"	104-1/2"
Housing Diameter	11"	20"	30"	35-3/8"
Inlet/Outlet[2]	2" Flange	3" Flange	4" Flange	6" Flange
Height of Inlet, inches	23-5/8"	35-1/4"	38"	44-1/4"
Height of Outlet, inches	9 3/4	12"	14-1/8"	20-1/2"
Drain (Qty 2, Female)	3/4" NPT	1-1/2" NPT	1-1/2" NPT	1-1/2" NPT
Weight, Dry	150 lbs.	420 lbs.	1,100 lbs.	1,600 lbs.
Weight, Wet	284 lbs.	929 lbs.	2,284 lbs.	3,535 lbs.
Floor Contact Area	.188 ft²	.292 ft²	.776 ft²	1.164 ft²
Floor Load (approx.)[2,3]	1,515 lbs/ft²	3,200 lbs/ft²	3,000 lbs/ft²	3,100 lbs/ft²
Floor Space[4]	1.6 ft²	4.5 ft²	8.5 ft²	14.0 ft²

Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided on the leg.
Housing Material:	Stainless Steel Construction. All wetted metallic components are ASTM A-240
Finish:	Electro-polish
O-ring Material:	EPDM is standard. Buna-N & Viton are available
Temperature Rating:	Up to 140°F, Note: Higher temperatures are possible, check cartridge specifications and contact a Harmsco® sales engineer.

* Models with -HP suffix 200 P.S.I.G. Max.

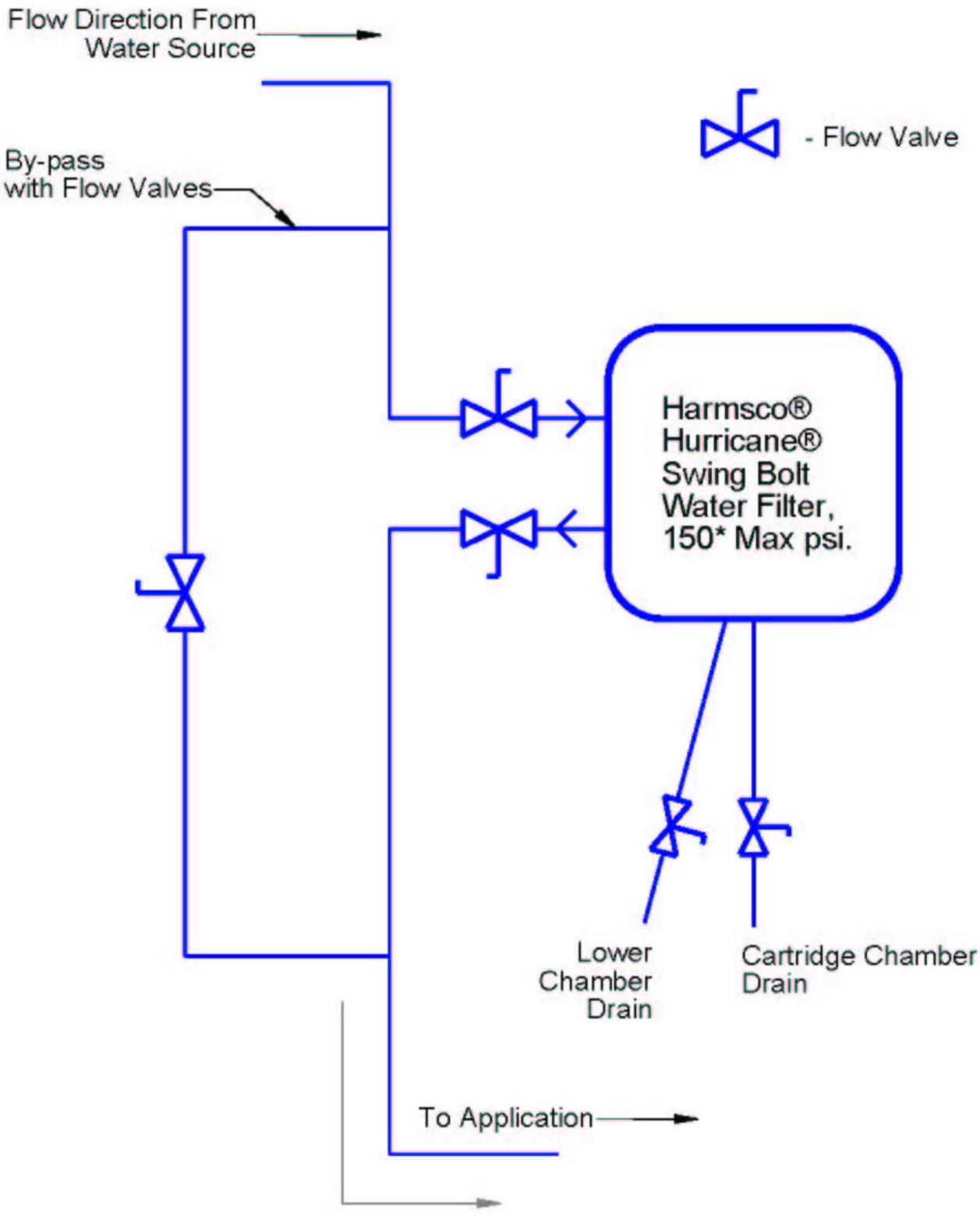
Notes:

1. Utilizes Genuine Harmsco® Hurricane® HC/170 cartridges.
   - HC/170 cartridge filters are available in many micron ratings and styles.
   - Activated carbon and several high temperature cartridges are also available.
   - The use of cartridges other than Genuine Harmsco® Hurricane® HC/170 filter cartridges will void certifications by NSF International.
2. Piping shall conform to all applicable codes and be independently supported.
3. If floor strength is suspect, use appropriate measures to adequately distribute load.
4. Does not include Cover/Davit swing position for models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

Installation Block Diagram

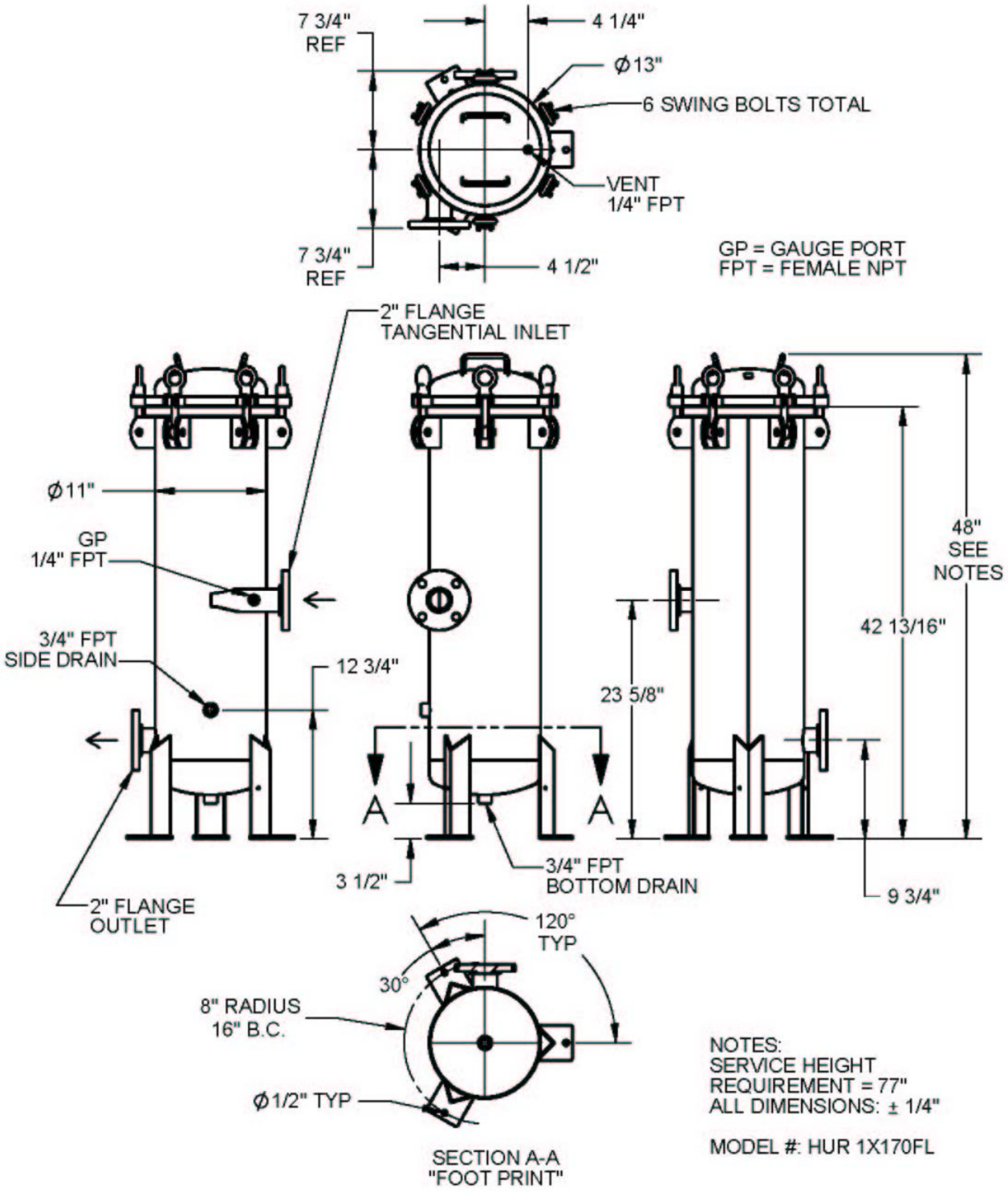


* Models with –HP suffix = 200 psi.

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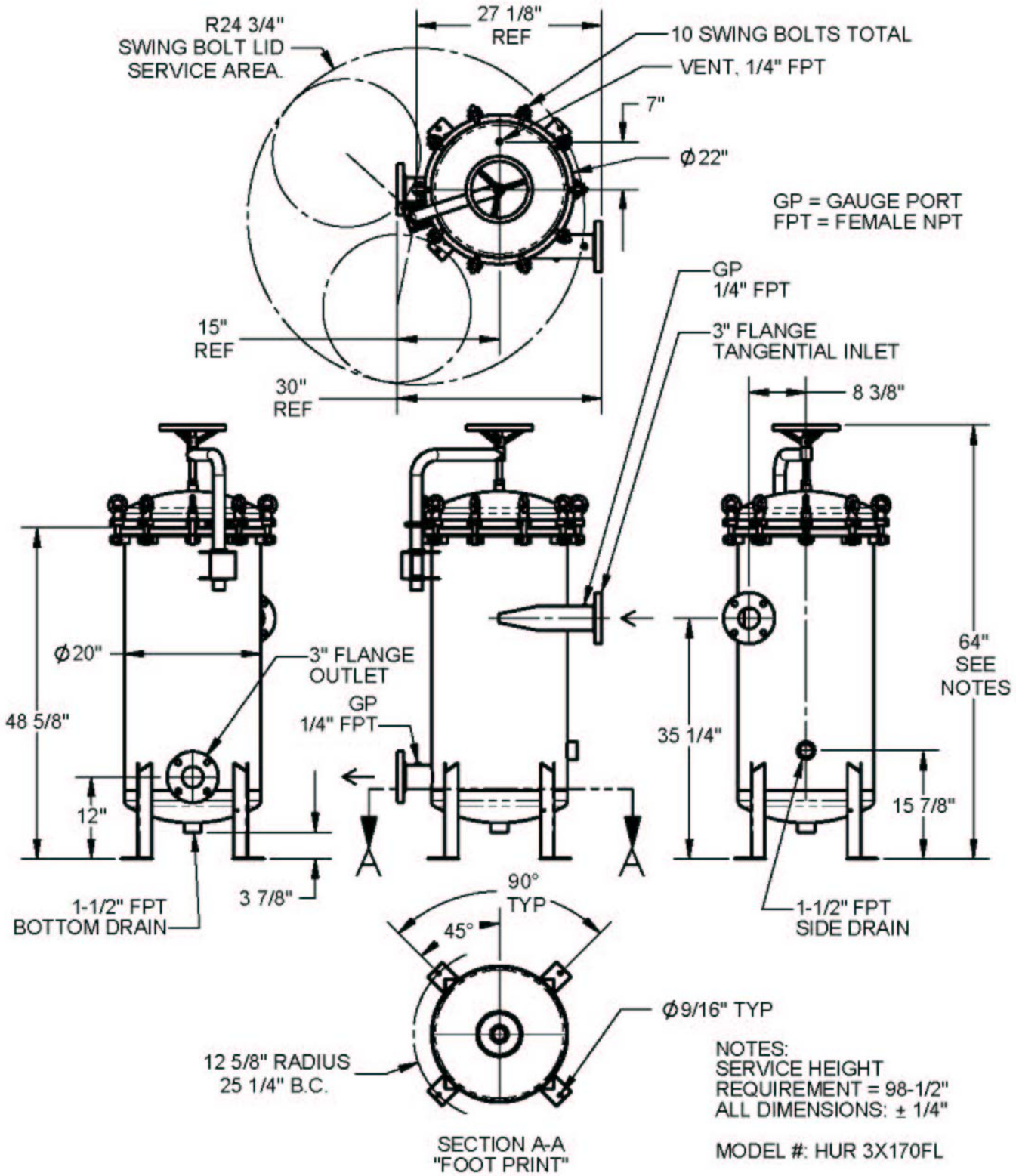
Installation Diagram
Model HUR 1X170FL



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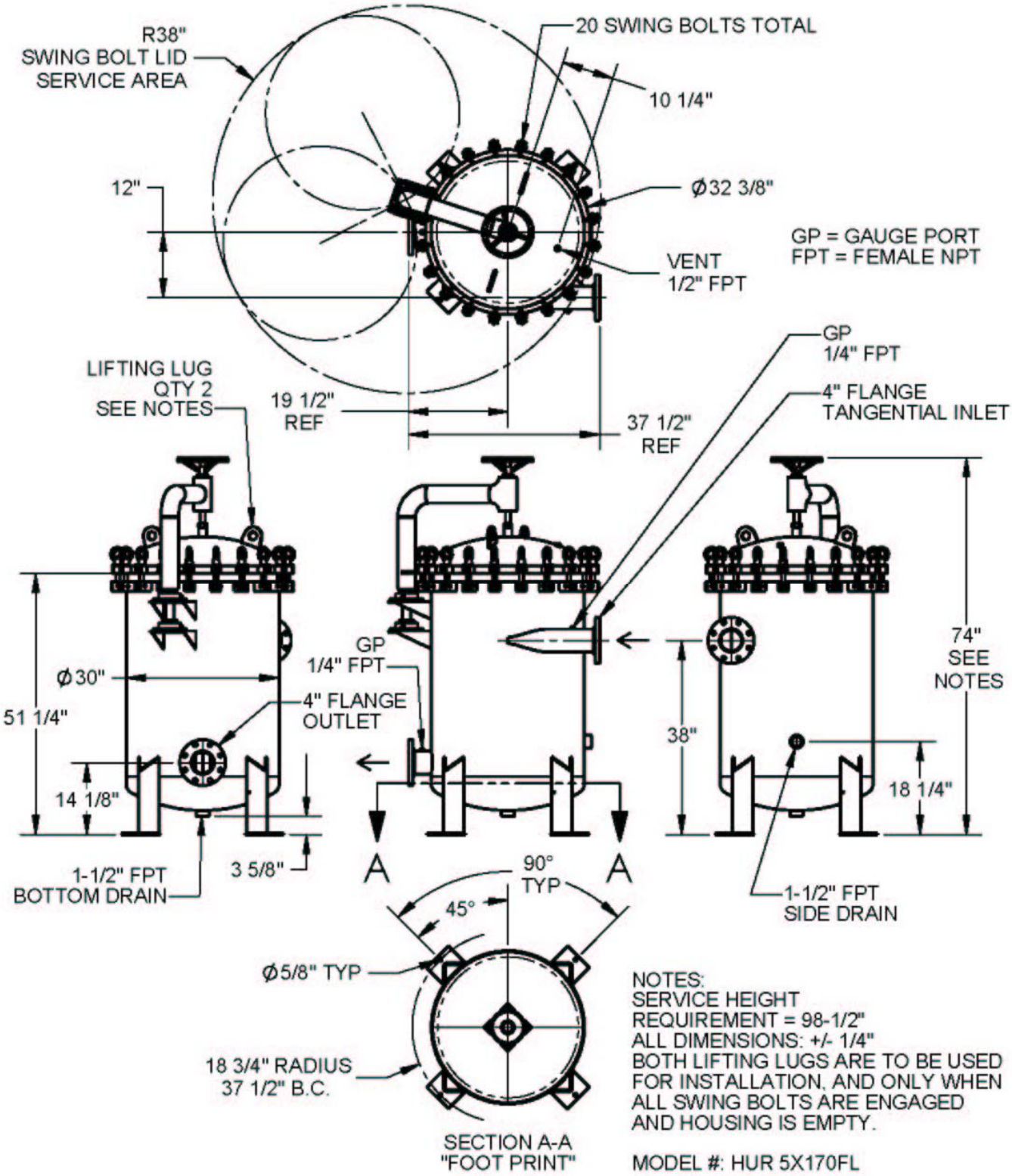
Installation Diagram
Model HUR 3X170FL



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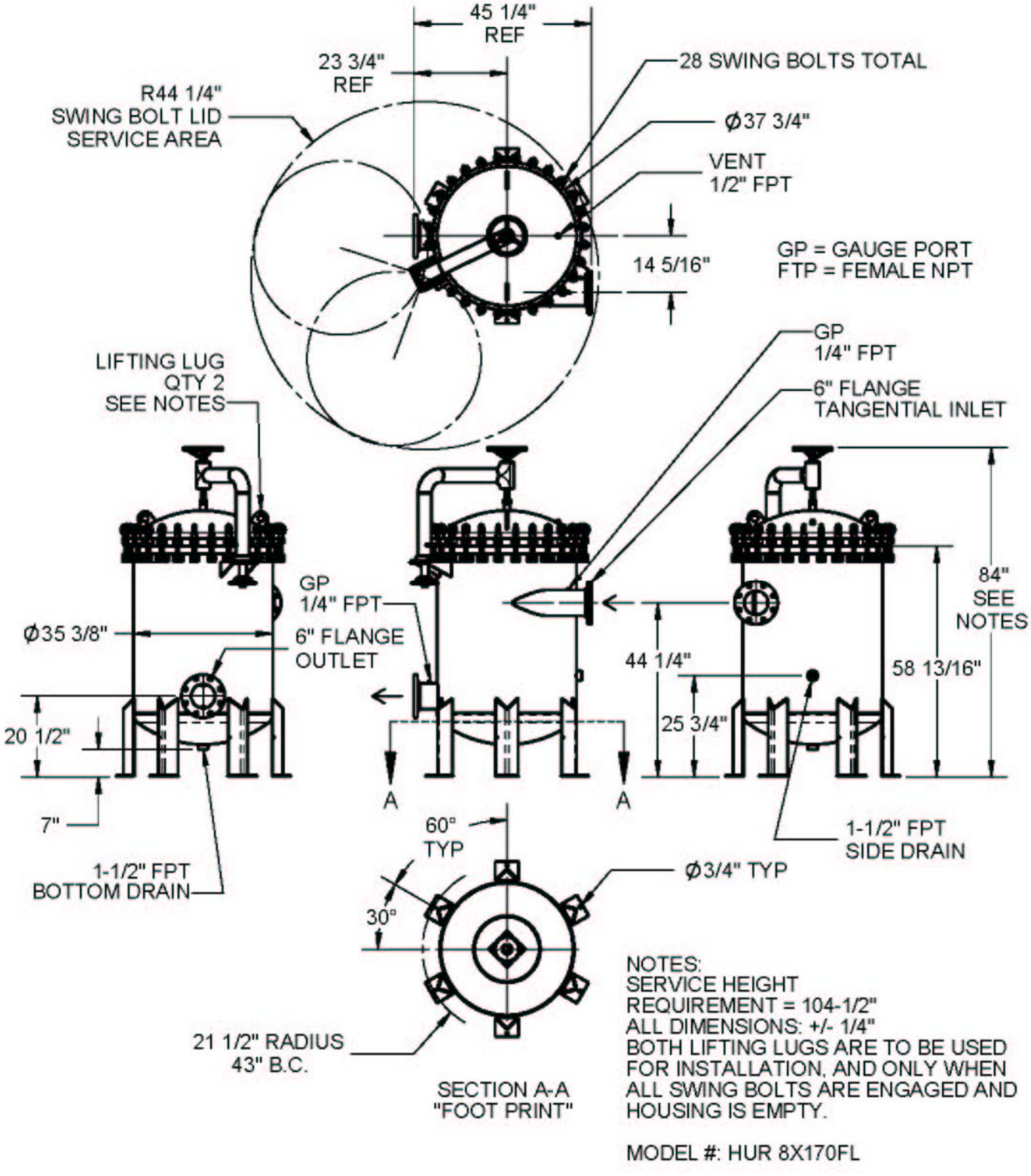
Installation Diagram
Model HUR 5X170FL



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Installation Diagram
Model HUR 8X170FL

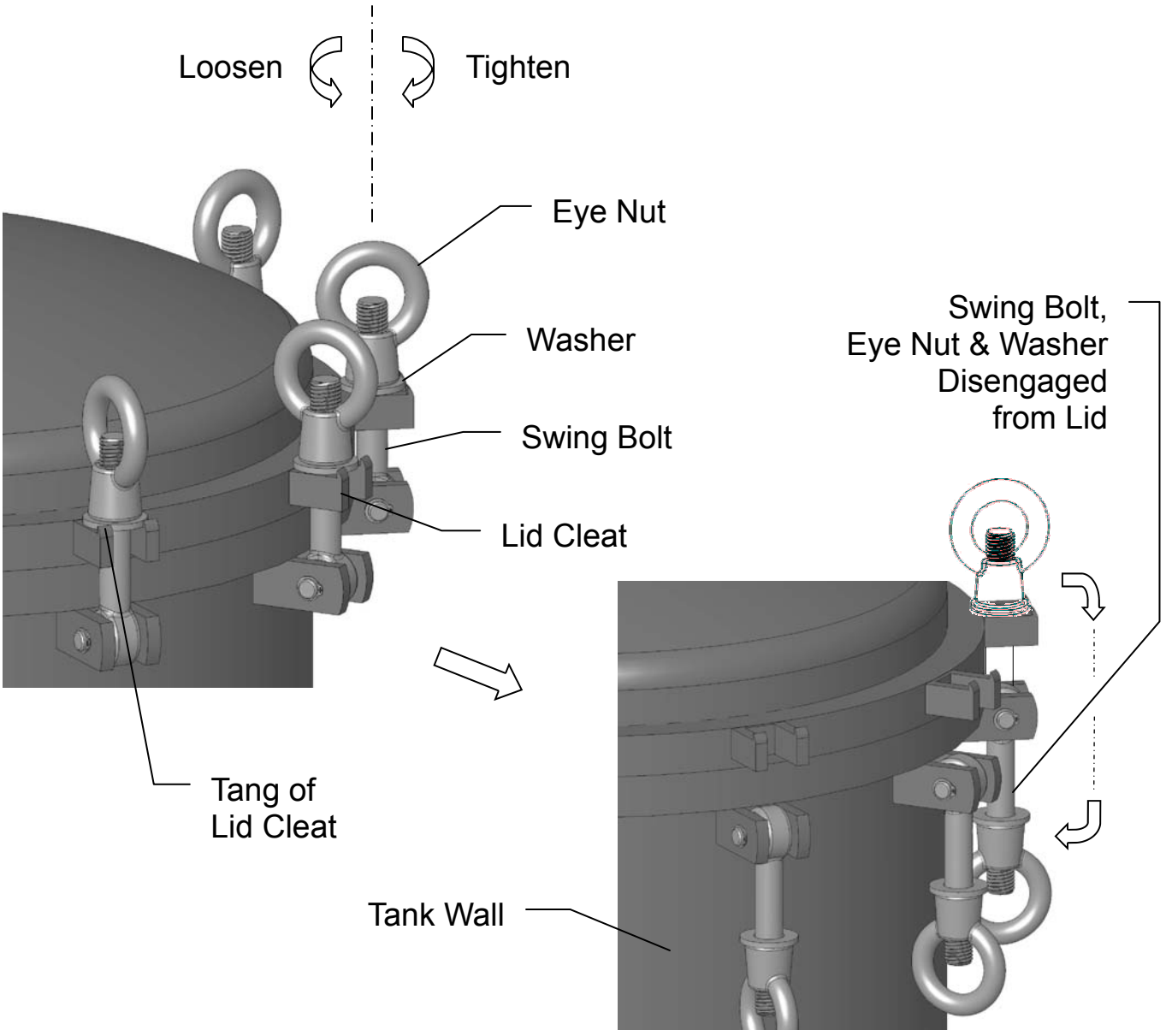


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HARMSCO® Hurricane®
Swing Bolt Water Filters

CARTRIDGE REPLACEMENT

1. Isolate unit from all water sources (close I/O lines) and relieve pressure to housing by first opening the housing's "Bottom Drain" and let drain completely. See Installation Diagrams (pgs. 8-11). This will protect the cartridges (installed) from experiencing a reverse flow that could cause damage.
2. Open Side Drain and let housing drain completely.
3. Loosen all Eye Nuts of Swing Bolts by 1/2 turn increments counter-clockwise to gradually step down load applied to swing bolts. Repeat process as needed.
4. Fully loosen Eye Nuts but do not remove from Swing Bolt. Lift Washer above Tangs in Lid Cleats and allow Swing Bolt to rotate downward along the side of the housing's Tank Wall.



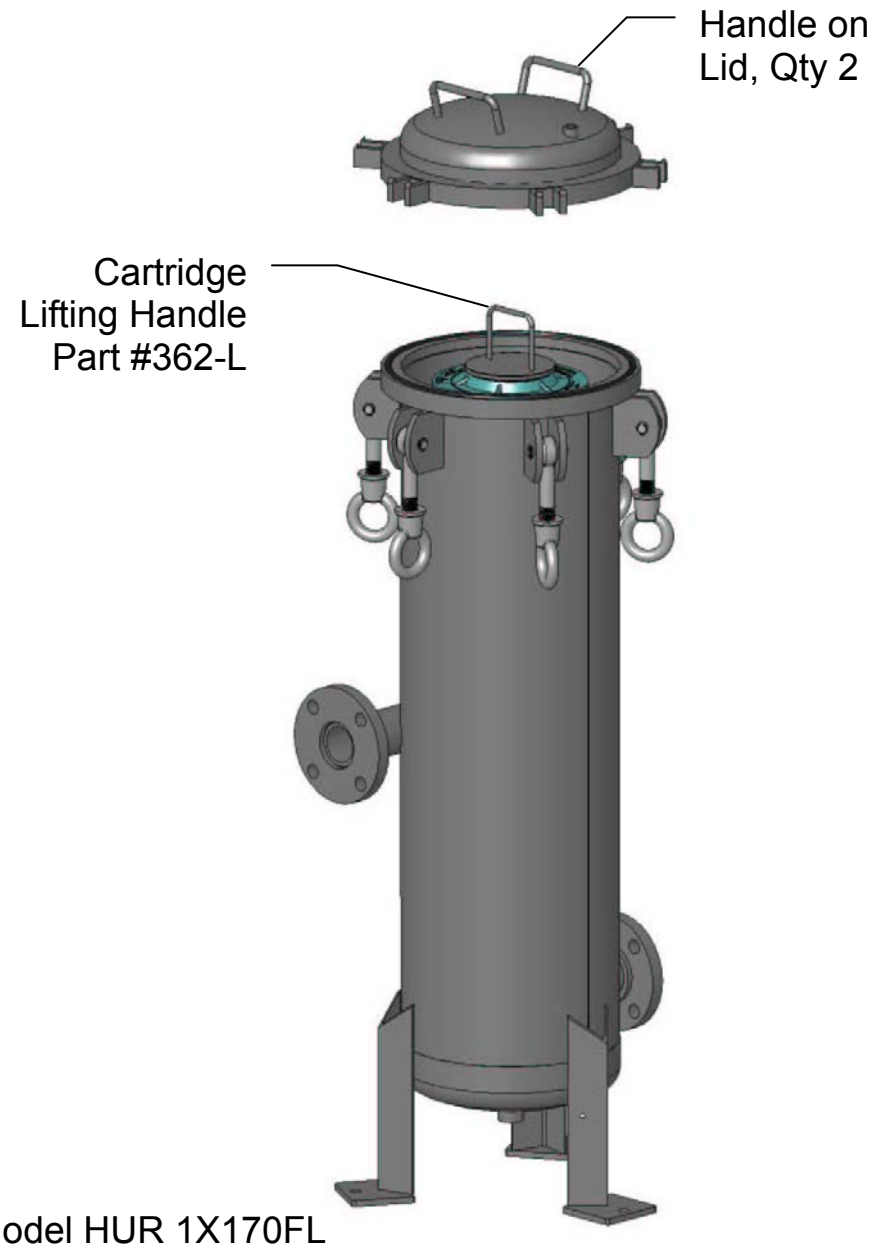
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CARTRIDGE REPLACEMENT cont.

5. When all of the Swing Bolt hardware is disengaged, the Lid can be removed.

5 a. For Model HUR 1X170FL the Handles on the Lid are used to raise and remove the Lid.

Note: The Lid must be raised sufficiently to clear the Cartridge Lifting Handle prior to removal.



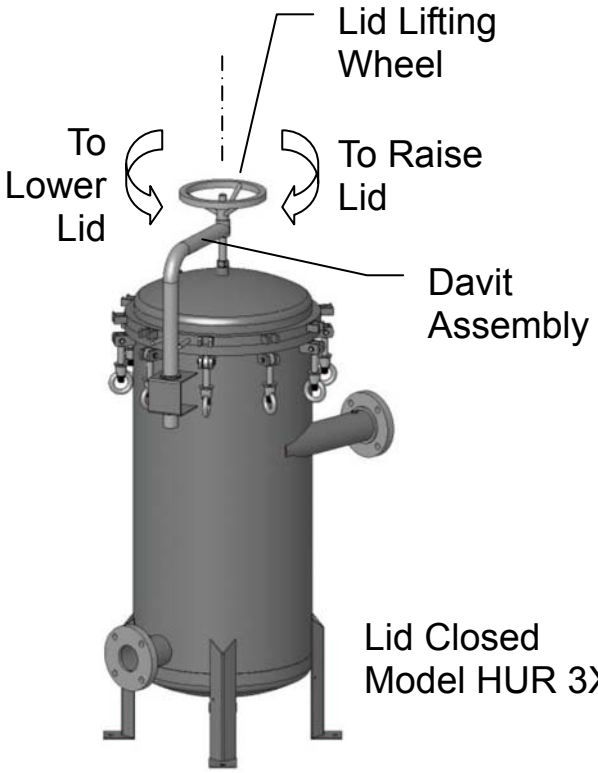
Model HUR 1X170FL

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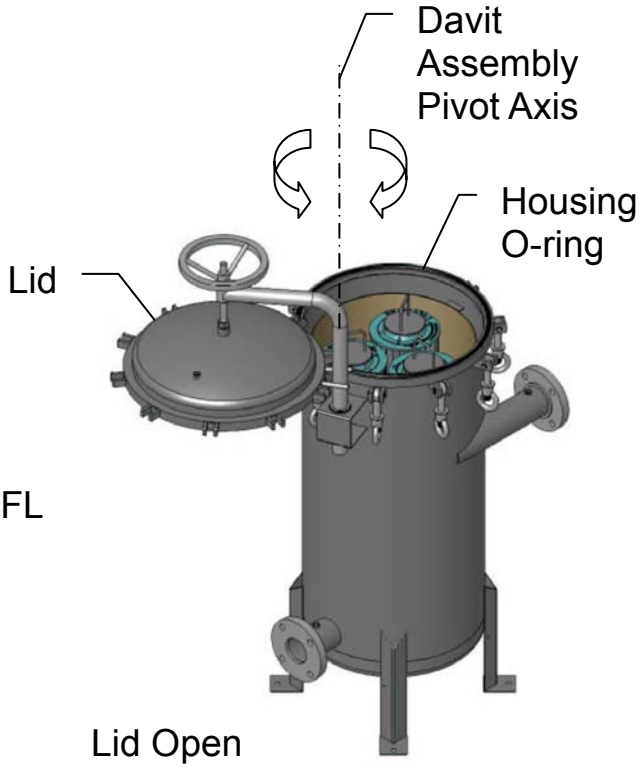
CARTRIDGE REPLACEMENT cont.

5 b. Models HUR 3X170FL, HUR 5X170FL & HUR 8X170FL all have a Davit Assembly and Lid Lifting Wheel to raise and lower the Lid. To raise Lid, turn Lid Lifting Wheel clockwise. To lower Lid, turn Wheel counter-clockwise.
Note: Housing O-ring may stick to Lid. To prevent this, it is suggested to raise the Lid about 1/8” inch and move the Lid/Davit Assembly slightly sideways to free the O-ring from Lid while keeping the O-ring in its housing channel.
Continue raising Lid approximately 1” to clear housing. Swing Lid and Davit Assembly until cartridge compartment is fully exposed.

Caution: The Lid should be secured when servicing.



Lid Closed
Model HUR 3X170FL



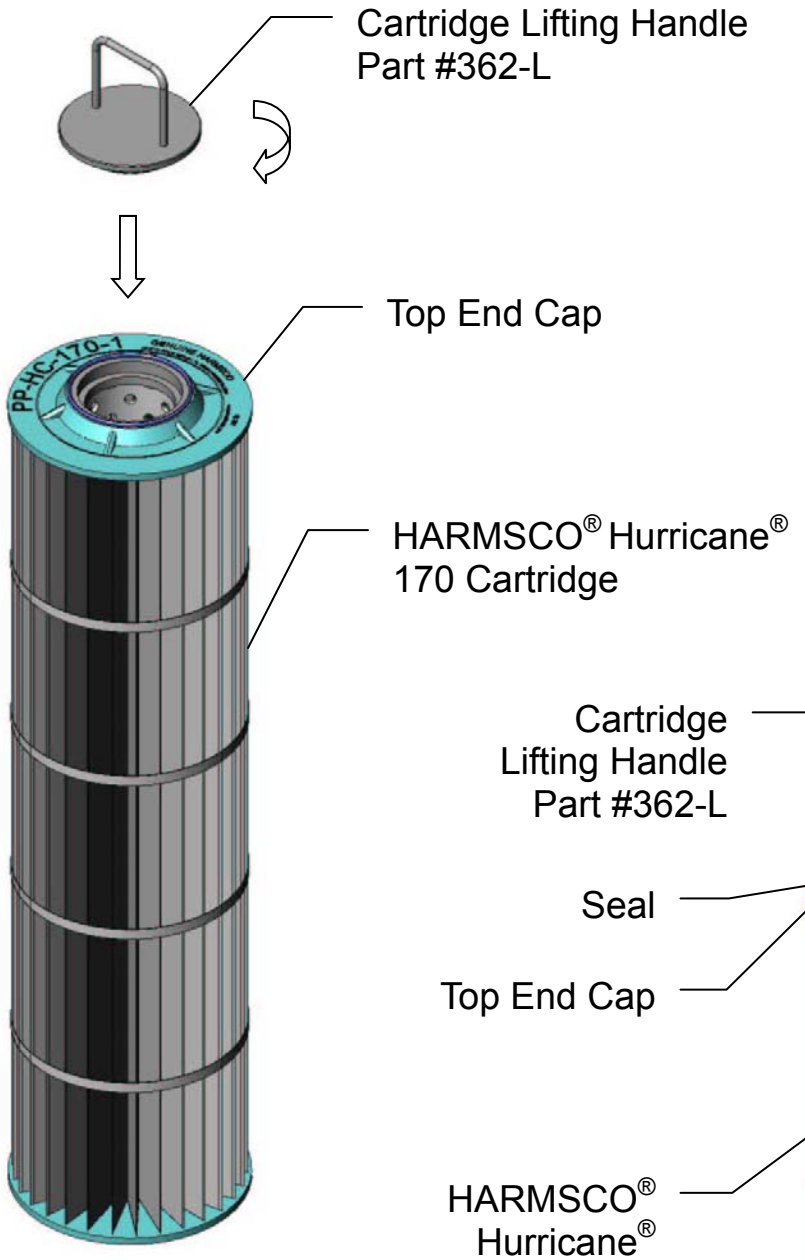
Lid Open
Model HUR 3X170FL

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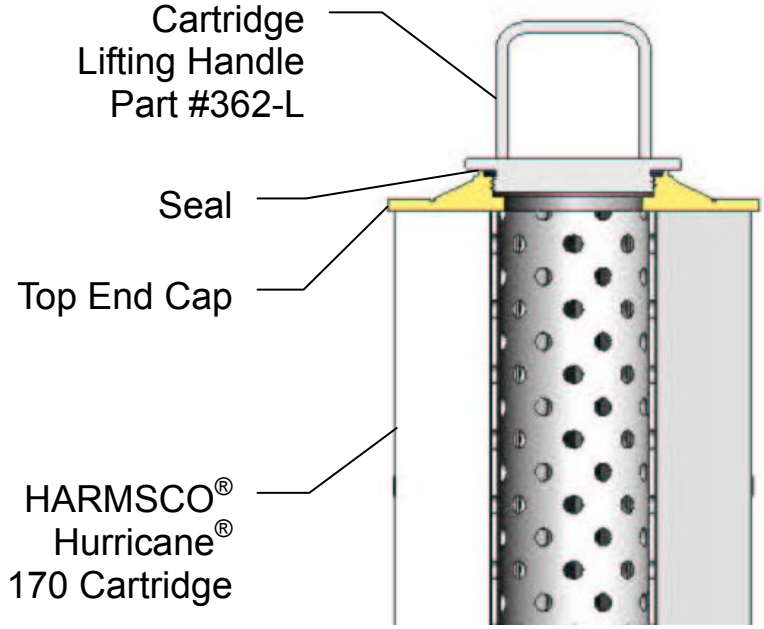
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Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.

6. Install Cartridge Handle(s), part #362-L, to Cartridge(s). Tighten securely to seal with Top End Cap to prevent by-passing of the Cartridge.



Exploded View



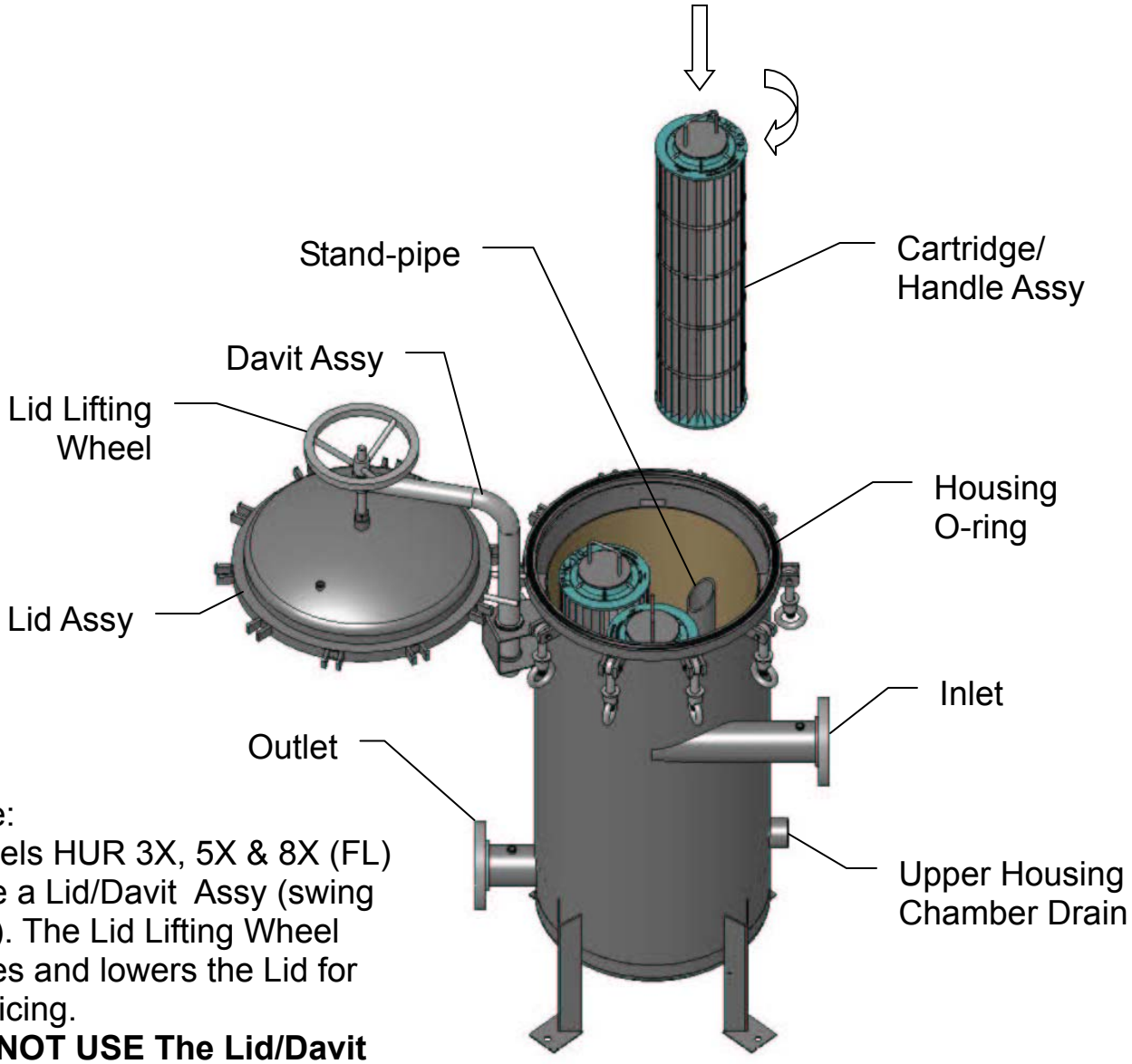
Partial Sectional View

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Swing Bolt Water Filters

CARTRIDGE REPLACEMENT cont.

7. With swing bolts disengaged and lid removed, install Cartridge/Handle assembly(s) onto Stand-pipe(s). Position Cartridge/Handle assembly downward until Cartridge's Bottom End Cap contacts the housing's Tube Sheet. The Cartridge's Bottom End Cap will seal with the Stand-pipe Coupling to prevent by-passing. A clockwise rotating motion will help to position the Cartridge while engaging the Stand-pipe Coupling. Confirm all Cartridge/Handle assemblies are fully installed with all Cartridge Bottom End Caps contacting the housing's Tube Sheet, see illustrations on page 17.



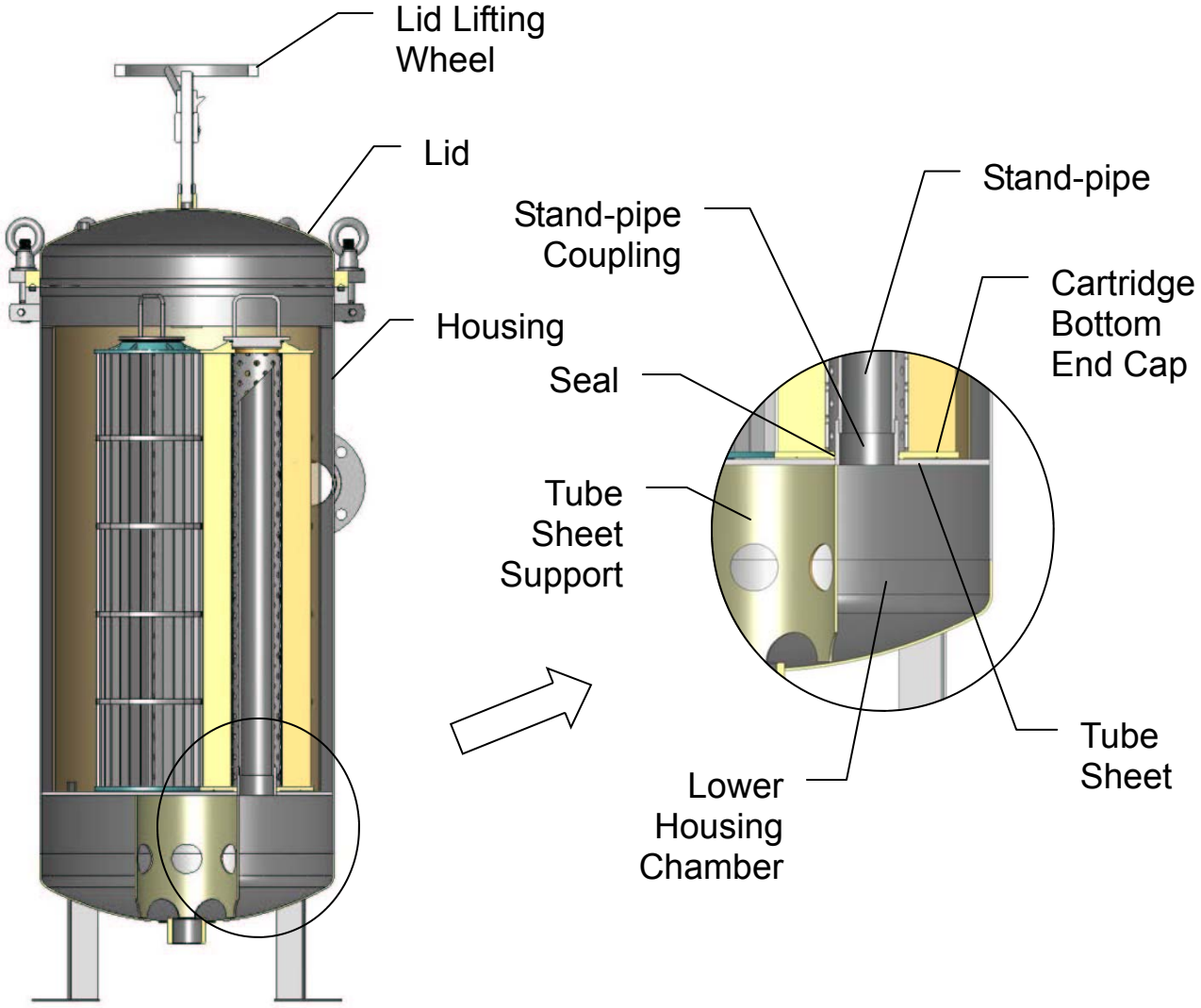
Model HUR 3X170FL

Note:
Models HUR 3X, 5X & 8X (FL) have a Lid/Davit Assy (swing arm). The Lid Lifting Wheel raises and lowers the Lid for servicing.
DO NOT USE The Lid/Davit Assy to raise the Lid while swing bolts are engaged.

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CARTRIDGE REPLACEMENT cont.



Section View
Model HUR 3X170FL

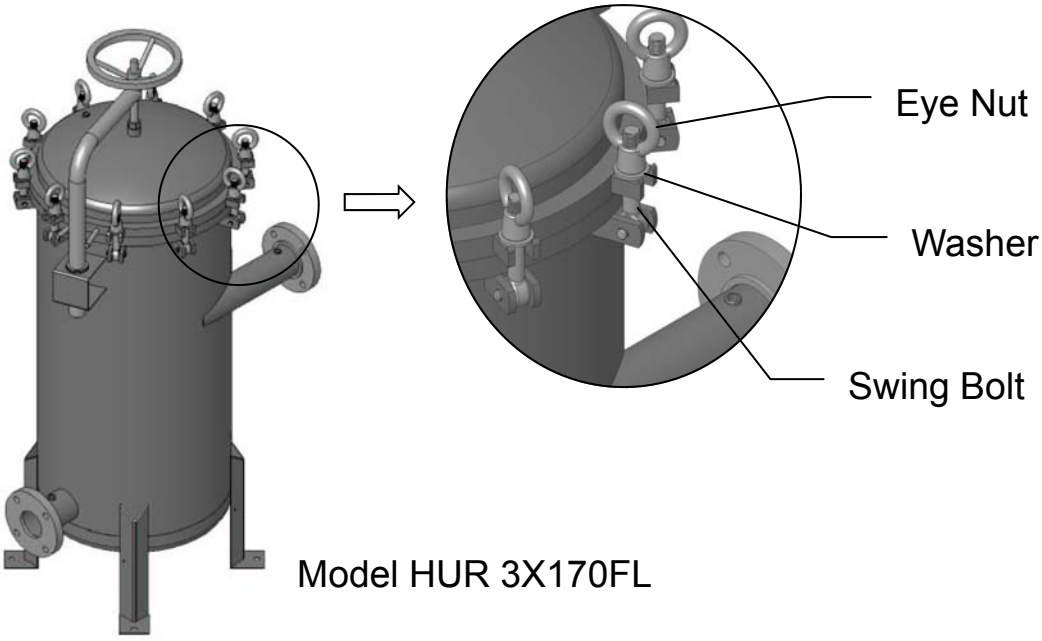
8. Inspect Housing O-ring and make sure that it is free from cracks and debris.
9. Clean Housing and Lid O-ring mating surfaces.
10. Place Housing O-ring into channel of Housing.
11. Return Lid to closure position and maintain alignment of Lid on Housing. Lower lid onto Housing O-ring. Make sure O-ring stays in the channel of the Housing. Do not allow tilting or cocking of Lid on the O-ring.

Note: The Lid/Davit Assembly is NOT to be carrying any load from the Lid at this time.

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CARTRIDGE REPLACEMENT cont.

12. Return all Swing Bolts, Eye Nuts, & Washers to their closure position.
13. Tighten all Eye Nuts by hand in a “star/criss-cross” pattern several times until all Eye Nuts are uniformly tight. Make sure Lid position and alignment to Housing is maintained.



Model HUR 3X170FL

14. Start the flow of water by first opening the inlet valve and allow the housing to completely fill, then, open the outlet valve.
15. Flush unit at recommended flow rate for 10 minutes prior to use. Inspect closure for any leaks. If a leak is observed, **Isolate and Remove Pressure in Housing,** then repeat steps 8 through 15.

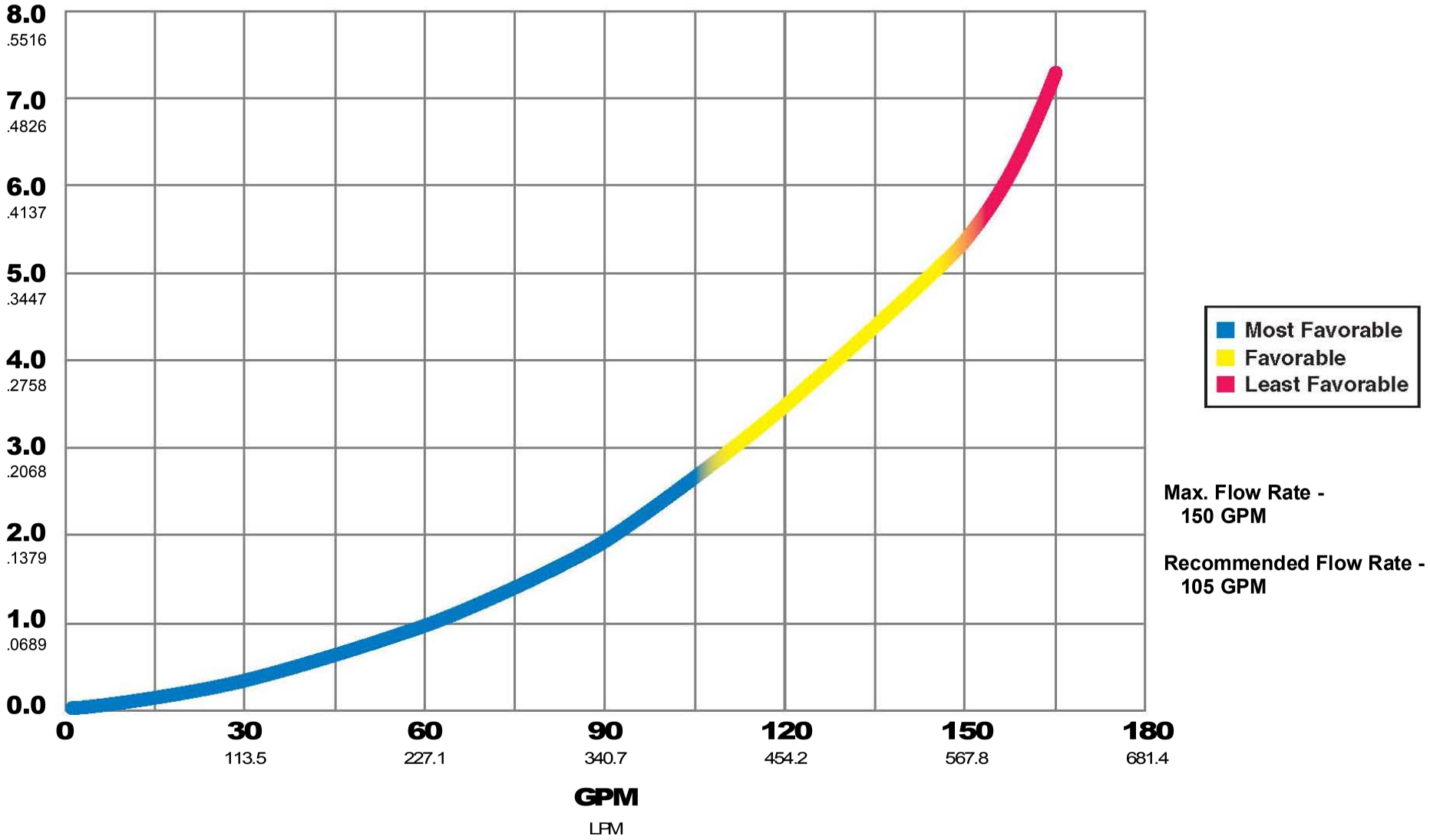
The Harmsco® Swing Bolt Water Filter is now operational.

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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 1X170FL
Hurricane® HC/170-20 Cartridge
Qty 1; with clean water.



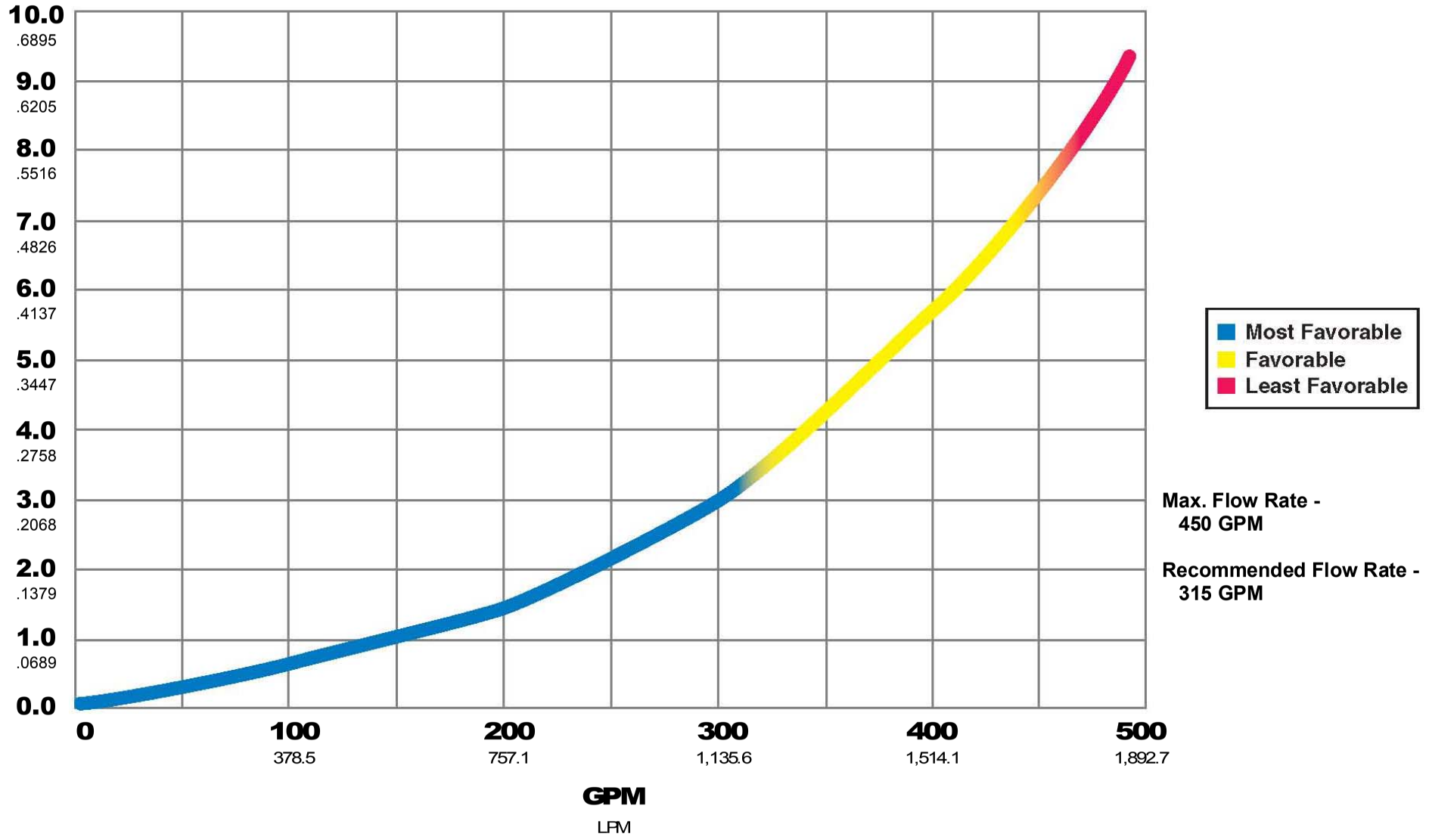
Max. Flow Rate -
150 GPM

Recommended Flow Rate -
105 GPM

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Pressure Drop vs. Flow Rate Curve

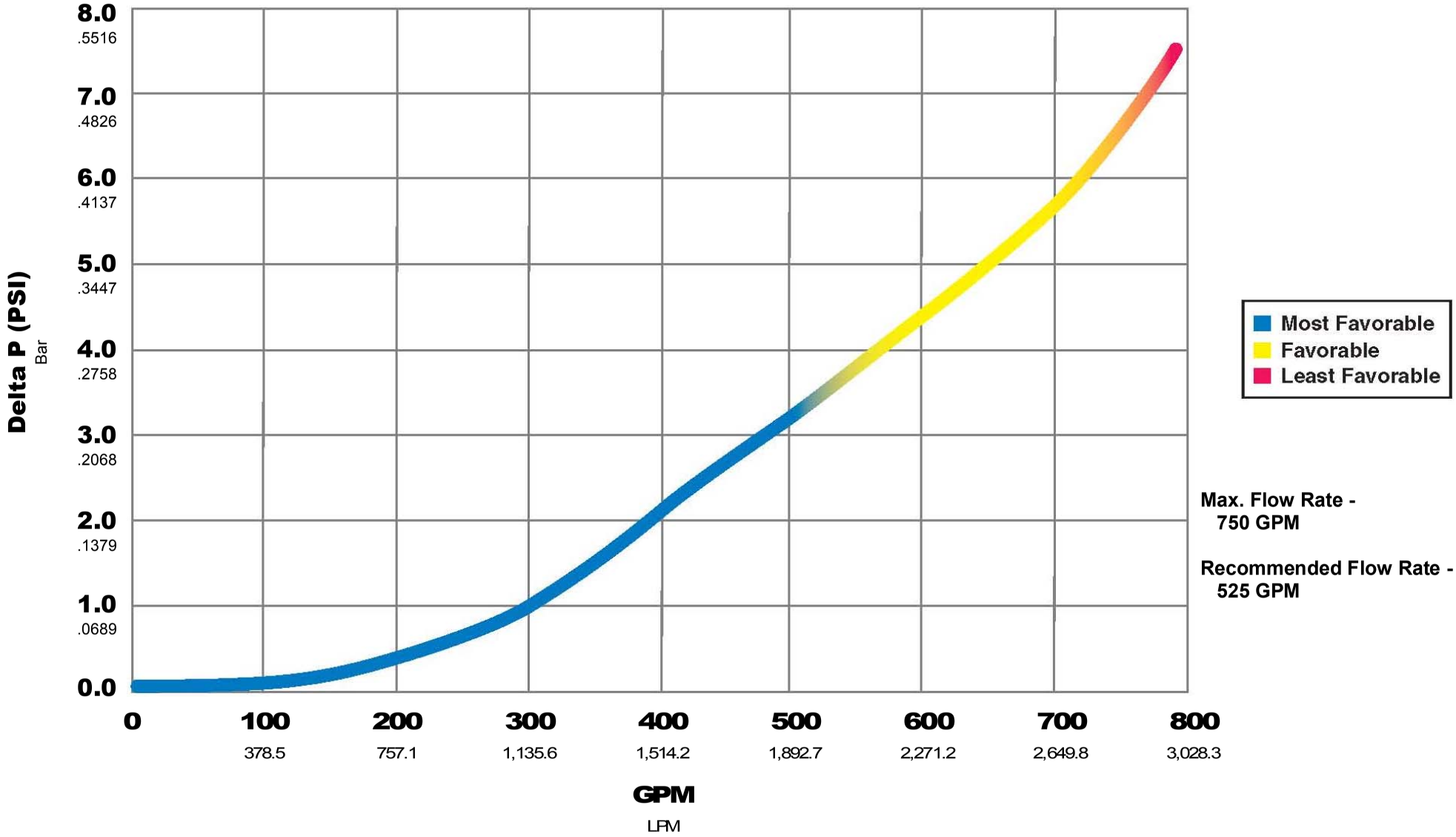
Harmsco® HUR 3X170FL
Hurricane® HC/170-20 Cartridges
Qty 3; with clean water.



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Pressure Drop vs. Flow Rate Curve

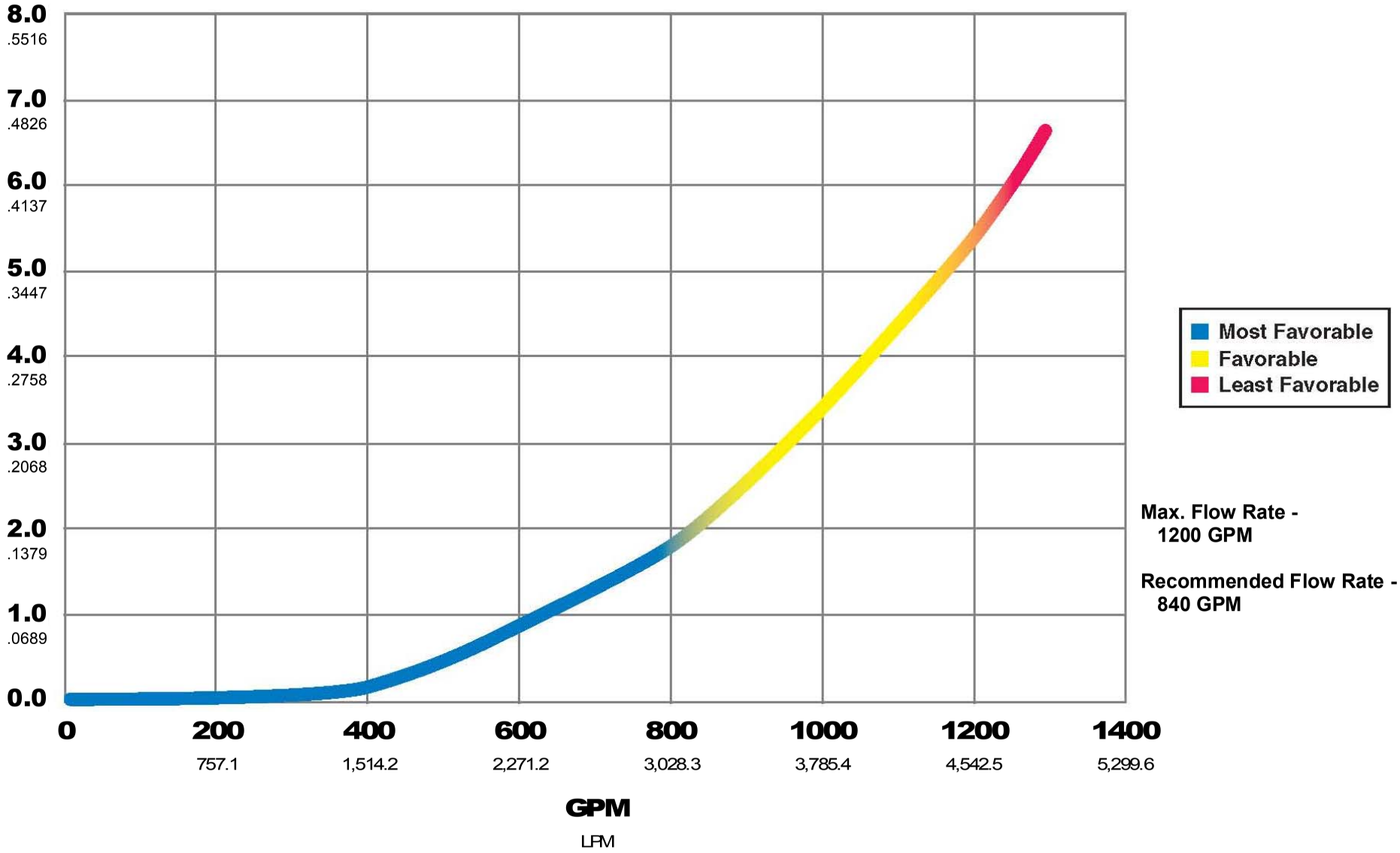
Harmsco® HUR 5X170FL
Hurricane® HC/170-20 Cartridges
Qty 5; with clean water.



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Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 8X170FL
Hurricane® HC/170-20 Cartridges
Qty 8; with clean water.



HARMSCO® Hurricane®
Swing Bolt Water Filters

Filter Cartridge Cleaning Instructions:

For Filter Housings With Swing Bolt Closure.

*** * NOTICE * ***

THE FOLLOWING INSTRUCTIONS MUST BE READ AND FOLLOWED PRIOR TO USE.

Harmsco® Hurricane® cartridges are made of Polyester Plus™, a proprietary blend of polyester fibers, which can be cleaned, and re-used, in most applications and micron ratings. For best results, follow the directions described below.

Harmsco® is not held liable for determining cartridge cleaning applications and/or cleaning procedures implemented.

When Cartridge Cleaning is Possible:

Clean cartridge when pressure differential is 12 psi above start-up differential.

Normal Cleaning Procedure: Cartridge Cleaning in Aqueous Applications. For best results, clean cartridges with pressure nozzle using standard hose. Direct spray at an angle to remove particulate.

Special Cleaning Procedures:
For oils, soak cartridge in a solution of tri-sodium phosphate or equivalent detergent (two lbs. to ten gallons of water). Soak for up to 12 hours. Rinse thoroughly.

For organic matter, algae, use tri-sodium phosphate solution as described above, plus 1 pint of liquid chlorine. Soak cartridge for one hour, or until filter surface is not slippery. Rinse thoroughly.

For calcium mineral deposits, follow directions for oils described above, then soak cartridge for ten minutes in a solution of one part muriatic acid to twenty parts of water. Rinse thoroughly.

Non-cleanable Applications:

Replace cartridge when pressure differential is 30 psi above start-up differential, or when flow has diminished to an unacceptable level.

Generally, it is not possible to clean filter cartridges when filtering petroleum base liquids, cyst reduction applications, toxic substances, and 1 micron or smaller rating.

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HARMSCO® Hurricane®
Swing Bolt Water Filters

Cartridge Replacement Instructions (Quick Reference):

For Filter Housings With Swing Bolt Closure.

*** * NOTICE * ***

THE FOLLOWING INSTRUCTIONS MUST BE READ AND FOLLOWED PRIOR TO USE.

1. **Always Isolate And Remove Pressure From Housing Before Servicing.** Housing is to be shut off and drained of fluid by first opening the lower drain.
2. Open filter housing by turning Eye Nuts counter-clockwise, disengaging Swing Bolts, and removing Lid. Take out used cartridge(s) and remove cartridge lifting handle(s).
3. Remove new cartridge(s) from packaging and make sure center cores are clear of all obstructions, dessicants and shipping materials.
4. Install cartridge lifting handle(s) into cartridge(s).
5. Insert Cartridge(s) into housing and onto Stand-pipe(s), cartridge(s) is(are) to contact Tube Sheet of housing.
6. Position housing O-ring seal in groove of housing.
7. Position Lid onto housing and properly align on O-ring before applying Swing Bolts. Do not allow tilting or cocking of Lid on the O-ring.
8. Close filter housing by tightening Eye Nuts clockwise by hand. Use a “star/criss-cross” pattern several times to tighten all of the Eye Nuts uniformly tight.
9. Open inlet valve and allow fluid to fill housing.
10. Open outlet valve.
11. Flush unit (through outlet) to drain for 10 minutes at recommended flow rates prior to use.

Should a leak appear at the housing O-ring, isolate and relieve pressure and repeat steps 6 through 11. Always isolate and remove pressure from housing before servicing any part of filter.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.

Harmsco® Filtration Products

With Patented Up-Flow Filtration Technology

www.harmsco.com

(561) 848-9628

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Harmsco Inc. Industrial Filters Limited Warranty

1. Harmsco, Inc. warrants its line of Industrial Filters to be free of defects in material and workmanship for a period of one year from the date of installation.
2. The warranty for Industrial Filters ordered with special coatings is limited only to the recoating of the defective parts due to failure in materials or workmanship for one year from date of installation.
3. This warranty does not cover any equipment purchased for use in applications in which the product is not suited. It is the responsibility of the buyer to determine if a product is suitable for a particular application.
4. **THIS WARRANTY EXCLUDES THE FOLLOWING:**
   - **A.** Any fresh water unit installed for salt water use.
   - **B.** Damage caused by improper installation, operation or care.
   - **C.** Chemical attack.
   - **D.** Modification or alteration by other than Harmsco employees.
   - **E.** Rubber type parts and normal wear items i.e. "O" rings, rim gaskets, wing-nuts, pipe caps, holding rods.
   - **F.** Any costs of labor or expenses expended in the removal and/or installation of unit, or any surrounding device.
   - **G.** Damage caused by galvanic or electrolytic attack.
   - **H.** Altering or removing the Harmsco, Inc. information label.
   - **I.** Any unit not grounded.
5. Service under this warranty is to be provided by the distributor who sold the unit to the user. If the distributor is unable to provide warranty service, contact:

Harmsco, Inc., P.O. Box 14066
North Palm Beach, Florida, 33408, U.S.A.
Phone: (561) 848-9628 • Fax: (561) 845-2474

A Returned Goods Authorization (RGA) number must be received from the above office and placed on all shipments to and correspondence with Harmsco, Inc. Please be prepared with the following information: **1.** Model number and serial number. **2.** Date of installation. **3.** Name of installer **4.** Nature of problem. **5.** Your address and telephone number.

****NOTICE****

Some of the information contained in this publication has been obtained from outside sources and is considered accurate. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. For this reason, we do not assume any liability for the accuracy or completeness of the data in this publication. End users should perform their own tests to determine suitability for each application.

Available from:

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Fax: (561) 845-2474
Local: (561) 848-9628
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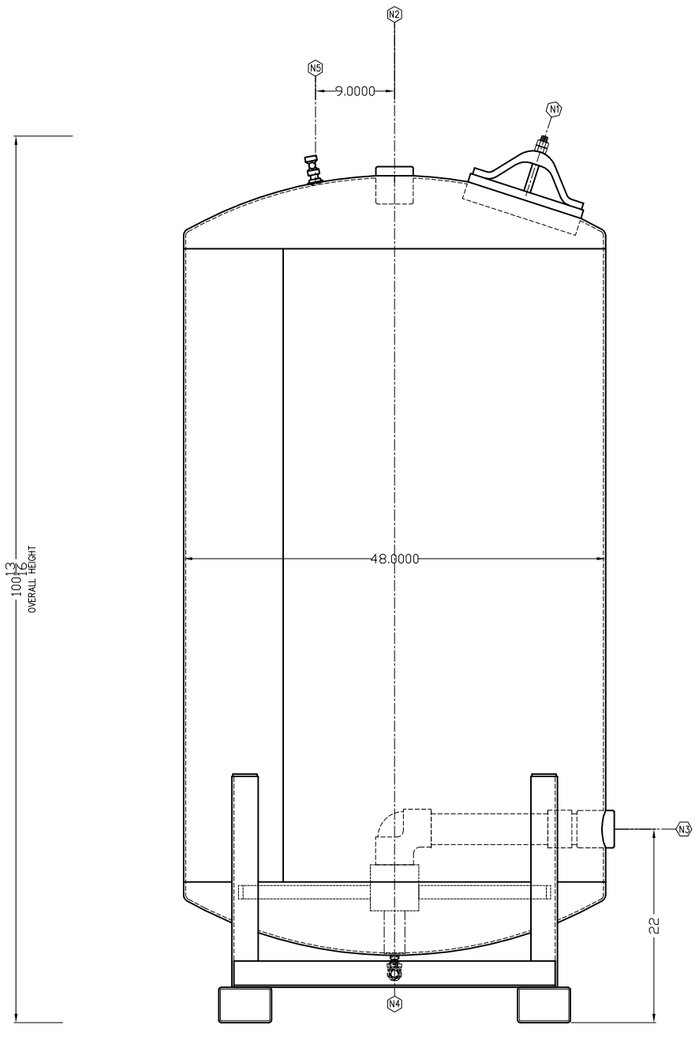
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Harmsco® Filtration Products

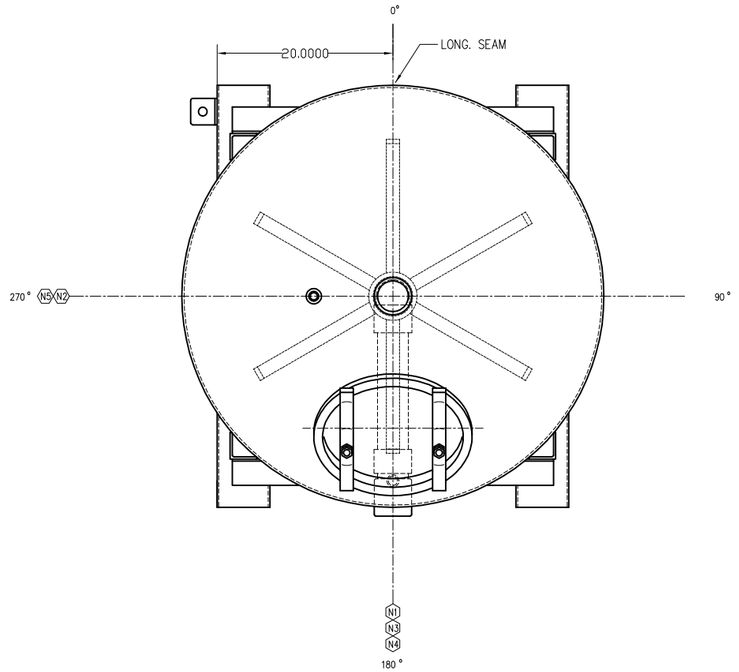
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RevNo	Revision note	Date	Signature	Checked



ELEVATION VIEW
NOT TRUE ORIENTATION



PLAN VIEW
TRUE ORIENTATION

NOZZLE SCHEDULE

ID	*Description*	*Service*
N1	12" x 16" ELLIPTICAL MANWAY w/COVER	Upper bed access with Cover (SA-36), Bolts, Neoprene Gasket
N2	3" MNPT 3000# Coupling	Process Inlet
N3	3" MNPT 3000# Coupling	Process Outlet
N4	1" 150# Thrd Tank Flange	Drain w/1/2" Ball Valve
N5	1/4" 150# Thrd Tank Flange	VENT
N6		
N7		

COATINGS SCHEDULE

Surface	*Surface Preparation*	*Product Specification*
Internal - 1	SSPC-SP6	SW Macropoxy 646 6-8 mils DFT
Internal - 2	Inspect	n/a
External - 1	SSPC-SP6	SW Kem Bond Primer 2-4 mils DFT
External - 2	n/a	SW Shercryl (Blue) 2-4 mils DFT
External - 3	n/a	n/a

NOTES

Item	*Details*
Construction	Non-Code Design Pressure: 75 PSIG @ 140 DEG F.
Mtrls Vessel	Shell: SA-36 Heads: SA-36 Pipe: SA-53 (see nozzle detail for others)
Mtrls Interls	Hub, Laterals (.012" Slot), Diffuser, Hose: PVC Gaskets: Neoprene Hardware: Plated
n/a	n/a
n/a	n/a
Media	Reactivated Vapor Phase Carbon

Designed by	Approved by	Customer	Job Number	Date	Scale/Unit
D Shreves	E Patterson	Newterra	4289JB	December 13, 2012	NTS / Inch

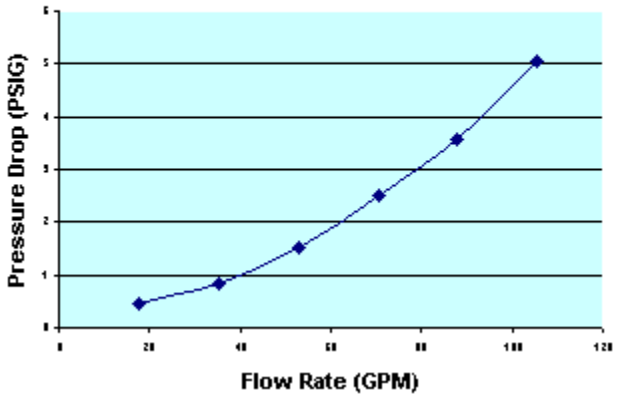
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1424 ABRAHAM DRIVE
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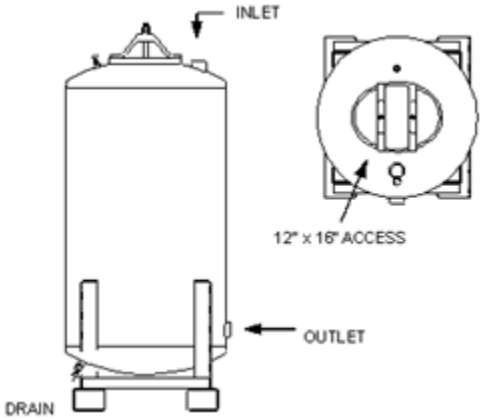
HPAF-2000 Media Filter

Drawing# M-1 / R1

HPAF-2000
High Pressure Aqueous Vessel

PRESSURE DROP GRAPH
*(As Filled - 8*30 GAC)*





HPAF-2000 SPECIFICATIONS			
Overall Height	8'6"	Vessel/Internal Piping Materials	CS (SA-36) / SCH 40 PVC
Diameter	48"	Internal Coating	Polyamide Epoxy Resin
Inlet / Outlet (FNPT)	3"	External Coating	Epoxy Mastic
Drain / Vent (FNPT)	3/4" / 1/2"	Maximum Pressure / Temp	75 PSIG / 140° F
GAC Fill (lbs)	2,000	Cross Sectional Bed Area	12.5 FT^2
Shipping / Operational Weight (lbs)	3,020/6,775	Bed Depth/Volume	5.5 FT / 68.7 FT^3

Tetrasolv Filtration

Operation & Maintenance Manual

AFD ● AF ● HPP ● HPAF SERIES

Tetrasolv Filtration Liquid Filters

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

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1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat water. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

Product data sheets, drawings, MSDS, etc are available from www.tetrasolv.com or call the number below or email your request to support@tetrasolv.com.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system.

♦ ***WARNING: We strongly recommend the use of a relief device in all installations. Exceeding the maximum pressure of the filter could result in catastrophic failure of the vessel.***

- Always adhere to “lockout/tagout” procedures when servicing the system.
- Wear appropriate safety equipment when operating system.
- Review the MSDS sheet for the installed media prior to working with the installed carbon.

♦ ***WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.***

- Understand the potential hazards of the stream

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being treated by the system. The media may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the media may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

- ***WARNING: Failure to follow the procedures outlined below can result in catastrophic damage to the system.***

Crane Lift - If a crane lift is to be used we recommend the following method. A "spreader" equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

- ***WARNING: Never attempt to pick up an adsorber which has wet carbon installed. The lifting eyes are designed only to lift the adsorber with dry carbon installed.***

3.3 Inspection

Perform the following inspections after un-loading the filter. Note any discrepancies and contact Tetrasolv Filtration immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.
- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.
- Visually inspect the interior (if possible) of the vessel for loose laterals and or internal damage.
- Inspect the carbon discharge, drain and vent valves for damage.

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it's maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped loose with the system.

The outlet piping should be designed to allow flooded operation of the Adsorber at all times to assure effective operation. If the outlet line does not provide for back pressure on the Adsorber unit, then the discharge piping should include an elevated piping loop to assure flooded operation.

Siphoning can occur when the discharge line allows suction to be placed on the process discharge. Siphoning can cause air pockets to occur in the adsorbers. If channeling is likely to occur we recommend the installation of an appropriately sized vacuum breaker.

If the supply pump is capable of producing pressure greater than the design limitation of the filter it is recommended that a rupture disk or pressure relief valve be installed prior to the influent connection.

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If water conditions such as high suspended solids exist a filter should be installed prior to the Adsorber. A simple cartridge or screen filter helps prevent pressure buildup in the media bed. Many other water issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

Connect the process inlet and outlet to the site influent and effluent process lines.

3.5 Wetting and Deaeration

Dry carbon and other medias must be wetted and deaerated prior to use. This procedure displaces air from the internal structure of the carbon granule, thus assuring that the liquid to be treated is in contact with the carbon surface.

Prior to operation, the filter must be filled with clean, uncontaminated liquid. The recommended method for filling the vessel is through the outlet line. Open the inlet line to purge air from the system. Feed water into the outlet line until water flows from the inlet line. The wet carbon or media should be allowed to set for a minimum of 1 hours.

This is also a good time to inspect the system for leaks which may have been caused in transit and unloading the system. If leaks are spotted, tighten the fitting or flange bolts carefully until the leak stops. Do not overtighten the bolt or fitting. If the leak persists contact Tetrasolv Filtration for assistance.

After wetting, the carbon bed can be deaerated by draining the adsorber, and again filling the adsorber upflow with uncontaminated water. This procedure will eliminate any air pockets which may have formed between the carbon granules.

After completing the wetting and Dearation it is recommended that a backwash be performed. The backwash will remove media fines which can cause excess pressure drop in the system if not removed. In addition backwashing helps equalize the bed. Follow the directions outlined in Backwashing ***(refer to section 4.2)***.

After backwashing close the system valves and wait 1 hour.

The system is now ready for operation.

4.0 OPERATION

Flowrates to the filter should be determined based upon the required contact time between the liquid and the filtration media. The required contact time normally is determined prior to installation and operation of the filter.

It is important that the filters remain flooded at all times. If it is necessary to drain adsorbers while off-line it is recommend the procedures in section 3.5 “Wetting and Dearation” be repeated.

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.
- Backwash Mode - Used when back-washing either filter.

4.2 Backwashing

IMPORTANT: Backwashing is not advisable with AFD or AF Series Filters. If a backwash is required please contact the number below or support@tetrasolv.com for assistance.

Usually backwashing is only performed in carbon adsorbers after new carbon has been installed or prior to removing the carbon from the adsorber. However, sometimes water conditions necessitate backwashing to remove suspended solids from the top of the carbon bed. Keep in mind that backwashing a carbon bed during normal service runs may cause the transfer zone to be disturbed leading to pre-mature breakthru of the carbon bed. Backwashing helps to reduce and equalize pressure drop across the media bed as well as removes

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collected particulate from the top of the bed. Backwash rates for filters typically fall in the 5 to 20 gpm/ft^2. Backwash rates are dependent upon temperature of the backwash water, filter design and the media conditions. Refer to the data sheet for the supplied filter to obtain the cross sectional bed area. Refer to the data sheet for the supplied media to obtain the recommended backwash rate. Backwashing should begin at a low rate and proceed upwards.

Clean, uncontaminated, sediment free water is introduced to the filter through the outlet connection. This liquid flows upwards through the filter and exits through the inlet line - directed to a back-wash water collection point or drain. The flow rate should not be high enough to cause a significant quantity of media to exit.

IMPORTANT: Use only clean un-contaminated water free of sediments. If there is any question that sediments may be present the water should be filters through a 100 micron filter or smaller. Sediments introduced into the lateral system during backwash can cause excessive pressure build-up in the underdrain leading to underdrain failure.

If possible position an observer at the backwash discharge point. The adsorber should note excessive media loss and general appearance of the backwash effluent. If conditions warrant the observer should also instruct that the backwash be stopped.

Monitor the differential pressure for the filter being backwashed during the operation. If the differential pressure exceeds 30 PSIG discontinue the backwash and contact Tetrasolv Filtration.

IMPORTANT: Differential Pressure exceeding 30 PSIG during backwash may damage the vessel underdrain.

4.3 Monitoring

Filter units only require periodic monitoring if properly installed. The following items may be monitored:

- Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate build-up of filtered solids. Never exceed maximum design pressure of filter. If the differential pressure exceeds 20 PSIG it may become necessary to perform a backwash ***(see Backwashing Section 4.2)***

- Samples: Inlet and outlet sample points if provided for liquid analysis to determine system performance. Before pulling a sample the sample valve should be opened and allowed to flow freely for a few minutes to insure a fresh sample is obtained.

- Air: Check for trapped air by opening upper vent valve and allowing small amount of liquid to flow out. If your system was provided with automatic vent systems it is still necessary to periodically verify their operation.

- Inspect the discharge stream periodically for filtration media. If filter media is present in the exit stream shut down the system and contact Tetrasolv Filtration immediately.

Note: When the system if first started up small amounts of fines may be present. This is normal and should discontinue within a short period of time.

5.0 FILTRATION MEDIA REPLACEMENT

Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the filtration media is complete, it is recommended that the inside of the filter be washed to remove all contamination and any trace of spent media. After the filter has been washed, the filter should also be checked thoroughly and any minor maintenance conducted.

5.1 Media Loading - Dry Method

Fill the adsorber 1/4 full of clean water to protect the lower manifold and limit the amount of dust generated.

- ***WARNING - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.***

Super Sacks - Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasping it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

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If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

5.2 Media Loading - Slurry Method

In this method dry-activated carbon will be delivered to the site in a slurry truck or slurry capable hoppers. To add the carbon to the filters use the following method:

- ***WARNING: Carbon slurry operation is a potentially hazardous operation which should only be performed by experienced operators with prior slurry experience. If you are un-trained do not attempt to perform a slurry without assistance.***

1. Use an appropriate sized hose connected to the carbon supply line for the adsorber. **Be sure the slurry line is adequately secured and the cam-lock mechanism is completely engaged. If the slurry line disconnects or fails large amounts of carbon will be expelled.**

2. Fill the adsorber 1/4 full of water to cushion the vessel internals from the entering carbon.

3. Completely cover the fresh carbon with clean water. Connect air source to the slurry container capable of producing 10 PSIG of air at 175 cfm.

4. Open the adsorber process outlet valve to allow excess water to escape the system (note: depending upon your discharge piping configuration this may not allow sufficient water drainage under non-pressure operation, consult Tetrasolv Filtration). Open the slurry in valve. Fresh carbon should begin flowing quickly into the filter. During this process it may become necessary to stop the slurry and allow excess water to drain from the adsorber.

5. When transfer is complete the transfer hose will begin blowing air only. It may be necessary to inspect the transfer hopper for carbon which did not transfer. If a sufficient quantity is present wash the carbon to the center using clean water and add enough water to re-cover the carbon and repeat the above procedures.

6. Close the valves and proceed to Section 3.5 “Wetting and Deaeration” then perform a backwash.

5.3 Media Removal - Slurry Method

This method can only be used with slurry equiped HPAF Series!

In this method spent activated carbon will be removed from the spent adsorber into a slurry truck or slurry capable hoppers. To remove the carbon from the filter use the following method:

- ***WARNING: Carbon slurry operation is a potentially hazardous operation which should only be performed by experienced operators with prior slurry experience. If you are un-trained do not attempt to perform a slurry without assistance.***

Backwashing the adsorber to be serviced for a few minutes prior to servicing will make the slurry occur more easily. It is important the the adsorber to be backwashed be full of water prior to attempting the slurry.

1. Connect the carbon discharge line to the carbon discharge connection on the adsorber to be emptied.

2. Connect an air source to the carbon fill line capable of producing 50 PSIG of air at 175 cfm.

- ***WARNING - The inlet air should be closely monitored to insure the pressure does not exceed the design pressure leading to rupture disc activation. If this can not be done the use of a pressure limiting device which still allows adequate air flow should be used.***

3. Open the air vent valve and pressurize the adsorber to 15 PSIG.

IMPORTANT: The initial pressure required for slurry transfer will be between 10 and 20 PSIG. Because of the compressibility of air the pressure should be reduced as the adsorber empties. If the operator supplying compressed air into the adsorber cannot see the pressure gauge there must be another operator who can call out the pressure reading during the transfer.

4. Open the slurry out valve. Spent carbon should begin flowing quickly out of the carbon vessel.

5. When transfer is complete the transfer hose will begin blowing air only. Bleed all air from the adsorber, remove the manway and inspect the adsorber for carbon which did not transfer. If a sufficient quantity is present wash the carbon to the center using clean water and add enough water to re-cover the carbon and repeat the above procedures.

6. Inspect the internals prior to refilling the adsorber.

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Inspect the interior lining. Do not place the adsorber back into operation if any defects are noted.

6.0 MAINTENANCE

6.1 Extended Shut Down

If the filter will be shutdown for extended periods certain procedures should be taken to protect the filter.

If possible backflush the filter. Drain all water from the adsorber utilizing the effluent connection and the drain port if available. When draining allow air to enter the system by venting the influent line. Store the drained filter with system vented.

Caution should be taken during system startup following exposure to freezing conditions as the media may still be in a frozen state days or weeks after.

Prior to placing the adsorber back into service it is recommended the procedures outlined in section 3.5 "Wetting and Dearation" be followed.

Monitor the filter closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

6.2 Manway Opening & Closing

When it becomes necessary to open a manway the following methods should be closely followed:

- ***WARNING: Opening a manway while a vessel is pressurized can cause serious injury or death. Always verify pressure is relieved before attempting to remove a cover.***

- ***WARNING: Opening the lower manway on an filter which contains media can result in large quantities of media being discharged. Worse still the manway may not be able to be successfully sealed without removal of the media.***

Verify vessel is isolated and relieve pressure using filter vent valve.

Round T-Bolt Closures

1. Carefully loosen retaining nuts around manway ring. If while loosening the bolts you hear a hissing or any other indication of pressure immediately re-tighten the bolts and verify pressure has been relieved.

3. Swing all T-Bolts away from manway cover and slowly open cover. If gasket sticks to manway cover gently pry away to avoid tearing the gasket.

4. Clean O-Ring surface. Lubricate gasket with petroleum jelly.

5. Close manway and tighten bolts. It may be necessary to further tighten bolts after pressure has been applied to filter to prevent leaking.

Elliptical Closures

1. Slip a bent bar between the manway handle and the flange frame. ***This is to insure the manway does not fall into the vessel when the yokes are removed.***

2. Carefully loosen both large nuts holding the yokes to the manway. Remove the yokes.

3. Slide the bar out of the handle while holding it. Push the manway in and tilt to allow the manway to be pulled out of the filter.

Closing the manways:

1. Clean the gasket surface and replace if necessary. Apply tape to the gasket and the cover to hold the gasket in place while it is placed into position.

2. Slip a bent bar between the manway handle and the flange frame. ***This is to insure the manway does not fall into the vessel when the yokes are removed.***

3. Place the yoke into the manway cover slot and hand tighten. Carefully inspect the gasket to be sure it can be seen around the inside surface of the manway opening.

4. Wrench tighten nuts.

7.0 Troubleshooting

The following situations are typical problems which may arise during the operation of filters. If these problems cannot be resolved by using this guide or problems occur which are not addressed in this guide please contact TetraSolv Filtration at the number listed below or e-mail **support@tetrasolv.com**

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Situation:

High pressure drop or inadequate flow through filters at expected pressure drop levels.

Probable Cause:

a) Verify effluent and influent lines to and from adsorber are not restricted.

b) Sediments or solids may have clogged the surface of the media. Remove the top manway cover and inspect the surface of the media. Backwashing the media should resolve this issue. Explore the possibility of pre-filtration ahead of the media filter to limit future problems.

c) Air is trapped in the top of the filter or the system piping. Relieve air using vent valves.

d) Underdrain collection baskets clogged. Contact Tetrasolv Filtration for recommendations.

Situation:

Manways failing to seal. Water leaking from.

Probable Cause:

a) Manway not installed properly.

b) Missing or damaged gasket

c) Debris trapped between gasket and ring

Solution:

Tighten the bolts on the manway first. If this does not solve the problem remove and reinstall manway as outlined in 6.4 if possible. If problem persists contact TetraSolv Filtration for further assistance.

Situation:

Premature filter exhaustion.

Probable Cause:

a) Inadequate contact time between the media and the liquid stream.

b) Contaminants in stream not originally accounted for in initial design or higher levels of contaminants than originally accounted for.

c) Trapped air or solids on bed causing channeling.

Solution:

Sample and analyze the influent water stream. Verify proper conditions exist. Also look closely at suspended and dissolved solids.

Verify contact time sufficient for contaminate being adsorbed. Decrease flow rate or install additional media.

Inspect surface of filter for fouling.

Release excess air from top of filter through filter vent line.

Situation:

Activated Carbon bed discharge stream has higher level of contaminants than influent stream.

Probable Cause:

Carbon bed has reached saturation. Carbon beds will often release larger amounts of contaminants than they are adsorbing as the mechanical bonds are broken when the carbon has reached it's saturation point.

Also, activated carbon will preferentially exchange more easily adsorbed compounds for ones already trapped in the carbon surface releasing the compounds trapped in unpredictable levels.

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WWW.TETRASOLV.COM

CARBON ACTIVATED CORP.

Activated Carbon and Related Services

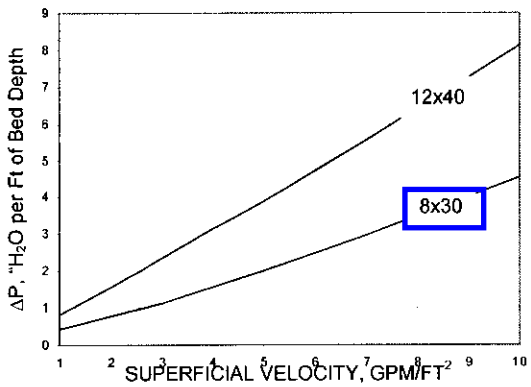
PRODUCT BULLETIN

ACOL – GL 60

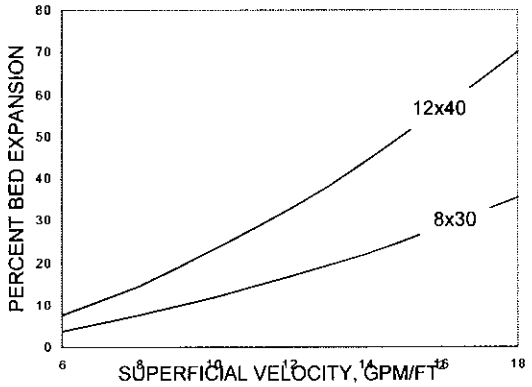
Acid Washed Bituminous Coal Base Carbon

ACOL-GL60 Granular Activated Carbon (GAC) is manufactured from select grades of Bituminous Coal and acid washed to yield a high purity and low ash content. ***ACOL-GL60*** features a high density, large pore volume and high surface area. It's commonly used for beverage manufacture, dialysis, potable water, and a variety of food grade applications. ***ACOL-GL60*** meets AWWA Standard B-600-74, ANSI/NSF Standard 61 and Food Chemicals Codex Standards for drinking water applications.

DOWNFLOW PRESSURE DROP



UPFLOW BED EXPANSION



TYPICAL PHYSICAL PROPERTIES / SPECIFICATIONS

Total Surface Area (BET), m^2/g		950 - 1000
Iodine Number, min.		950 - 1000
Apparent Density (ASTM 2854), g/cc		0.44 – 0.46
	lb/ft^3	27 - 29
Density, BWD	lb/ft^3	23 - 25
Abrasion No., min.		85
Particle Sizes:		8 x 30
		12x40
		20x50
Ash, max.		8%
Moisture as packed, max.		2%

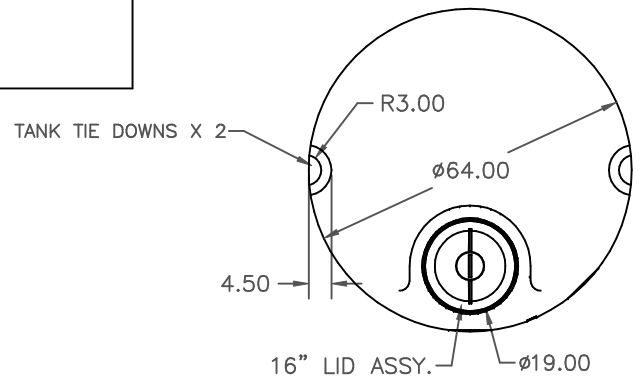
NSF

STANDARD PACKAGING:
55lb or 27.5lb POLYLINED POLYPROPYLENE BAGS. 200lb FIBER DRUMS. 1100lb SUPERSACKS.

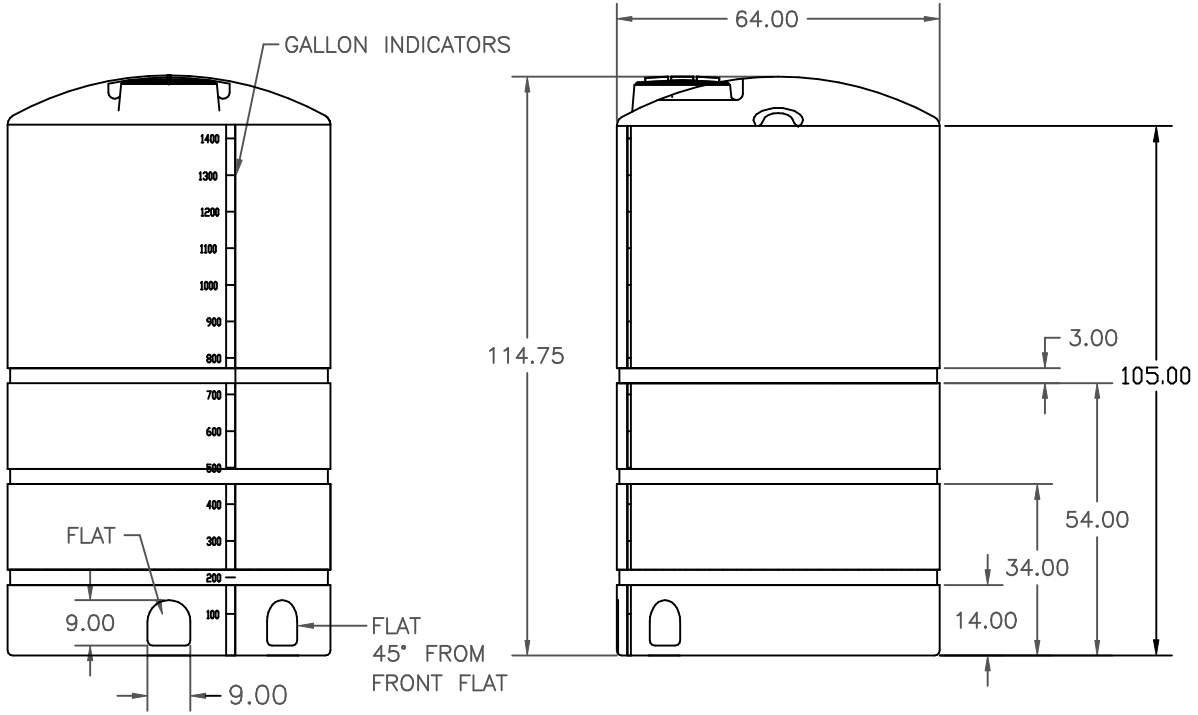
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PROPRIETARY DATA

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1. HEAVY DUTY POLYETHYLENE CONSTRUCTION
2. 1 PIECE ROTATIONALLY MOLDED
3. TRANSLUCENT
4. FDA APPROVED RESIN
5. CALIBRATED IN GALLONS
6. THREE YEAR WARRANTY
7. UV STABILIZED



REV	DESCRIPTION	DATE	APPRD

DRAWN / DATE: DHJ 01/02/03

APPRD. / DATE: ADH 11/19/07

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M

MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET
FOR SPECIFIC PROPERTIES.

NOTES:
1. BLUE, YELLOW, WHITE, OR BLACK COLOR
2. SHOT WEIGHT 335 LBS.
3. NOM. WALL .340

ACE ROTO-MOLD
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4018 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION: 1500 GALLON VERTICAL TANK

SCALE: N.S.

PART NO.: VT1500-64

VERTICAL TANKS - DOME TOP

Syphon tube included with tanks 300 gallon or greater



VT1050-86



VT2050-86

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
VT0010-12†	10 GAL	9	12 X 25	8"	3/4"	2.0
VT0020-16†	20 GAL	15	16 X 28	8"	3/4"	2.0
VT0025-18†	25 GAL	14	18 X 30	5"	3/4"	2.0
VT0040-18†	40 GAL	19	18 X 43	5"	3/4"	2.0
VT0055-20†	55 GAL	23	20 X 47	5"	1"	2.0
VT0065-23†	65 GAL	27	23 X 42	5"	1"	2.0
VT0110-32	110 GAL	42	32 X 41	5"	2" TOP	2.0
VT0135-23	135 GAL	47	23 X 82	16"	1"	2.0
VT0300-42	300 GAL	74	42 X 55	8"	2"	2.0
VT0405-52	405 GAL	92	52 X 48	8"	2"	2.0
VT0425-42	425 GAL	102	42 X 75	8"	2"	2.0
VT0505-46	505 GAL	120	46 X 80	16"	2"	2.0
VT0550-52	550 GAL	118	52 X 66	8"	2"	2.0
VT0600-46	600 GAL	132	46 X 91	16"	2"	2.0
VT0625-64	625 GAL	102	64 X 50	8"	2"	2.0
VT0800-46	800 GAL	177	46 X 118	16"	2"	1.7
VT0900-46	900 GAL	222	46 X 132	16"	2"	1.7
VT1000-64	1000 GAL	252	64 X 81	16"	2"	1.7
VT1050-86	1050 GAL	192	86 X 54	16"	2"	1.7
VT1200-64	1200 GAL	277	64 X 97	16"	2"	1.7
~~VT1350-86~~	~~1350 GAL~~	~~230~~	~~86 X 65~~	~~16"~~	~~2"~~	~~1.7~~
VT1500-64	1500 GAL	337	64 X 115	16"	2"	1.7
~~VT1500-86~~	~~1500 GAL~~	~~252~~	~~86 X 69~~	~~16"~~	~~2"~~	~~1.7~~
VT1525-64	1525 GAL	352	64 X 122	16"	2"	1.7
VT1650-86	1650 GAL	280	86 X 74	16"	2"	1.7
VT2000-64	2000 GAL	467	64 X 156	16"	2"	1.7
VT2000-90	2000 GAL	377	90 X 84	16"	2"	1.7
VT2050-86	2050 GAL	402	86 X 93	16"	2"	1.7
VT2150-102	2150 GAL	417	102 X 71	16"	2"	1.7
VT2500-90	2500 GAL	422	90 X 103	16"	2"	1.7
VT3000-90	3000 GAL	552	90 X 120	16"	2"	1.7
VT3100-102*	3100 GAL	552	102 X 103	16"	2"	1.7
VT3400-102*	3400 GAL	587	102 X 107	16"	2"	1.7
VT4000-96*	4000 GAL	902	96 X 140	16"	2"	1.7
VT4200-96*	4200 GAL	952	96 X 148	16"	2"	1.7
VT4995-142*	4995 GAL	952	142 X 90	16"	3"	1.7
VT5000-102*	5000 GAL	1302	102 X 156	16"	3"	1.7
VT5150-102*	5150 GAL	1352	102 X 161	16"	3"	1.7
VT6250-102*	6250 GAL	1552	102 X 194	16"	3"	1.7
VT6500-120*	6500 GAL	1502	120 X 152	16"	3"	1.7
VT7000-142*	7000 GAL	1752	142 X 125	16"	3"	1.7
VT7800-120*	7800 GAL	1902	120 X 176	16"	3"	1.7
VT8000-120*	8000 GAL	1932	120 X 180	16"	3"	1.7
VT9150-120*	9150 GAL	2202	120 X 203	16"	3"	1.7
VT9500-120*	9500 GAL	2352	120 X 213	16"	3"	1.7
VT10500-2500*	10,500 GAL	2502	142 X 177	16"	3"	1.6
VT10500-2800*	10,500 GAL	2802	142 X 177	16"	3"	1.8
VT12500-142*	12,500 GAL	3402	142 X 208	16"	3"	1.7

† INDICATES CAN BE SHIPPED VIA UPS/FED EX
* HEAVY DUTY FITTING



WO2500-VT

WO3000-VT

WATER ONLY TANKS

Additional water only tanks available

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
WO2500-VT	2500 GAL	392	96 X 92	16"	2"	1.0
WO3000-VT	3000 GAL	487	96 X 109	16"	2"	1.0

Water Only Vertical Tanks

Water tanks are free standing for indoor or outdoor stationary applications. Tanks are manufactured from FDA compliant high-density polyethylene with UV inhibitors. They are designed for the storage of chemicals with a specific gravity of 1.0 or less and available in dark green. Contact customer service for additional water only options.

Heavy Duty Straight Centrifugal Pumps

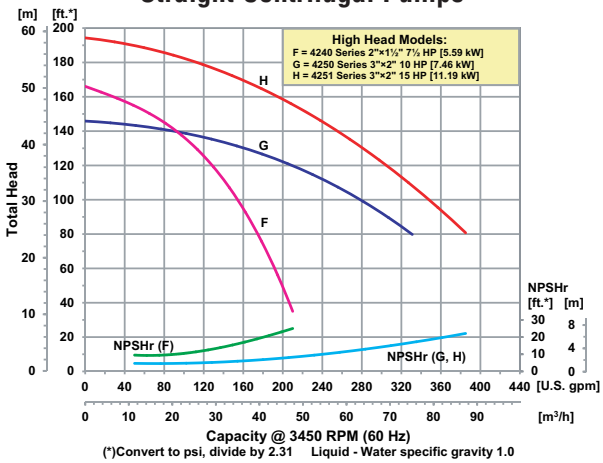


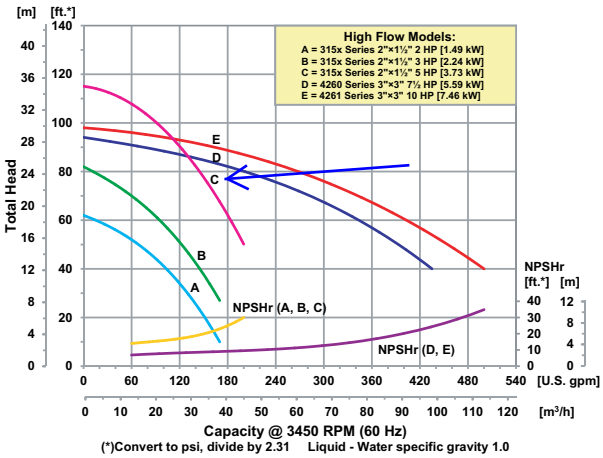
High Head Pump

High Flow Pump

- **Available in: 300 Series Investment Cast Stainless Steel, Cast Bronze and Cast Iron Construction with Stainless Steel Impeller**
- **Buna-N Mechanical Seal and O-Ring on Cast Iron Models**
- **Viton® Mechanical Seal and O-Ring on Stainless Steel and Bronze Models**
- **Optional Silicon Carbide Seals Available**
- **Front Drain Plugs Located 90° Apart**
- **Maximum Head 194 Feet (84 PSI)**
- **Maximum Flow 500 GPM**
- **2 HP to 15 HP NEMA Motors, Single and Three Phase**
- **Optional Mounting Base Available**

Performance of Heavy Duty Straight Centrifugal Pumps





AMT Heavy Duty Solids Handling End Suction Centrifugal pumps are suited for liquid and chemical transfer, heating and cooling, recirculation, booster service, dirty water and other industrial applications. Stainless steel units are especially effective in applications where rust and/or corrosion can develop in systems. Semi-open impeller features self-cleaning ability that makes the unit useful in applications involving up to 1/8" diameter solids and muddy or dirty liquids, as well as clean, clear fluids. Discharge position can be adjusted in 90° increments with vent and drain plugs for all positions. Type 21 mechanical seal and O-ring casing seal. Pumps are close coupled to Totally Enclosed Fan Cooled (TEFC) motors. **Pumps are not self-priming and require flooded suction.**

AMT®
A Gorman-Rupp Company

400 Spring Street • Royersford, PA 19468 USA

www.amtpump.com • 888-amt-pump (268-7867)

For use with nonflammable liquids compatible with pump component materials. Viton® and Teflon® are registered trademarks of E. I. Dupont.

Heavy Duty Straight Centrifugal Pumps

Pump Dimensional & Specification Data

Model ‡	Curve	HP	PH	Frame	ENC	Voltage @ 60 Hz +	Full Load Amps	SUC*	DIS*	A**	B**	C**	D**	E	F**	G	J**	K	L**	W**	H	‡ Ship Wt. (Lbs.)
3156			1	56J		115/230	22/11			5.4 [13.8]	5.0 [12.7]	8.5 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	17.4 [44.2]	10.6 [26.9]	9.6 [24.4]	78
3150	A	2	3	145JM	TEFC	230/460	6/3	2	1½	6.1 [15.5]	3.5 [8.9]	10.7 [27.1]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	2.7 [7.0]	1.3 [3.5]	19.2 [48.7]	11.4 [28.9]	9.6 [24.4]	84
3157			3	56J		230/460	6/3			5.4 [13.8]	3.6 [9.1]	8.5 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	16.9 [42.9]	10.6 [26.9]	9.6 [24.4]	71
315A			1	56J		230	12			5.4 [13.8]	5.0 [12.7]	8.6 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	17.9 [45.4]	10.6 [26.9]	9.6 [24.4]	87
3151	B	3	3	182JM	TEFC	230/460	8/4	2	1½	7.1 [18.0]	6.6 [16.8]	10.9 [27.6]	4.5 [11.4]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	3.7 [9.5]	0.3 [0.9]	20.0 [50.8]	12.8 [32.5]	9.6 [24.4]	137
315B			3	56J		230/460	8/4			5.4 [13.8]	3.6 [9.1]	8.5 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	17.4 [44.2]	10.6 [26.9]	9.6 [24.4]	75
315E	C	5	1	184JM	TEFC	230	16	2	1½	7.8 [19.9]	6.6 [16.8]	10.8 [27.6]	4.5 [11.4]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	3.7 [9.5]	0.3 [0.9]	24.2 [61.4]	13.9 [35.3]	9.6 [24.4]	143
3152			3	184JM		230/460	17/9			7.1 [18.0]	6.6 [16.8]	10.8 [27.6]	4.5 [11.4]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	3.7 [9.5]	0.3 [0.9]	21.7 [55.1]	12.8 [32.5]	9.6 [24.4]	145
4264	D	7½	1	213JM	TEFC	230	32	3	3	9.0 [22.9]	7.3 [18.7]	12.3 [31.4]	5.2 [13.3]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	4.2 [10.8]	0.2 [0.7]	27.0 [68.6]	16.2 [41.1]	12.0 [30.4]	205
4260			3	184JM		230/460	22/11			7.0 [18.0]	6.6 [16.8]	11.6 [29.5]	4.5 [11.4]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	3.7 [9.5]	1.0 [2.6]	22.5 [57.1]	14.3 [36.3]	12.0 [30.4]	172
4265	E	10	1	215JM	TEFC	230	40	3	3	9.0 [22.9]	6.2 [15.7]	12.3 [31.4]	5.2 [13.3]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	4.2 [10.8]	0.2 [0.7]	27.0 [68.5]	16.2 [41.1]	12.0 [30.4]	213
4261			3	215JM		230/460	26/13			8.1 [20.7]	7.3 [18.7]	12.3 [31.4]	5.2 [13.3]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	4.2 [10.8]	0.2 [0.7]	26.0 [66.0]	15.0 [38.1]	12.0 [30.4]	204
4242	F	7½	1	213JM	TEFC	230	32	2	1½	9.0 [22.9]	7.3 [18.7]	11.3 [28.9]	5.2 [13.3]	2.4 [6.2]	3.8 [9.7]	4.4 [11.3]	4.2 [10.8]	N/A	26.0 [66.0]	14.6 [37.1]	11.1 [28.1]	196
4240			3	184JM		230/460	22/11			7.1 [18.0]	6.6 [16.8]	10.6 [27.0]	4.5 [11.4]	2.4 [6.2]	4.5 [11.4]	4.5 [11.4]	3.7 [9.5]	0.1 [0.3]	21.5 [54.6]	12.6 [32.0]	10.5 [30.6]	163
4253	G	10	1	215JM	TEFC	230	40	3	2	9.0 [22.9]	5.5 [14.2]	11.5 [29.3]	5.2 [13.3]	2.7 [7.1]	4.7 [12.1]	5.0 [12.9]	4.2 [10.8]	0.3 [0.9]	26.1 [66.3]	15.9 [40.4]	10.6 [26.9]	217
4250			3	215JM		230/460	26/13			8.1 [20.7]	7.3 [18.7]	11.5 [29.3]	5.2 [13.3]	2.7 [7.1]	4.7 [12.1]	5.0 [12.9]	4.2 [10.8]	0.3 [0.9]	25.2 [64.0]	14.7 [37.3]	10.6 [26.9]	208
4251	H	15	3	215JM	TEFC	230/460	47/24	3	2	8.1 [20.7]	7.3 [18.7]	11.5 [29.3]	5.2 [13.3]	2.7 [7.1]	4.7 [12.1]	5.0 [12.9]	4.2 [10.8]	0.3 [0.9]	25.2 [64.0]	14.7 [37.3]	10.6 [26.9]	218

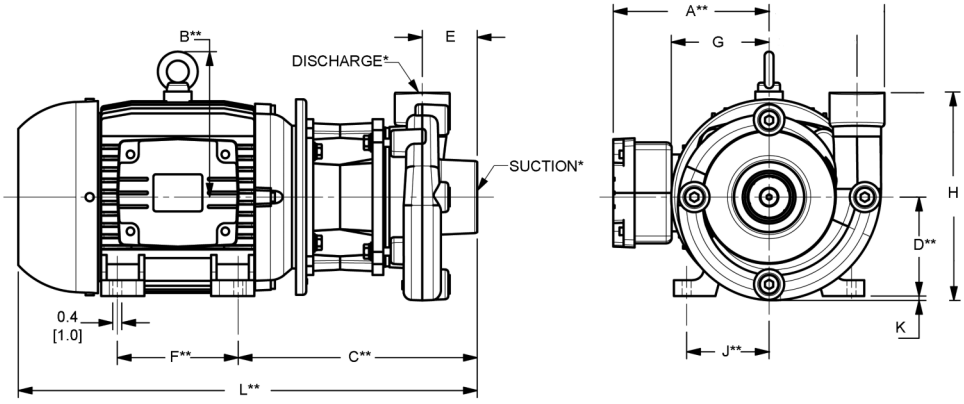
(*) Standard NPT (Female) pipe thread.
(**) This dimension may vary due to motor manufacturer's specifications.
(+) 3-Phase motors can also operate on 50 Hz. (This will change full load amps, service factor and RPM)
NOTE: Dimensions are in inches (centimeters) and have a tolerance of ± 1/4".
NOTE: Electric supply for **ALL** motors must be within ±10% of nameplate voltage rating (e.g. 230V ±10%= 207 to 253).

NOTE: Check Price Book for Specific Pump Construction/Material Availability.
Maximum Solids Handling Capacity: 1/4" Diameter

‡ When Ordering, Add the Correct (-9X) Suffix to Model Number Indicating Material Selection (Ex. 315A-95)

- XCI (-95) Cast Iron Construction with Buna-N Seals
- XB (-94) Cast Bronze Construction with Viton® Seals
- XSS (-98) Cast Stainless Steel Construction with Viton® Seals

(All Models Come Standard with Stainless Steel Impeller)



Standard Features

- Stainless Steel, Bronze and Cast Bronze Construction
- Buna-N or Viton® Mechanical Seal and O-ring, Depending on Model
- Optional Silicon Carbide Mechanical Seals Available
- Stainless Steel Motor Shaft and Hardware
- NEMA TEFC Single and Three Phase Motors, Depending on Model
- Optional Mounting Base Available for 182/184/215 JM Frames
- Self-cleaning Stainless Steel Impeller
- Maximum Working Pressure 150 PSI
- Maximum Temperature
  - Viton® 200° F
  - Buna-N 180° F
- Optional Seal Wash Port and Hose Available on All Models
- Pedestal Version Models Available for Frame Models 145/182/184JM
- QSP – Quick Ship Pump for Many Models

Hazardous Duty/Xplosion Proof motors available from stock ranging from 1 to 10 HP; *CALL FOR QUOTATION & LEAD TIME!*

Manufacturer of AMT & IPT Pumps
400 Spring Street • Royersford, PA 19468 USA
www.amtpump.com • 888-amt-pump (268-7867)

The Gorman-Rupp Company reserves the right to discontinue any model or change specifications at any time without incurring any obligation.
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Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference. AMT reserves the right to discontinue any model or change specifications at any time without incurring any obligation.

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Periodic maintenance and inspection is required on all pumps to ensure proper operation. Unit must be clear of debris and sediment. Inspect for leaks and loose bolts. Failure to do so voids warranty.

Electric Motor-Driven Pumps

Refer to Specific Information and Repair Parts Manual for product specific information.

AMT® A Gorman-Rupp Company

SAFETY GUIDELINES

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:

⚠ DANGER

Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠WARNING

Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION

Caution Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

NOTE: ***Indicates important information that, if not followed, may cause damage to equipment.***

UNPACKING

When unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing or damaged parts. (See pump exploded view and Repair Parts List.) **Do not attempt to assemble or operate pump if any parts are missing or damaged. Determine that all parts are properly installed.**

GENERAL SAFETY INFORMATION

1. Know the pump application, limitations, and potential hazards. Read all manuals included with this product carefully. Be thoroughly familiar with the pump and the proper use of the equipment.

⚠WARNING

Pump should only be used with liquids compatible with pump component materials.



⚠ DANGER

Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres.

When pumping hazardous or dangerous materials, use only in room or area designated for that purpose. For your protection, always wear proper clothing, eye protection, etc. in case of any malfunction. For proper handling techniques and cautions, contact your chemical supplier, insurance company and local agencies (fire dept., etc.). Failure to comply with this warning could result in personal injury and/or property damage.

2. Make certain that the power source (engine) conforms to the requirements of your equipment.
3. Provide adequate protection and guarding around moving parts.
4. Disconnect power before servicing. If the power disconnect is out of sight, lock in the open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock!
5. Release all pressure within the system before servicing any component.
6. Drain all liquids from the system before servicing.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Check hoses for weak or worn condition before each use, making certain that all connections are secure.
9. Periodically inspect pump and system components. Perform routine maintenance as required (See Maintenance section).
10. Provide a means of pressure relief for pumps whose discharge line can be shut-off or obstructed.
11. **Personal Safety:**
    a. Wear safety glasses at all times when working with pumps.
    b. Wear a face shield and proper apparel when pumping hazardous chemicals.
    c. Keep work area clean, uncluttered and properly lighted; replace all unused tools and equipment.
    d. Keep visitors at a safe distance from the work area.
    e. Make workshop childproof – with padlocks, master switches, and by removing starter keys.
12. This unit is not waterproof and is not intended to be used in showers, saunas or other potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block airflow to and around the motor. This unit is not weatherproof nor is it able to be submersed in water.
13. When wiring an electrically driven pump, follow all electrical and safety codes, as well as the most recent United States National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

⚠WARNING

Risk of Electric shock!

Electric Motor-Driven Pumps

14. **THREE-PHASE MOTORS:** These units are for permanent installation using a power supply with a ground. To reduce the risk of electric shock, electric motor must have one of the following:
    a. Adequately grounded to a metal raceway system.
    b. Use of a separate grounding wire connected to bare metal on the motor frame or to the grounding screw located inside motor terminal box.
    c. By other suitable means.

    Refer to the most recent National Electrical Code (NEC) Article 250 (Grounding) for additional information. ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN.

    On three-phase power, voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance.

⚠WARNING

Risk of Electric Shock! Never connect the green (or green and yellow) wire to a live terminal!

15. **SINGLE PHASE MOTORS:** These units can be wired for either portability with flexible 3-wire cord, or permanent installation using a supply with a ground. To reduce the risk of electric shock, the motor must be securely and adequately grounded! This can be accomplished by either (1) inserting plug (portable) directly into a properly installed and grounded 3-prong grounding type receptacle (as shown in Figure A for 110-120 volt, or Figure B for 220-240 volt) (2) permanently wiring the unit with a grounded, metal raceway system (3) using a separate ground wire connected to the bare metal of the motor frame or (4) other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire.

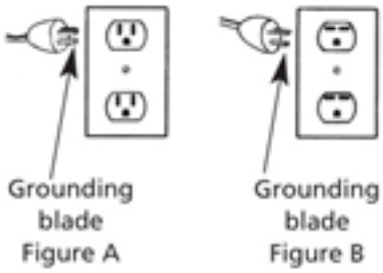


Figure 1 - Grounding Methods

    Where a 2-prong wall receptacle is encountered, it must be replaced with a properly grounded 3-prong receptacle installed in accordance with the National Electrical Code, local codes and ordinances. To ensure a proper ground, the grounding means must be tested by a qualified electrician.
16. Use only 3-wire extension cords that have 3-prong grounding type plugs and 3-pole receptacles that accept the equipment plug.
17. All wiring should be performed by a qualified electrician.
18. Protect electrical cord from sharp objects, hot surfaces, oil and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.
19. Keep fingers and foreign objects away from ventilation and other openings. Do not insert any objects into the motor.
20. Use wire of adequate size to minimize voltage drop at the motor.
21. Disconnect power before servicing a motor or its load. If the power disconnect is out of sight, lock it in the open position and tag it to prevent unexpected application of power.
22. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.

⚠WARNING

Do not handle a pump or pump motor with wet hands, when standing on a wet or damp surface or in water.

⚠WARNING

Specific single phase pump motors are equipped with an automatic resetting thermal protector and may restart unexpectedly. Protector tripping is an indication of motor overloading as a result of operating the pump at low heads (low discharge restriction), excessively high or low voltage, inadequate wiring, incorrect motor connections or a defective motor or pump. A motor equiped with a automatic thermal protection will be inidicated on the motor nameplate

INSTALLATION

⚠WARNING

The pumps should not be used in flammable or explosive atmospheres. In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the unit. This pump is not suitable for many liquids.

For installations where property damage might result from an inoperative or leaking pump due to power outages, discharge line blockage or any other reason, a backup system(s) should be used.
Failure to follow any warning can result in personal injury and/or property damage.

LOCATION

a. **Open Drip Proof Motor** - Clean dry locations with access to an adequate supply of cooling air.
b. **Totally Enclosed Motor** - Harsher environments where damp and dirty conditions may exist. Totally enclosed motors are not water proof.
c. Use only UL listed **Hazardous Location** motors for service in **Hazardous Locations** as defined in Article 500 of the NEC.
d. Temperature around the motor should not exceed 104°F (40°C). Minimum temperature is -20°F (29°C).
e. If the motor nameplate indicates “Air-Over, Cont. A.O.,” etc., the motor must be mounted in the air stream of an air moving device.

1. Locate pump as close to the fluid source as possible, thus making the suction line short and direct as possible.

⚠ CAUTION

The unit should be placed where the motor and electrical components are protected from the weather and extremes of heat, cold and humidity.

2. Attach piping suction line to suction inlet and piping discharge line to discharge outlet. Avoid using looped section of pipe or fittings, which might permit air to ensure airtight pipe connections.

IMPORTANT: If plastic or fabric hose is used for the suction piping, it should be of a reinforced type so as not to collapse under suction. The suction piping should be one size larger than the discharge piping.

Electric Motor-Driven Pumps

3. Support the piping independently of the pump to avoid universal or excessive stresses on the pump casing, which would cause impeller misalignment and possible pump failure.
4. Install both a union and a gate valve (not furnished) on the discharge side of the pump for service convenience.

⚠ CAUTION

Do not use a globe or other restricting type of valve at the discharge. Globe valves seriously restrict the capacity of the pump; however, restricting the discharge of a centrifugal pump will not overload the drive motor.

5. **SELF-PRIMING PUMPS:** It is recommended that a foot valve be used on the suction line to assure quick priming and that a suitable suction strainer be attached to the suction line so that large pieces of foreign material are not drawn into the pump.
    a. Locate pump as close to the fluid source as possible making the suction line as short and direct as possible.

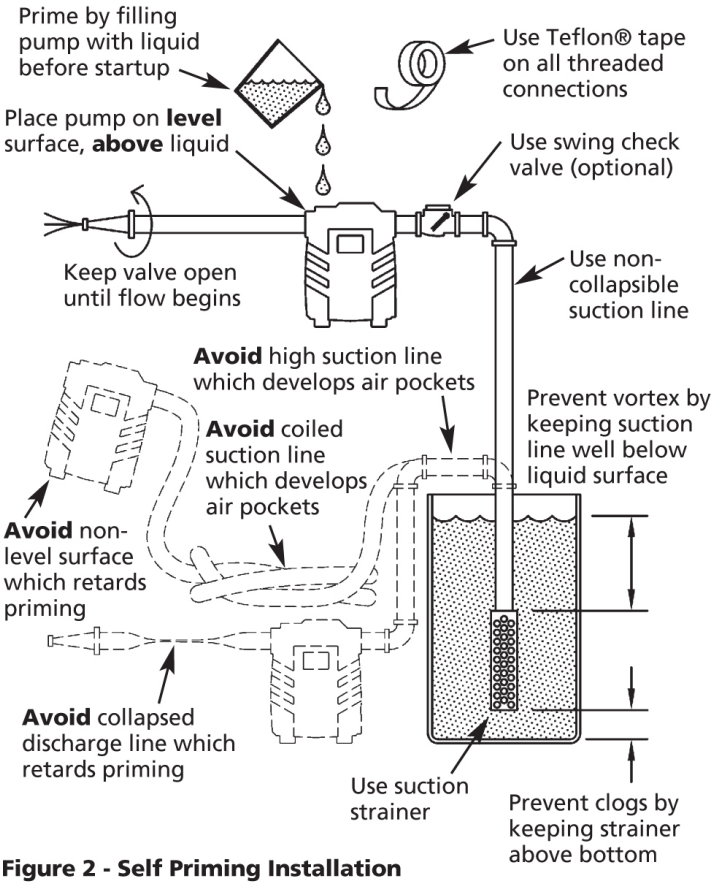


Figure 2 - Self Priming Installation

    b. The suction line should be positioned such that there is a continual upward slope from the fluid source to the pump. Avoid using loops or sections of pipe or fittings which might permit air to become trapped.
    c. Suction piping should be the same size as the discharge piping.

6. **WIRING:** For proper electrical connections, refer to the diagram located on the nameplate or inside the terminal of the motor. Make sure the connections are correct for the voltage being supplied to the motor. Connections should be made with flexible conduit to minimize vibration transmission.

    Whenever possible, the pump should be powered from a separate branch circuit of adequate capacity to keep voltage drop to a minimum during starting and running.

    Select the voltage to be used, either
        a. Single phase - 115V or 230V
        b. Three phase - 230V or 460V

    Check motor wiring to verify which voltage the motor is currently wired for. If the wiring must be changed to conform to a specific voltage requirement, then the motor should be wired according to recommendations of wiring diagrams located on motor nameplate or wiring compartment cover. Make sure unit is properly grounded. A motor to be used with single phase power cannot be used with three phase power and vice versa. If unsure about the above information or the wiring diagrams, consult an electrician familiar with motor wiring.

NOTE: Dual hertz motors (see motor nameplate) that can operate at 50Hz will impact the AMPs, RPMs, service factor, performance and self-priming capabilities.

⚠WARNING

A wrong connection can burn out the pump motor, cause an electrical short or produce an electrical shock. Failure to follow the above warning can result in property damage and/or personal injury. Always wire the motor with a three-wire system, ensuring that a ground wire runs to a good electrical ground such as a grounded water system or conduit. Also, ensure that a good electrical ground is provided at the supply end of the line. Connections should be made with flexible conduit to minimize vibration transmission.

7. Do not operate pump dry. Mechanical seal damage will result.
8. Install any auxiliary components (e.g. pressure switch, time).

OPERATION

SELF-PRIMING PUMPS

It is necessary to prime the pump before initial startup. Prime the pump by filling the casing with liquid through the top fill plug, the discharge port, or by installing a pipe tee at the discharge of the pump. (When installing a tee, use the horizontal leg of the tee as the pump discharge and place a pipe plug in the vertical leg. This procedure will help facilitate priming later.)

NON-PRIMING PUMPS

1. The casing and suction piping must be filled with liquid before the unit can begin pumping. In order to completely fill casing with liquid, entrapped air in casing must be vented. This is accomplished by momentarily loosening or removing the top drain plug located on the casing.

⚠ CAUTION

Do not run pump dry as permanent damage to the mechanical seal will result.

2. Activate the unit.

Electric Motor-Driven Pumps

IMPORTANT: Proper Rotation- Power supply should be applied momentarily to the pump at first and the direction of rotation checked. When viewing the front of the pump, the motor shaft (impeller) should be rotating counterclockwise. If it is not, disconnect power and re-check wiring to motor. (See “Installation” section.) To change rotation on three phase models, interchange any two incoming line (power) leads. Other models, consult driver information that came with driver.

NOTE: Never shut off discharge or restrict suction flow while the pump is operating. It may take up to 5 minutes for a **SELF-PRIMING** pump to prime if long horizontal/ vertical lines are used. If pump has not picked up prime in 2 minutes, re-prime piping and casing after letting unit cool down for 5 minutes. Re-check all suction connections making sure pipe compound has sealed all connections. Initial priming may take 2 to 3 tries to prime successfully.

NOTE: Dual hertz motors (see motor nameplate) that can operate at 50Hz will impact the AMPs, RPMs, service factor, performance and self-priming capabilities.

⚠ CAUTION

The proper Impeller (motor) rotation is CCW (counter clockwise) facing the front of the pump. Wrong rotation will give low performance, low head and could damage unit and/or injure personnel.

3. On initial start-up (after 15 minutes running time), check power consumption to be sure motor is not overloaded.
4. If motor is overloaded, install a valve on discharge to increase back pressure. Close the valve until pump motor is below full nameplate or within Service Factor (SF) amps.

MAINTENANCE

⚠WARNING

Make certain that the unit is disconnected from the power source before attempting to service or remove any components!

NOTE: Always flush pump thoroughly after use or if unit is not going to be used for any prolonged length of time to prevent crystallization and/or damage to seal and pump.

ROUTINE

1. Pump should be drained when subjected to freezing temperatures. A drain plug is provided on the pump casing.
2. Clean the suction line strainer at regular intervals.
3. Properly selected and installed electric motors are capable of operating for years with minimal maintenance. Periodically clean dirt accumulations from open-type motors, especially in and around vent openings, preferably by vacuuming (avoids imbedding dirt in windings).
4. Periodically check to see if electrical connections are tight.
5. Pump should be checked daily, weekly, monthly, etc. for proper operation. If anything has changed since unit was new, unit should be removed and repaired or replaced. Only qualified electricians or service personnel should attempt to repair this unit. Improper repair and/or assembly can cause an electrical shock hazard.

TROUBLESHOOTING CHART

Problem	Possible Cause(s)	Corrective Action
Motor will not start or run	1 Improperly wired.	1 Check wiring diagram on motor.
	2 Blown fuse or open circuit breaker.	2 Replace fuse or close circuit breaker after reason for overload has been determined and corrected.
	3 Loose or broken wiring.	3 Tighten connections, replace broken wiring.
	4 Stone or foreign object lodged in impeller.	4 Disassemble pump and remove foreign object.
	5 Motor shorted out.	5 Replace.
	6 Thermal overload has opened circuit.	6 Allow unit to cool. Restart after reason for overload has been determined.
	7 Voltage too low at motor terminals due to line drop.	7 Consult local power company. Increase wire size. Check for poor connections.
Motor runs slowly; will not get up to speed	1 Motor wired improperly.	1 Check and recheck wiring diagram on motor. Make internal wiring changes in wiring compartment.
	2 Capacitor burned out (single phase units only).	2 Replace capacitor.
	3 Voltage too low at motor terminals.	3 Increase wire size. Check for poor connections. Check for voltage unbalance (3 phase).
Motor overheats while running under load	1 Dirt blocking ventilation openings.	1 Clean Motor.
	2 Unbalanced supply voltage.	2 Check for faulty connections. Voltage on all three lines should be balanced within 1%. Excessive single phase loads.
	3 Faulty connection.	3 Clean, tighten, or replace.
	4 High or low voltage.	4 Check voltage at motor, should not be more than 10% above or below rated.
Pump will not prime	1 No priming water in casing.	1 Fill pump casing.
	2 Mechanical seal is leaking.	2 Replace (See Maintenance).
	3 Leak in suction line.	3 Use threaded sealant on piping, tighten, repair or replace.
	4 Discharge line is closed and priming air has nowhere to go.	4 Open.
	5 Suction line (or valve) is closed.	5 Open.
	6 Pipe union was used on suction side instead of discharge.	6 Remove union from suction side. Replace with single section of pipe.
	7 Pump is worn.	7 Replace worn parts.

TROUBLESHOOTING CHART (continued)

Problem	Possible Cause(s)	Corrective Action
Little or no discharge	1 Casing not filled with water.	1 Fill pump casing with liquid.
	2 Total head too high.	2 Shorten suction lift and/or discharge head.
	3 Suction head too high.	3 Lower suction head, install foot valve and prime.
	4 Impeller plugged.	4 Disassemble pump and clean impeller.
	5 Rotation incorrect.	5 Correct (See wiring diagram on motor)
	6 Hole or air leak in suction line.	6 Repair or replace suction line.
	7 Foot valve was too small.	7 Match foot valve to piping or install one size larger foot valve.
	8 Impeller damaged.	8 Replace.
	9 Foot valve or suction line not submerged deep enough in water.	9 Submerge lower in water.
	10 Suction piping too small.	10 Increase to pump inlet size or one size larger.
	11 Discharge piping too small.	11 Match to discharge outlet size on pump.
	12 Motor wired incorrectly.	12 Check wiring diagram.
	13 Casing gasket leaking.	13 Replace.
	14 Suction or discharge line valve closed.	14 Open.
	15 Single phase, new installation. Motor wired for 230V, etc. but supply is 115V, etc.	15 Check voltage of incoming power supply. Rewire as necessary.
	16 Mechanical seal is leaking.	16 Replace (See Maintenance).
Loss of suction	1 Air leak in suction line.	1 Use threaded sealant on piping, tighten, repair or replace.
	2 Suction lift too high.	2 Lower suction lift, install foot valve and prime.
	3 Clogged foot valve or strainer.	3 Clean.
Pump vibrates and/or makes excessive noise	1 Mounting plate or foundation not rigid enough.	1 Reinforce.
	2 Foreign material in pump.	2 Disassemble pump and clean.
	3 Impeller damaged.	3 Replace.
	4 Worn motor bearings.	4 Replace.
	5 Suction lift too high.	5 Decrease suction lift.
	6 Cavitation present.	6 Check suction line for proper size and be sure valve is open. Remove excessive lops in suction line. Install gate valve on discharge side of pump and reduce flow as necessary to match suction conditions available.
Pump leaks at shaft	1 Damaged or worn mechanical seal.	1 Replace (See Maintenance).
	2 Corrosion due to character of liquid pumped.	2 Discontinue pumping liquid and consult factory.
	3 Abrasive material in liquid causing an accumulation around the rotating assembly which results in faces opening up and allowing grit between them.	3 Pump not designed for abrasives. Discontinue use
	4 Liquid not compatible with seal.	4 Consult factory. Operational seal may be available.
	5 Temperature too high.	5 Lower liquid temperature below temperature rating of pump, See Specifications.
Pinholes in casting, drips around seal area	1 Cavitation caused by insufficient inlet pressure or suction head (NPSH).	1 Increase inlet pressure by adding a higher liquid level of fluid to source, increasing inlet pressure, or remove piping restrictions(valves, lops, etc.) in suction line.

AMT Pump Company
(herein "AMT")
400 Spring Street
Royersford, PA 19468
Phone: (610) 948-3800
Fax: (610) 948-5300
www.amtpump.com

General Information

SALES POLICY: AMT products are sold through our established Distributors. We do not sell direct to the consumer or organization not entitled to trade recognition. Therefore, possession of our catalogs and/or price list(s) does not infer an offer to sell.

MINIMUM ORDER: We appreciate your order, however, all orders are subject to a minimum $35.00 net invoice charge (excluding freight). This applies to all pump and parts purchase orders.

PRICES: Prices are subject to change without notice. All orders accepted are subject to prices in effect at time of shipment.

PAYMENT TERMS: Terms, upon establishment of credit, are Net 30 days. Past due accounts may be subject to a service charge of 1.5% per month. Domestic or assignable letter of credit is required for all export trade.

PAST DUE ACCOUNTS: AMT reserves the right to withhold open account shipments on any past due account. Invoices are considered past due after thirty (30) days. In the interest of sound business, all orders are subject to approval of the Credit Department.

SHIPPING INSTRUCTIONS: All shipments will be made F.O.B. the factory. Where instructions for shipment do not appear on the order, the shipment will be made according to our best judgment. Full risk of loss (including transportation delays and losses) shall pass to the customer upon delivery of the products to the carrier at the F.O.B. point. When loss or delay occurs, primary responsibility for tracing rests with the customer. When there is LOSS or APPARENT VISIBLE DAMAGE to a shipment, when tendered for delivery, *DO NOT* give the carrier a clear receipt. Note such damage on the carrier's delivery receipt and *HAVE THE DRIVER SIGN THE RECEIPT.*

PRODUCT REVISIONS: AMT reserves the right to discontinue, change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

LEAD TIME: Products designated "Quick Ship Product", also referred to as "QSP" will normally be shipped within 24 hours of receipt of a non-cancellable purchase order. Only limited quantities of "QSP" pumps are available.

STANDARD LEAD TIME: Lead time is two weeks for all non "QSP" product. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control.

VIP SHIPMENT: Select AMT and IPT branded pumps are available for next day shipment for non-QSP (Quick Ship Products) items and subjected to a specific model surcharge per unit noted in the respective price book. Requires calling for availability, confirmation and a non-cancellable purchase order or credit card payment prior to shipment. The expedited shipping charges are an additional cost added separately from the VIP charges per item. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control. QSP quantities are limited as determined by AMT.

ALL purchase orders must be submitted via hard copy sent to AMT customer service department by fax, EDI or e-mail.

RETURN GOODS POLICY: Goods shall not be returned without a return goods authorization number (RGA) issued by AMT customer service. The RGA number must be listed on the packing list. Only current model and part numbers with a valid date code may be returned (within one year from date of purchase). **A 20% restocking and packaging charge will apply to all returns. All shipping charges must be pre-paid. No exceptions.**

ORDER CHANGES BY CUSTOMER: Orders in process may not be changed except with written consent and may be subject to special charges.

12 Month Limited Warranty

EXTENT AND DURATION OF LIMITED WARRANTY

Coverage: AMT Pump Company (herein "AMT") or IPT Pumps by Gorman-Rupp (herein "IPT") or Gorman-Rupp Industries Division of the The Gorman-Rupp Company, Patterson, or the Gorman-Rupp Company (herein referred to as "G-R Unit) each individually warrants that its products and parts shall be free from defects in material and workmanship for twelve (12) months from the date of purchase by the original end user when installation is made and maintenance is performed in accordance with G-R Unit's recommendations. Wear and tear resulting from use and items normally consumed in use are not covered.

EXCEPTIONS

(A) This Limited Warranty shall not apply to mechanical seals in AMT or IPT pumps and the following products and parts: engines, motors, trade accessories and all other products, components, parts and materials not manufactured by the G-R Units. These items may, however, be covered by the warranties of their respective manufacturers. (B) This warranty does not extend to or apply to any unit which has been repaired or altered at any place other than by a G-R Unit, or by persons not expressly approved by a G-R Unit to make repairs or alterations, nor to any unit the serial number, model number or identification of which has been removed, defaced or altered. (C) This warranty does not extend to any product manufactured by a G-R Unit, which has been subjected to mis-use, neglect, accident, improper installation, or use in violation of instructions furnished by a G-R Unit. (D) Pump Kits: This warranty does not extend to any product sold by a G-R Unit unassembled as a Pump Kit. Pump Kits are warranted against defects in material and workmanship for 60 days from the date of shipment from a G-R Unit. Any Pump Kit parts deemed defective by a G-R Unit will be replaced free of charge within 60 days of shipment. Pump Kits are not returnable for credit.

LIMITATIONS

THE G-R UNITS' SOLE AND EXCLUSIVE WARRANTY WITH RESPECT TO THEIR PRODUCTS AND PARTS IS THIS LIMITED WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS AND/OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

EXCLUSIVE REMEDY AND DAMAGES

The sole and exclusive remedy for breach of this Warranty by a G-R Unit and the entire extent of its liability for such breach or for damages arising from the use of the products and parts covered under this Limited Warranty, shall be as follows:

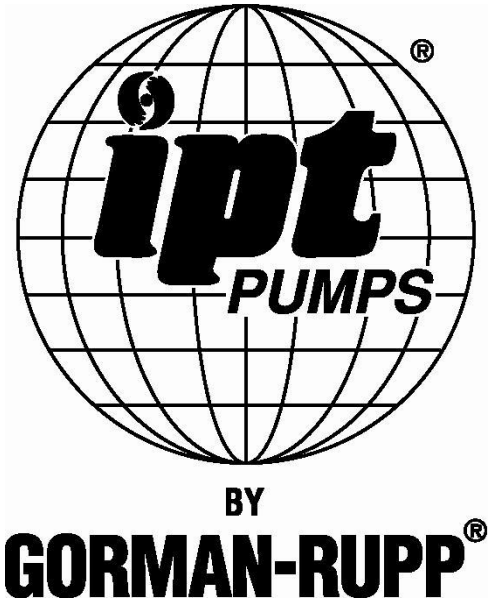
1. **Repair or Replacement:** If inspection shows that any G-R Unit product or part covered under this Limited Warranty is defective in materials or workmanship, the G-R Unit shall repair or replace the defective or non-conforming product or part without charge, whichever the G-R Unit chooses. You must have properly maintained and used the product or part claimed to be defective in accordance with the maintenance schedule or manual, which comes with the product. No allowance will be made for labor, installation, removal, transportation or other charges incurred by you in connection with such repair or replacement.
2. To obtain the above remedy:
    A. Immediately notify the G-R Unit upon discovery of the claimed defect in materials or workmanship and provide the serial number or date code of the product and/or part(s) or provide the G-R Unit with the invoice or bill of sale referencing the product by no later than the expiration date of the warranty period.
    B. The G-R Unit will advise whether inspection will be necessary and how whether repair or replacement will be made. If inspection by the G-R Unit is necessary, the pump or defective part must be sent freight pre-paid to the G-R Unit. Return shipment will be F.O.B. the G-R Unit's plant.
    C. **Return Goods Authorization Requirement:** No product will be accepted for return or replacement without the prior written authorization of the G-R Unit. Upon such authorization, and in accordance with instructions from the G-R Unit, the product will be returned to the G-R Unit, shipping charges prepaid by the Buyer.

3. **Damages:** The G-R Unit's liability for damages for breach of this Limited Warranty shall not exceed the amount of the purchase price of the product or part(s) in respect to which Such damages are claimed. **IN NO EVENT SHALL THE G-R UNITS BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES FOR BREACH OF THIS LIMITED WARRANTY.**

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.



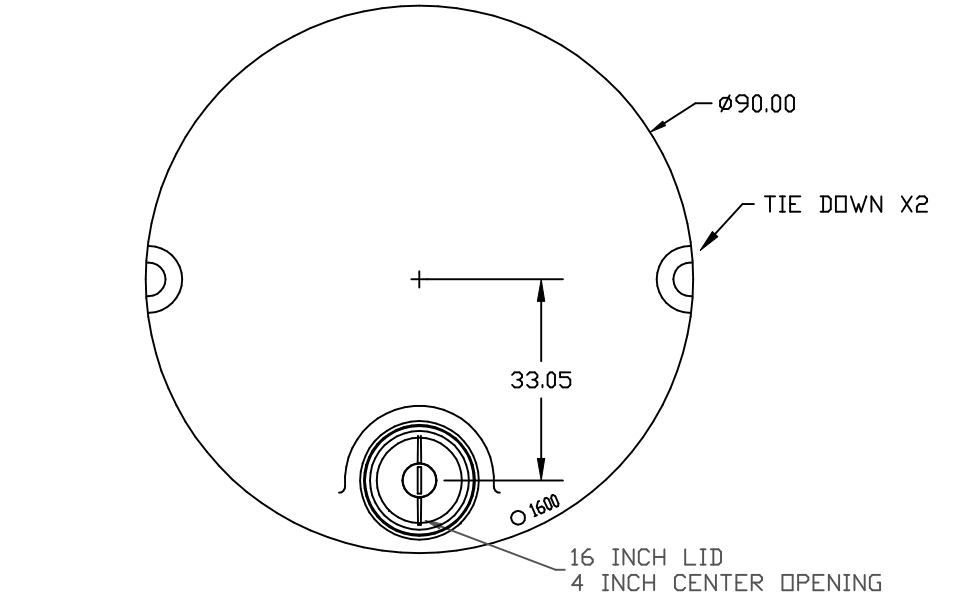
A Gorman-Rupp Company

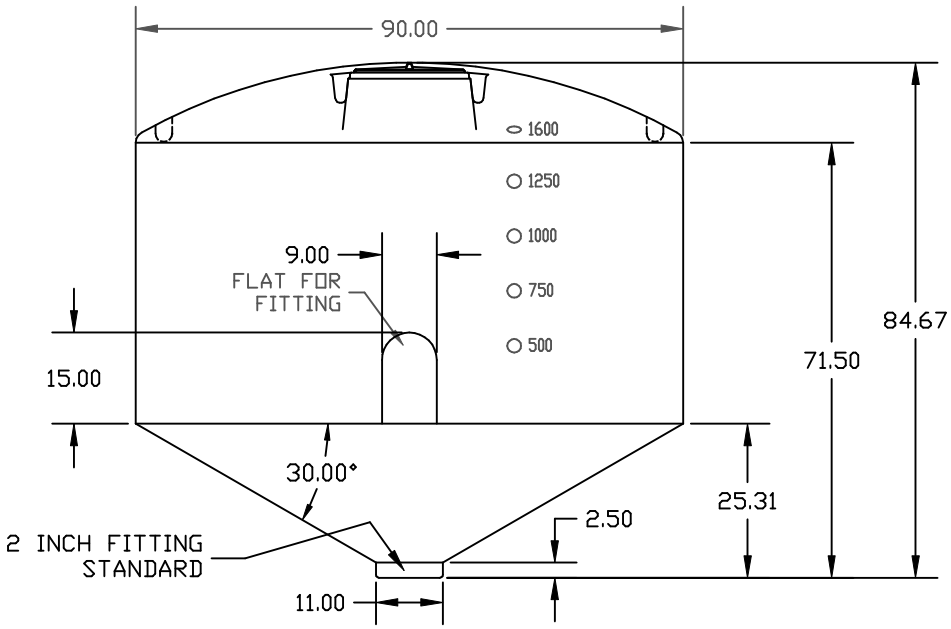


www.amtpump.com

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REV	DESCRIPTION	DATE	APPRD
D	ISOLATED STAND AND TANK	6/6/06	NVE
C	ADDED HEIGHT DIMENSIONS	4/11/06	
B	CHANGE SUMP	3/9/06	
A	CHANGE DIM BASE	4/9/03	

DRAWN / DATE
DHJ 3/10/03

APPRD. / DATE
REH 4/18/07

MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET FOR SPECIFIC PROPERTIES.

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M

NOTES:
1. NOM. WALL @ .326
2. SHOT WEIGHT 284 LBS.

ACE ROTO-MOLD
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4010 HWY. 60 BLVD, BOX 425, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION
1600 GALLON CONE BOTTOM TANK

SCALE
N.S.

PART NO.
CB1600-90

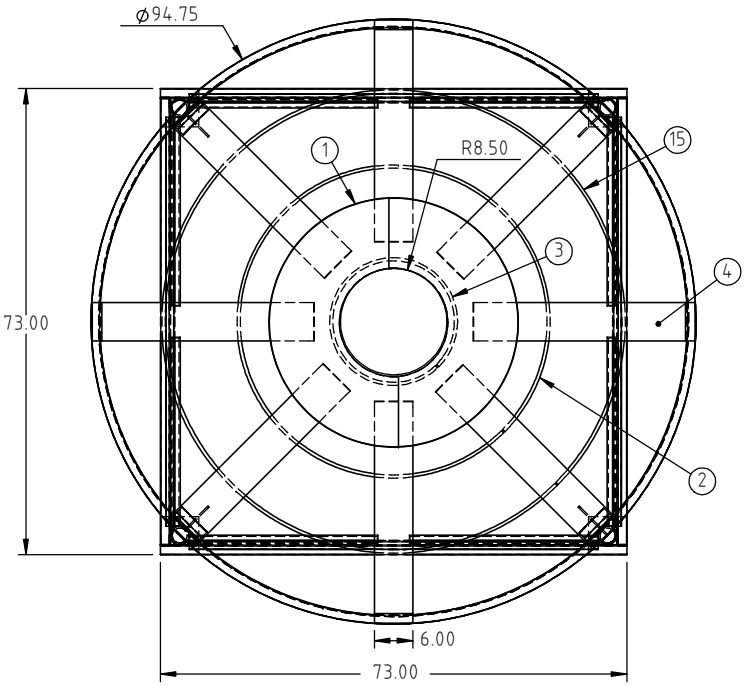
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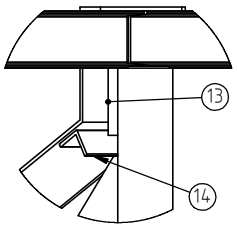
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CB090-30ST

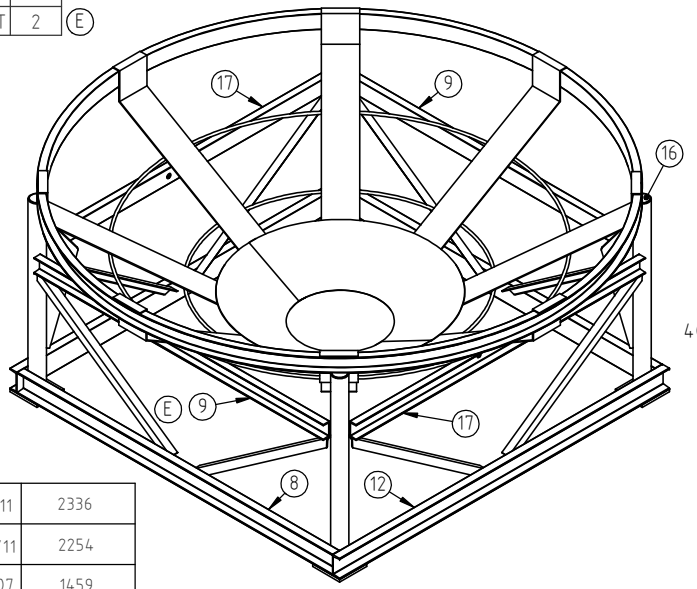
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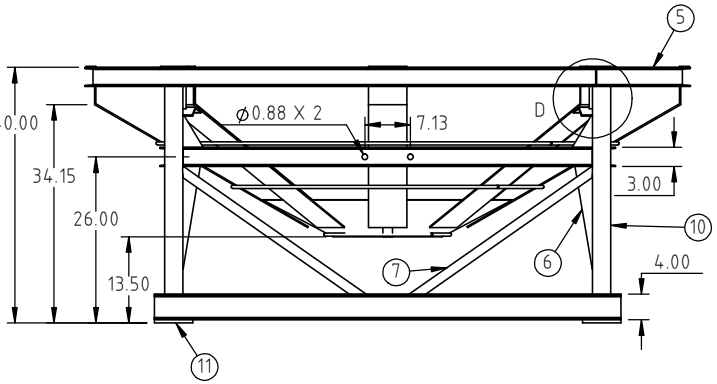
KEY	PART NUMBER	DESCRIPTION	QTY.	
1	CB090-30ST-1	PANBASE	2	
2	CB090-30ST-2	MIDDLE RING	1	
3	CB090-30ST-3	LOWEST RING	1	
4	CB090-30ST-4	BENT SUPPORT STRAP	8	
5	CB090-30ST-5	CHANNEL RING	1	
6	12118	GUSSET	4	D
7	CB090-30ST-7	ANGLE BRACING	8	F
8	CB090-30ST-8	BASE CHANNEL (SHORT)	2	
9	CB090-30ST-9	CHANNEL BRACE	2	
10	CB090-30ST-10	LEG PIPE	4	
11	CB090-30ST-11	LEG BASE	4	
12	CB090-30ST-12	BASE CHANNEL	2	
13	CB090-30ST-13	ROD FILLER	8	
14	CB090-30ST-14	ANGLE BRACING (SHORT)	4	
15	CB090-30ST-15	TOP RING	1	
16	CB090-30ST-16	LEG PLUG	4	
17	CB090-30ST-17	CHANNEL BRACE-POWDER COAT	2	E





DETAIL D
SCALE 1 : 10





REV	DESCRIPTION	BY / DATE	CCN
F	ANGLE DETAIL ADDED TO PRINT	ADH 12/8/11	2336
E	HOLES FOR POWDER COATING ADDED TO TWO LEGS COMPONENT TABLE/DRAWING TEMPLATE UPDATED	ADH 7/22/11	2254
D	PART NUMBER CORRECTED	ADH 9/18/07	1459
C	S-14GA UPDATED TO SJCB090 P.B.	GWC 3/8/07	
B	TOLERANCE WAS 1% @ 68° F	GWC 3/8/07	
A	ISOLATED STAND, ADDED B.O.M.	NVE 6/6/06	

DRAWN / DATE: ADH 7/2/07

APPRD. / DATE: REH 7/18/07

MATERIAL

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED

POLYETHYLENE: ±1% @ 68° F

METAL: DECIMAL ± .125" FRACTION ± 1/4" ANGLE ± 1°

THIRD ANGLE PROJECTION ANSI 14.5M

SHOT WEIGHT:

SHIPPING WEIGHT: 640.00 LBS

FINISH: POWDER COATING, BLACK TILE, 40012

NOTES:

Den Hartog INDUSTRIES, INC.

Ace Roto-Mold Injection Molding Blow Molding Sowjoy

4010 HOSPERS DRIVE S. BOX 425, HOSPERS, IOWA 51238-0421

DESCRIPTION: CONE BOTTOM STAND FOR 30°, 90ø TANK

SCALE: N.S.

PART NO.: CB090-30ST

CONE BOTTOM TANKS - FLAT TOP

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	OVERALL HEIGHT (INCLUDING STAND)	LID	FITTING	SPEC. GRAVITY
CB0200-42	200 GAL – 45°	77	42 X 55	67"	12"	2"	2.0
CBFD240-42	240 GAL – 45° FULL DRAIN	77	42 X 59	69"	12"	2"	1.7
CB0345-52	345 GAL – 45°	102	52 X 58	70"	12"	2"	2.0
CB0350-42	350 GAL – 45°	120	42 X 81	93"	12"	2"	2.0
CB0500-52	500 GAL – 45°	132	52 X 81	92"	12"	2"	2.0
CB0850-90	850 GAL – 15°	212	90 X 56	67"	16"	2"	1.7
CB1150-90	1150 GAL – 15°	242	90 X 67	78"	16"	2"	1.7
CB1550-90	1550 GAL – 30°	286	90 X 88	97"	16"	2"	1.7
CB2450-90	2450 GAL – 15°	437	90 X 114	125"	16"	2"	1.7
CB2550-90	2550 GAL – 30°	502	90 X 126	134"	16"	2"	1.7

CONE BOTTOM TANKS - DOME TOP

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	OVERALL HEIGHT (INCLUDING STAND)	LID	FITTING	SPEC. GRAVITY
CB0300-42	300 GAL – 45°	102	42 X 67	79"	16"	2"	2.0
CB0800-86	800 GAL – 15°	182	86 X 48	58"	16"	2"	1.7
CB1000-64	1000 GAL – 45°	252	64 X 98	112"	16"	2"	1.7
CB1000-90	1000 GAL – 15°	212	90 X 54	64"	16"	2"	1.7
CB1200-90	1200 GAL – 15°	242	90 X 62	74"	16"	2"	1.7
CB1300-90	1300 GAL – 15°	262	90 X 65	75"	16"	2"	1.7
CB1490-64	1490 GAL – 45°	342	64 X 132	146"	16"	2"	1.7
CB1500-96	1500 GAL - 30°	252	96 X 80	92″	16″	2″	1.7
CB1600-90	1600 GAL – 30°	286	90 X 85	94"	16"	2"	1.7
CB1700-86	1700 GAL – 15°	286	86 X 85	96"	16"	2"	1.7
CB2000-96	2000 GAL - 30°	292	96 X 96	108″	16″	2″	1.7
CB2495-90	2495 GAL – 30°	487	90 X 119	129"	16"	2"	1.7
CB2500-90	2500 GAL – 15°	437	90 X 111	122"	16"	2"	1.7
CB2600-90	2600 GAL – 30°	502	90 X 123	132"	16"	2"	1.7
CB2600-86	2600 GAL – 45°	502	86 X 146	158"	16"	2"	1.7
CB3000-90	3000 GAL – 15°	552	90 X 128	138"	16"	2"	1.7
CB3000-96	3000 GAL – 30°	552	96 X 125	137"	16"	2"	1.7
CB4200-122	4200 GAL – 15°	1102	122 x 113	126"	16"	3"	1.7
CB4600-102	4600 GAL – 15°	1202	102 X 155	166"	16"	2"	1.7
CB4900-102	4900 GAL – 15°	1302	102 X 159	170"	16"	2"	1.7
CB6000-122	6000 GAL – 15°	1602	122 x 150	162"	16"	3"	1.7
CB6900-122	6900 GAL – 15°	1702	122 X 168	178"	16"	3"	1.7
CB8250-122	8250 GAL – 15°	2102	122 X 195	206"	16"	3"	1.7

CB4900-102



CONE BOTTOM STANDS

PART #	DESCRIPTION	WEIGHT	DIMENSIONS (DIA X HEIGHT)	CLEARANCE
CB036-45ST	150 GAL – 45°	63	64 X 61	12"
CB042-45ST	200, 300 OR 350 GAL – 45°	82	41 X 34	11"
CBFD042-45ST	240 GAL FULL DRAIN – 45°	82	42 X 42	10"
CB052-45ST	345 OR 500 GAL – 45°	174	55 X 41	13"
CB064-45ST	1000 OR 1490 GAL – 45°	320	64 X 61	14"
CB086-15ST	800 OR 1700 GAL – 15°	360	86 X 23	11"
CB086-45ST	2600 GAL – 45°	580	86 X 49	12"
CB090-15ST	850, 1000, 1150, 1200, 1300, 2450, 2500 OR 3000 GAL – 15°	380	90 X 24	11"
CB090-30ST	1550, 1600, 2550 OR 2600 GAL 300	640	90 X 40	9"
CB096-30ST	1500, 2000, 3000 GAL – 30°	553	96 X 38	12"
CB102-15ST	4600 OR 4900 GAL – 15°	640	102 X 25	11"
CB122-15ST	4200, 6000, 6900 OR 8250 GAL – 15°	1020	122 X 27	10"

TECHNICAL BROCHURE
BNPE R2



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F R

Casing Rotation, Optional
R = 3 o'clock L = 9 o'clock
B = 6 o'clock
NOTE: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

Rotación de la cubierta, opcional
R = 3 hora L = 9 hora
B = 6 hora
NOTA: *Rotación cuando está visto del extremo de la succión de la bomba. La posición estándar de la descarga es las 12.*

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	Pump Size, *Tamaño de la bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

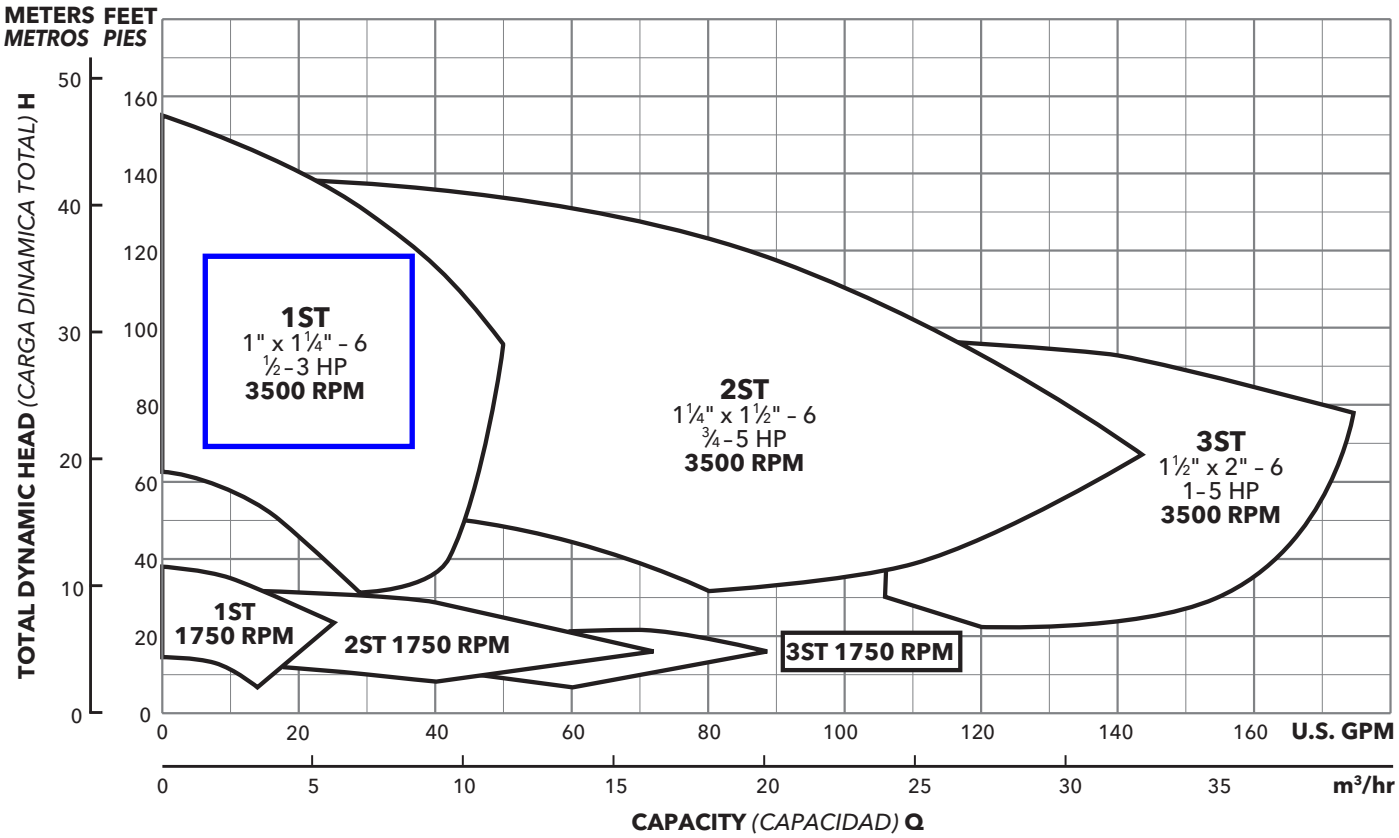
Driver: Hertz/Pole/RPM,
~~***Conductor: Hercios/Polo/RPM***~~
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

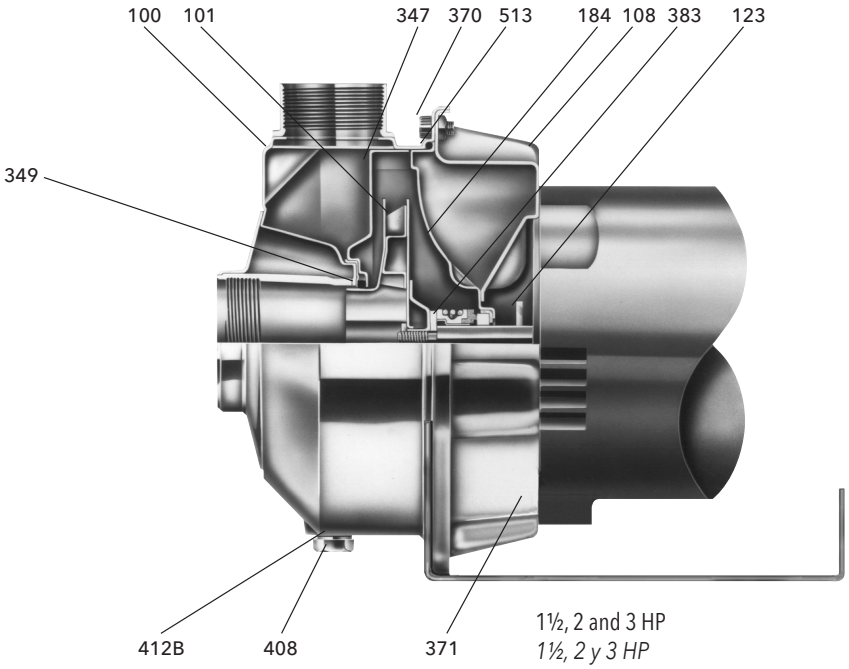
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

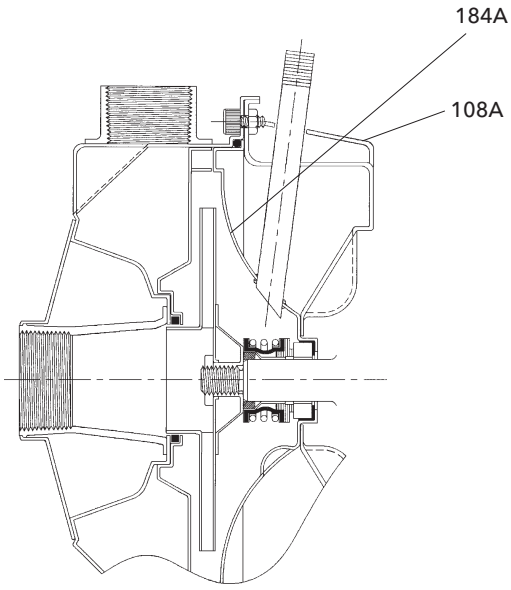
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

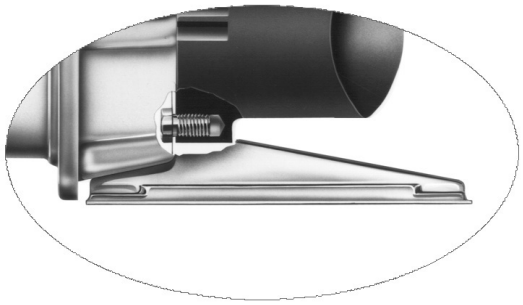


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370 *able*	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxid-*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408 *able*	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxid-*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

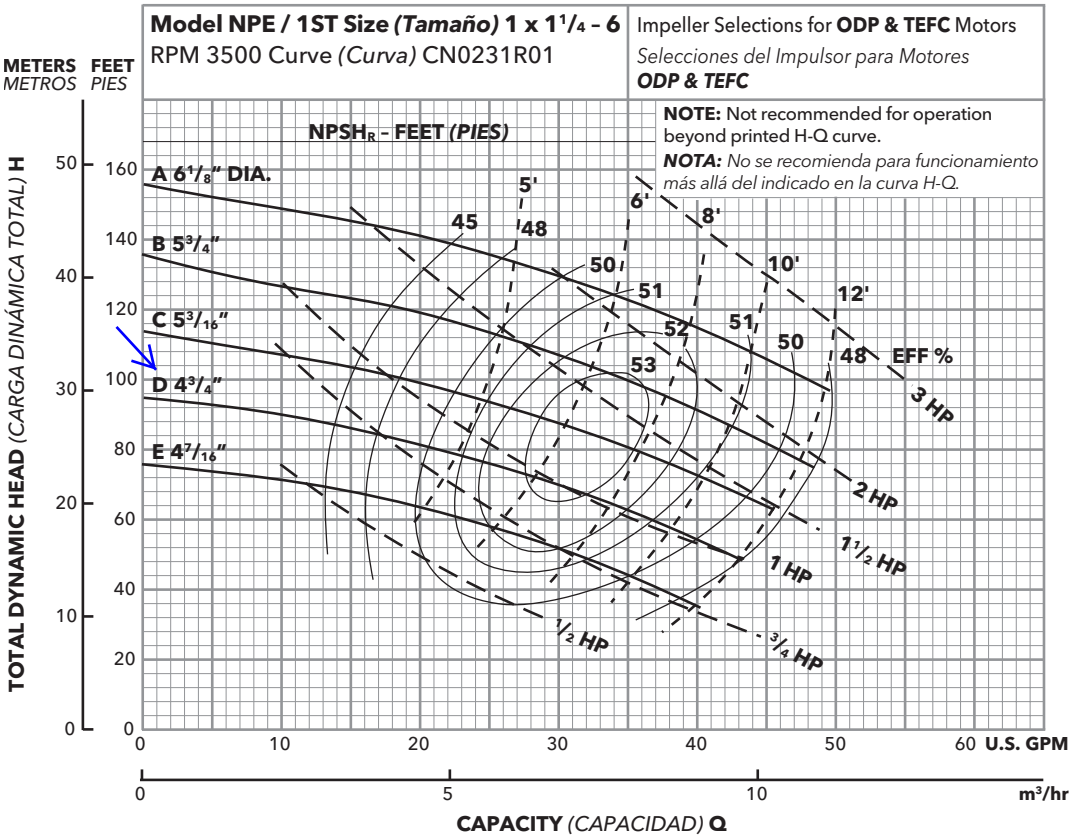


½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

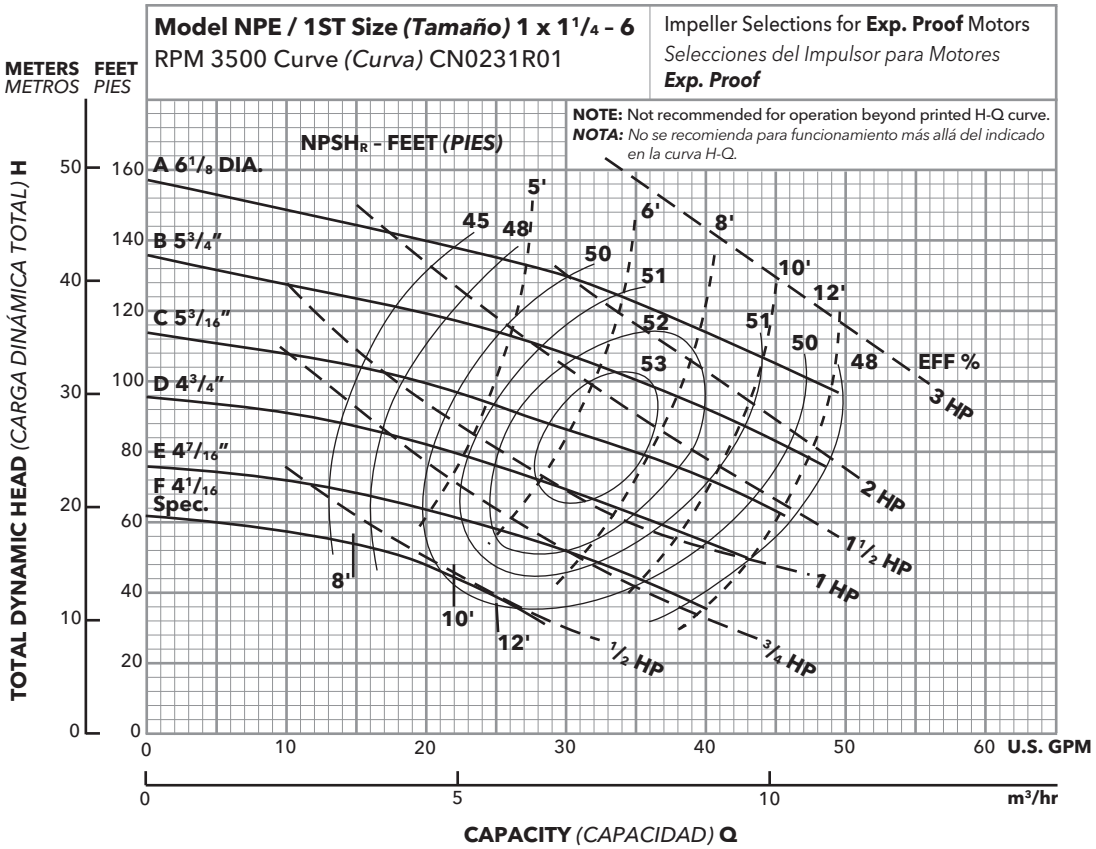
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4 7/16"
D	¾	4¾
C	1	5 3/16
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*



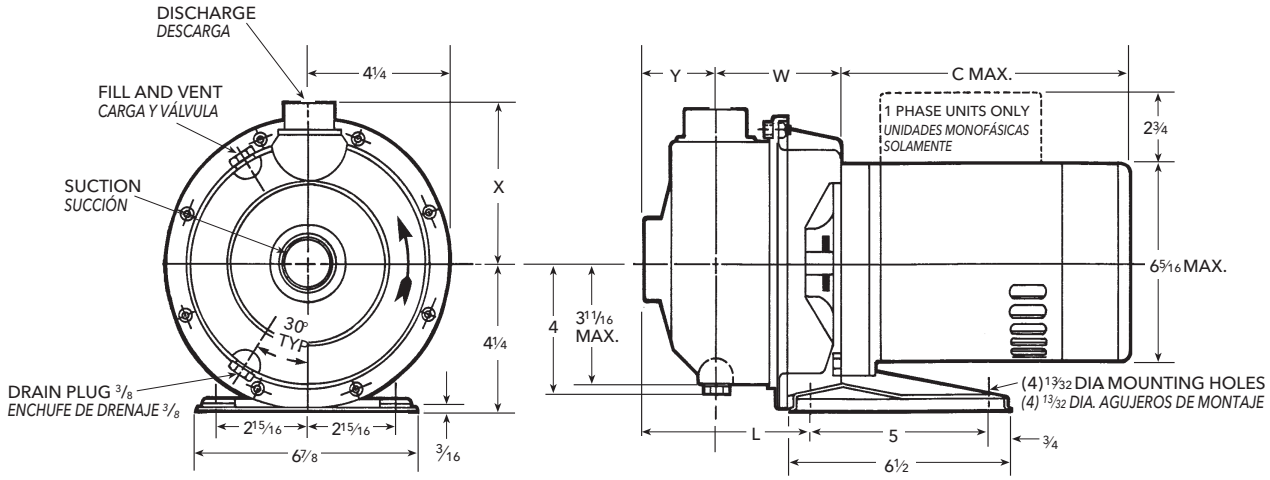
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4 1/16" spec.
E	¾	4 7/16
D	1	4¾
C	1½	5 3/16
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

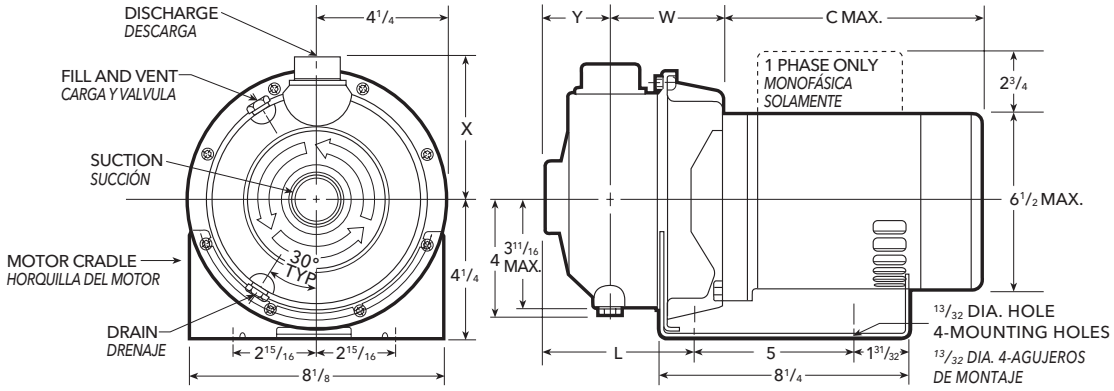
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón* 56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM Single Phase, *Monofásicos* ODP	TEFC	Three Phase, *Trifásicos* ODP	TEFC	C Max.	Wt. Max., *Peso Máx.*
56	½ – 1½	½ – 1½	½ – 1	½ – 1	13	45
143T	–	–	1½	1½	13 3/8	45
145T	2	2	1½ – 3	1½ – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	–	5	18 1/8	112

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

INSTRUCTION MANUAL
IM013R10



Model NPE/NPE-F

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

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Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Dealer: _____

Dealer Phone No.: _____

Date of Purchase: _____

Date of Installation: _____

Current Readings at Startup:

1 Ø	3 Ø	L1-2	L2-3	L3-1
Amps: _____	Amps: _____	_____	_____	_____
Volts: _____	Volts: _____	_____	_____	_____

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.

This is a **SAFETY ALERT SYMBOL.** When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

⚠ DANGER Warns of hazards that **WILL** cause serious personal injury, death or major property damage.

⚠ WARNING Warns of hazards that **CAN** cause serious personal injury, death or major property damage.

⚠ CAUTION Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

⚠WARNING



Hazardous fluids can cause fire, burns or death.

UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. IMPORTANT:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

⚠ CAUTION **Always disconnect electrical power when handling pump or controls.**

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	250° F (120° C)
Pressure:	125 PSI
Starts Per Hour:	20, evenly distributed

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. INSTALLATION:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

⚠ CAUTION **Never draw piping into place by forcing the pump suction and discharge connections.**

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units

2.2.1. Units may be installed horizontally, inclined or vertically.

⚠ CAUTION **Do not install with motor below pump. Any leakage or condensation will affect the motor.**

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.

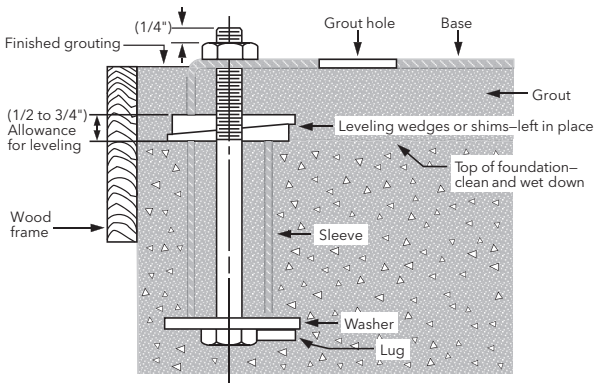


Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. SUCTION PIPING:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

⚠CAUTION **Do not use suction isolation valve to throttle pump.**

3.5. Installation with pump above source of supply

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

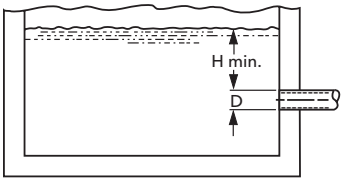


Figure 2

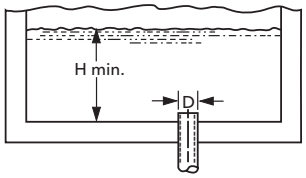


Figure 3

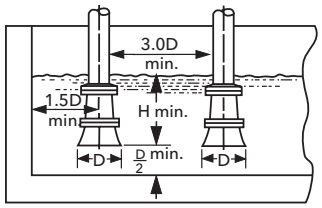


Figure 4

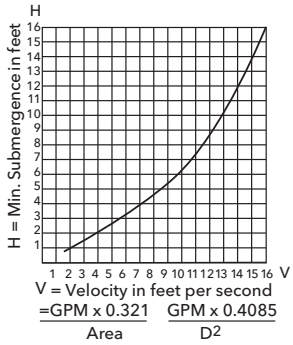


Figure 5

4. DISCHARGE PIPING:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.

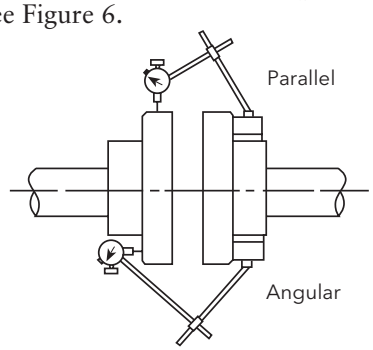


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

⚠CAUTION Always recheck both alignments after making any adjustment.

6. ROTATION:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. OPERATION:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

⚠CAUTION Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. MAINTENANCE:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

⚠CAUTION Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

⚠CAUTION Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 and 168).

10. REASSEMBLY:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame.

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end.

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

⚠CAUTION **Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.**

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. TROUBLE SHOOTING CHART:

MOTOR NOT RUNNING:
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

NPE STANDARD REPAIR PARTS LIST

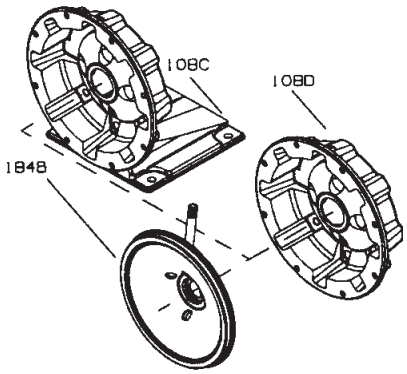
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and flush	
108D	Motor adapter less foot with flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton (standard)
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton (standard)
		EPR
		BUNA
513	O-Ring, casing	Viton (standard)
		EPR
		BUNA

MECHANICAL SEAL APPLICATION CHART

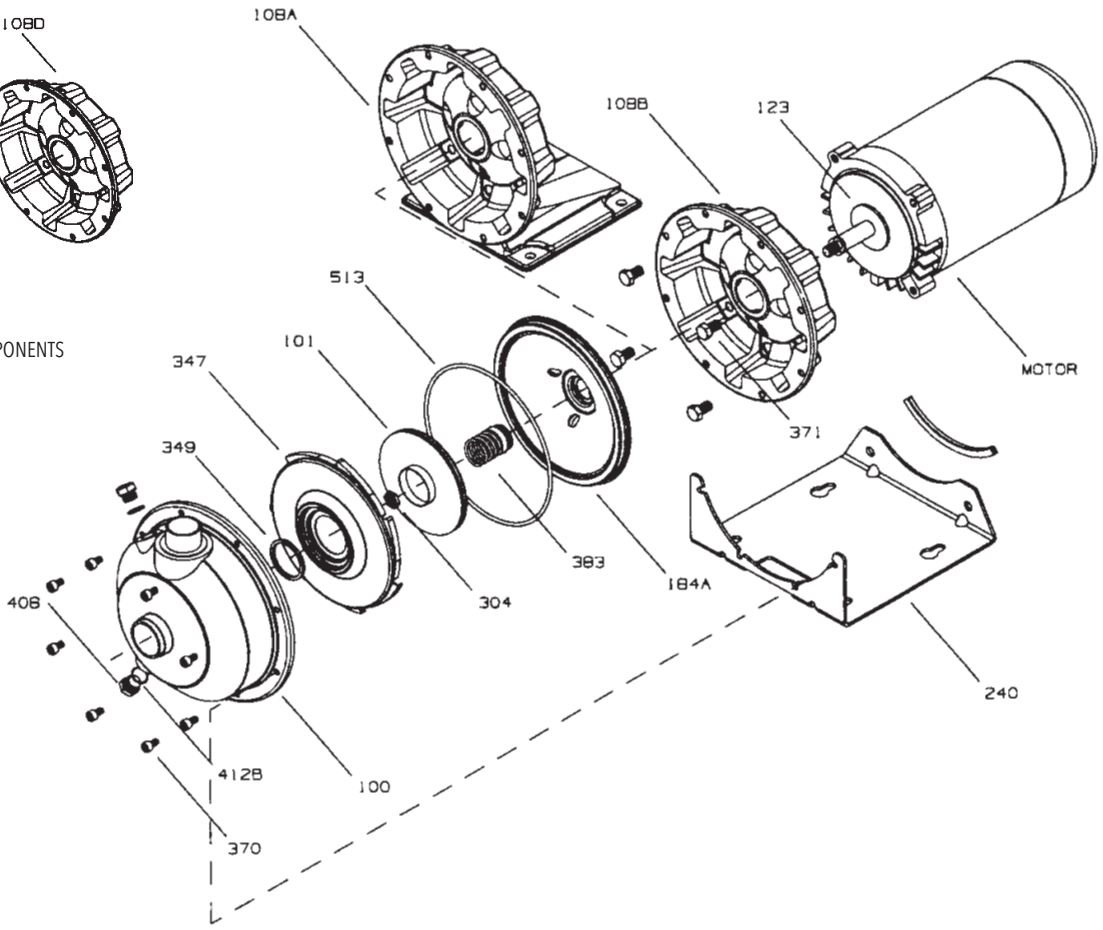
Item 383 Mechanical Seal (⅝" seal)				
Rotary	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

NOTE: Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



COMMERCIAL WARRANTY

For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or twelve (12) months from the date of shipment (which date of shipment shall not be greater than eighteen (18) months after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

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xylem
Let's Solve Water

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www.goulds watertechnology.com

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Declaration of Conformity

We at,
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declare that the following products: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS comply with Machine Directive 06/42/EC. This equipment is intended to be incorporated with machinery covered by this directive, but must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the actual provisions of the directive.

Declaración de Conformidad

Nosotros en
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declaramos que los siguientes productos: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS cumplen con las Directivas para Maquinarias 06/42/EC. Este equipo ha sido diseñado para ser incorporado a la maquinaria cubierta por esta directiva pero no debe ponerse en funcionamiento hasta que se declare que la maquinaria en la que será incorporado cumple con las disposiciones reales de la directiva.

Déclaration de Conformité

Nous, à
Goulds Water Technology, Xylem Inc.
1 Goulds Drive
Auburn, NY, U.S.A. 13021,
déclarons que les produits NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB et LBS sont conformes à la directive 06/42/EC (législation relative aux machines). Ils sont destinés à être intégrés dans la machinerie faisant l'objet de ladite directive, mais ne doivent pas être mis en service tant que la machinerie en question ne sera pas déclarée conforme aux stipulations de la directive.

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NPE/NPE-F REPAIR PARTS



GOULDS
WATER TECHNOLOGY
a xylem brand

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Motor Chart....7

NOTE:
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS.

(3) Mechanical Seal upgrades as noted on page 3.

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F R

CASING ROTATION, OPTIONAL
R = 3 o'clock L = 9 o'clock B = 6 o'clock
Note: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

SEAL VENT/FLUSH OPTION

MECHANICAL SEAL and O-RING
4 = Pre-Engineered Standard. For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (⅝" seal)						
Seal Code	**Rotary**	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**	**Casing O-Ring**
2	Carbon	Sil-Carbide	EPR	316 SS	10K18	EPR
4			Viton		10K55	Viton
5	Sil-Carbide		EPR		10K81	EPR
6			Viton		10K62	Viton

IMPELLER OPTION CODE . . . NO ADDER REQUIRED
For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.
Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	1 x 1¼-6	**1¼ x 1½-6**	**1½ x 2-6**
	Diameter	**Diameter**	**Diameter**
K		6⅛	
G		5 15/16	5⅜
H		5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	

Note: Not recommended for operation beyond printed H-Q curve.

For critical application conditions, consult factory.

Note: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with factory on non-cataloged numbers.

Note: Impeller diameter is measured at the vane. The overall diameter of the shroud may be greater.

DRIVER
1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

HP RATING
C = ½ HP F = 1½ HP J = 5 HP
D = ¾ HP G = 2 HP
E = 1 HP H = 3 HP

DRIVER: HERTZ/POLE/RPM
1 = 60 HZ, 2 pole, 3500 RPM
2 = 60 HZ, 4 pole, 1750 RPM
3 = 60 HZ, 6 pole, 1150 RPM
4 = 50 HZ, 2 pole, 2900 RPM
5 = 50 HZ, 4 pole, 1450 RPM

MATERIAL
ST = Stainless Steel

PUMP SIZE
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

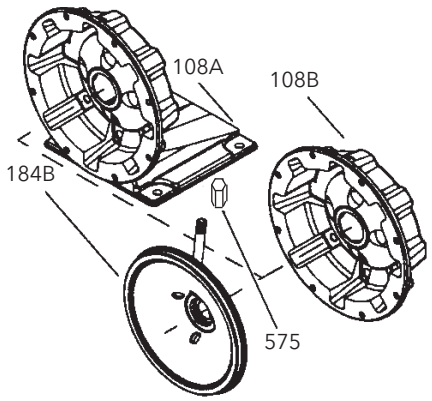
For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QUANTITY
100	Casing	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller	AISI 316L SS	See Impeller chart on page 6			1
108A	Motor adapter with foot*	AISI 316L SS	1L80			1
108B	Motor adapter less foot*	AISI 316L SS	1L87			1
123	Deflector	BUNA-N	5K7			1
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush	AISI 316L SS	1L333			1
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 3			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

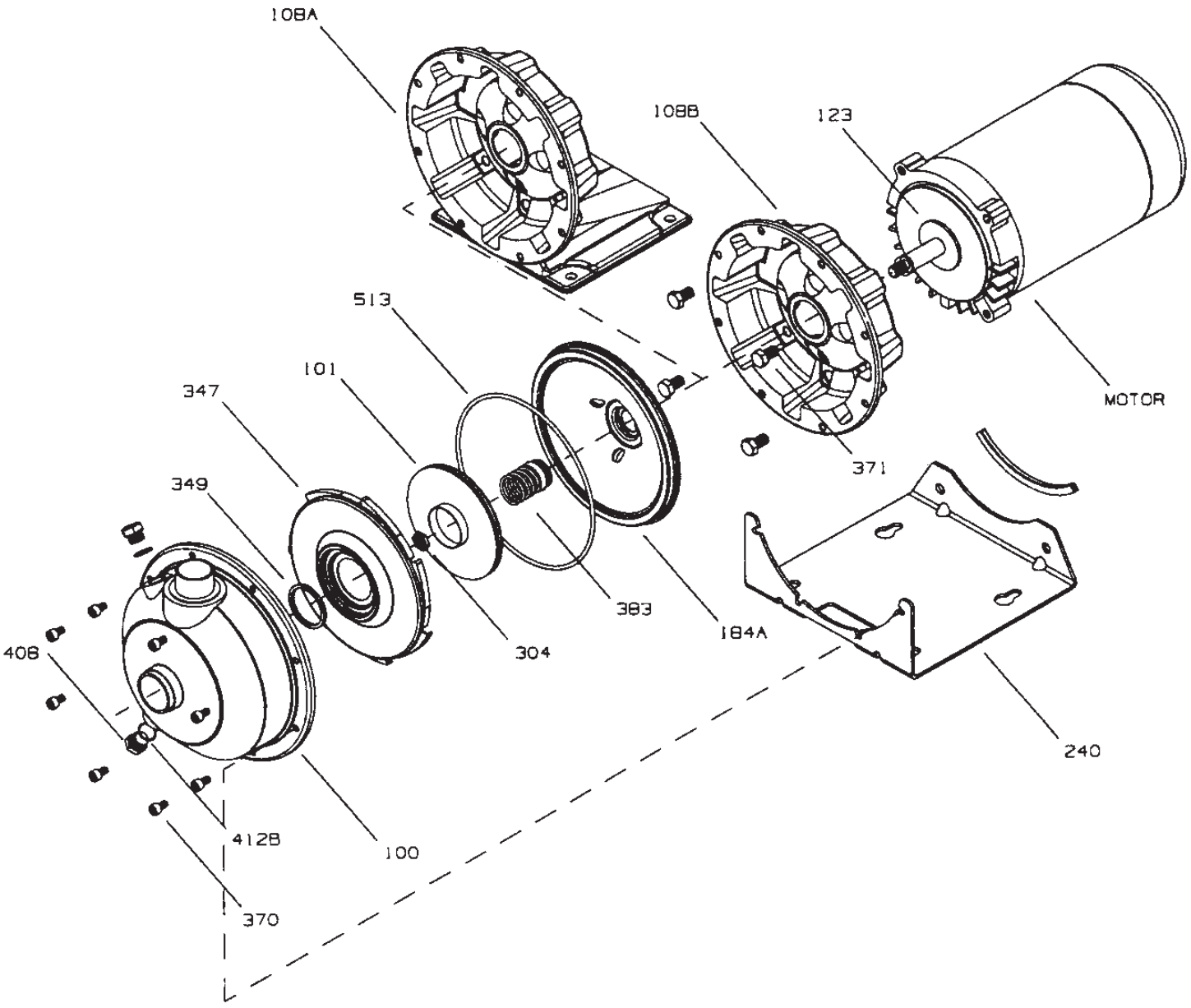
** Flush access hole provided.*

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS



NOTE:
Close-coupled units using motors ½ – 1 HP (TEFC and ODP) will use footed motor adapter as standard.
Close-coupled units using motors 1½ – 3 HP (TEFC and ODP) will use footless motor adapter as standard.
Close-coupled units using motors 5 HP and all X-Proof will have a foot attached to the motor.

NOTE:
Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power Frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x 1¼-6		1¼ x 1½-6		1½ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			6 1/8	2K1221		
G			5 15/16	2K1206	5 3/8	2K1209
H			5 1/2	2K1205	5	2K1208
A	6 1/8	2K1203	5 1/4	2K1216	4 3/4	2K1220
B	5 3/4	2K1202	5 1/16	2K1204	4 5/8	2K1207
C	5 3/16	2K1201	4 7/8	2K1215	4 3/8	2K1219
D	4 3/4	2K1200	4 5/8	2K1214	4 1/16	2K1218
E	4 7/16	2K1199	4 1/4	2K1213	3 5/8	2K1217
F	4 1/16	2K1211	3 7/8	2K1212		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST	2ST		3ST
			ODP/TEFC	ODP/TEFC		ODP/TEFC
½	C	Repair #	2K1199			
		Dia.	4 7/16			
		Imp. Code	E			
¾	D	Repair #	2K1200	2K1212		
		Dia.	4 3/4	3 7/8		
		Imp. Code	D	F		
1	E	Repair #	2K1201	2K1213		2K1217
		Dia.	5 3/16	4 1/4		3 5/8
		Imp.Code	C	E		E
1½	F	Repair #	2K1202	2K1214		2K1218
		Dia.	5 3/4	4 5/8		4 1/16
		Imp. Code	B	D		D
2	G	Repair #	2K1203	2K1215		2K1219
		Dia.	6 1/8	4 7/8		4 3/8
		Imp. Code	A	C		C
3	H	Repair #	2K1203	2K1216		2K1220
		Dia.	6 1/8	5 1/4		4 3/4
		Imp. Code	A	A		A
5	J	Repair #		2K1206	2K1221	2K1209
		Dia.		5 15/16	6 1/8	5 3/8
		Imp. Code		G	K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST		2ST		3ST	
			ODP	TEFC/EXP	ODP	TEFC/EXP	ODP	TEFC/EXP
½	C	Repair #	2K1199	2K1211				
		Dia.	4 7/16	4 1/16				
		Imp. Code	E	F				
¾	D	Repair #	2K1200	2K1199	2K1212			
		Dia.	4 3/4	4 7/16	3 7/8			
		Imp. Code	D	E	F			
1	E	Repair #	2K1201	2K1200	2K1213	2K1212	2K1217	
		Dia.	5 3/16	4 3/4	4 1/4	3 7/8	3 5/8	
		Imp. Code	C	D	E	F	E	
1½	F	Repair #	2K1202	2K1201	2K1214	2K1213	2K1218	2K1217
		Dia.	5 3/4	5 3/16	4 5/8	4 1/4	4 1/16	3 5/8
		Imp. Code	B	C	D	E	D	E
2	G	Repair #	2K1203	2K1202	2K1215	2K1214	2K1219	2K1218
		Dia.	6 1/8	5 3/4	4 7/8	4 5/8	4 3/8	4 1/16
		Imp. Code	A	B	C	D	C	D
3	H	Repair #	2K1203	2K1203	2K1216	2K1204	2K1220	2K1207
		Dia.	6 1/8	6 1/8	5 1/4	5 1/16	4 3/4	4 5/8
		Imp. Code	A	A	A	B	A	B
5	J	Repair #			2K1206 / 2K1221		2K1209	
		Dia.			5 15/16 / 6 1/8		5 3/8	
		Imp. Code			G / K		G	

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821S	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821S	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821S	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821S	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854S	26.8/13.4	36	E08821S	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854S	14.0	40	E09821S	11.89	44			
5	E10754S	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873S	2.6/1.3	19	E04876S	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873S	3.4/1.7	19	E05876S	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873S	4.2/2.1	22	E06876S	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878S	5.8/2.9	25	E07876S	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874S	6.9/3.3	39	E08876S	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874S	7.2/3.6	31	E09876S	7.6/3.8	37			
5	E10774S	7.2/14.4	50	E10876S	6.2/12.4	48			

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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AMT
A Subsidiary of The Gorman-Rupp Company ™

NEW FOR 2007
90° ROTATABLE BASE ON ALL MODELS

Self-Priming Diaphragm Pumps

- ***Sand Cast Aluminum** Construction for Portability and Durability*
- ***Thermoplastic Rubber Diaphragm***
- ***2" to 3" NPT Suction and Discharge Sizes***
- ***1-5/8" Diameter Solids Handling Capability***
- ***Modular Component Design Permits Easy Maintenance and Cleanout***
- ***Engine Driven Models: Choice of Honda and Briggs & Stratton Gas or Yanmar Diesel Engines***
- ***Delivers up to 90 GPM***
- ***Maximum Temperature 180°F***

The AMT line of 2" and 3" Diaphragm pumps features 2-stage, 44 to 1 gear reduction with a large diameter output gear and heavy duty ball bearing construction. Often referred to as Mud Pumps or Sludge Pumps, diaphragm pumps are designed to pump mud, slurry, sewage, and thick liquids that have the ability to flow. AMT Diaphragm pumps are available with a choice of drivers to meet your application requirements: Briggs & Stratton or Honda gasoline engines, Yanmar Diesel, and 115 VAC electric motor with weatherproof cord and switch. Built-in molded polyurethane flapper/check valve assures self-priming to 20 ft. after initial prime. Heavy duty gear box is designed to operate pumps at 40 strokes per minute for Electric Motor Models and 60 strokes per minute for Engine-Driven Models. Each unit includes a 2" or 3" NPT steel suction strainer, two NPT nipples, and a wheel kit with 10" semi-pneumatic transport wheels for portability. Models 336E-K6, 336G-K6, 335G-K6, and 335E-K6, are kits provided less motor or engine. Pumps are designed for use with non-flammable liquids which are compatible with pump component materials. ***Suction and discharge port size cannot be reduced.***



Model 335D-96*

*shown with 90° rotatable base

INDUSTRIAL DUTY

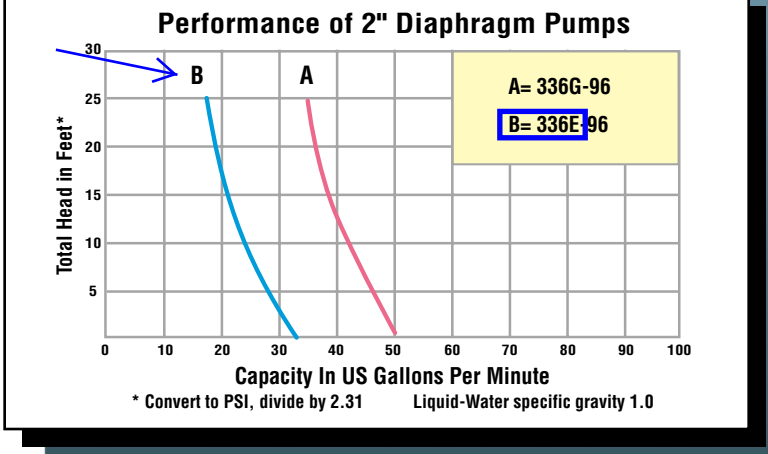


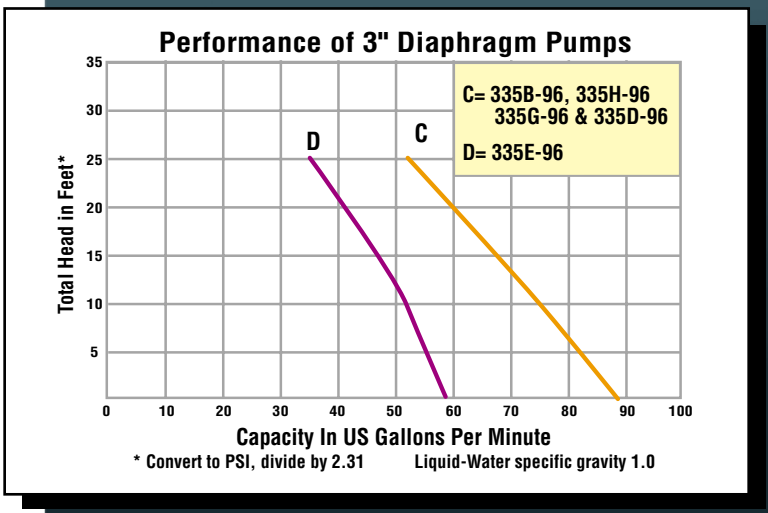
Model 335H-96*

*handle not shown

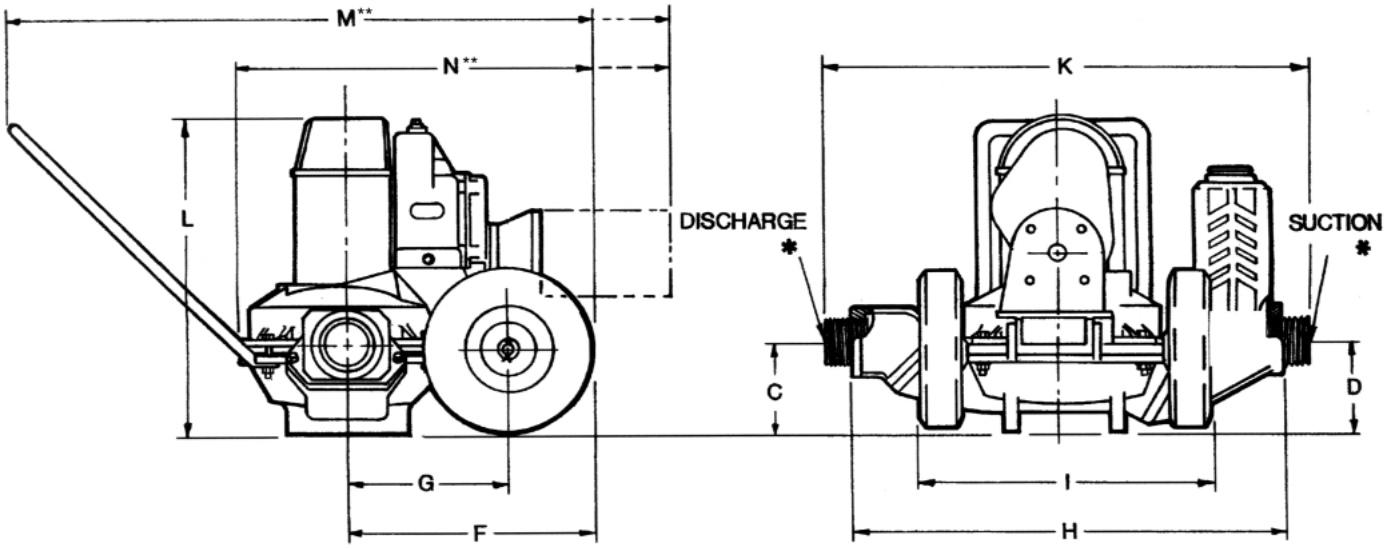


Model 335E-96





Diaphragm Pumps

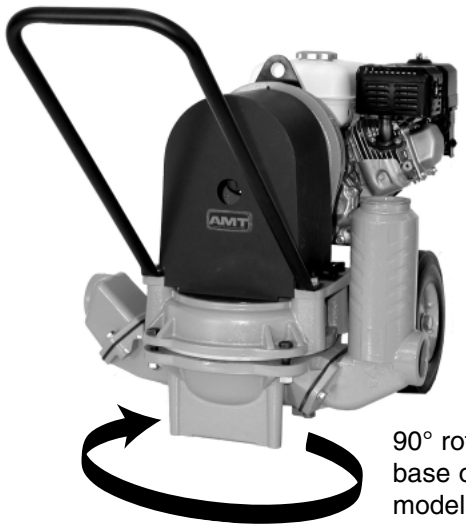


Model #	Curve	Driver	SUC*	DIS*	C	D	F	G	H	I	K	L	M**	N**	Shpg. Wt.
336G-96	A	HONDA GX120	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	39.2	25.0	125 lbs.
336E-96	B	1.5 HP Elec. Motor	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	41.1	26.8	131 lbs.
335G-96	C	HONDA GX120	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	42.0	46.0	175 lbs.
335E-96	D	1.5 HP Elec. Motor	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	43.5	27.5	186 lbs.
335B-96	C	B&S CP550	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	41.5	25.5	181 lbs.
335H-96	C	HONDA GX160	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	41.5	25.5	182 lbs.
335D-96	C	YANMAR DIESEL L48	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	43.0	27.0	203 lbs.
336G-K6	A	Kit, Less Engine	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	N/A	N/A	95 lbs.
336E-K6	B	Kit, Less Motor	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	N/A	N/A	95 lbs.
335G-K6	C	Kit, Less Engine	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	N/A	N/A	146 lbs.
335E-K6	D	Kit, Less Motor	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	N/A	N/A	146 lbs.

(*) Standard NPT (female) pipe thread.
(**) This dimension may vary due to motor or engine manufacturer's specifications.
NOTE: Dimensions have a tolerance of ±1/8".

Standard Features for AMT Diaphram Pumps

- Engine Driven Models - Choice of Honda, Briggs & Stratton Gas or Yanmar Diesel Engines
- 2" to 3" NPT Port Sizes
- Models 336E-96/335E-96 – 1.5 HP single phase, 115/230 Volt motor with manual reset overload includes 20 foot 115 VAC power cord and weather-proof on/off switch
- Models 336G-K6/335G-K6 – Kit, furnished less engine. For use with gasoline or diesel engines with .75" keyed shaft (SAE J609a Mounting Flange)
- Model 336E-K6/335E-K6 – Kit, furnished less motor. For use with electric motor (1725 RPM) or air motor with a minimum of 1.5 HP. 56C Mounting Flange required.



90° rotatable base on all models

WARNING: Do not use in explosive atmosphere or for pumping volatile flammable liquids.

See price book page 13

The Gorman-Rupp Company reserves the right to discontinue any model or change specifications at any time without incurring any obligation.

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference. AMT reserves the right to discontinue any model or change specifications at any time without incurring any obligation.
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Periodic maintenance and inspection is required on all pumps to ensure proper operation. Unit must be clear of debris and sediment. Inspect for leaks and loose bolts. Failure to do so voids warranty.

Diaphragm Pumps

A Gorman-Rupp Company

DESCRIPTION

These diaphragm pumps are high capacity, self-priming (to 25 ft. lift), portable units shipped completely assembled (except for handle). The pumps are used for operation with fluids mixed with abrasive solids such as sand, silt, mud, sludge and waste. Not for use with pumping cement or mortar. Handles liquids from 40º to 180º F (4º to 82 º C). Pump is capable of handling solids up to 1-5/8" diameter. For use with water and other non-flammable fluids compatible with pump component materials.

Model	Driver Type	Material	Diaphragm	Check Valve	Gear Box	Bearings	NPT
336Z-96	Hatz 1B20 Diesel	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	2"
336G-96	Honda GX120	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	2"
336E-96	1.5 HP 115 VAC @60 Hz	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	2"
335A-96	B&S 525 Series	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	3"
335G-96	Honda GX120	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	3"
335E-96	1.5 HP 115 VAC @60 Hz	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	3"
335B-96	B&S CP550	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	3"
335H-96	Honda GX160	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	3"
335Z-96	Hatz 1B20 Diesel	Aluminum	Thermoplastic/TPE	Neoprene	Oil Bath	Needle	3"

NOTE: Driver is subject to change without notice, see labels and manual with driver for operation, specifications, maintenance and warranty.

UNPACKING

After unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing or damaged parts.

Specific Safety Information for Gasoline Engine Driven Pumps

1. Carefully read the instruction manuals supplied by the engine manufacturer before attempting to assemble, disassemble or operate the engine or any other part. The "Warning" and "Caution" statements in this manual signal potentially hazardous conditions to the operator or equipment. Know when these conditions can exist. Take necessary steps to protect personnel, as well as equipment.

⚠WARNING

Gasoline is a highly combustible fuel. Use it with care! The improper use, handling and/or storage of gasoline can be dangerous. Help prevent accidents by following these safety rules:

a. Use gasoline only as a fuel, never as a cleaning fluid.
b. Always use an approved container to hold or store gasoline. Never store gasoline in familiar containers such as milk gallons or soda pop bottles.
c. Never store gasoline near a heater or an open flame.
d. When storing or using gasoline, make sure container is out of the reach of children.
e. Never add gasoline to a running or hot engine. Spilled gasoline on a hot engine may cause a fire or an explosion. Fill gasoline tank outdoors and wipe up any spills.
f. Have a fire extinguisher nearby. Be sure extinguisher is in operating condition – check the pressure gauge or indicator. Be familiar with its proper use. Consult the local fire department for the correct type of extinguisher for your application. Extinguishers rated ABC by the National Fire Protection Association are appropriate for all applications.
g. On permanent installations, be sure all fuel supplies have a positive shutoff valve. Fuel lines must be of steel piping, adequately secured and free from leaks. Do not use copper piping on flexible lines as copper becomes hardened and brittle and will break. Use black pipe on natural gas or gaseous fuels, but not on gasoline or diesel fuels. Piping at the engine should be a suitable flexible line that is compatible with the fluid.

Positively no smoking!

2. Check engine oil, fuel levels and gear box oil levels before initial startup each day. Stay away from moving parts due to the danger of becoming caught in moving parts. Avoid loose jackets, shirts, sleeves and ties. Make sure all nuts and bolts are secure. Keep power shields and guards in place. If adjustment MUST be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.
3. Do not work with this equipment when mentally or physically fatigued.
4. Be careful not to touch the exterior of the engine, especially the muffler and the area around it. It is hot enough to be painful or cause injury.
5. To prevent accidental starting, always remove the spark plug or disconnect and ground the spark plug wire before working on the engine or the equipment driven by the engine.
6. ***DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!!*** Exhaust gases contain carbon monoxide, which is an odorless and deadly gas that will cause death if breathed too long. If equipment is located in an enclosed area with an

Diaphragm Pumps

exhaust line to the outside, regularly check the exhaust system for leaks. Be sure the area is well ventilated.

7. If the gas engine is equipped with a spark arrester screen in the muffler, it should be inspected for wear periodically and replaced when necessary.

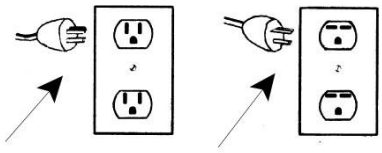
Specific Safety Information for Electric Motor Driven Pump

1. This unit is not waterproof and is not intended to be used in potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104º F (40º C). For outdoor installations, motor must be protected by a cover that does not block air flow to and around the motor. This unit is not weatherproof nor is it able to be submersed in water.
2. When wiring an electrically driven pump, follow all electrical and safety codes, as well as the most recent United States National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

⚠WARNING

Risk of electrical shock! Never connect the green (or green and yellow) wire to a live terminal.

3. To reduce the risk of electric shock, the motor must be securely and adequately grounded!. This can be accomplished by either: (1) inserting plug (portable) directly into a properly installed and grounded 3-prong grounding-type receptacle (as shown in Figure 2); (2) permanently wiring the unit with a grounded metal raceway system; (3) using a separate ground wire connected to the bare metal of the motor frame; or (4) other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire. The motor must be securely and adequately grounded for your protection against shock hazards! Where a 2-prong wall receptacle is encountered, it must be replaced with a properly grounded 3-prong receptacle with a grounded 3-prong receptacle installed in accordance with the National Electrical Code and local codes and ordinances. To ensure a proper ground, the grounding means must be tested by a qualified electrician. Use only 3-wire extension cords that have 3-prong, grounding-type plugs and 3-pole receptacles that accept the equipment plug.
4. All wiring should be performed by a qualified electrician.



Grounding blade

Figure 2 Grounding Methods

⚠WARNING

An incorrect connection may cause an electric short, produce an electrical shock or burn out the pump motor, resulting in property damage and/or personal injury.

5. Protect electrical cord from sharp objects, hot surfaces, oil and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.
6. Provide safety shields on all moving and electrical parts to prevent personal injury.
7. Keep fingers and foreign objects away from ventilation and other openings. Do not insert any objects into the motor.
8. Use wire of adequate size to minimize voltage drop at the motor.
9. Disconnect power before servicing a motor or its load. If the power disconnect is out of sight, lock it in the open position and tag it to prevent unexpected application of power.
10. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.

General Safety Information (All Units)

1. Know the pump application, limitations and potential hazards.

⚠WARNING

Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, or kerosene, etc. Do not use in flammable and/or explosive atmospheres. Pump should only be used with liquids compatible with pump component materials. Failure to follow this warning can result in personal injury and/or property damage.

2. Make certain that the power source conforms to the requirements of your equipment.
3. Provide adequate protection and guarding around moving parts.
4. Disconnect power before servicing.
5. Release all pressure within the system before servicing any component.
6. Drain all liquids from the system before servicing.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Check hoses for weak or worn condition before each use, making certain that all connections are secure.
9. Periodically inspect pump and system components. Perform routine maintenance as required (see Maintenance Section).
10. Provide a means of pressure relief for pumps whose discharge line can be shut off or obstructed.
11. ***Personal Safety:***
    a. Wear safety glasses at all times when working with pumps.
    b. Wear a face shield and proper apparel when pumping hazardous chemicals.
    c. Keep work area clean, uncluttered and properly lighted - replace all unused tools and equipment.
    d. Keep visitors at a safe distance from the work area.
    e. Make workshop childproof – with padlocks, master switches and by removing starter keys.
12. For air drive units follow Safety Information in instruction sheet supplied with air motor.

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ASSEMBLY

1. **HANDLE ON 2" PUMP** (Refer to Figure A)
    a. Remove two hex cap screws (Ref. No. A6) and washers (Ref. No. A7) from gearbox (Ref. No. A1).
    b. Place handle (Ref. No. A35) on gearbox flange and align holes.
    c. Reinstall two hex cap screws and washer assemblies, then tighten.

    HANDLE ON 3" PUMP (Refer to Figure A)
    d. Remove two hex nuts (Ref. No. A14) from pump well (Ref. No. A3).
    e. Place handle (Ref. No. A35) under pump well.
    f. Reinstall two hex nut and washer assemblies, then tighten.
2. **ROTATING SUCTION/DISCHARGE PORTS (OPTIONAL)** (Refer to Figure A,W,P)

Diaphragm Pumps

In some applications, it may be preferable to have suction/discharge ports rotated 90 degrees to be in line with driver. If so, proceed as follows:

a. Remove four hex cap screws (Ref. No. A9), hex nuts (Ref. No. A13 & A14) and washers (Ref. Nos. A11 & A12) from pump assembly to separate pump well (Ref. No. A3) from pump base (Ref. No. A8).
b. Rotate pump well 90 degrees clockwise so that driver is positioned over top of discharge plate (Ref. No. W7).
c. Be sure that pump well base and diaphragm (Ref. No. P17) are aligned properly with one another. Then, reinstall four hex cap screws, hex nuts and washer assemblies and tighten.

GEAR BOX OIL (Refer to Figure A,G)

3. Place pump on a level surface. Fill pump gear box (Ref. No. A1) with gear box oil before the pump is operated. Gear oil must meet requirements of API GL-5 and military specification MIL-L-2105B. Remove gear box housing fill plug (Ref. No. G6). Remove level plug (Ref. No. G5). Pour gear oil into gear box slowly until oil comes out of level plug.

Warranty on this unit is void unless the gear box is lubricated with appropriate gear oil listed above. DO NOT OVER FILL!

INSTALLATION

NOTE: In any installation where property damage can occur by pumps not operating due to power outages, discharge line freezing or any other reason, a backup system(s) and/or warning system(s) should be used.

1. Place the pump on a level, solid foundation, locating it as close to the liquid as possible, making the suction line as short and direct as possible.
2. Install pipe nipples (Ref. No. A36) so the smoother side of pipe end faces the suction and discharge hose.

⚠ CAUTION

Maximum discharge head is 25 feet or 10.9 psi. Operation over this head or pressure will cause pump to stall and/or gearbox damage. Use only rigid hoses.

3. Attach suction piping to the suction inlet (Ref. No. W2) and discharge piping to the discharge outlet (Ref. No. W7). The suction line should be positioned such that there is a continual upward slope from the fluid source to the pump. Avoid using loops or sections of pipe or fittings, which might permit air to become trapped.

NOTE: If hose is used, be sure to use reinforced hose on both the suction and discharge. ***DO NOT USE*** canvas or similar collapsible materials. ***NEVER USE PIPE REDUCER; PIPE SIZE MUST BE EQUAL TO OR LARGER THAN PUMP PORT SIZE***. Suction line must be airtight so that air cannot leak in and destroy priming vacuum. On a permanent installation where piping is used, always connect a piece of flexible hose between pump and piping so pump is free to move slightly.

4. It is advisable to use a strainer (Ref. No. W16) on the inlet end of the suction hose or pipe. A properly sized strainer is supplied with this unit and should be used at all times to prevent damage. Keep the strainer clean. If possible, suspend it to keep it from becoming clogged with muck, roots, debris or leaves. It is best to keep hose free of kinks as they will restrict flow and add excess loading to pump and gearing.
5. **GASOLINE ENGINE UNITS:** Follow all instructions in the engine manual before starting the engine. Fill engine with oil, gasoline, etc.
   AIR MOTOR UNITS: Follow all instructions in the air motor manual before starting unit.
   ELECTRIC MOTOR UNITS: It is strongly recommended that this unit is plugged into a G.F.I. (Ground Fault Interrupter) circuit. Consult your local electrician for installation and availability.
6. Input RPM (to pump) – Input RPM must be between 1750 and 2750 RPM. Final pump speed will be 40 strokes/min. with a 1750 RPM input and 60 strokes/min. with a 2750 RPM input.

Do not exceed 60 strokes per minute with the diaphragm pump.

OPERATION

Operate the diaphragm pump in an upright position only.

1. This diaphragm pump is capable of priming "dry" up to fifteen feet; it will prime much faster when it is filled with clean water through priming cap (Ref. No. W6). Primed, it can lift to 25 feet.
2. Activate unit following engine or air motor manual or turning unit on if electrical.

⚠ CAUTION

Do not control discharge capacity with a valve or similar device.

CLEARING JAM-UP

If large solids or an accumulation of sand or other sediment becomes lodged in the pump well (Ref. No. A3) preventing the plunger arm (Ref. No. A2) from making a full stroke, the pump should be thoroughly cleaned as described in "If Pump Stalls" shown below. Refer to parts list and illustration for parts identification.

⚠ CAUTION

If pump has stopped or stalled for any unknown reason, clean out pump cavity thoroughly. Failure to comply with the "caution" could result in damage to crank (Ref. No. P5/P9), plunger arm (Ref. No. P1) or other parts of assembly.

1. IF PUMP STALLS:
   a. Remove handle (Ref. No. A35).
   b. Remove four bolts (Ref. No. A9 & A10).
   c. Clean obstruction and all debris from pump well (Ref. No. A3).
   d. Reassemble pump in reverse order of disassembly and return to service.
2. IF PLUNGER ARM (Ref. No. P1) SEIZES AND GEAR BOX OUTPUT SHAFT (Ref. No. G8) TURNS IN CRANK (Ref. No. P5):
   a. Remove sheet metal guard (Ref. No. A4) by loosening hand knob screws (Ref. No. A5).
   b. Disassemble pump and clean as described in steps (a) through (d) listed for stalled engine jam up.
   c. Torque the crank lock screw (Ref. No. P6) to 70 foot pounds with an appropriate torque wrench (see Figure 3).

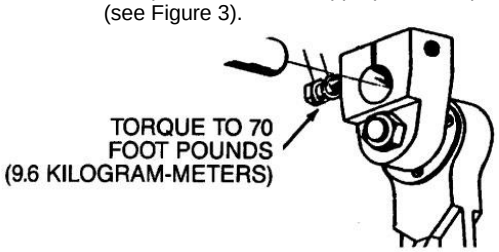


Figure 3

   d. Reassemble the pump in reverse order of disassembly and return to service.

Diaphragm Pumps

⚠WARNING

Pump jamming with an over-torqued lock screw may cause internal damage. Under torqueing may allow the output shaft to spin and wear parts necessitating replacement.

MAINTENANCE

⚠WARNING

Make certain that unit is disconnected from power source before attempting to service or remove any component.

1. Check gear box oil level every 20 hours of operation or at least once a week; more often if any leakage is detected around the gear box. Change gearbox oil after the first 40 hours of operation. Fill to the oil level plug. Change gearbox oil every 350 hours of operation.
2. The plunger bearing (Ref. No. P3) must be greased (any automotive grease) after every 8 hours of use. This is done by rotating plunger bearing to the 12 o'clock position. At this point, grease fitting will be visible through hole in guard (Ref. No. A4). Bearing may be cleaned and kept well lubricated by pumping grease slowly into fitting until new grease oozes out between bearing and journal.
3. During freezing weather, be sure to drain the pump when it is not running. Remove discharge hose and tip unit towards discharge side.
4. Keep pump clean. After use with liquids containing foreign materials, flush with clean water.

REPLACEMENT OF FLAPPER VALVE

(Ref. No. W15)

1. Remove two bolts (Ref. No. W3) and remove suction priming chamber (Ref. No. W2). Replace flapper (Ref. No. W15) on flapper pin to locate on priming chamber.
2. Remove two bolts (Ref. No. W8) and remove discharge plate (Ref. No. W7). Replace flapper valve on flapper pin to locate valve on pump well (Ref. No. W1).

REPLACEMENT OF DIAPHRAGM

(Ref. No. P17)

1. Remove sheet metal guard (Ref. No. A4) by loosening hand knob screws (Ref. No. A5).
2. Rotate pump until plunger arm (Ref. No. A2) is in the down position.
3. Remove handle (Ref. No. A35).
4. Remove pump well (Ref. No. A3) by removing screws, (Ref. No. A9/A10).
5. Remove diaphragm by removing three nuts (Ref. No. P12) from bolts (Ref. No. P11).
6. Replace diaphragm and reverse steps 1 through 5 for reassembly.

GEAR BOX OVERHAULING

A completely assembled gear box is available as a replacement part (Ref. No. G28).

DISASSEMBLY

1. Remove diaphragm (Ref. No. P13) as described in "Replacement of Diaphragm".
2. Remove crank (Ref. No. P5) by removing machine screw (Ref. No. P6). Use screwdriver in slot of crank to release clamp on output shaft (Ref. No. G8).
3. Drain oil from gear box by removing drain plug (Ref. No. G4).
4. Remove driver (Ref. Nos. A28/A32) from adapter (Ref. No. G26) by removing four bolts (Ref. No. A27) plus 4 additional bolts (Ref. No. A29) from engine mount bracket (Ref. No. A16) for gas driver models. Slide driver back from adapter until driver shaft disengages pinion (Ref. No. G20).
5. Remove adapter by removing four bolts (Ref. No. G27).
6. Remove gear box from pump base (Ref. No. A8) by removing four bolts (Ref. No. A9 & A10).
7. Remove pinion/bearing assembly (Ref. Nos. G15, G24, G20, G16) by pulling straight out. Use a slide hammer puller gripping in pinion groove
8. Remove twelve bolts (Ref. No. G3) holding gear box halves (Ref. Nos. G1 & G2) together.
9. Carefully separate gearbox halves.
10. Remove gasket (Ref. No. G22).
11. Remove output shaft/bearing assembly (Ref. Nos. G8, G9, G12, G11, G12, G13) and idler pinion/bearing assembly (Ref. Nos. G13, G14, G17, G18, G19).
12. Remove output shaft oil seal (Ref. No. G23)
13. Remove bearings (Ref. Nos. G15 & G16) from ends of input pinion shaft (Ref. No. G20).
14. Remove bearings (Ref. Nos. G13 & G14) from ends of idler pinion shaft (Ref. No. G17).
15. Remove internal spur gear (Ref. No. G19) and key (Ref. No. G18) from idler pinion shaft.
16. Remove retaining ring (Ref. No. G10) and bearings (Ref. Nos. G12 & G13) from ends of output shaft (Ref. No. G8).
17. Remove output gear (Ref. No. G11) and key (Ref. No. G9) from output shaft.

REASSEMBLY

1. Assemble input pinion/bearing assembly, idler pinion/bearing assembly and output shaft/bearing assembly.
2. Install output shaft oil seal into gearbox output half. Lubricate lip seal.
3. Slide output shaft through lip seal. Start output bearing in bore in gear box output half. Position idler pinion bearing assembly in its bore in output half. Simultaneously press both assemblies into output half.
4. Install gasket on output half.
5. Position gear box input half; align shaft bearings with bearing bores. Press gear box halves together, align pins in output half with pin bore in input half.
6. Secure halves together with twelve bolts.
7. Slide input pinion/bearing assembly into bore in gear box input half. Rotate pinion during installation to make sure gear teeth align with internal spur gear teeth.
8. Install O-ring (Ref. No. G25) on outside of pinion bearing.
9. Reassemble gear box to pump base with four bolts.
10. Reassemble adapter to gear box with four bolts.
11. Align driver shaft key (Ref. No. A26) with keyway in pinion. Slide driver into pinion, secure to adapter with four bolts (Ref. No. A27).
    a. **(Gas engine only)** Attach engine to engine mount with four additional screw assemblies (Ref. No. A29).
12. Reassemble crank to output shaft as described under "Operation" section.
13. Replace diaphragm as described under "Replacement of Diaphragm" section.
14. Fill gear box with oil as described under "Assembly" section.
15. Pump should be checked daily, weekly, monthly for proper operation.

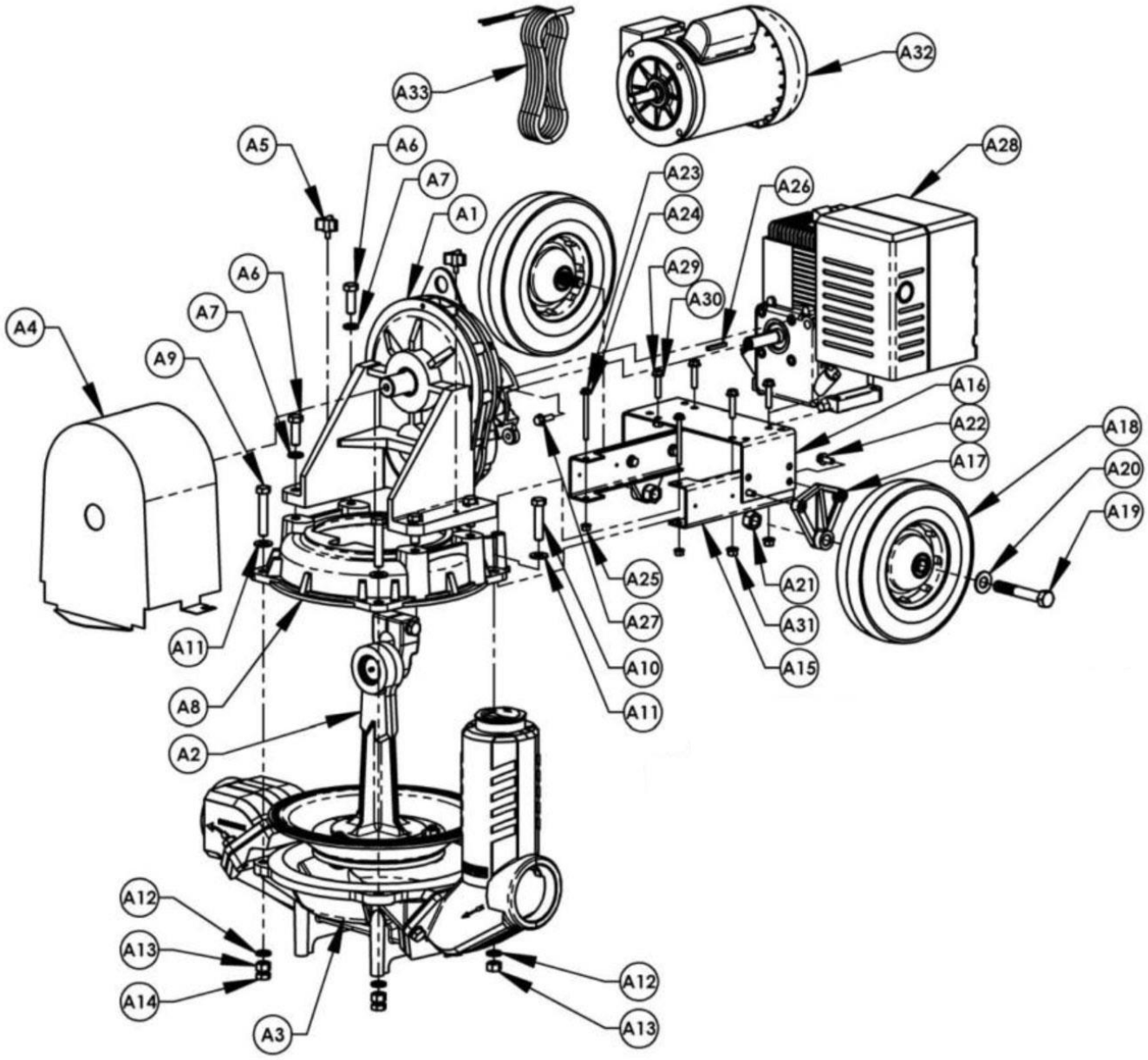
NOTE: Only qualified service personnel should attempt to repair this unit. Improper repair and/or assembly can cause pump damage, driver damage and/or an electrical shock hazard depending on model.

Diaphragm Pumps

Symptom	Possible Cause(s)	Corrective Action
Pump will not prime or retain prime after operating	1. Air leak in suction line 2. Defective flapper valves 3. Clogged foot valve or strainer 4. No liquid in suction line 5. Material jammed in pump well	1. Repair or replace 2. Replace 3. Clean or replace 4. Fill suction line & pump with liquid 5. Clean (See Maintenance)
Flow rate is slow	1. Incorrect driver speed 2. Piping is fouled or damaged 3. Clogged pump 4. Discharge line restricted or undersized 5. Collapsible discharge hose 6. Too many bends 7. Lines are too long	1. Increase speed (see Specifications) 2. Clean or replace 3. Clean 4. Flush out piping or replace 5. Replace with rigid or non-collapsible hose 6. Straighten hose 7. Shorten lines
Pump runs but no fluid	1. Faulty suction piping 2. Pump located too far from fluid source 3. Gate valve closed 4. Clogged strainer 5. Discharge height too great	1. Replace 2. Place pump closer to source 3. Open gate valve 4. Clean or replace 5. Lower discharge height
Pump starts and stops pumping	1. Leak in suction line 2. Leak in foot valve 3. Diaphragm has a crack or hole 4. Defective or clogged flapper valves	1. Repair 2. Repair or replace 3. Replace 4. Clean or replace
Excessive noise while pump in operation	1. Pump not secured to firm foundation 2. Restricted suction line	1. Secure properly 2. Clean or correct
Pump stalls repeatedly or stops for no apparent reason	1. Discharge height over 25 feet of head 2. Material jammed in pump well	1. Lower height (see Specifications) 2. Clean out pump well (See Operation & Maintenance section)

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)
Part description and number as shown in parts list



Assembled Pump – Figure A

Repair Parts List - Assembled Pump (Reference Figure A)

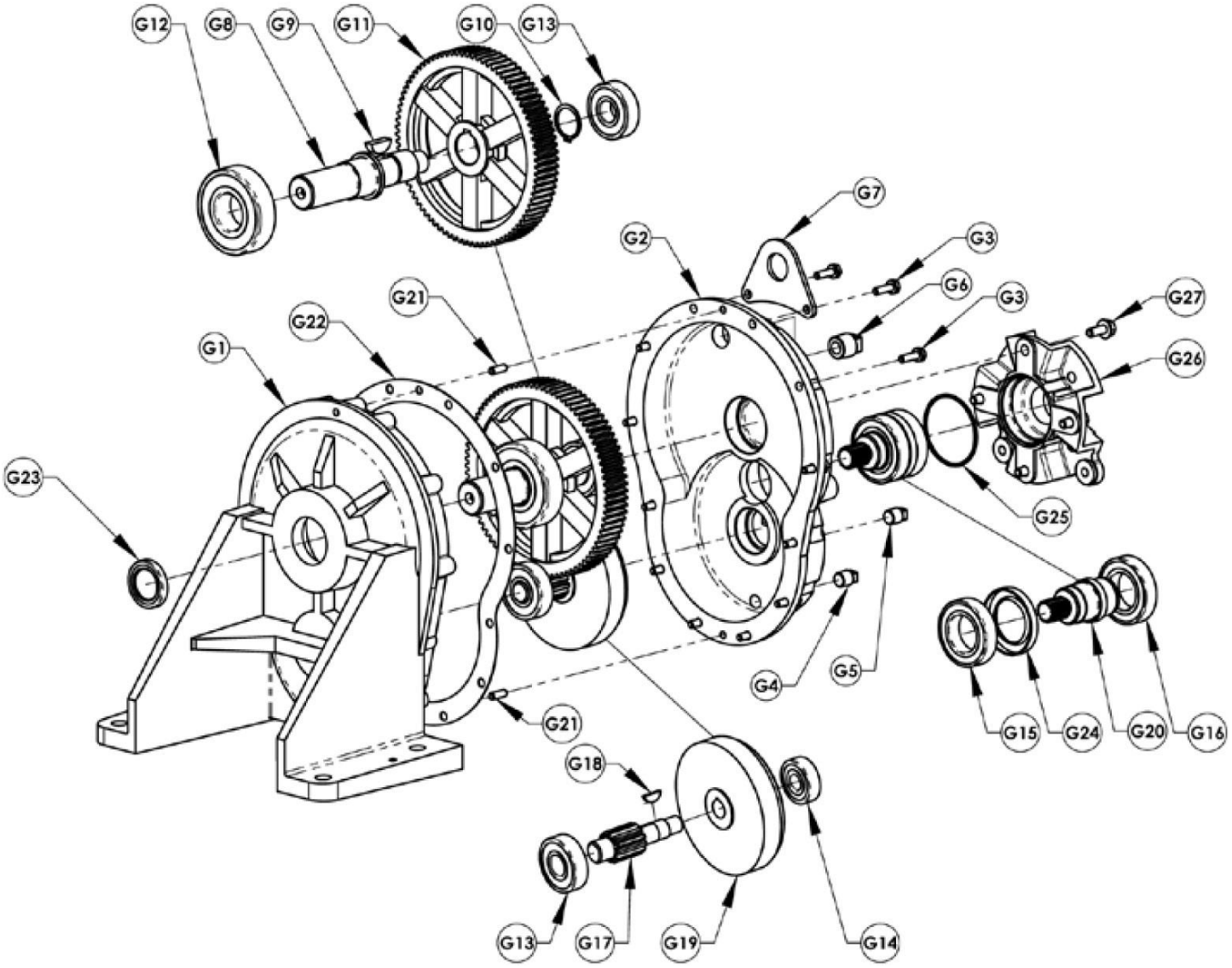
Ref. No.	Description	3" Engine Driven Pump Part Number	3" Motor Driven Pump Part Number	2" Engine Driven Pump Part Number	2" Motor Driven Pump Part Number	Qty.
A1	Gearbox Assembly	Ref. Page 8	Ref. Page 8	Ref. Page 8	Ref. Page 8	1
A2	Plunger/Diaphragm Assembly	Ref. Page 10	Ref. Page 10	Ref. Page 10	Ref. Page 10	1
A3	Well Assembly	Ref. Page 11	Ref. Page 11	Ref. Page 11	Ref. Page 11	1
A4	Plunger Guard	3354-103-00	3354-103-00	3354-103-00	3354-103-00	1
A5	¼-20X1/2 Plastic Knob	1716-010-00	1716-010-00	1716-010-00	1716-010-00	2
A6	½-13x1-1/2 Hex Head Cap Screw	1766-013-00	1766-013-00	1766-013-00	1766-013-00	2 (3" Version) 4 (2" Version)
A6	½-13x2-1/4 Hex Head Cap Screw	1766-016-00	1766-016-00	N/A	N/A	2
A7	½ Lock Washer	1798-001-00	1798-001-00	1798-001-00	1798-001-00	4
A8	Base	3354-001-01	3354-001-01	3360-020-01	3360-020-01	1
A9	½-13x2-1/4 Hex Head Bolt Grade-5	1766-016-00	1766-016-00	1766-016-00	1766-016-00	2
A10	½-13x2-1/4 Hex Head Bolt Grade-5	1766-016-00	1766-016-00	1766-016-00	1766-016-00	2
A11	½ Flat Washer	1798-002-00	1798-002-00	1798-002-00	1798-002-00	4
A12	½ Lock Washer	1798-001-00	1798-001-00	1798-001-00	1798-001-00	4
A13	½-13 Hex Nut	1782-002-00	1782-002-00	1782-002-00	1782-002-00	4
A14	½-13 Hex Jam Nut	1782-001-00	1782-001-00	N/A	N/A	2
A15	Mount Brace	3354-107-00	3354-107-00	3354-107-00	3354-107-00	2
A16	Engine Mount	3354-108-00	3354-108-00	3354-108-00	3354-108-00	1
A16	Engine Mount Kit for Hatz	335Z-101-90	N/A	335Z-101-90	N/A	1
A17	Wheel Bracket	3354-109-00	3354-109-00	3354-109-00	3354-109-00	2
A18	Wheel	1663-000-00	1663-000-00	1663-000-00	1663-000-00	2
A19	5/8-11x4 Hex Head Bolt	1769-000-00	1769-000-00	1769-000-00	1769-000-00	2
A20	5/8 Flat Washer	1799-000-00	1799-000-00	1799-000-00	1799-000-00	2
A21	5/8-11 Hex Nut	1782-020-00	1782-020-00	1782-020-00	1782-020-00	2
A22	5/16-18x3/4 Hex Flange Screw	1745-002-00	1745-002-00	1745-002-00	1745-002-00	4
A23	¼-20x3 Hex Head Bolt	1734-013-00	1734-013-00	1734-013-00	1734-013-00	2
A24	¼ Flat Washer	1789-000-00	1789-000-00	1789-000-00	1789-000-00	2
A25	¼-20 Hex Nut	1776-000-00	1776-000-00	1776-000-00	1776-000-00	2
A26	3/16 Square Key	1517-001-00	1517-001-00	1517-001-00	1517-001-00	1
A27	5/16-24x1 Hex Flange Screw	1753-000-00	N/A	1753-000-00	N/A	4
A27	3/8-16X1-1/4 Hex Head Cap Screw	N/A	1757-003-00	N/A	1757-003-00	4
A28	Engine ¾ Keyed PTO	See Chart	N/A	See Chart	N/A	1
A29	5/16-18x1-1/2 Hex Head Bolt	1748-000-00	N/A	1748-000-00	N/A	4
A29	5/16-18 x ¾ Hex Bolt (Hatz)	1745-002-00	N/A	1745-002-00	N/A	4
A30	5/16 Flat Washer	1790-000-00	N/A	1790-000-00	N/A	4
A31	5/16-18 Hex Nut	1785-000-00	N/A	1785-000-00	N/A	4
A32	Motor	N/A	1626-095-00	N/A	1626-095-00	1
A33	Cord Assembly	N/A	335E-352-90	N/A	335E-352-90	1
A34	Switch Assembly (not shown)	N/A	335E-350-90	N/A	335E-350-90	1
A35	Handle Kit (not shown)	3354-116-90	3354-116-90	3354-116-90	3354-116-90	1
A36	Nipple Pack (2 NPT nipples)	3270-170-00	3270-170-00	3160-170-00	3160-170-00	1

Repair Parts List - Engine Chart

Ref. No.	Description	3" Pump Model Number	2" Pump Model Number	Part Number	Qty.
A28	Honda GX120UT1QX2	335G-96	336G-98	1630-007-00	1
A28	Honda GX160UT1QX2	335H-96	N/A	1639-017-00	1
A28	Hatz 1B20	335Z-96	336Z-96	1630-021-90	1

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)
Part description and number as shown in parts list



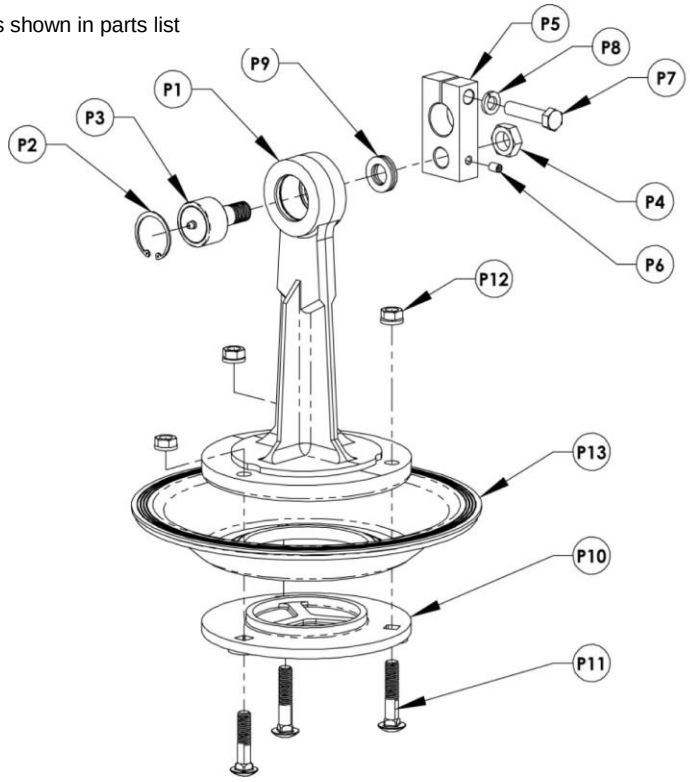
Gearbox – Figure G

Repair Parts List - Gearbox (Reference Figure G)

Ref. No.	Description	3" Pumps Part Number	Qty.	2" Pumps Part Number	Qty.
G1	Gearbox Output Half	3354-090-01	1	3354-090-01	1
G2	Gearbox Input Half	3354-091-01	1	3354-091-01	1
G3	¼-20x7/8" Screws and Washer Kit (12 each)	3354-420-90	1	3354-420-90	1
G4	¼ NPT Plug (drain) (kit includes 1)	1767-002-00	1	1767-002-00	1
G5	¼ NPT Plug (oil level) (kit includes 1)	1767-002-00	1	1767-002-00	1
G6	½ NPT Vented Plug (fill) (kit includes 1)	1767-001-00	1	1767-002-00	1
G7	Lift Bracket	3354-106-00	1	3354-106-00	1
G8	Output Shaft	3354-140-00	1	3354-140-01	1
G9	Woodruff Key #1008	2141-000-00	1	2141-000-00	1
G10	External Retaining Ring SH-112	1806-064-00	1	1806-064-00	1
G11	Output Gear	3354-120-00	1	3354-120-00	1
G12	Bearing –Open- 35x80x21 #6307 JEM	3354-190-00	1	3354-190-00	1
G13	Bearing –Open- 20x52x15 #6304 JEM	3354-191-00	2	3354-191-00	2
G14	Bearing –Open- 15x42x13 #6302 JEM	3354-192-00	1	3354-192-00	1
G15	Bearing –Open- 35x62x14 #6007 JEM	3354-194-00	1	3354-194-00	1
G16	Bearing –Sealed- 35x62x14 #6007 2RSJEM	3354-193-00	1	3354-193-00	1
G17	Idler Pinion Shaft	3354-121-00	1	3354-121-00	1
G18	Woodruff Key #406	2157-000-00	1	2157-000-00	1
G19	Internal Spur Gear	2149-000-00	1	2149-000-00	1
G20	Input Pinion (3/4 keyed engine)	3354-122-00	1	3354-122-00	1
G20	Input Pinion (5/8 keyed 56C motor)	3354-123-00	1	3354-123-00	1
G21	1/4x1 Dowel Pin	1717-002-00	1	1717-002-00	1
G22	Gasket	3354-300-00	1	3354-300-00	1
G23	Oil Lip Seal 1.25x1.75x0.25	2148-000-00	1	2148-000-00	1
G24	Oil Lip Seal 40x62x8	2148-001-00	1	2148-001-00	1
G25	O-Ring- Buna #143	2181-005-00	1	2181-005-00	1
G26	Adapter (engine)	3354-093-01	1	3354-093-01	1
G26	Adapter (56C motor)	3354-092-01	1	3354-092-01	1
G27	5/16-18x3/4 Hex Flange Screw	1745-002-00	4	1745-002-00	1
G28	Assembled Gearbox for Gas Engine Models (includes Ref. Nos. G1 thru G24)	3354-402-90	1	3360-402-90	1
G28	Assembled Gearbox for Electric Models (includes Ref. Nos. G1 thru G24)	3354-403-90	1	3360-403-90	1

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)
Part description and number as shown in parts list



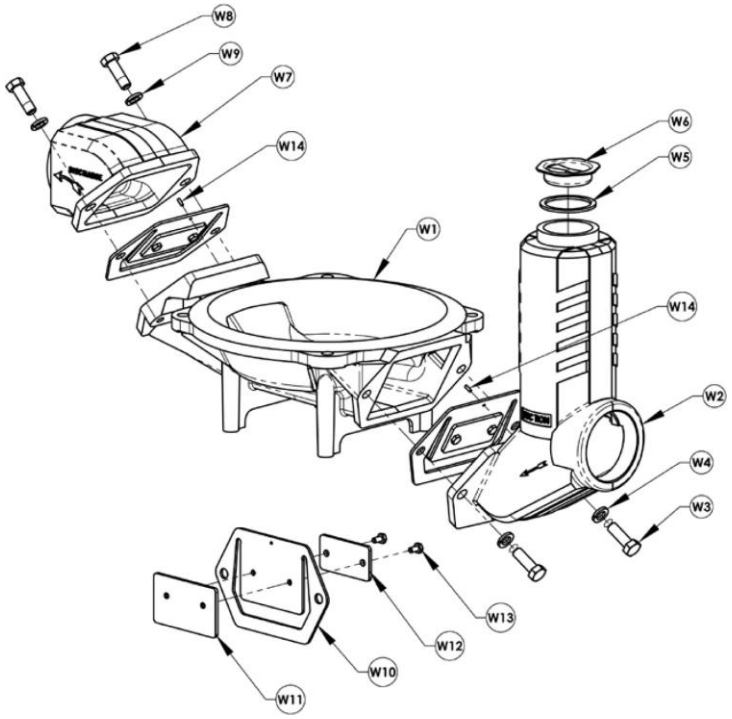
Plunger Assembly – Figure P

Repair Parts List - Plunger Assembly (Reference Figure P)

Ref. No.	Description	3" Pumps Part Number	Qty.	2" Pumps Part Number	Qty.
P1	Plunger	2134-000-01	1	3360-090-01	1
P2	Retaining Ring	3350-190-00	1	3360-191-00	1
P3	Plunger Bearing (includes Ref. No. P4)	2138-000-90	1	3360-190-90	1
P4	Bearing Lock Nut	Incl. w/P3	1	Incl. w/P3	1
P5	Crank Assembly Kit (includes Ref. Nos. P6, P7, P8, P9)	2140-000-90	1	3360-094-90	1
P6	5/16-18x1/2 Socket Set Screw	Incl. w/P5	1	Incl. w/P5	1
P7	½-13 Hex Head Cap Screw Grade-5	Incl. w/P5	1	Incl. w/P5	1
P8	½ Lock Washer	Incl. w/P5	1	Incl. w/P5	1
P9	Bearing Shim	Incl. w/P5	2	Incl. w/P5	1
P10	Diaphragm Retaining Plate	2133-000-00	1	3360-092-00	1
P11	Carriage Bolt Kit	3350-011-90	1	3360-011-90	1
P12	½-13 Hex Nut	1782-001-00	3	N/A	-
P12	3/8-16 Hex Nut	N/A	-	1780-000-00	3
P13	Diaphragm (Santoprene)	2132-000-00	1	3360-300-00	1

For Repair Parts contact dealer where pump was purchased.

Please provide following information:
-Model Number
-Serial Number (if any)
Part description and number as shown in parts list



Well Assembly – Figure W

Repair Parts List - Well Assembly (Reference Figure W)

Ref. No.	Description	3" Pumps Part Number	Qty.	2" Pumps Part Number	Qty.
W1	Well	2120-001-00	1	3360-001-01	1
W2	Suction Plate	2123-000-01	1	3360-050-01	1
W3	½-13x1-1/2 Hex Head Cap Screw Grade-5	1766-013-00	2	N/A	-
W3	3/8-16x1-1/2 Hex Head Cap Screw Grade-5	N/A	-	1759-001-00	2
W4	½ Lock Washer	1798-001-00	2	N/A	-
W4	3/8 Lock Washer	N/A	-	1793-001-00	2
W5	Gasket	2125-000-00	1	2125-000-00	1
W6	Cap	2124-000-00	1	2124-000-00	1
W7	Discharge Plate	2131-000-01	1	3360-052-01	1
W8	½-13x1-1/2 Hex Head Cap Screw Grade-5	1766-013-00	2	N/A	-
W8	3/8-16x1-1/2 Hex Head Cap Screw Grade-5	N/A	-	1759-001-00	2
W9	½ Lock Washer	1798-001-00	2	N/A	-
W9	3/8 Lock Washer	N/A	-	1793-001-00	2
W10	Check Valve (neoprene)	Incl. w/W15	2	Incl. w/W15	2
W11	Check Valve Weight Top	Incl. w/W15	2	Incl. w/W15	2
W12	Check Valve Weight Bottom	Incl. w/W15	2	Incl. w/W15	2
W13	¼-20x1/2 Hex Head Cap Screw	Incl. w/W15	4	Incl. w/W15	4
W14	1/8 diameter x 3/8 Pin	2121-000-00	2	2121-000-00	2
W15	Flapper Valve Assembly Kit (includes Ref. Nos. W10, W11, W12, W13)	3354-071-90	2	3360-070-90	2
W16	Suction Strainer (not shown)	1680-000-00	1	C230-170-00	1

AMT Pump Company
(herein "AMT")
400 Spring Street
Royersford, PA 19468
Phone: (610) 948-3800
Fax: (610) 948-5300
www.amtpump.com

General Information

SALES POLICY: AMT products are sold through our established Distributors. We do not sell direct to the consumer or organization not entitled to trade recognition. Therefore, possession of our catalogs and/or price list(s) does not infer an offer to sell.

MINIMUM ORDER: We appreciate your order, however, all orders are subject to a minimum $35.00 net invoice charge (excluding freight). This applies to all pump and parts purchase orders.

PRICES: Prices are subject to change without notice. All orders accepted are subject to prices in effect at time of shipment.

PAYMENT TERMS: Terms, upon establishment of credit, are Net 30 days. Past due accounts may be subject to a service charge of 1.5% per month. Domestic or assignable letter of credit is required for all export trade.

PAST DUE ACCOUNTS: AMT reserves the right to withhold open account shipments on any past due account. Invoices are considered past due after thirty (30) days. In the interest of sound business, all orders are subject to approval of the Credit Department.

SHIPPING INSTRUCTIONS: All shipments will be made F.O.B. the factory. Where instructions for shipment do not appear on the order, the shipment will be made according to our best judgment. Full risk of loss (including transportation delays and losses) shall pass to the customer upon delivery of the products to the carrier at the F.O.B. point. When loss or delay occurs, primary responsibility for tracing rests with the customer. When there is LOSS or APPARENT VISIBLE DAMAGE to a shipment, when tendered for delivery, *DO NOT* give the carrier a clear receipt. Note such damage on the carrier's delivery receipt and *HAVE THE DRIVER SIGN THE RECEIPT.*

PRODUCT REVISIONS: AMT reserves the right to discontinue, change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

LEAD TIME: Products designated "Quick Ship Product", also referred to as "QSP" will normally be shipped within 24 hours of receipt of a non-cancellable purchase order. Only limited quantities of "QSP" pumps are available.

STANDARD LEAD TIME: Lead time is two weeks for all non "QSP" product. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control.

VIP SHIPMENT: Select AMT and IPT branded pumps are available for next day shipment for non-QSP (Quick Ship Products) items and subjected to a specific model surcharge per unit noted in the respective price book. Requires calling for availability, confirmation and a non-cancellable purchase order or credit card payment prior to shipment. The expedited shipping charges are an additional cost added separately from the VIP charges per item. AMT reserves the right to revise lead times as required due to availability of materials and all other causes beyond our control. QSP quantities are limited as determined by AMT.

ALL purchase orders must be submitted via hard copy sent to AMT customer service department by fax, EDI or e-mail.

RETURN GOODS POLICY: Goods shall not be returned without a return goods authorization number (RGA) issued by AMT customer service. The RGA number must be listed on the packing list. Only current model and part numbers with a valid date code may be returned (within one year from date of purchase). **A 20% restocking and packaging charge will apply to all returns. All shipping charges must be pre-paid. No exceptions.**

ORDER CHANGES BY CUSTOMER: Orders in process may not be changed except with written consent and may be subject to special charges.

12 Month Limited Warranty

EXTENT AND DURATION OF LIMITED WARRANTY

Coverage: AMT Pump Company (herein "AMT") or IPT Pumps by Gorman-Rupp (herein "IPT") or Gorman-Rupp Industries Division of the The Gorman-Rupp Company, Patterson, or the Gorman-Rupp Company (herein referred to as "G-R Unit) each individually warrants that its products and parts shall be free from defects in material and workmanship for twelve (12) months from the date of purchase by the original end user when installation is made and maintenance is performed in accordance with G-R Unit's recommendations. Wear and tear resulting from use and items normally consumed in use are not covered.

EXCEPTIONS

(A) This Limited Warranty shall not apply to mechanical seals in AMT or IPT pumps and the following products and parts: engines, motors, trade accessories and all other products, components, parts and materials not manufactured by the G-R Units. These items may, however, be covered by the warranties of their respective manufacturers. (B) This warranty does not extend to or apply to any unit which has been repaired or altered at any place other than by a G-R Unit, or by persons not expressly approved by a G-R Unit to make repairs or alterations, nor to any unit the serial number, model number or identification of which has been removed, defaced or altered. (C) This warranty does not extend to any product manufactured by a G-R Unit, which has been subjected to mis-use, neglect, accident, improper installation, or use in violation of instructions furnished by a G-R Unit. (D) Pump Kits: This warranty does not extend to any product sold by a G-R Unit unassembled as a Pump Kit. Pump Kits are warranted against defects in material and workmanship for 60 days from the date of shipment from a G-R Unit. Any Pump Kit parts deemed defective by a G-R Unit will be replaced free of charge within 60 days of shipment. Pump Kits are not returnable for credit.

LIMITATIONS

THE G-R UNITS' SOLE AND EXCLUSIVE WARRANTY WITH RESPECT TO THEIR PRODUCTS AND PARTS IS THIS LIMITED WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS AND/OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

EXCLUSIVE REMEDY AND DAMAGES

The sole and exclusive remedy for breach of this Warranty by a G-R Unit and the entire extent of its liability for such breach or for damages arising from the use of the products and parts covered under this Limited Warranty, shall be as follows:

1. **Repair or Replacement:** If inspection shows that any G-R Unit product or part covered under this Limited Warranty is defective in materials or workmanship, the G-R Unit shall repair or replace the defective or non-conforming product or part without charge, whichever the G-R Unit chooses. You must have properly maintained and used the product or part claimed to be defective in accordance with the maintenance schedule or manual, which comes with the product. No allowance will be made for labor, installation, removal, transportation or other charges incurred by you in connection with such repair or replacement.
2. To obtain the above remedy:
    A. Immediately notify the G-R Unit upon discovery of the claimed defect in materials or workmanship and provide the serial number or date code of the product and/or part(s) or provide the G-R Unit with the invoice or bill of sale referencing the product by no later than the expiration date of the warranty period.
    B. The G-R Unit will advise whether inspection will be necessary and how whether repair or replacement will be made. If inspection by the G-R Unit is necessary, the pump or defective part must be sent freight pre-paid to the G-R Unit. Return shipment will be F.O.B. the G-R Unit's plant.
    C. **Return Goods Authorization Requirement:** No product will be accepted for return or replacement without the prior written authorization of the G-R Unit. Upon such authorization, and in accordance with instructions from the G-R Unit, the product will be returned to the G-R Unit, shipping charges prepaid by the Buyer.

3. **Damages:** The G-R Unit's liability for damages for breach of this Limited Warranty shall not exceed the amount of the purchase price of the product or part(s) in respect to which Such damages are claimed. **IN NO EVENT SHALL THE G-R UNITS BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES FOR BREACH OF THIS LIMITED WARRANTY.**

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

Model 8 Bag Filter Housings Sizes #1 & #2

Strainers or Bag Filters: Your Choice!

Model 8 strainer/filter housings are made in 2 sizes and can serve as basket strainers (for particle retention down to 74 micron size) or as bag filters (for particle retention down to 1 micron size). In all cases, covers are easily removed without special tools.

Features

- Low pressure drops
- Permanently-piped housings
- Covers are O-ring sealed
- Carbon steel or stainless steel (304 or 316) and aluminum construction for housings
- Easy to clean!
- Adjustable-height legs, standard
- O-Ring seals: Buna N, EPR, Viton®, teflon®
- Duplex unites are available
- Pipe sizes 3/4 thru 4-inch, NPT or flanged
- Two basket depths: 15 or 30 inches (nominal)

Options

- Sanitary connections
- Different outlet connections
- Extra-length legs
- Liquid displacers for easier servicing



Model shown in Stainless Steel



Model shown in Carbon Steel

Choosing A Basket Strainer or Bag Filter

Choose between straining (removing particles down to 74 micron size) or filtering a fluid (removing particles down to 1 micron size). This will direct you to choose the correct basket when ordering.

Operation

Unfiltered liquide enters the housing above the bag or basket and passes down through them. Solids are contained inside the bag or basket, where they're easily and completely removed when the unit is serviced.

Fluid bypass around the basket is prevented because the outside diameter of the filter bag seals radially against the housing inside diameter. A single cover gasket is used to seal the opening, and covers can be installed and removed without tools.

Model 8 Pressure Drop Data

Basket strainer and bag filters are usually selected so that the pressure drop does not exceed 2 psi, when they are clean. Higher pressure drops may be tolerated, when contaminant loading is low. Bag change out should occur at 15 psid.

The pressure drop data is accurate for all housings with strainer or bag filter baskets. When bag filters are added, total pressure drop becomes the sum of the pressure drop as determined by the steps below.

	Viscosity, cps								
	1 (H_2O)	50	100	200	400	600	800	1000	2000
All unlined baskets	.65	.85	1.00	1.10	1.20	1.40	1.50	1.60	1.80
40-mesh lined	.73	.95	1.20	1.40	1.50	1.80	1.90	2.00	2.30
60-mesh lined	.77	1.00	1.30	1.60	1.70	2.10	2.20	2.30	2.80
80-mesh lined	.93	1.20	1.50	1.90	2.10	2.40	2.60	2.80	3.50
100-mesh lined	1.00	1.30	1.60	2.20	2.40	2.70	3.00	3.30	4.40
200-mesh lined	1.30	1.70	2.10	3.00	3.40	3.80	4.40	5.00	6.80

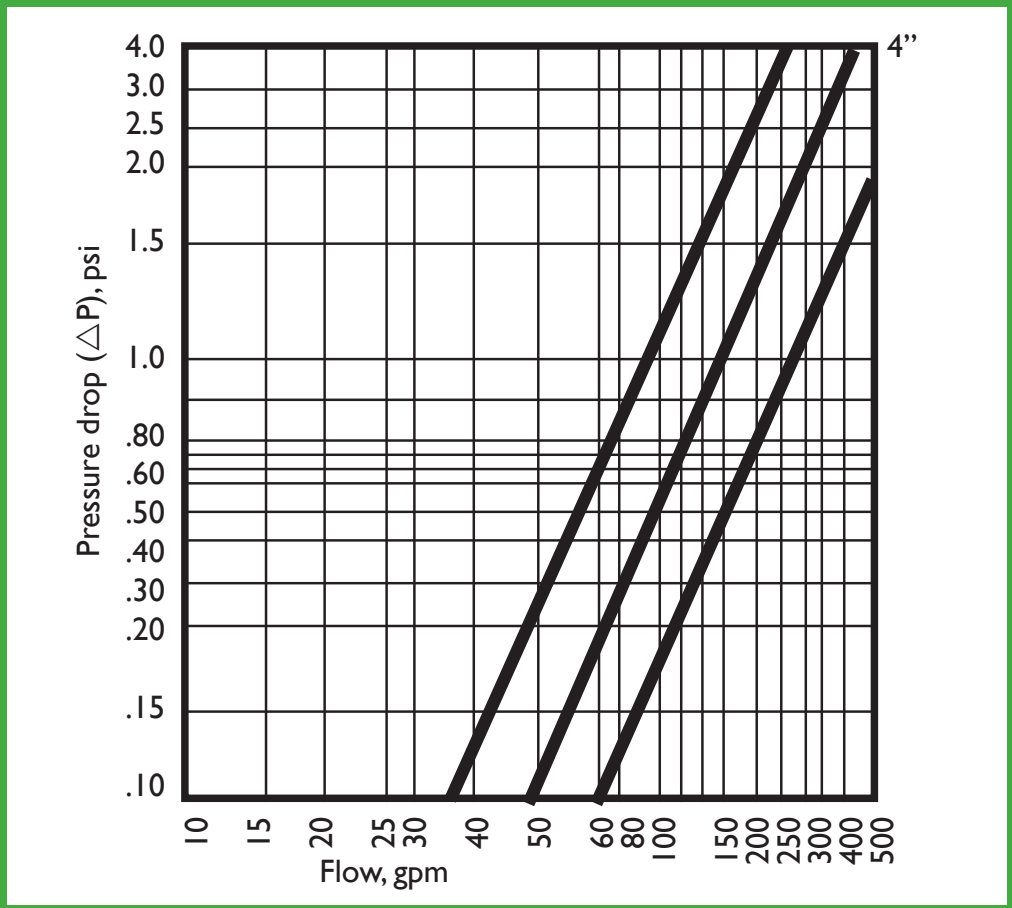
Follow these easy steps:

1) Using the desired pipe size and approximate flow rate, determine the basic pressure drop from the appropriate graph.
2) Multiply the pressure drop obtained in step 1 by the viscosity correction factor found in the accompanying table. This is the adjusted (clean) pressure drop for all baskets, without filter bags.
3) Add the pressure drop for the bag filter.

Basket Data

Depth Nominal (inches)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)	Bag Size No.
15	6.7	2.3	500	1
30	6.7	4.4	1000	2

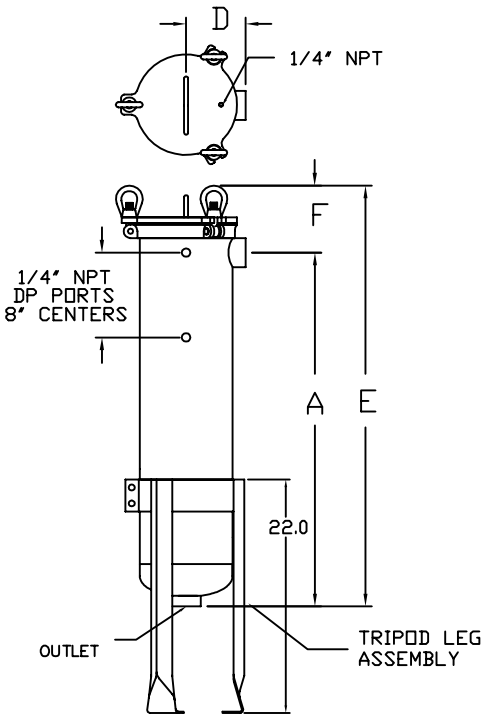
Model 8 — For flow rates to 220 gpm*



* Based on housing only. Fluid viscosity, bag filter used, and expected dirt loading should be considered when sizing a filter.

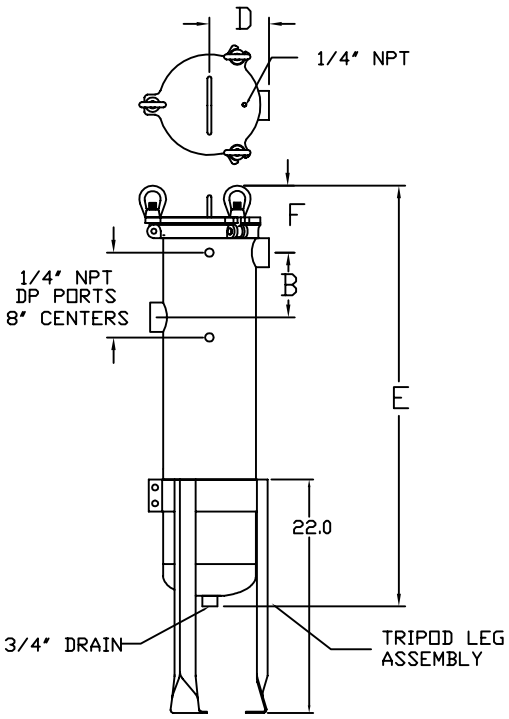
Model 8: Sizes #1 & #2 — Available in four styles and four materials

Carbon Steel



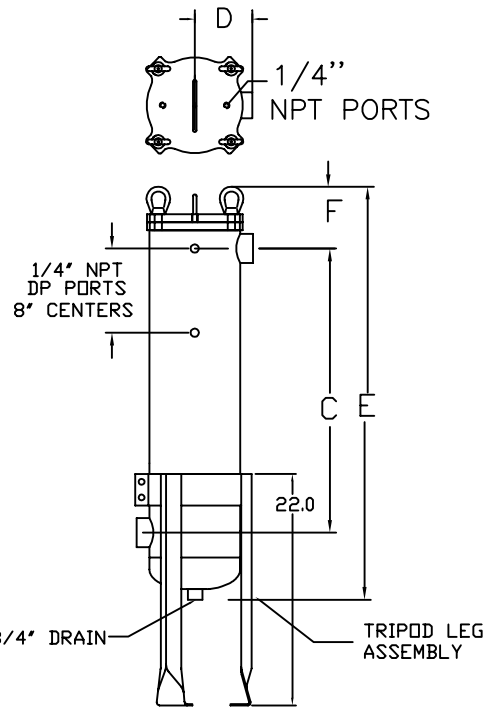
Style 1
Bottom Outlet

304-316 Stainless Steel



Style 2
Side Outlet Top

Aluminum



Style 2B
Side Outlet Bottom

Carbon Steel
304-316 Stainless Steel
Aluminum

Standard Features
- Hinged Eye Bolt Cover (CS & SS)
- Eye Bolt Cover (Aluminum)
- 304 Stainless Basket
- Buna Seal
- 1/4" NPT Gauge Port
- Adjustable C.S. Legs

Options
- 316 Stainless Basket
- DP Ports
- O-Ring Seal Materials
- 304, 316 Adjustable Legs
- Style 3 90 Elbow
- Flange Connections
- Sanitary Connections

#1 SIZE 8-15

Pipe Size In NPT	A	B	C	D	E	F
0.75	30.5	5.6	13	5.3	24.3	5.6
1.00	30.5	5.6	13	5.3	24.5	5.7
1.25	30.5	5.6	13	5.3	24.9	5.9
1.50	30.5	5.6	13	5.3	25.6	6.1
2.00	30.5	6.1	13	5.3	25.7	6.3
3.00	30.5	7.3	13	5.3	26.8	6.9
4.00	30.5	8.3	13	5.3	27.9	7.4

#2 SIZE 8-30

Pipe Size In NPT	A	B	C	D	E	F
0.75	34.5	5.6	27	5.3	38.3	5.6
1.00	34.5	5.6	27	5.3	38.5	5.7
1.25	34.5	5.6	27	5.3	38.9	5.9
1.50	34.5	5.6	27	5.3	39.6	6.1
2.00	34.5	6.1	27	5.3	39.7	6.3
3.00	34.5	7.3	27	5.3	40.8	6.9
4.00	34.5	8.3	27	5.3	41.9	7.4

How To Order Model 8: Size #1 & #2 Filter Bag Housings

HOUSING OPTIONS

EXAMPLE: 8 - 30 - 2P - 1 - 150 - CS - BS - PB - 200 - D - DP

Model #
#8 - 8

Housing Size
15 inch -15
30 inch -30

Pipe Size NPT / Flange
1" Female NPT -1P
1 1/4" Female NPT - 1 1/4P
1 1/2" Female NPT - 1 1/2P
2" Female NPT - 2P
3" Female NPT - 3P
1" 150 Class ANSI Flange -1F
1 1/4" 150 Class ANSI Flange - 1 1/4F
1 1/2" 150 Class ANSI Flange -1 1/2F
2" 150 Class ANSI Flange - 2F
3" 150 Class ANSI Flange - 3F

Outlet Style
Bottom - 1
Side - 2
Side Bottom - 2B
90 Degree Elbow - 3

Pressure Rating
150 PSI(Flanged or NPT)

Housing Material
Aluminum - AL
Carbon Steel - CS
304 Stainless Steel - 4S
316 Stainless Steel - 6S

DP Ports
DP

Displacer
Displacer - D

Mesh Sizes
20,30,40,50,60,70,80
100,150,200

Basket Type
Standard Basket - PB
Mesh Lined - BM
Perforated Basket - P
1/4,3/16,9/64,3/32,1/16

Basket Seal
Buna Seal - BS
Ethylene Propylene(EPR) - ES
Teflon Encapsulated Viton -TS
Solid Teflon - ST
Viton - VS

* Aluminum Housings only available with Eye Bolt Covers
* Carbon Steel & Stainless Housing only available with Hinged Eye Bolt Covers
* All Filter Bag Housings come with Carbon Steel Legs & Standard 304 SS Basket
* 304 Stainless & 316 Stainless Legs are available & 316 SS Baskets are available

Data Sheet

ROYTRONIC EXCEL™ Series AD
Electronic Metering Pumps

Model AD 2 5 1 - 8 3 8 S I

Model Code Configuration

Drive

Control Code

2 - Dual Manual Control
Stroke frequency and length manually adjustable, LCD display, low level indication (remote input). Display configurable to indicate theoretical pump flow.

8 - Pulse/Analog Input w/ Dual Manual Control
Pulse or 4-20 mA signal input controls frequency, LCD display, manual stroke length control, frequency manually adjustable when in local control, pulse multiply/divide functions, 24 V output for remote device. Includes dual low level float switch input. Display configurable to indicate theoretical pump flow.

9 - Pulse/Analog Input w/Dual Manual Control & Enhanced Controls
Advanced Features - Pulse or 4/20 mA signal input controls frequency, graphical display, manual stroke length control, Frequency manually adjustable when in local control, Pulse multiply/divide functions, 24 V output for remote device, dual low level float switch input, Remote on/off signal input. Outputs include: 4-20 mA, pulse, & Alarm. Remote internal/external mode input. Display configurable to indicate theoretical pump flow.

Output Code with FastPrime™ Liquid End

	Max Capacity	Max Pressure
1 -	0.21 GPH (0.8 l/h)	250 psi (17.2 Bar)
4 -	0.5 GPH (1.9 l/h)	250 psi (17.2 Bar)
5 -	1.0 GPH (3.8 l/h)	110 psi (7.6 Bar)
6 -	2.0 GPH (7.6 l/h)	50 psi (3.4 Bar)

Voltage Code

1 – 110-120V US Plug
2 – 220-240V US Plug
3 – 220-240V DIN Plug
5 – 220-240V UK Plug
6 – 220-240V Aust/NZ Plug
7 – 220-240V Swiss Plug
8 – 110-120V No Plug

Liquid End

Liquid End Code

See Accompanying Pages for Options

Liquifram™ Size Code

1 – 0.2 in²
2 – 0.4 in²
3 – 0.8 in²
4 – 1.6 in²

Material Code

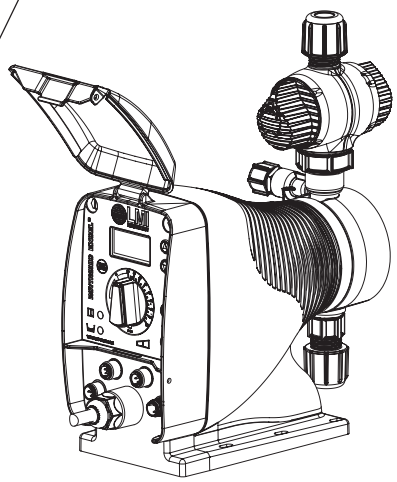
See Accompanying Pages for Options

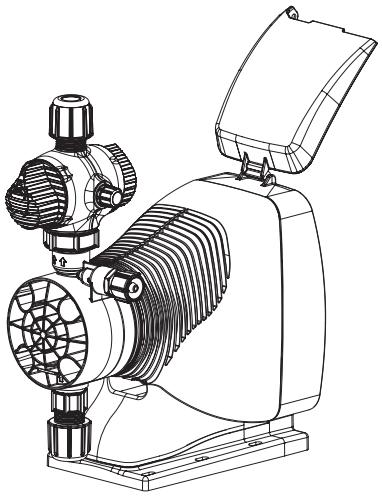
Head/Valve Code

S – FastPrime™ Head + 4FV
N – FastPrime™ Head
H – AutoPrime™ Head + 4FV
A – AutoPrime™ Head
V – High Viscosity Head
P – High Viscosity with Ported Head

Connection Code

I – Inch Tube connections with tubing
M – Metric Tube connection without tubing
U – Inch Tube connection with Black UV resistant suction/discharge tubing
P – 1/2" NPT - 1/2" BSP Pipe (SS 1/4" NPT)





Certified to NSF/ANSI 61

Certified to NSF/ANSI Standard 50

Specifications

Series	Strokes Per Minute (Adjustable) Min	Max	Stroke Length (Adjustable) Recommended Minimum	Average Input Power @ Max Speed and Pressure	Max. Shipping Weight
AD 2X* AD 8X* AD 9X*	1	120	20%	25 watts	10 lbs (4.75 kg)

* where X = output code

LMI MILTON ROY

201 Ivyland Road
Ivyland, PA 18974 USA
TEL: (215) 293-0401
FAX: (800) 327-7563
http://www.lmipumps.com

2039.B 6/2011

Standard FastPrime™ Liquid End Configuration Data & Materials of Construction

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD91 ■ AD81 ■ AD21 ■	910SI†	1	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	915SI†	1	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	918SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	919SI†	1	Acrylic/PVDF	PTFE	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	917NP	1	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	812SI†	1	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	813SI†	1	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	818SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	718SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD94 ■ AD84 ■ AD24 ■	920SI†	2	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	925SI†	2	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	928SI†	2	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	929SI†	2	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	927NP	2	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	822SI†	2	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	823SI†	2	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	828SI†	2	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	728SI†	2	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	624VI*	2	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	626VI	2	Acrylic/PP	316ss	Fluorofilm™	Viton®/ Polyprel®	—	PE.5"O.D. Vinyl.938"O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD95 ■ AD85 ■ AD25 ■	930SI†	3	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	935SI†	3	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	938SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	939SI†	3	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	937NP	3	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	832SI†	3	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	833SI†	3	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	838SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	738SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	634VI*	3	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	636VI	3	Acrylic/PP	316ss	Fluorofilm™	Viton®/ Polyprel®	—	PE.5"O.D. Vinyl.938"O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD96 ■ AD86 ■ AD26 ■	940SI†	4	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	945SI†	4	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	948SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	949SI†	4	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	947NP	4	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	842SI†	4	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	843SI†	4	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	848SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	748SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	644VI*	4	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	646VI	4	Acrylic/PP	316ss	Fluorofilm™	Viton®/ Polyprel®	—	PE.5"O.D. Vinyl.938"O.D.

Output Information with FastPrime™ Liquid End

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
ADX1	0.002	0.21	0.01	0.8	0.132	13.2	0.011	0.11	250 psi (17.2 Bar)
ADX4	0.005	0.5	0.02	1.9	0.315	31.5	0.013	0.13	250 psi (17.2 Bar)
ADX5	0.01	1.0	0.04	3.8	0.630	63.0	0.026	0.26	110 psi (7.6 Bar)
ADX6	0.02	2.0	0.08	7.6	1.260	126.0	0.053	0.53	50 psi (3.4 Bar)

(Where X = Control Code 2,8,9).

AutoPrime™ Liquid End Configuration Data & Materials of Construction

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquiframe™	Seat/O-Ring	Accs. Valve	Tubing & Connections
AD91 ■ AD81 ■ AD21 ■	910HI†	1	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	918HI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
AD94 ■ AD84 ■ AD24 ■	920HI†	2	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	928HI†	2	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
AD95 ■ AD85 ■ AD25 ■	930HI†	3	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
	938HI†	3	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
AD96 ■ AD86 ■ AD26 ■	940HI†	4	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
	948HI†	4	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.

Output Information with AutoPrime™ Liquid End — Estimated

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
ADX1	0.0015	0.15	0.006	0.6	0.095	9.5	0.0008	0.079	150 psi (10.3 Bar)
ADX4	0.0033	0.33	0.012	1.2	0.21	20.8	0.0017	0.17	150 psi (10.3 Bar)
ADX5	0.008	0.8	0.030	3.0	0.50	50.5	0.0042	0.42	110 psi (7.6 Bar)
ADX6	0.018	1.8	0.068	6.8	1.14	113.6	0.0095	0.95	50 psi (3.4 Bar)

(Where X = Control Code 2,8,9).

AUTOPRIME™ liquid ends have 3 check valves: suction on the bottom; discharge on the front; autoprime bleed on the top. By design, a repeatable portion of the process fluid continuously bleeds through the top check valve to be returned to the chemical supply. The result is the assurance that any gas in the head is automatically relieved thus eliminating air-binding. Depending on application, output may be reduced up to 50%. Variables include supplier piping, stroke length and speed setting. Maximum pressure is 150 psi (10.3 Bar) for AX1, AX4, 110 psi (7.6 Bar) for AX5, 50 psi (3.4 Bar) for AX6 models. (Where X = control codes 0,1,3,7,8).

■ See front page for voltage code specifications.

† To specify black, UV resistant tubing, change 'I' to 'U'. To specify head only and no 4FV, change S to N for FastPrime or change H to A for AutoPrime. To specify 1/2" NPT Male, change "I" to "P".

* To specify Ported Head, change "V" to "P".

4FV indicates that the pump is equipped with an LMI Four Function Valve. This diaphragm type, anti-syphon/pressure relief valve is installed on the pump head. It provides anti-syphon protection and aids priming, even under pressure.

Fluorofilm™ is a copolymer of PTFE and PFA. Polyprel® is an elastomeric PTFE copolymer.

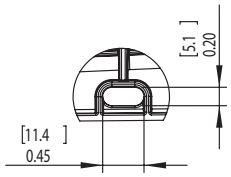
Polyprel is a registered trademark of the Milton Roy Company.

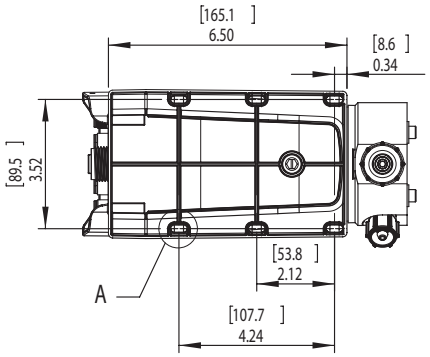
Fluorofilm and Liquiframe are trademarks of the Milton Roy Company.

Viton® is a registered trademark of E.I. DuPont Company.

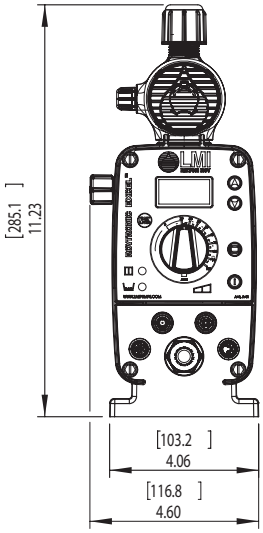
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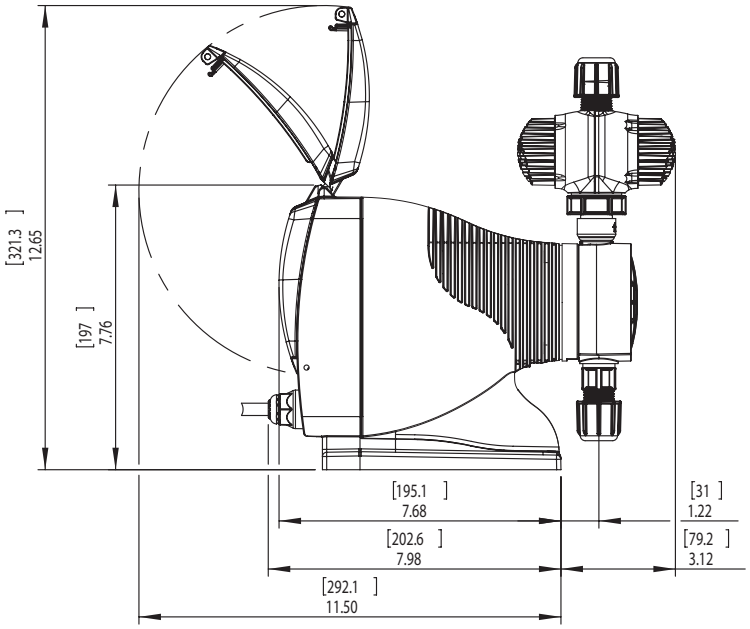
VIEW A



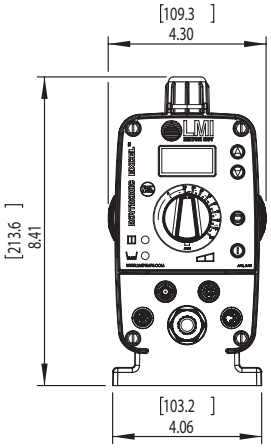


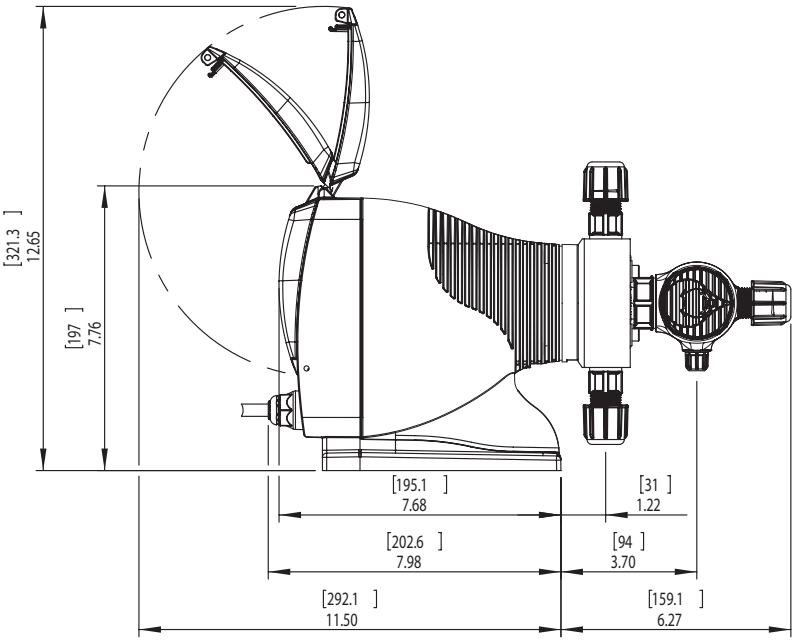
FASTPRIME LIQUID ENDS





AUTOPRIME LIQUID ENDS





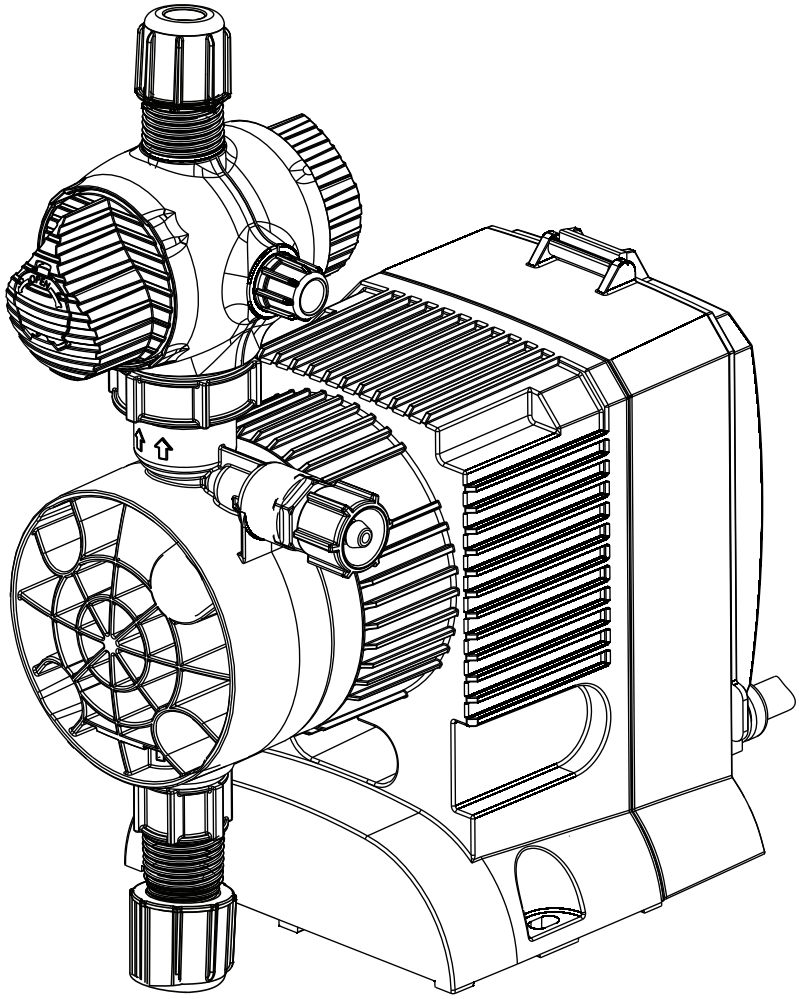
NOTE: ALL DIMENSIONS ARE IN INCHES [MM]. DIMENSIONS SHOWN ARE FOR LARGEST LIQUID END.
DIMENSIONS WILL VARY DEPENDING ON LIQUID END SELECTED.

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Specifications Subject to Change

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ROYTRONIC is a registered trademark of Milton Roy Company.

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New 4-Function Valve For 300/400/700/800/900 Series Cartridge Valve Liquid Ends

Data Sheet

Manual No : 1996
Rev. : C
Rev. Date : 11/2015

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NEW 4-FUNCTION VALVE

The Four Functions:

Anti-Syphon

The discharge flow path goes through a port that only opens on the discharge stroke of the pump. This prevents the discharge line from syphoning liquid from the supply tank in most applications.

Back Pressure

The diaphragm that controls anti- syphoning creates approximately 20 psi (1.4 Bar) back pressure on the pump's discharge valve which improves system performance.

Pressure Relief

A second diaphragm protects the pump from overpressure by releasing fluid to a relief port in the event of excessive discharge line pressure.

Pressure Release

This function makes it easy and safe to depressurize the discharge line without loosening tubing or fittings.

The ROYTRONIC® series metering pumps are available with a new 4-function valve designed with advanced features.

1. Ergonomic design for easy control of functions.
2. A new mounting connection that swivels 360º to the position best suited for the installation.
3. LMI®'s new tubing connection system for the most secure connection available with an electronic metering pump.
4. Hardware is protected from chemicals.

Model Numbers

Valve Number	Wetted Materials			Max Pressure
	Body	Diaphragm	"O" Ring	
48753	PVC	FLUOROFILM™	POLYPREL™	150 PSI (10 Bar)
48754	PVDF		POLYPREL™	
48755	PVDF		PTFE	
48756	PP		PTFE	
48798	PVC		POLYPREL™	250 PSI (17 Bar)
48799	PVDF		POLYPREL™	
48800	PVDF		PTFE	
48801	PP		PTFE	

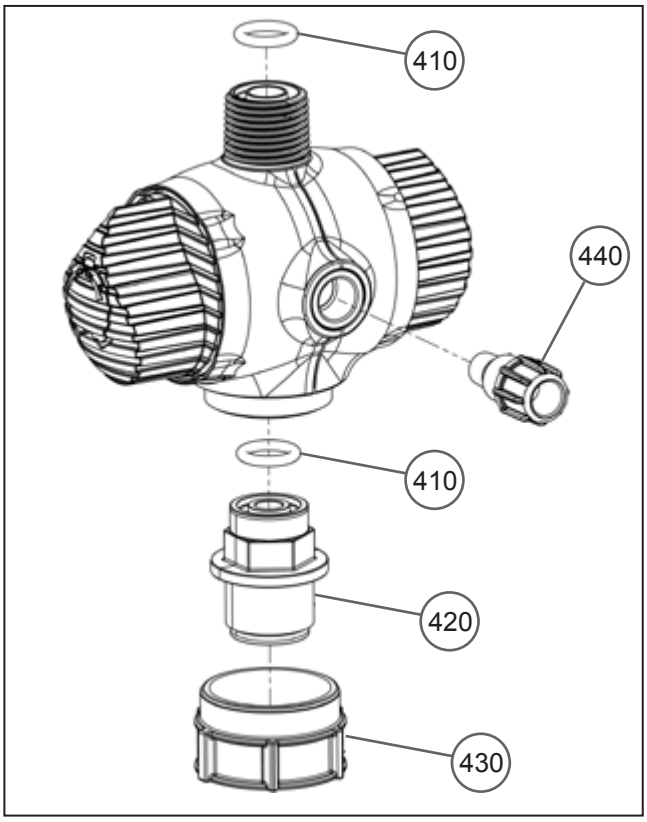
Note:

Valves supplied with a pump include connections as specified by pump model number. All valves sold as separate accessories are supplied with universal tubing connection. Units with a solid black knob are rated for 150 psi. Units with a black knob with a yellow insert are rated for 250 psi. For tubing connection, order one of the following kits:

Connection Kits

Kit #	LMI® Tubing Size	Contents
77378	3 x 6 mm	1 Knob, 1 Ferrule
77379	6 x 8 mm	1 Knob, 1 Ferrule
77380	9 x 12 mm	Insert, 1 Sleeve
77382	1/4"	1 Knob, 1 Ferrule
77383	3/8"	1 Knob, 1 Ferrule
77384	1/2"	Insert, 1 Sleeve

NEW 4- FUNCTION VALVE



Connections

1. To mount to a pump, remove the discharge fitting from the pump (if present) leaving the cartridges in the pump head. Position the coupling nut (part 430 on diagram) on pump head over cartridges with threads up, and insert 4- FV fitting (part 420 on diagram) and thread into pump head over cartridges. Tighten the fitting to 50 in-lbs using a 13/16" or 20 mm socket. Insert the large opening on the 4- Function valve into the coupling knob and hand tighten. You can position the valve to have the bypass port in any convenient location by tightening the coupling nut with the bleed port positioned 90º CCW from desired location, then holding the nut stationary while turning the valve the final 90º to desired position.
2. Connect 1/4" tubing to the bypass port and route to supply container.
3. Connect discharge line using LMI® tubing connection system or 1/2" pipe thread.

   The New 4- Function Valve is designed for double ball checks. A second check valve cartridge is required when mounting a new 4- Function Valve to an existing pump with a 300, 400 or 700 liquid end. The table below provides cartridge part numbers.

Liquid End Cartridge Numbers

Liquid End	Cartridge
353, 455	37334
352, 358, 450, 458	37335
313, 363, 393, 415, 465, 495	37337
312, 318, 362, 368, 392, 398, 410, 418, 460, 468, 490, 498	37338
459	37858
419, 469, 499	37859
718	48542
728, 738, 748	48543

Method of Operation

A. Priming

1. Connect all tubing per instructions.
2. Turn black knob about 1/8 turn CCW to stop point to open bypass port.
3. Set pump at 100% speed and 100% stroke length. Start pump. When fluid has been flowing through the bypass port tubing for 10-20 seconds, the pump is primed.
4. Stop pump and return black knob to normal position.

Note:

The pumps are normally self priming if suction lift is less than 5 feet (1.5 meters), check valves are wet (there is usually water in the pump head when shipped from the factory), and the steps above are followed. If the pump does not self prime, you can choose one of 2 ways to help prime:

1. Remove the 4- Function valve and discharge cartridges and slowly pour water or solution into the pump head until it is filled. Replace cartridges and 4- Function valve and repeat steps above.
2. Or, temporarily improve suction conditions by pumping from a container closer to or above pump.

B. Depressurizing the Discharge Line

When preparing to maintain the pump or any component in the discharge line, the 4- Function valve is used to depressurize the line. Be sure an injection check valve is properly installed and is operating, and that all tubing connections on the 4- Function valve are secure.

1. Turn off the pump.
2. If any valves have been installed downstream of the pump, close them.
3. If the supply tank for the pump is higher than the pump head, fluid will flow through unless a suction line valve is closed.
4. Turn the black knob on the 4- Function valve about 1/8 turn CCW to its open position. This relieves pressure between the pump and the 4- Function valve.
5. To release line pressure, while the black knob is in the open position, turn the yellow knob and hold open until fluid flow through the bypass port stops.

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ROYTRONIC EXCEL™ Series AD

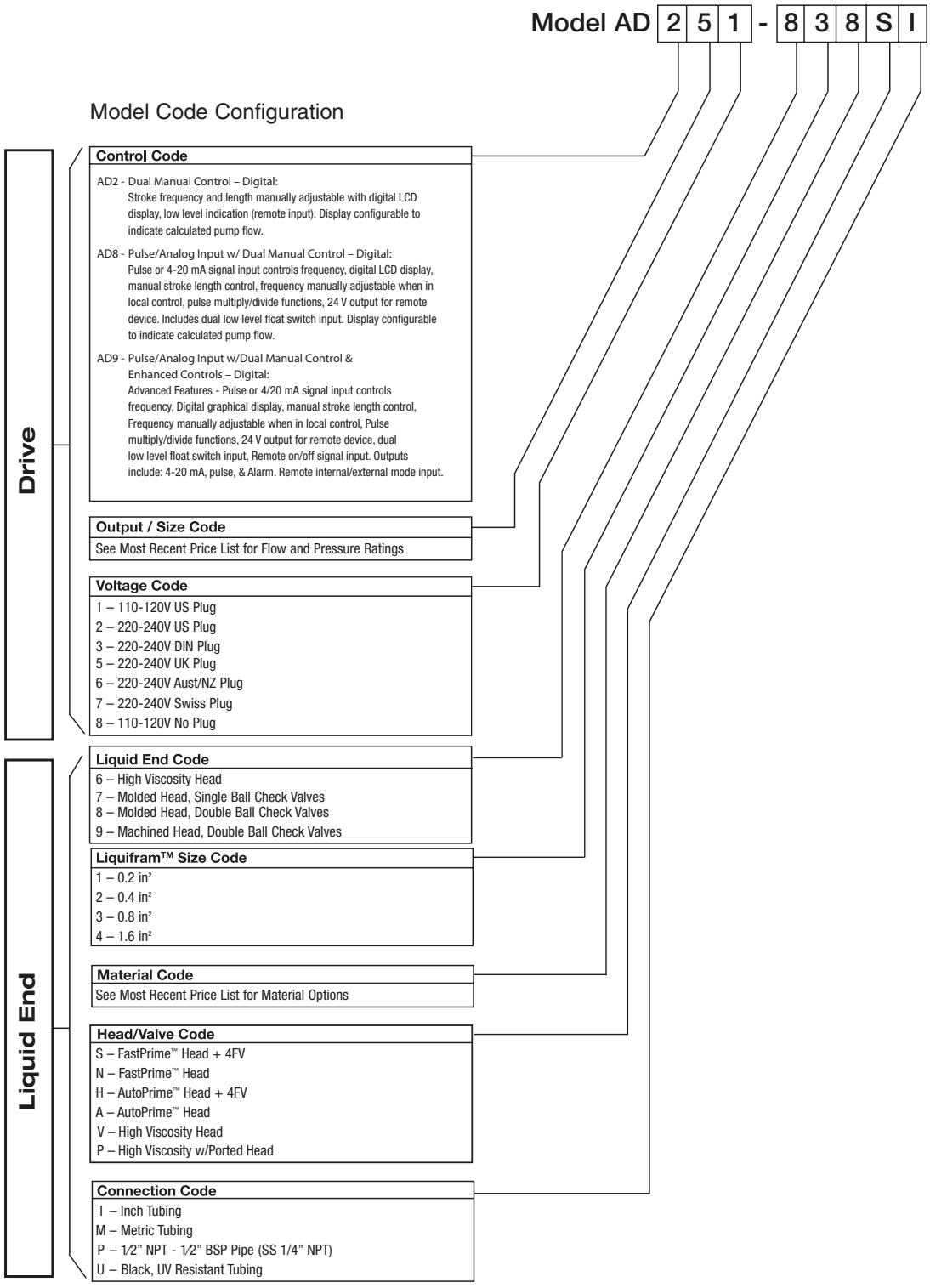
Electronic Metering Pumps

Instruction Manual

Manual No : 2024
Rev. : E
Rev. Date : 11/2015

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**Note: Not all configurations are available. Please See your local distributor or price list for available options.*

ROYTRONIC EXCEL™ Series AD

PRECAUTIONS

The following precautions should be taken when working with LMI® metering pumps.
Please read this section carefully prior to installation.

Protective Clothing



ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to SDS precautions from your solution supplier.

Water Pre-Prime



All LMI® pumps are pre-primed with water when shipped from the factory. If your solution is not compatible with water, disassemble the Pump Head Assembly. Thoroughly dry the pump head, valves, seal rings, balls and LIQUIFRAM™ (diaphragm). Reassemble head assembly tightening screws in a crisscross pattern. Refill the pump head with the solution to be pumped before priming the pump. (This will aid in priming.)

Liquid Compatibility



The evaluation performed by UL was tested with water only. LMI® pumps are tested to NSF 50 for use on muriatic acid (40%) and sodium hypochlorite (12.5%). The pumps are certified to NSF 61 with: sodium hypochlorite (12.5%), sulfuric acid (98.5%), sodium hydroxide (50%), and hydrochloric acid (30%). Determine if the materials of construction included in the liquid handling portion of your pump are adequate for the solution (chemical) to be pumped. Always refer to the solution supplier and the LMI® Chemical Resistance Chart for compatibility of your specific LMI® metering pump. Contact your local LMI® distributor for further information.

Tubing Connections



Inlet and outlet tubing or pipe sizes must not be reduced. Make certain that all tubing is SECURELY ATTACHED to fittings prior to start-up (see Section 2.3, Tubing Connections). ALWAYS use LMI® supplied tubing with your pump, as the tubing is specifically designed for use with the pump fittings. It is recommended that all tubing be shielded to prevent possible injury in case of rupture or accidental damage. If tubing is exposed to sunlight, black UV resistant tubing should be installed. Check tubing frequently for cracks and replace as necessary.

Vinyl Tubing



Your carton may contain a roll of clear vinyl tubing; this is only for connection to the return line of the FASTPRIME™ Head and must not be used as discharge tubing.

Fittings and Machine Threads



All fittings should be hand-tightened. An additional 1/8 - 1/4 turn after the fitting is snug may be necessary to provide a leak-proof seal. Excessive overtightening or use of a pipe wrench can cause damage to the fittings, seals, or pump head.

Most LMI® pumps have straight screw machine threads on the head and fittings and are sealed by the O-rings. DO NOT use PTFE tape or pipe dope to seal threads. PTFE Tape may only be used on the 1/2" NPT thread side of the Injection Check Valve, the stainless steel liquid end connections, except for the head's discharge port, or if piping is directly connected to the pipe threads of the suction or discharge fittings.

Plumbing



Always adhere to your local plumbing codes and requirements. Be sure installation does not constitute a cross connection. Check local plumbing codes for guidelines. LMI® is not responsible for improper installations.

Back Pressure / Anti-Syphon Valve



If you are pumping downhill or into low or no system pressure, a back pressure/anti-syphon device such as LMI®'s Four Function Valve should be installed to prevent over pumping or syphoning. Contact your LMI® distributor for further information.

Electrical Connections



To reduce the risk of electrical shock, the metering pump must be plugged into a properly grounded grounding-type receptacle with ratings conforming to the data on the pump control panel. The pump must be connected to a good ground. DO NOT USE ADAPTERS! All wiring must conform to local electrical codes. If the supply cord is damaged, it must be replaced by the manufacturer, stocking distributor, or authorized repair center in order to avoid a hazard.

Fuse (all models) and Battery (AD9 only)



Caution, Battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire. The battery and fuse are internal, factory serviceable parts, and must be replaced by the factory or a qualified distributor with parts of the same type and rating.

Flooding



Install this pump in a location where flooding cannot occur.

Ground Fault Circuit Interrupter



To reduce the risk of electric shock, install only on a circuit protected by a Ground Fault Circuit Interrupter (GFCI).

Line Depressurization



To reduce the risk of chemical splash during disassembly or maintenance, all installations should be equipped with line depressurization capability. Using LMI®'s Four-Function Valve (4 FV) is one way to include this feature.

Over Pressure Protection



To ensure safe operation of the pump it is recommended that some type of safety/pressure relief valve be installed to protect the piping and other system components from failing due to excessive pressure.

Chemical Concentration



There is a potential for elevated chemical concentration during periods of no flow, for example, during backwash in the system. Steps, such as turning the pump off, should be taken during operation or installation to prevent this. See your distributor about other external control options to help mitigate this risk.

Retightening Components



Plastic materials will typically exhibit creep characteristics when under pressure over a period of time and to insure a proper fit it may be necessary to retighten the head bolts periodically. To insure proper operation, we recommend tightening the bolts to 25 inch-pounds after the first week of operation and on a monthly basis thereafter.

Flow Display



The default flow value as shown on the pump display is accurate at maximum pressure and 100% stroke length. If your operating conditions differ from this, then calibration is necessary in order to display an accurate measure of the flow.

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SECTION 1 - INTRODUCTION

LMI® is the world's most versatile manufacturer of economical and efficient metering pumps. This manual addresses the installation, maintenance and troubleshooting procedures for manually and externally controlled pumps. LMI® has a worldwide network of stocking representatives and authorized repair centers to give you prompt and efficient service.

Note:

Please review this manual carefully. Pay particular attention to warnings and precautions. Always follow good safety procedures, including the use of proper clothing, eye and face protection.

1.1 SPECIFICATIONS

	AD2XY (where X is any number; where Y is 1, or 8)	**AD2XY (where X is any number; where Y is 2,3,4,5,6,7, or 9)**	**AD8XY, or AD9XY (where X is any number; where Y is any number)**
Operating Temperature	14 to 113°F –10 to 45°C	14 to 113°F –10 to 45°C	14 to 113°F –10 to 45°C
Voltage	110 to 120 V	220 to 240 V	95 to 240 V
Frequency	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz
Max. Current	2.0 A	1.0 A	1.4 A
Wattage	25 W	22 W	20 W

Table 1

	AD2	**AD8**	**AD9**
Battery	N/A	N/A	Panasonic BR1225 or Renata CR1225 or Energizer/Eveready CR1220
Fuse	Bel Fuse 5HT1.25-R Time-lag, 5mm x 20mm	Bel Fuse 5HT 2-R Time-lag, 5mm x 20mm	Bel Fuse 5H 2-R Time-lag, 5mm x 20mm

Table 2

Note:

The battery and fuse are internal, factory serviceable parts, and must be replaced by the factory or a qualified distributor with parts of the same type and rating.

1.2 UNPACKING CHECK LIST

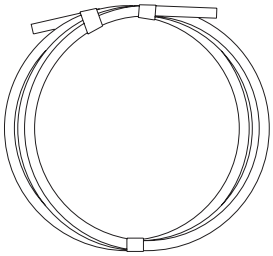
Your carton will contain many or all of the following items. Please notify the carrier immediately if there are any signs of damage to the pump or its parts.



Metering Pump



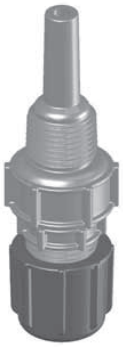
Foot Valve



Tubing (0 to 3 Rolls)



Ceramic Foot Valve Weight



Injection Check Valve



Four-Function Valve (Optional)



External Control Cable (0, 1, or 2 Cables)



Tube Connection Hardware

Figure 1. Unpacking Check Sheet

SECTION 2 - INSTALLATION

2.1 PUMP LOCATION AND INSTALLATION

Locate pump in an area convenient to solution tank and electrical supply.

The pump should be accessible for routine maintenance, and should not be operated in ambient temperatures above 113°F (45°C). If the pump will be exposed to direct sunlight, LMI® black, UV resistant tubing should be installed.

This pump is cord connected and not intended for permanent mounting to a building. However, temporary mounting to stabilize the pump during operation may be necessary as long as tools are not required for the installation or removal of the pump.

2.2 PUMP MOUNTING

The pump can be mounted in one of two ways:

A. FLOODED SUCTION (ideal installation); or

B. SUCTION LIFT - when suction lift is less than 5 feet (1.5 m) for solutions having a specific gravity of water or viscosity of less than 100 cSt (centistokes). For denser or more viscous solutions, consult distributor.

Note that suction conditions can affect the performance of the pump. This effect is more pronounced with lower pressure pumps. Consult your distributor for additional information.

Your LMI® metering pump must be mounted so that the suction and discharge valves are vertical. **NEVER position pump head and fittings horizontally**.

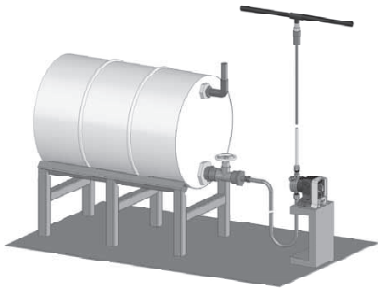
2.2.1 Flooded Suction

For flooded suction the pump is mounted at the base of the storage tank. This installation is the most trouble-free, and is recommended for very low outputs, solutions that gasify, and high-viscosity solutions. Since the suction tubing is filled with solution, priming is accomplished quickly and the chance of losing prime is reduced. A foot valve is not necessary in a flooded suction installation.

When pumping downhill or into low or no pressure system, a back pressure/anti-syphon device should be installed to prevent overpumping or syphoning. Although popular for all solutions, LMI® recommends flooded suction installations for all high-viscosity fluid applications.



INCORRECT
Avoid this type of false flooded suction



CORRECT

Figure 2. Flooded Suction Pump Mounting

2.2.2 Suction Lift - Wall Bracket Mount

The pump may be mounted using an LMI® Wall Mount Bracket Assembly (part no. 34643) directly above the solution tank. A pump mounted in this manner allows for easy changing of solution tanks or drums.

2.2.3 Suction Lift - Tank Mount

The pump may be mounted on a LMI® 10-gallon tank (part no. 27421), 35-gallon tank (part no. 27400), and 50-gallon tank (part no. 26350).

2.2.4 Suction Lift - Shelf Mount

The pump may be mounted on a shelf (customer supplied) maintaining a suction lift of less than 5 ft (1.5 m).

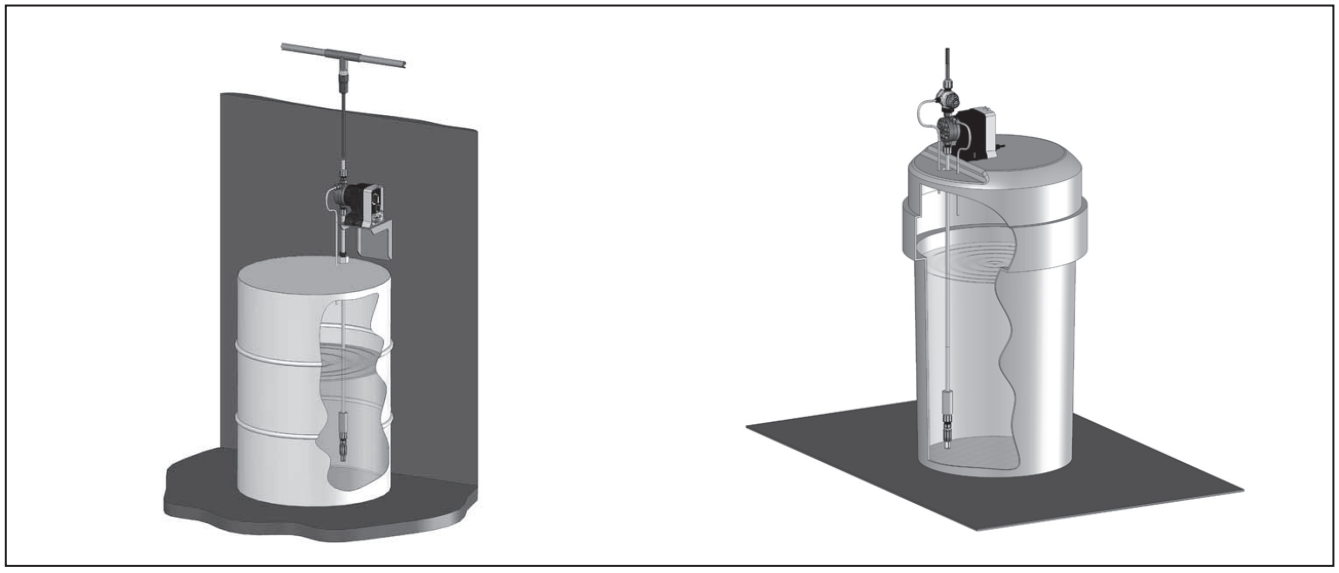


Figure 3

2.3 TUBING CONNECTIONS

1. Insert tubing through Coupling Nut. Tubing should enter the smaller end of the Coupling Nut first, orienting the larger opening of the Coupling Nut toward the tubing end.

2a. For 1/4” OD tubing: Position the Female Ferrule so that 1/4” to 3/8” (5-10 mm) of tubing protrudes from the Female Ferrule. Orient the raised collar of the Ferrule toward the Coupling Nut (reference *Figure 4*).

2b. For 3/8” or 1/2” OD tubing: Position a Female Ferrule about 1 inch (25 mm) from end of tubing. Orient the raised collar of the Female Ferrule toward the Coupling Nut. Then, insert the Male Ferrule onto the end of the tube, pushing the tube into the bottom of the groove in the Male Ferrule. Then slide the Female Ferrule down the tubing and with your fingers, press tightly into the Male Ferrule (reference *Figure 5*).

3. Firmly hand tighten the Coupling Nut onto the fitting.

Note:
Tightening with pliers may cause the Ferrules to break.

⚠ CAUTION

A. USE ONLY LMI® TUBING. ALWAYS USE LMI® SUPPLIED TUBING WITH YOUR PUMP, AS THE TUBING IS SPECIFICALLY DESIGNED FOR USE WITH THE PUMP FITTINGS.

B. DO NOT USE CLEAR VINYL TUBING ON THE DISCHARGE SIDE OF THE PUMP. THE PRESSURE CREATED BY THE PUMP CAN RUPTURE VINYL TUBING.

C. BEFORE INSTALLATION, ALL TUBING MUST BE CUT WITH A CLEAN SQUARE END.

D. VALVE AND HEAD CONNECTIONS FROM THE FACTORY ARE CAPPED OR PLUGGED TO RETAIN PRE-PRIME WATER. REMOVE AND DISCARD THESE CAPS OR PLUGS BEFORE CONNECTING TUBING.

DO NOT USE PLIERS OR PIPE WRENCH ON COUPLING NUTS OR FITTINGS.

DO NOT REUSE FERRULES. USE ONLY NEW FERRULES.

Replacement Ferrules, and Coupling Nuts are available as the following kit numbers.

Tube Size	Kit Number
1/2” Tube	77382
3⁄8” Tube	77383
1/2” Tube	77384
3 x 6 mm Tube	77378
6 x 8 mm Tube	77379
9 x 12 mm Tube	77380
*One kit is needed for each end of the tube.	

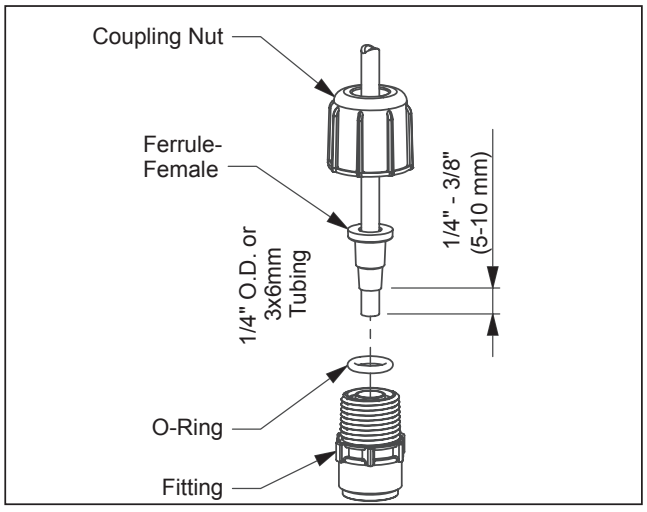


Figure 4

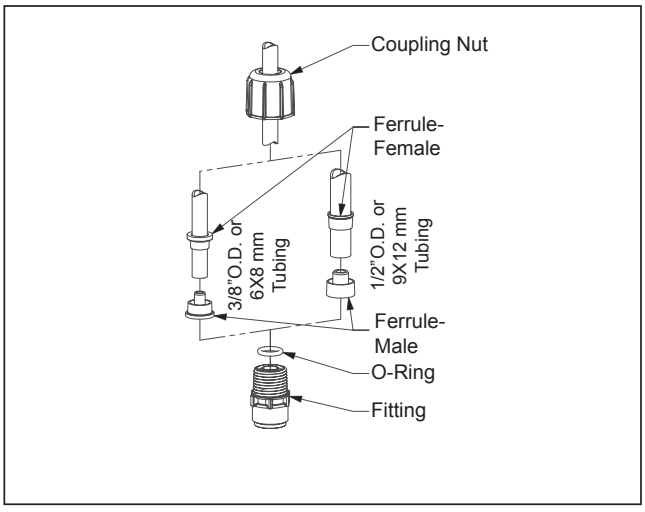
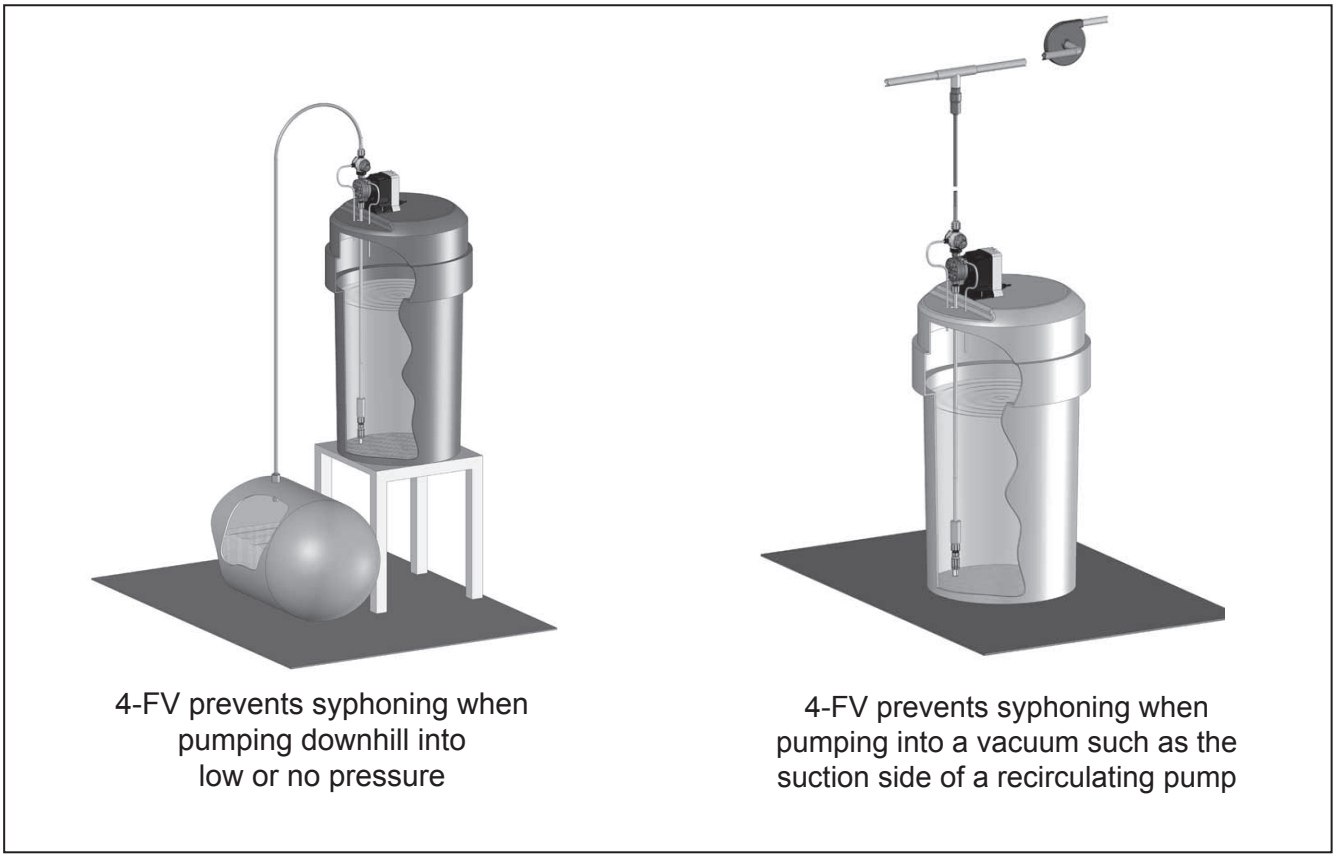


Figure 5

2.4 FOUR-FUNCTION VALVES (4-FV)

Your pump may be equipped with a 4-FV, or standard discharge valve. If your pump is not equipped with a four-function valve and you feel it is needed in your application, it can be purchased as an accessory. Contact your local LMI® stocking distributor. The features of a 4-FV are listed below.

1. **Pressure Relief:** If the discharge line is over pressurized, the valve opens sending solution back to the supply tank.
2. **Line Depressurization:** Opening the relief knob provides line drain back to the supply tank.
3. **Anti-Syphon:** Prevents syphoning when pumping solution downhill or into a vacuum.
4. **Back Pressure:** Supplies approximately 20 psi back pressure to prevent overpumping when little or no system back pressure is present.



4-FV prevents syphoning when pumping downhill into low or no pressure

4-FV prevents syphoning when pumping into a vacuum such as the suction side of a recirculating pump

Figure 6. Typical Installations Requiring the Anti-Syphon Feature of a Four-Function Valve

2.5 FOUR-FUNCTION VALVE INSTALLATION

To install a 4-FV, the 4-FV Fitting and Coupling Nut should be assembled with the appropriate cartridges into the discharge port of the pump. Use a 13/16” or 20 mm socket to tighten fitting. Tightening to 50 inch-pounds is recommended. Do not over tighten.

To assemble the Four-Function Valve Body, insert the large opening on the Four-Function Valve Body into the 4-FV Coupling Nut and hand tighten. You can position the valve to have the Bleed Nut pressure relief port in any convenient location by tightening the 4-FV Coupling Nut with the Bleed Nut positioned 90º CCW from desired location, then holding the 4-FV Coupling Nut stationary while turning the 4-FV Body the final 90º to desired position. Next, insert the ¼” tubing through the Bleed Nut. Ensure that about ¼” (6 mm) of tubing is protruding through the tip of the Bleed Nut. Firmly hand tighten the Bleed Nut in the hole on the side of the 4-FV. This tubing should be routed back to the supply tank. To ensure proper function of the priming function, the end of this tubing should not be submerged in the solution.

⚠ CAUTION **THIS RETURN LINE TUBING MUST BE SECURED TO ENSURE PUMPED SOLUTION WILL SAFELY RETURN TO SUPPLY.**

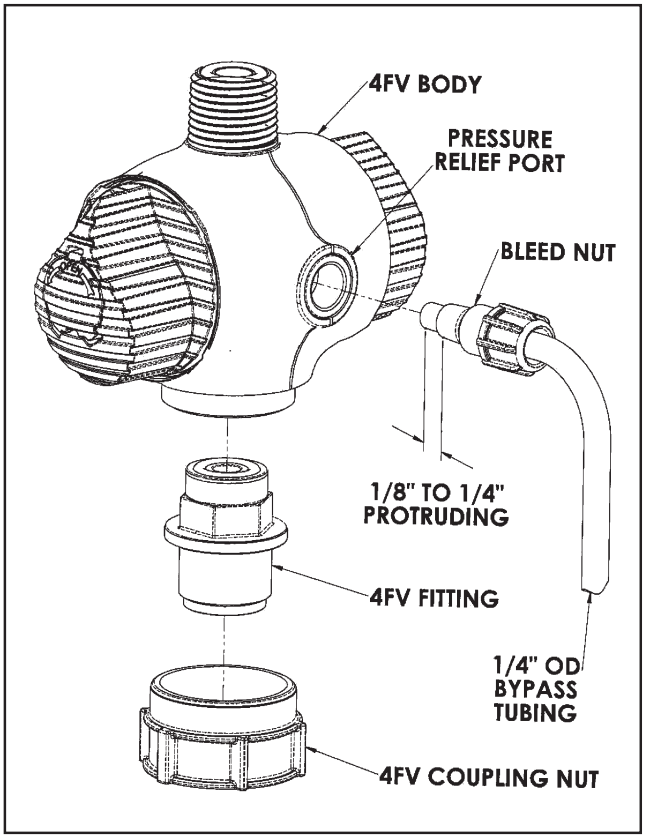


Figure 7. Four-Function Valve Tubing Connection

2.6 FASTPRIME™

The FASTPRIME™ Head is equipped with a valve that allows for opening the head to atmospheric pressure. When installing a pump equipped with a FASTPRIME™ Head connect the 3/8" outer diameter clear vinyl tubing provided with the pump to the barbed nozzle. Route the vinyl return line back to the solution tank. This tubing must not be submerged in the solution.

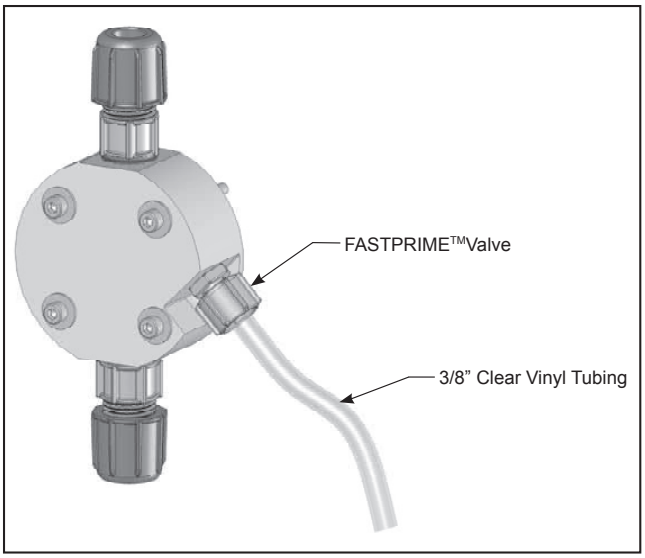


Figure 8. FASTPIME™ Head

2.7 AUTOPRIME™

Pumps installed with the AUTOPRIME™ Liquid End are equipped with a valve that allows for constant removal of vapors and gasses inherent with effervescent chemicals such as Sodium Hypochlorite and Hydrogen Peroxide. The valve keeps the pump primed automatically. When installing a pump equipped with an AUTOPRIME™ Liquid End, connect the 1/2" OD Polyethylene tubing to the top vertical fitting, and route this line back to the supply tank. To ensure priming, this tubing should not be submerged in the solution. The horizontal fitting is the discharge, and the bottom vertical fitting is the suction.

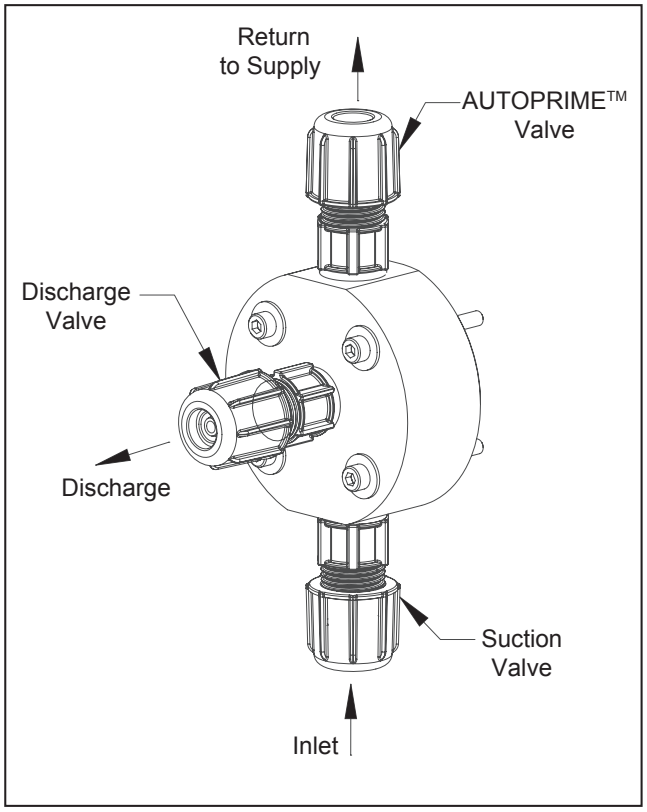


Figure 9. AUTOPRIME™ Liquid End Example

2.8 FOOT VALVE / SUCTION TUBING INSTALLATION

The Foot Valve acts as a check valve to keep the pump primed in suction lift applications.

The foot valve is designed to be submersed in the solution tank or drum and must sit in a vertical position at the bottom. Position approximately 2 inches (50 mm) off the bottom if the tank or drum contains sediment.

Note:

Pump models equipped with high-viscosity liquid ends are not equipped with foot valves. Flooded suction is recommended. A 1/2" NPT connector is included for flooded suction installations.

The ceramic weight, when installed, positions the foot valve in a vertical position.

1. Attach the foot valve to one end of the suction tubing (see Tubing Connections, Section 2.3).
2. Slide the ceramic weight over the tubing end until it contacts the top of the foot valve coupling nut.
3. Place foot valve and tubing into the solution tank. Check that the foot valve is vertical and approximately 2 inches (50 mm) from the bottom of the tank or drum (see illustration). Connect the other end of the tubing to the suction side of the pump head (bottom side) (see Tubing Connections, Section 2.3).

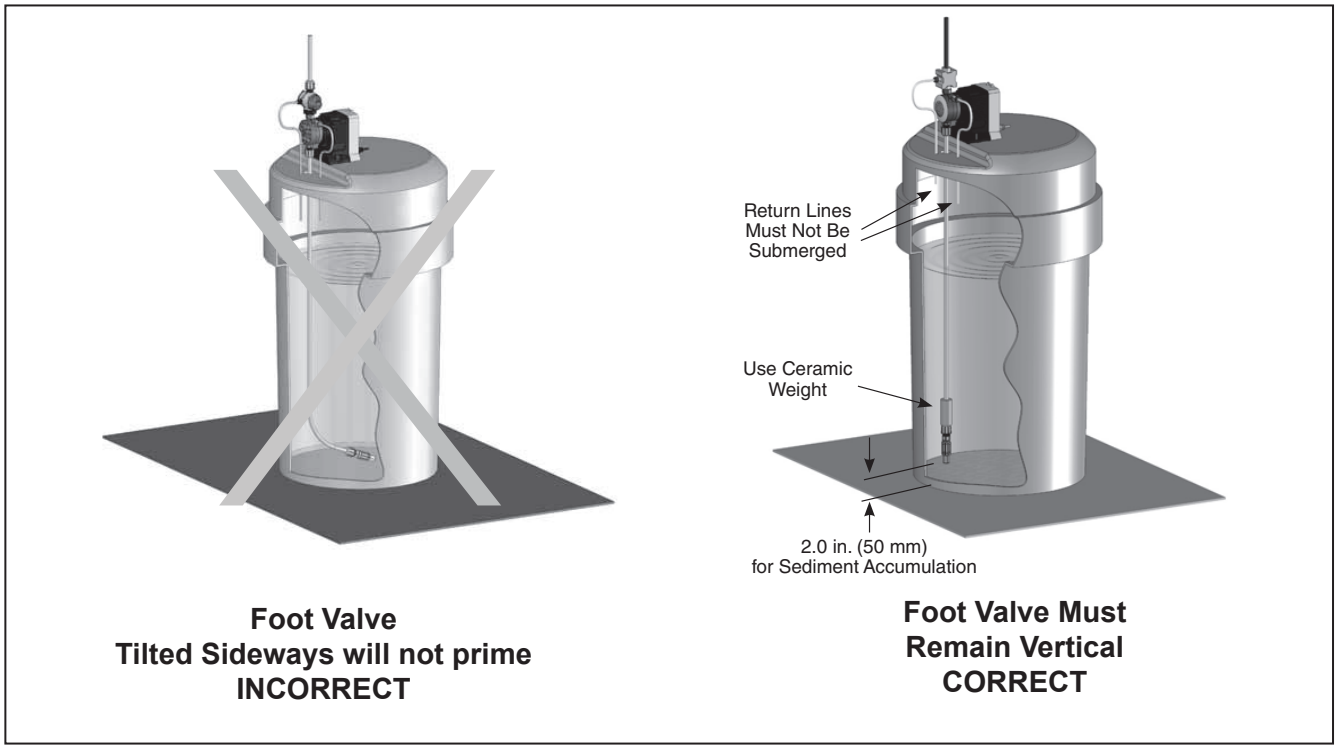


Figure 10. Foot Valve / Suction Tubing Installation

2.9 INJECTION CHECK VALVE AND DISCHARGE TUBING INSTALLATION

The Injection Check Valve prevents backflow from a treated line. Install the injection check valve at the location where chemical is being injected into the system. Any size Female NPT fitting or pipe tee with a reducing bushing to ½" Female NPT will accept the injection check valve. PTFE tape should only be used on threads that are connected with pipes.

When installing the Injection Check Valve, be sure to position it so that the valve enters the bottom of your pipe in a vertical position. Variations left and right within 80° acceptable (See illustration).

After cutting an appropriate length of tubing, connect tubing to the injection check valve then back to the discharge side of the pump head. Make sure it does not crimp or come into contact with hot or sharp surfaces (see Tubing Connections, Section 2.3).

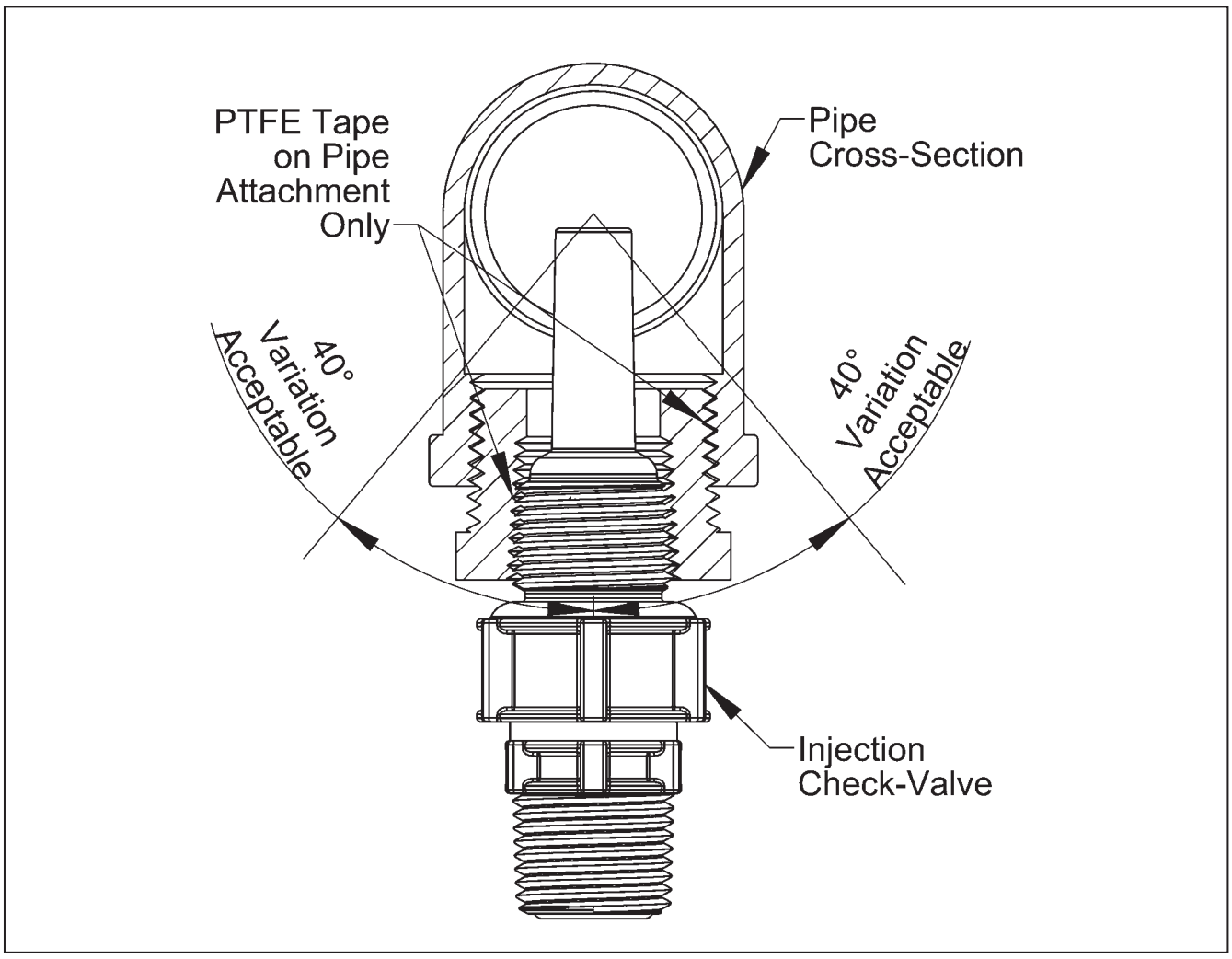


Figure 11. Typical Injection Check Valve Installation

SECTION 3 - OPERATION

3.1 OUTPUT ADJUSTMENT CONTROLS

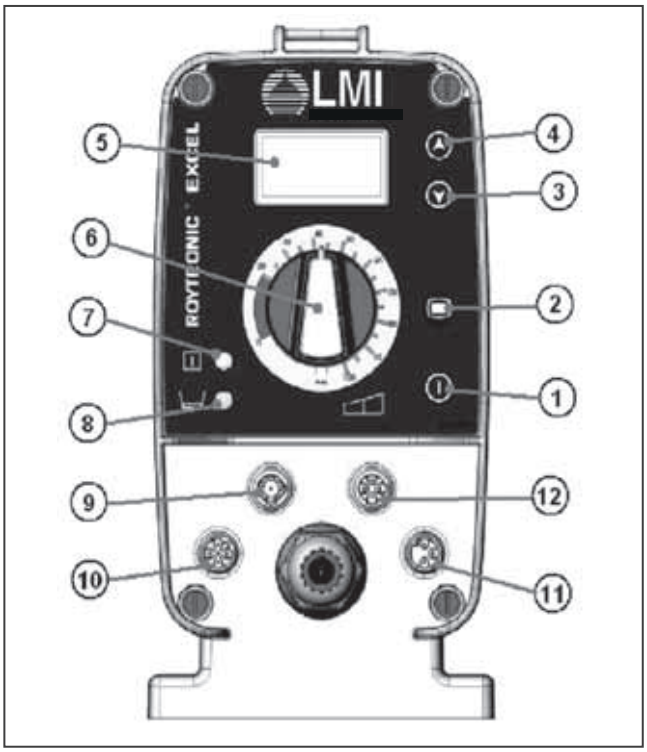
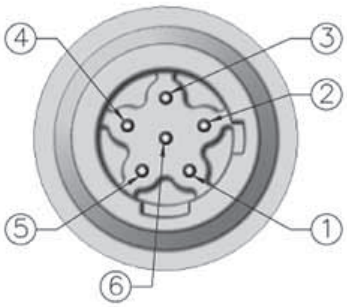


Figure 12

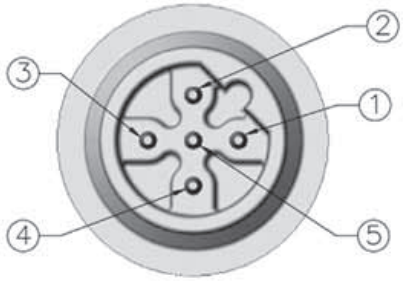
1. **Power Button:** This button allows convenient starting and stopping of the pump.
2. **Mode Selection Button:** For pumps with external control capability (AD8, AD9) this button switches pump operation between internal and external modes. When operating in internal mode the Pulse Indicator Light will flash green while pumping. When operating in external mode the Pulse Indicator Light will flash yellow while pumping.
3. **Down Button:** This button reduces the stroke speed of the pump. It will reduce the stroke speed by 1 each time it is pressed. If this button is held down, it will rapidly reduce the stroke speed. When a speed of 1 stroke per minute (SPM) is reached the speed can be further reduced by pressing this button again to enter stroke per hour settings.
4. **Up Button:** This button increases the stroke speed of the pump. It will increase the stroke speed by 1 each time it is pressed. If this button is held down, it will rapidly increase the stroke speed. When a speed of 59 strokes per hour (SPH) is reached the speed can be further increased by pressing this button again to enter stroke per minute settings.
5. **LCD Display:** This display will show the stroke speed of the pump. Pumps with theoretical (AD2, AD8, AD9) or actual (AD9 when combined with a flow meter) flow will display the flow here.
6. **Stroke Adjustment Knob:** This knob provides adjustment of the stroke length. Turning this knob clockwise ↻ increases the stroke length, which results in a higher amount of chemical displaced per stroke. It is recommended that the stroke range stay between 20% and 100%.
7. **Pulse Indicator Light:** This light will flash green when pumping in internal mode and will flash yellow when pumping in external mode. The light is on between strokes and off during the actual stroke.
8. **Low-Level Indicator Light:** For units with Single-Level Float Sensors this light will turn red when the Low-Level Sensor registers empty. This will turn the pump off. For units compatible with Dual-Level Sensors (AD8, AD9) the light will turn yellow when a low level is registered, and red when an empty level is registered. The pump will turn off when it registers an empty level.

9. Output, Alarm & Remote Mode Connector (6-Pin): This connector is used for the special functions associated with the AD9 controls. For the AD9 this connector is associated with the 4-20ma out, Alarm Out, and Internal/ External remote modes.



1. Alarm Out (Red/White) - Programmed as either an Alarm Output or Internal/External mode indicator. As an Alarm Output, pins 1 and 2 will give a closure (solid state) triggered by: empty tank indication, input pulse error, exceed batch error, or flow switch activation.For remote mode indication it is open for internal mode and closed for external.
2. Alarm Return (Red) - Return side for the above pin 1 Alarm Out.
3. Remote Internal/External Mode (AD9) (Green) - This pin is programmed as Internal/ External remote mode control for an AD9. If programmed as the Internal/External control, a closure will put the AD9 into external mode.
4. Pulse Out (AD9) (Red/Yellow) - On the AD9 this pin gives a 100ms pulse output for each pump stroke.
5. 4-20mA Out (AD9) (Red/Black) - On the AD9 this pin is the positive 4-20ma output. This output will show you 4ma when the pump is idle, 20ma at max stroke speed.
6. Ground/Return Connection (Red / Blue) - Common Ground

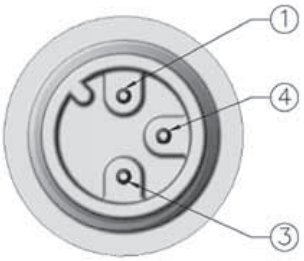
10. External Control Connector (5-Pin):



This connector is for the connection of various options and accessories that can be used to externally control the pump. The pin functions (and the wire color for the standard LMI® external control cable) are as follows:

1. Remote On/Off Signal (Brown)
2. Ground/Return Connection (White)
3. External Pulse Signal (Blue)
4. 24V 75 mA* Power Supply (Black)
5. 4-20mA Input Signal (Green/Yellow)

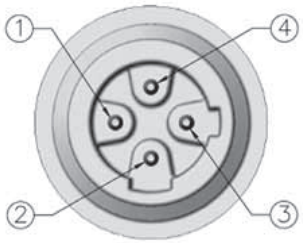
11. Low-Level Connector (3-Pin):



This connector is for the connection of a Low-Level Sensor (49246) or a Dual-Level Sensor (49249). The Tank Empty input connections are always active for all models in all functional modes. The Tank Low input connections are always active for models equipped with dual level functionality (AD8, AD9). If the fluid level drops below the top float on a Dual-Level Sensor, the Low-Level Indicator Light will turn yellow. If the fluid level drops below the float on a Low-Level Sensor, or the bottom float on a Dual-Level Sensor, the Low-Level Indicator Light will turn red, and the pump will stop. The pump is designed to recognize an open circuit as full and a closed circuit as low or empty. There is a five second delay between triggering the sensor, and the pump's reaction. This is intended to avoid triggering during refilling your supply tank. The pin functions are as follows:

1. Tank Empty Signal
3. Tank Low Signal
4. Ground/Return Connection

12. Flow Monitor / Meter Connector (4-Pin):



This connector will be used with a Milton Roy flow meter or the Milton Roy DIGI-PULSE™ flow monitor (FM-ROY-9). The pin functions are as follows:

1. Flow Meter In – A closure between this pin and ground registers a pulse for the flow meter/monitor.
2. 24 Volt 75 mA* Supply – Supply voltage for a Milton Roy flow meter.
3. Ground/Return Connection – Common ground
4. Flow Meter Sense – The condition of this pin will set the pump into the Digipulse or Flow Meter mode. This will automatically occur when the Milton Roy device is connected. A connection to ground indicates the use of a flow meter, while an open circuit indicates a flow monitor.

Note:

The total current output of the 5-pin and 4-pin connectors should not exceed 75 mA.

3.2 START-UP AND ADJUSTMENT

1. The pump is normally self-priming if suction lift is 5 ft (1.5m) or less and the steps below are followed.
2. Pumps are shipped from the factory with water in the pump head to aid in priming.

3.2.1 Start-Up/Priming for FASTPRIME™ Heads (LE-XXXNX)

⚠ CAUTION READ THIS ENTIRE SECTION COMPLETELY BEFORE PROCEEDING.

When all precautionary steps have been taken, the pump is mounted, and the tubing is securely attached, you may now start priming the pump.

1. Plug in or switch the pump on.
2. While the pump is running, set the Speed Adjustment Knob and the Stroke Adjustment Knob at 100%.
3. Turn The FASTPRIME™ knob 1 to 2 turns counter-clockwise ↺.
4. The suction tubing should begin to fill with solution from the tank.
5. A small amount of solution will begin to discharge out the return line of the FASTPRIME™ valve. Once this happens, turn the knob clockwise ↻ until hand tight and **SHUT THE PUMP OFF**.
6. The pump is now primed.
7. Proceed to output adjustment, Section 3.3.

Note:

If the pump does not self-prime, remove the fitting on the discharge side of the pump head. Remove the check valve and pour water or solution into the port until the head is filled. Replace valve, then follow start up/priming steps.

3.2.2 Start-Up/Priming for Pump Supplied with 4-FV (LE-XXXSX or LE-XXXHX)

⚠ CAUTION READ THIS ENTIRE SECTION COMPLETELY BEFORE PROCEEDING.

When all precautionary steps have been taken, the pump is mounted, and the tubing is securely attached, you may now start priming the pump.

1. Plug in or switch the pump on.
2. While the pump is running, set the Speed Adjustment Knob and the Stroke Adjustment Knob at 100%.
3. Open the relief side (black knob) of the 4-FV by turning to the stop (about 1/8 turn).
4. The suction tubing should begin to fill with solution from the tank.
5. A small amount of solution will begin to discharge out the return line of the 4-FV. Once this happens, return the knob to the 12:00 position and **SHUT THE PUMP OFF**.
6. The pump is now primed.
7. Proceed to output adjustment, Section 3.3.

Note:

If the pump does not self-prime, remove the 4-FV on the discharge side of the pump head. Remove the check valve and pour water or solution into the port until the head is filled. Replace valve, then follow start up / priming steps.

3.2.3 Start-Up/Priming for AUTOPRIME™ Heads (LE-XXXAX or LE-XXXHX)

⚠ CAUTION READ THIS ENTIRE SECTION COMPLETELY BEFORE PROCEEDING.

When all precautionary steps have been taken, the pump is mounted, and the tubing is securely attached, you may prime the pump.

1. Plug in or switch on the pump.
2. While the pump is running, set the speed knob and the stroke knob at 100%.
3. The suction tubing should begin to fill with solution from the tank as the AUTOPRIME™ valve purges air from the pump head.
4. Once the solution begins to exit the pump head through both the discharge valve and the AUTOPRIME™ valve, **SHUT THE PUMP OFF**.
5. The pump is now primed.
6. Proceed to output adjustment, Section 3.3.

3.3 OUTPUT ADJUSTMENT

Once the pump has been primed, an appropriate output adjustment MUST be made. Pump output should be calculated and adjustments made accordingly.

3.3.1 Total Pump Output

Calculate the approximate output of the pump as follows:

PUMP OUTPUT :
MAX PUMP OUTPUT X % SPEED X % STROKE
Example: AD251-938SI

Use Max Output (from dataplate on side of pump) = 1 GPH (1 gallon per hour).

If the pump is set at 60 strokes per minute (out of a possible 120 SPM) and 70% stroke length, the approximate pump output is:

1.0 x 60/120 x 0.70 = 0.35 GPH.

Multiply by 24 (hours in one day) to calculate in gallons per day.

Note:

When converting between different units, remember these conversion factors:

1 Gallon = 3.785 Liters

1 Day = 1,440 Minutes

120 SPM = 7,200 SPH

⚠ CAUTION IT IS IMPORTANT TO NOTE THAT THIS IS ONLY AN APPROXIMATE OUTPUT AND IT DOES NOT ACCOUNT FOR TOLERANCE VARIATIONS IN PUMP COMPONENTS OR FLOW VARIATIONS DUE TO PRESSURE SENSITIVITY, OR VISCOSITY EFFECTS. VARIATIONS DUE TO THESE EFFECTS CAN BE SIGNIFICANT, NECESSITATING CALIBRATION FOR YOUR PUMP.

3.3.2 Calibrating the Displayed Flow (AD2, AD8)

The Roytronic Excel Pumps are equipped to display a theoretical flow rate based upon the pump's stroke speed and stroke length. These calculations are based upon factory test conditions which may be significantly different from your application. It is necessary for the user to perform the following calibration procedure when the pump is connected to your system, and using the actual chemical. This one-point calibration procedure will greatly improve the accuracy of the pump's calculated flow. The closer the pump's stroke length is to the typical use stroke length, the more accurate the result. We recommend using the approximate settings determined in section 3.3.1 as a starting point for calibration.

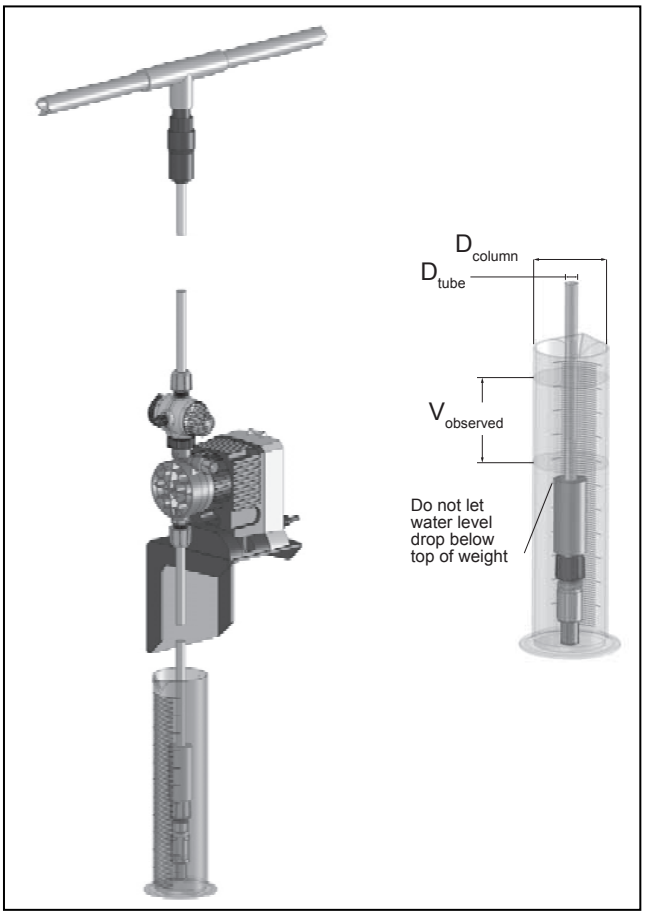


Figure 13

1. Prepare a flow measuring device such as a graduated cylinder or a scale sensitive to a gram.
2. Ensure the pump is primed following the procedures in 3.2.
3. Put the pump into Internal Mode and use the Power Button ⏻ to turn the pump off.
4. Hold the Up Button ▲ and Down Button ▼ in at the same time for 8 seconds until 'CAL' is displayed on the LCD Display, then release the buttons. Note 'FLO' will be displayed first. Continue to press the buttons until 'CAL' is displayed.
5. Push the Power Button ⏻ and release until a "0" is displayed.
6. Note the reading on the calibration device. If using a graduated cylinder note the starting liquid level. If using a scale note the displayed weight, or reset the scale's display to zero.
7. Push the Power Button ⏻ and release to start the pump. Notice that the display will count the total number of strokes. (The screen will show SPH).
8. Allow the pump to run; the accuracy will improve with more strokes. Use the Power Button ⏻ to stop the pump. The number of strokes will be displayed up to 999 strokes. If you will be pacing the pump externally, note the number of strokes.
9. Press and release the Power Button ⏻ again. This will display the pump's estimated volume pumped in mL. (The screen will show ml/h).

10. Use the Up Ⓐ and Down Ⓥ Buttons to match the displayed volume to the measured volume. If using a graduated cylinder, the presence of the tubing will cause the measurement to be slightly higher than actual. The measurement should be adjusted using the formulas shown below. If using a scale, the number of grams can be divided by the specific gravity of your chemical to determine the number of mL pumped. If the pump will be controlled externally, the output volume per stroke can be determined by dividing the measured output by the number of strokes.
11. Once the displayed value has been adjusted, hold and release the Power Button ⏻ to return the pump to internal mode.

$$V_{Actual} = V_{Observed} * R$$

where $$R = 1 - (D_{Tubes} / D_{Column})^2$$

For accuracy, it is important that the water level does not drop below the top of the ceramic foot valve weight.

Note:

If you will be using the pump at a different stroke length, or pressure, the pump should be recalibrated under those conditions using the procedure above to ensure accuracy.

3.4 METHODS OF EXTERNALLY TRIGGERING OR PACING AD8 AND AD9 PUMPS

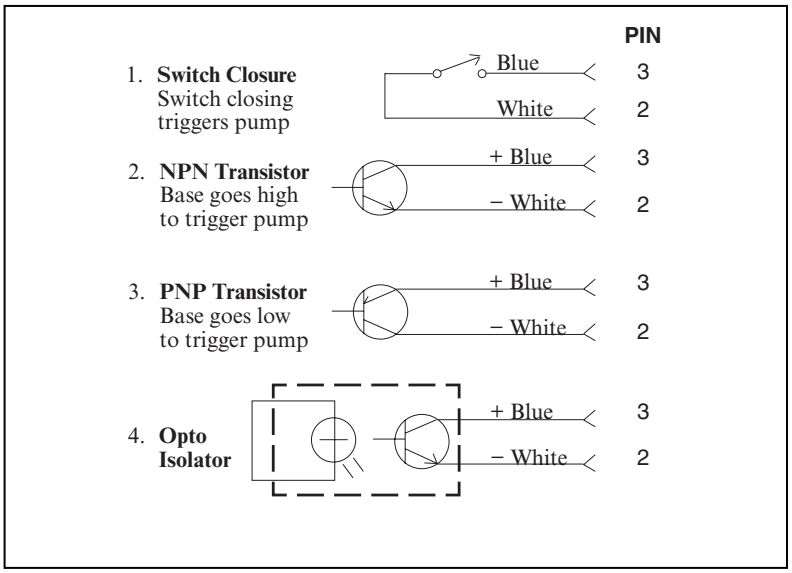
Method of Triggering AD8 and AD9 Pumps through External Control Connector.

Switch or transistors must be capable of switching 24V DC at 15 milliamperes. Minimum time in low impedance state (ON) is 25 milliseconds. Minimum time in high impedance state (OFF) is 50 milliseconds.

The remote on/off input (using pins 1 and 2) is active in all modes. In the out-of-box configuration, the pump will run when contacts are open. The pump is monitoring these pins for a change in closure condition. Regardless of the pump being on or off, when the contacts close, then the pump will turn on. When the contacts open, the pump will turn off.

The Power Button overrides the remote on/off and can still be used to turn the pump on and off. If the contacts are closed when the on/off button is pressed, the pump will turn off. To restart the pump remotely, the contacts must be opened and then closed again.

These pumps have two operating modes: Local (Pulse Indicator Light flashes green) and Remote (Pulse Indicator Light flashes yellow). Pressing the Mode Selection Button switches between Local and Remote modes. The default configuration for operating mode is Local mode.



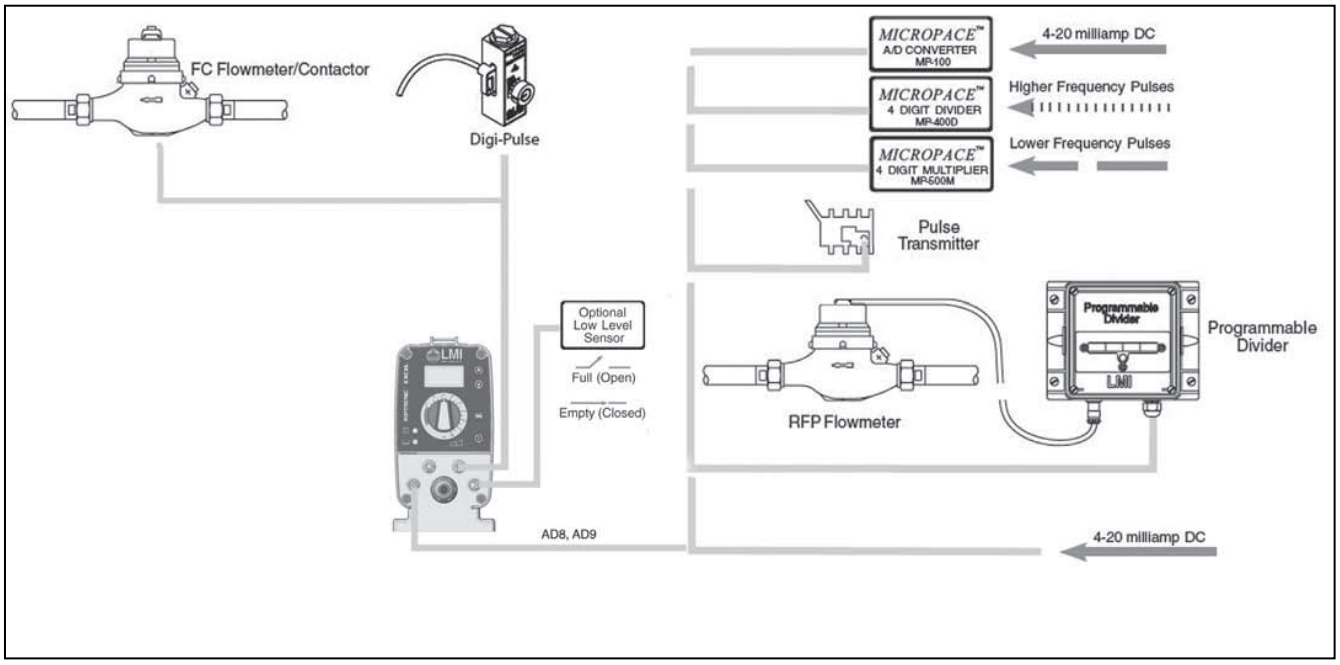


Figure 14. Methods of Externally Triggering or Pacing AD8 and AD9 Pumps

3.4.1 Control Modes

3.4.1.1 Local/Internal Mode

1. When in local mode Roytronic Excel pumps run at the speed indicated on the LCD Display.
2. The stroking speed can be adjusted from the maximum speed of 120 strokes per minute (SPM) down to 1 stroke per hour (SPH).

3.4.1.2 Changing Displayed Flow Units (AD2, AD8)

1. When in Internal Mode use the Power Button to turn the pump off.
2. Hold the Up Button and Down Button in at the same time until 'FLO' is displayed on the LCD Display, then release the buttons.
3. Use the Up or Down Buttons to select the desired units of measure.
4. Press the Power Button and the pump will return to internal mode with the desired units displayed.

3.4.1.3 Remote Mode (for AD8)

In Remote mode the pump can be controlled in a variety of ways: pulse divide, pulse multiply, or analog milliamp input. To cycle through the available modes, start in external mode, then press and hold the Power Button and Mode Selection Button simultaneously for about five seconds.

3.4.1.3.1 Divide Mode (for AD8)

The pump is in Divide Mode when a division symbol (÷) is shown on the left-hand side of the LCD Display. Use the Up Button and Down Button to select the number of incoming pulses received before a stroke occurs. Once the Power Button is pushed to turn the pump on, the LCD Display will show the approximate stroke rate of the pump based on the incoming pulses.

If it is necessary to change the pulse duration required to recognize a pulse from the factory default of 60 ms, hold both the Up Button and Down Button until a number appears followed by the letter 'm'. This number is the minimum required time in milliseconds needed to count as a pulse. Use the Up Button and Down Button to adjust this number as needed. If no button is pressed for about 4 seconds, the pump will save the value and return to the previous screen.

3.4.1.3.2 Multiply Mode (for AD8)

The pump is in Multiply Mode when a multiplication symbol (X) is shown on the left-hand side of the LCD Display. Use the Up Button and Down Button to select the number of strokes that will occur for each incoming pulse. Once the Power Button is pushed to turn the pump on, the LCD Display will count down the number of strokes starting at the multiplier value each time a pulse input is recognized. The strokes will occur every half second until it has counted down to zero. The pump will then wait for the next pulse input.

If it is necessary to change the pulse duration required to recognize a pulse from the factory default of 60 ms, hold both the Up Button and Down Button until a number appears followed by the letter 'm'. This number is the minimum required time in milliseconds needed to count as a pulse. Use the Up Button and Down Button to adjust this number as needed. If no button is pressed for about 4 seconds, the pump will save the value and return to the previous screen.

3.4.1.3.3 Analog Mode (for AD8)

The pump is in Analog Mode when ‘mA’ is shown on the left-hand side of the LCD Display.

Pressing the Up or Down Button will display ‘P1’ and the milliamp input that corresponds to zero strokes. The Up and Down Buttons can be used to adjust this value. Pressing the Power Button (or waiting for about 8 seconds) will display ‘P2’ and the milliamp input that corresponds to max stroke rate. Note that the maximum stroke rate will be either 120 strokes per minute or 59 strokes per hour. This depends on the stroke speed set in Internal Mode.

SECTION 4 - MAINTENANCE

4.0 SPARE PARTS REPLACEMENT AND ROUTINE MAINTENANCE

LMI® metering pumps are designed for trouble-free operation, yet routine maintenance of elastomeric parts is essential for optimum performance. This involves replacing the LIQUIFRAM™, cartridge valves, O-rings, and the injection check valve spring. LMI® recommends replacing these parts at least once a year; however, frequency will depend on your particular application.

4.1 DEPRESSURIZING THE DISCHARGE LINE (FOR PUMPS EQUIPPED WITH A 4-FV ONLY)

⚠ CAUTION **ALWAYS WEAR PROTECTIVE CLOTHING, FACE SHIELD, SAFETY GLASSES AND GLOVES WHEN PERFORMING ANY MAINTENANCE OR REPLACEMENT ON YOUR PUMP.**

⚠ CAUTION **TO REDUCE THE RISK OF CHEMICAL SPLASH DURING DISASSEMBLY OR MAINTENANCE, ALL INSTALLATIONS SHOULD BE EQUIPPED WITH LINE DEPRESSURIZATION CAPABILITY. USING LMI®'S FOUR-FUNCTION VALVE (4-FV) IS ONE WAY TO INCLUDE THIS FEATURE.**

⚠ CAUTION **READ STEPS 1 AND 2 BELOW BEFORE PROCEEDING.**

1. Be sure the Injection Check Valve is properly installed and is operating. If a shut off valve has been installed downstream of the Injection Valve, it should be closed.

⚠ CAUTION **BE SURE YOUR RELIEF TUBING IS CONNECTED TO YOUR 4-FV AND RUNS BACK TO YOUR SOLUTION DRUM OR TANK.**

2. Turn the black knob on the 4-FV 1/8 turn to the stop. Turn and hold the yellow knob for a few seconds. The discharge line is now depressurized. Keep both valve knobs open until solution drains back down the discharge tubing into the solution tank or drum. Then release the yellow knob, and turn the black knob to its normal position.

4.2 DEPRESSURIZING THE DISCHARGE LINE (FOR DOUBLE BALL FASTPRIME™ HEADS ONLY)

⚠ CAUTION **ALWAYS WEAR PROTECTIVE CLOTHING, FACE SHIELD, SAFETY GLASSES AND GLOVES WHEN PERFORMING ANY MAINTENANCE OR REPLACEMENT ON YOUR PUMP.**

⚠ CAUTION **READ STEPS 1 AND 2 BELOW BEFORE PROCEEDING.**

1. Be sure the Injection Check Valve is properly installed and is operating. If a shut off valve has been installed downstream of the Injection Valve, it should be closed.

⚠ CAUTION **BE SURE YOUR RELIEF TUBING IS CONNECTED TO YOUR FASTPRIME™ VALVE AND RUNS BACK TO YOUR SOLUTION DRUM OR TANK.**

2. Turn the FASTPRIME™ knob one-and-a-half turns counter-clockwise. The discharge line is now depressurized. Keep valve open until solution drains back down the discharge tubing into solution drum or tank. Then turn the knob clockwise to tighten knob to closed position.

4.3 LIQUIFRAM™ (DIAPHRAGM) REPLACEMENT

⚠ CAUTION **ALWAYS WEAR PROTECTIVE CLOTHING, FACE SHIELD, SAFETY GLASSES AND GLOVES WHEN WORKING NEAR OR PERFORMING ANY MAINTENANCE OR REPLACEMENT ON YOUR PUMP. SEE SDS INFORMATION FROM SOLUTION SUPPLIER FOR ADDITIONAL PRECAUTIONS.**

LMI® metering pumps are designed for trouble-free operation, yet routine maintenance of elastomeric parts is essential for optimum performance. This involves replacing the LIQUIFRAM™, cartridge valves, O-rings and the injection check valve spring. LMI® recommends replacing these parts at least once a year; however, frequency will depend on your particular application.

When replacing the LIQUIFRAM™, the cartridge valves, or O-rings, the injection check valve spring should also be replaced (see next Section 4.4). A Spare Parts Kit or RPM PRO PAC™ kit containing these parts may be obtained from your local distributor.

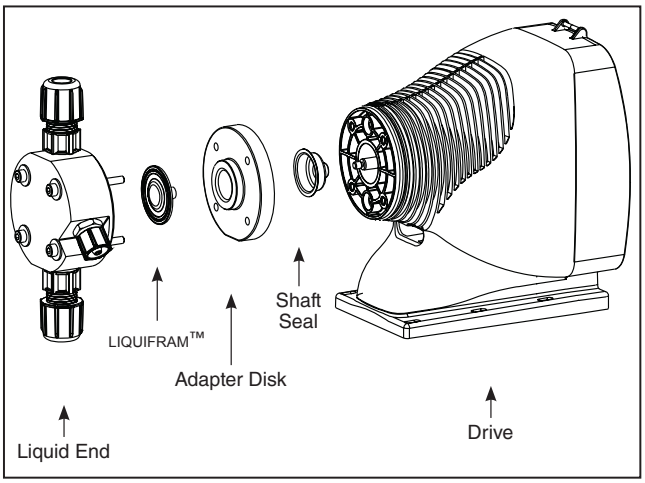


Figure 15. LIQUIFRAM™ (Diaphragm) Replacement

Replacing the LIQUIFRAM™:

1. Carefully depressurize, drain, and disconnect the discharge line (see previous sections in this manual).
2. Place the Foot Valve into a container of water or other neutralizing solution. Turn the pump on to flush the head assembly. Once the pump head has been flushed, lift the Foot Valve out of the solution and continue to pump air into the pump head until the pump head is purged of water or neutralizing solution.

Note:

If the liquid cannot be pumped due to LIQUIFRAM™ rupture, carefully disconnect the suction and discharge tubing using protective clothing, gloves and face shield, immerse the head in water or other neutralizing solution.

3. Remove the four metric screws and washers from the head using an M4 Allen wrench.
4. Start the pump. While running, set the Stroke Adjustment Knob to 0% and then turn the pump off.
5. With the unit off, unscrew the LIQUIFRAM™ by carefully grasping the outer edge and turning it counter-clockwise ↺. Discard old LIQUIFRAM™. Remove the Adapter Disk (located behind the LIQUIFRAM™) and ensure that the diameter of the raised section is the same as the diameter of the replacement LIQUIFRAM™.
6. Check condition of the Shaft Seal. Replace Shaft Seal if necessary.
7. Replace the Adapter Disk so that the drain hole of the disk is oriented downward, and the mounting holes line up with the mounting holes of the pump.

⚠ CAUTION **BE CAREFUL NOT TO SCRATCH THE FLUOROFILM™ FACE OF THE NEW LIQUIFRAM™.**

8. Screw on the new LIQUIFRAM™ clockwise until turned all the way in. Start the pump and turn the stroke knob to 100%. Stop the pump.
9. Remount the pump head using the four (4) screws and washers. Tighten in a criss-cross pattern. Torque screws to 25 inch-pounds. After one week of operation, recheck the screws and tighten if necessary.

4.4 CARTRIDGE VALVE AND O-RING REPLACEMENT

⚠CAUTION **ALWAYS WEAR PROTECTIVE CLOTHING, FACE SHIELD, SAFETY GLASSES AND GLOVES WHEN WORKING ON OR PERFORMING ANY MAINTENANCE OR REPLACEMENT ON YOUR PUMP. SEE SDS INFORMATION FROM SOLUTION SUPPLIER FOR ADDITIONAL PRECAUTIONS.**

Refer to the LMI® Metering Pump Price List for the proper Spare Parts Kit or RPM PRO PAC™ kit number or contact your local LMI® stocking distributor.

1. Carefully depressurize and disconnect the discharge line (see Section 4.1 or 4.2 in this manual).
2. Place the Foot Valve into a container of water or other neutralizing solution. Turn the pump on to flush the head assembly. Once the pump has been flushed, lift the Foot Valve out and continue to pump to let air into the pump head until pump is purged of water or neutralizing solution.

Note:

If the liquid cannot be pumped due to LIQUIFRAM™ rupture, carefully disconnect the suction and discharge tubing using protective clothing, gloves and face shield. Remove the four screws and washers from the head and immerse the head in water or other neutralizing solution.

Spare part replacement kits include specific instructions for valve replacement. Please follow the instructions included with the replacement kit.

3. Carefully disconnect one tubing connection and fitting at a time, then remove and replace the worn valve and O-rings. If necessary, carefully loosen stuck valves by prying side to side using a small screwdriver through the center hole of the valve.

Note:

Before disassembling the check valves, note the orientation of the valve.

4. Install new check valves in each location. Ensure that the cartridges are oriented correctly.

4.5 INJECTION CHECK VALVE PARTS REPLACEMENT

⚠ CAUTION **DEPRESSURIZE AND DRAIN PIPELINE (OR ISOLATE INJECTION CHECK VALVE POINT USING VALVES) SO THAT INJECTION CHECK VALVE CAN SAFELY BE DISASSEMBLED.**

⚠ CAUTION **ALWAYS WEAR PROTECTIVE CLOTHING, FACE SHIELD, SAFETY GLASSES AND GLOVES WHEN WORKING NEAR OR PERFORMING ANY MAINTENANCE OR REPLACEMENT ON YOUR PUMP. SEE SDS INFORMATION FROM SOLUTION SUPPLIER FOR ADDITIONAL PRECAUTIONS.**

Refer to the LMI® Metering Pump Price List for the proper Spare Parts Kit or RPM PRO PAC™ kit number or contact your local LMI® stocking distributor.

1. Isolate Injection Check Valve and depressurize pipe or drain pipeline.
2. Carefully depressurize and disconnect the discharge line (see Section 5.1 or 5.2 in this manual).

Spare part replacement kits include specific instructions for valve replacement. Please follow the instructions included with the replacement kit.

3. Carefully disconnect the tubing leading to the Injection Check Valve, then remove the Injection Check Valve Fitting. Remove and replace the worn spring, seat, ball, and O-ring.

Note:
Before disassembling the check valves, note the orientation of the valve.

4. Install a new spring, seat, ball, and O-ring. Ensure that the parts are oriented correctly.

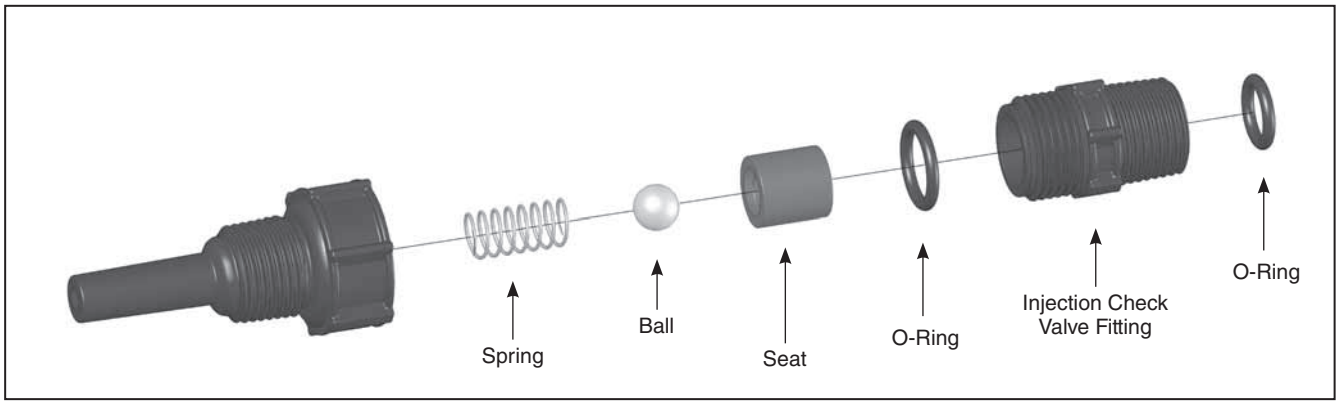


Figure 16. Injection Check Valve Parts Replacement

4.6 FASTPRIME™ VALVE O-RING REPLACEMENT

⚠ CAUTION **ALWAYS WEAR PROTECTIVE CLOTHING, FACE SHIELD, SAFETY GLASSES AND GLOVES WHEN PERFORMING ANY MAINTENANCE OR REPLACEMENT ON YOUR PUMP.**

Refer to the LMI® Metering Pump Price List for the proper Spare Parts Kit or RPM PRO PAC™ kit number or contact your local LMI® stocking distributor.

1. Be sure the Injection Check Valve is properly installed and is operating. If a shut off valve has been installed downstream of the Injection Valve, it should be closed.

⚠ CAUTION **BE SURE YOUR RELIEF TUBING IS CONNECTED TO YOUR FASTPRIME™ VALVE AND RUNS BACK TO YOUR SOLUTION DRUM OR TANK.**

2. Turn the FASTPRIME™ Knob one-and-a-half turns counter-clockwise. This will depressurize the head. Keep valve open. Carefully remove the return line by gently pulling tubing and moving it from side to side to gradually back tubing off of the barbed fitting.
3. Hold return line tubing upright until solution drains back into solution drum or tank.
4. Using a 3/4” (or 19mm) socket or wrench remove Retaining Nut, and pull out the entire FASTPRIME™ Valve assembly. Remove and replace the two small O-rings.
5. Reinsert the FASTPRIME™ Valve assembly and retighten the Retaining Nut. Then turn the FASTPRIME™ Knob clockwise to tighten knob to closed position. To avoid damaging the parts, it is important that the flange on the FASTPRIME™ Valve is flush with the Retaining Nut prior to reassembly.
6. Recut 1 to 2 inches off the tip of the return line and ensure the end is squared. Press the return line tubing on completely past the barbs.

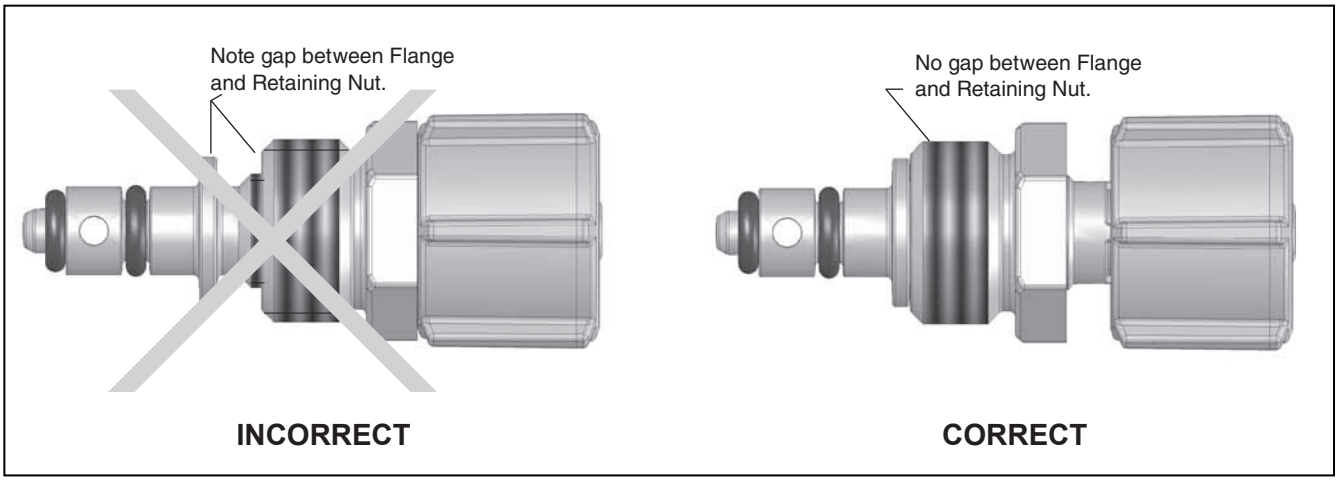


Figure 17a

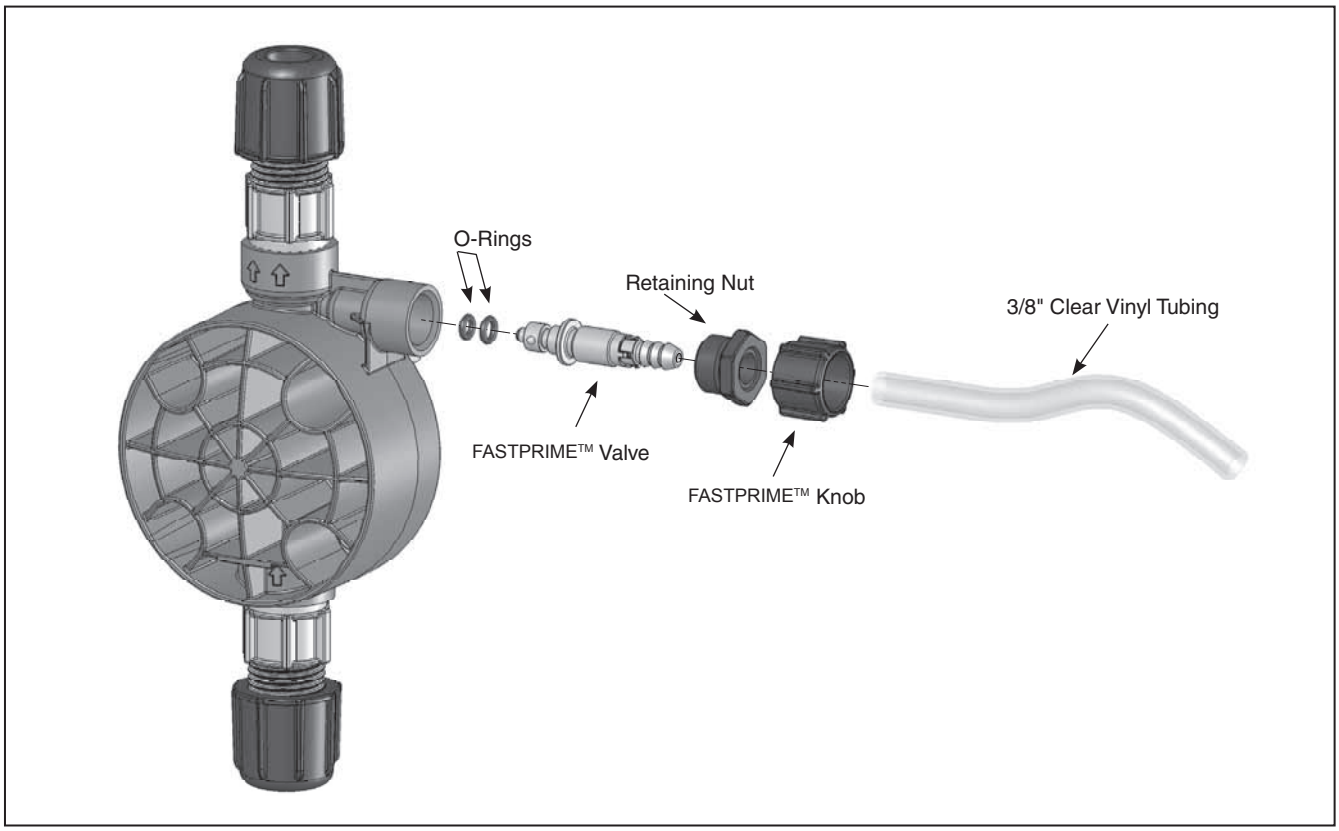


Figure 17b. FASTPRIME™ Valve O-Ring Replacement

4.7 DRIVE PARTS LIST

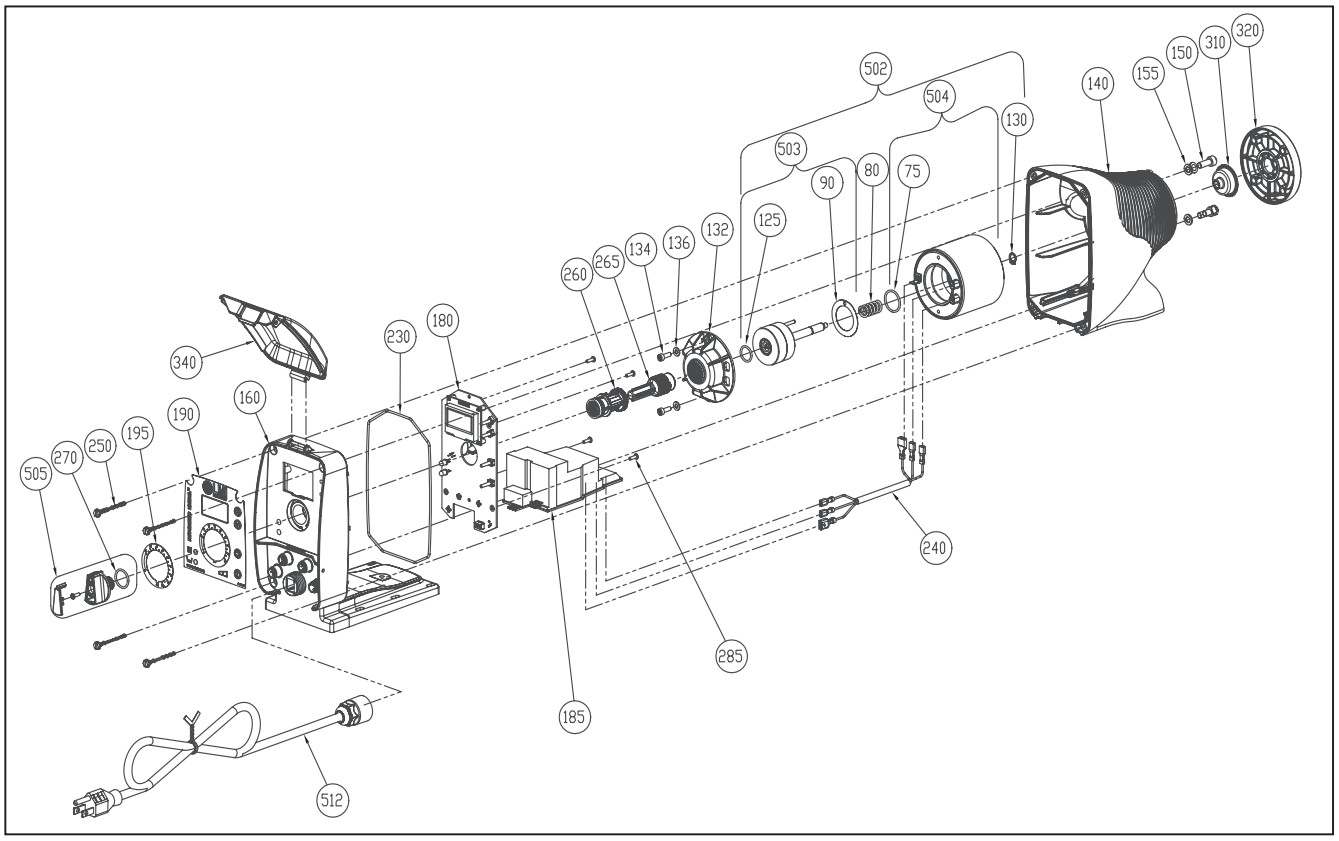


Figure 18. Drive Parts List

Bubble Number	Description
75	EPU O-Ring
80	EPU Return Spring
90	EPU Shim
125	Plunger O-Ring
130	Retaining Ring
132	Stroke Bracket
134	Stroke Bracket Screw
136	Stroke Bracket Washer
140	Drive Housing
150	EPU Attachment Bolt
155	EPU Attachment Washer
160	Control Panel
180	Control Board
185	Power Board
190	Nameplate

Bubble Number	Description
195	Stroke Dial
230	Control Panel O-Ring
240	Wire Harness
250	Drive Assembly Screws
260	Female Stroke Shaft
265	Male Stroke Shaft
270	Stroke Shaft O-Ring
285	PCB Attachment Screw
310	Shaft Seal
320	Adapter Disk
340	Clear Cover
502	EPU Assembly
503	Plunger Assembly
504	Pole Piece Assembly
505	Stroke Knob Assembly
512	Power Cord Assembly

Table 3. Drive Parts List

4.8 EPU WIRING DIAGRAM

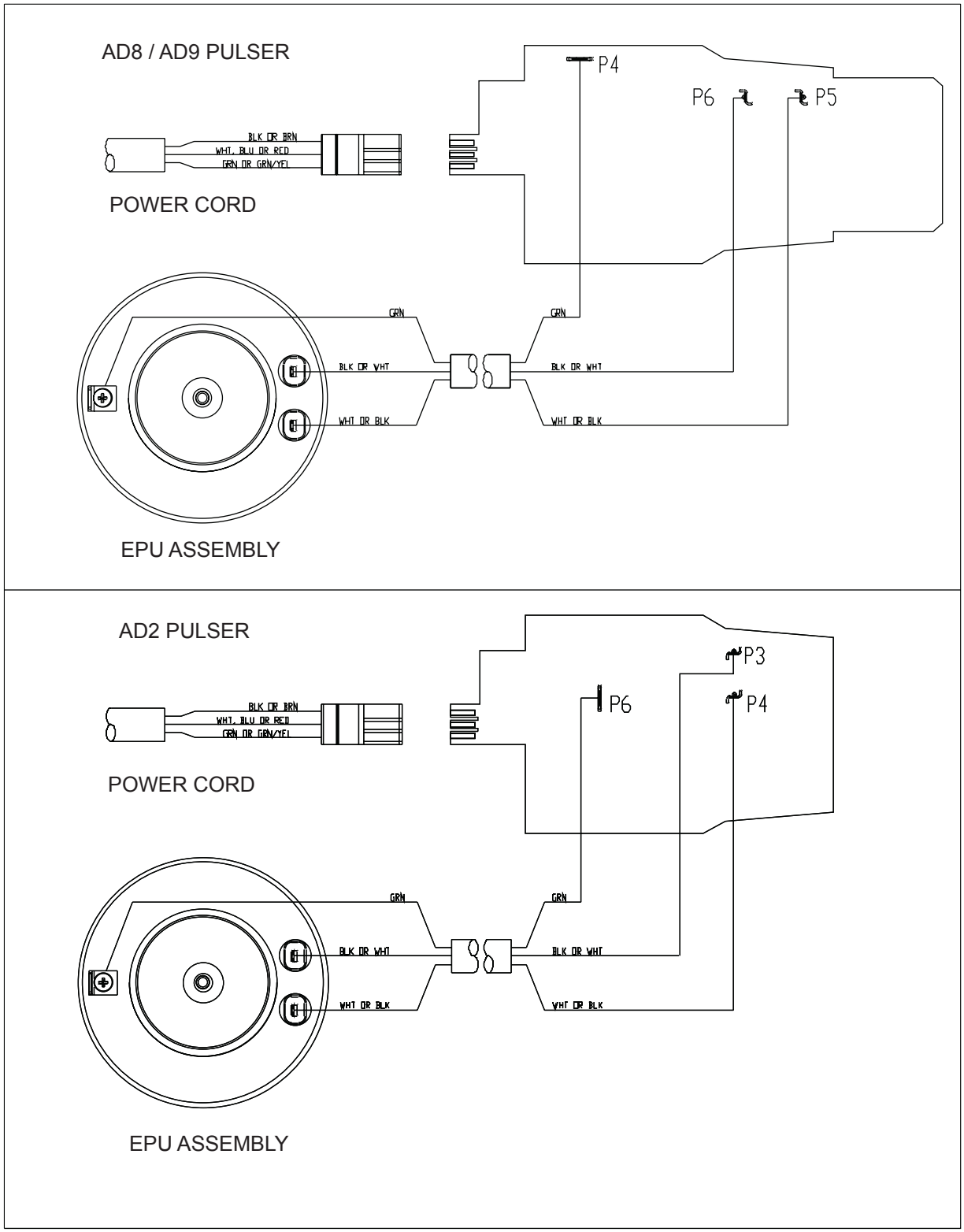


Figure 19. EPU Wiring Diagram

4.9 LIQUID END PARTS

For the latest and most accurate information on your liquid end, please refer to the Liquid End Sheets available in the LMI® Online Library at: www.lmipumps.com.

1. Select “Online Literature Library” in the Navigation Bar on left.
2. Once on Online Literature Library use “Product” drop down to select “Liquid Handling Assemblies.”
3. Select “Gallery” or ”Index” to view Liquid End sheets.

The following images are for reference and may not represent your particular liquid end.

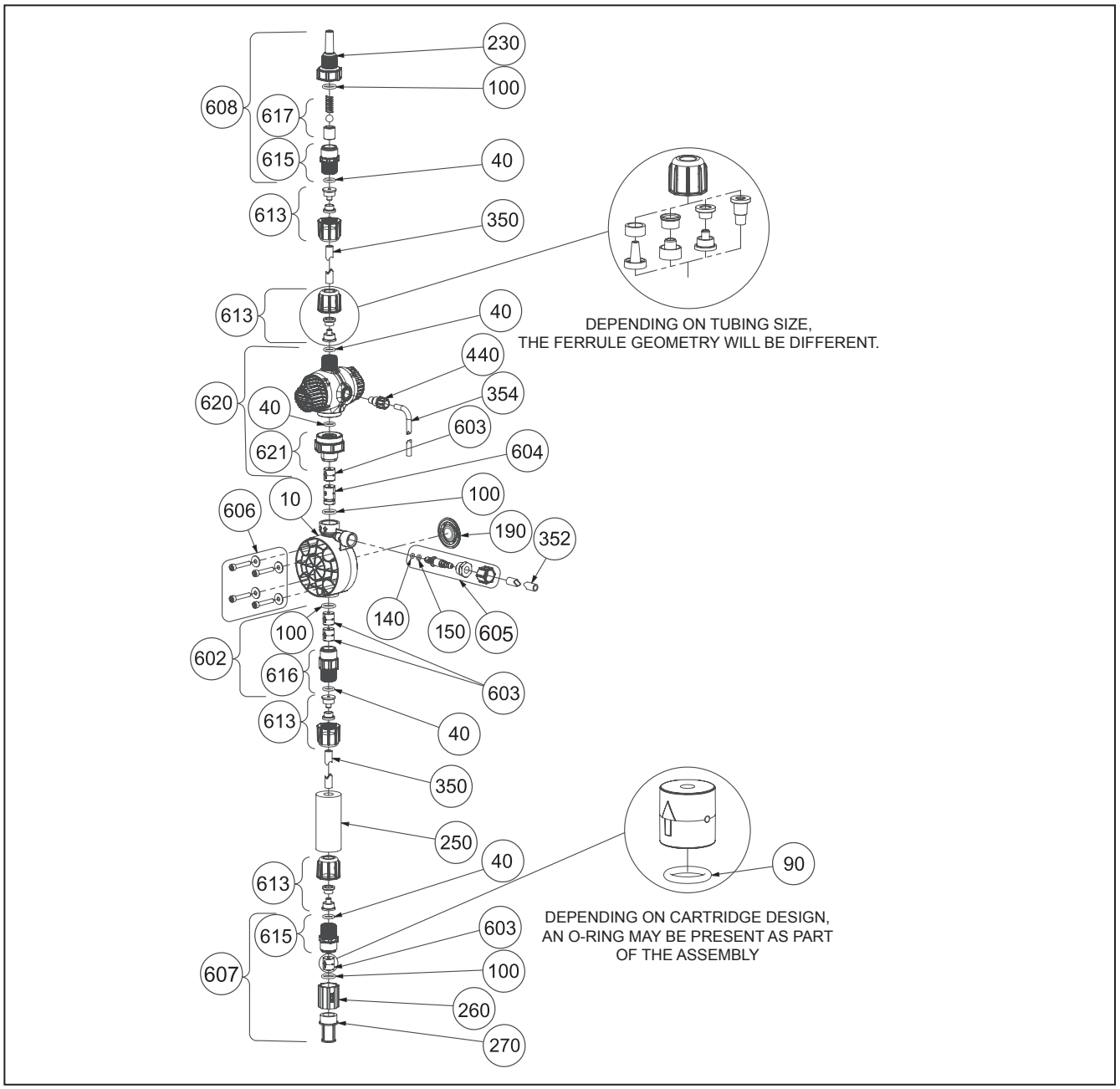


Figure 20. FASTPRIME™ Liquid End Assembly

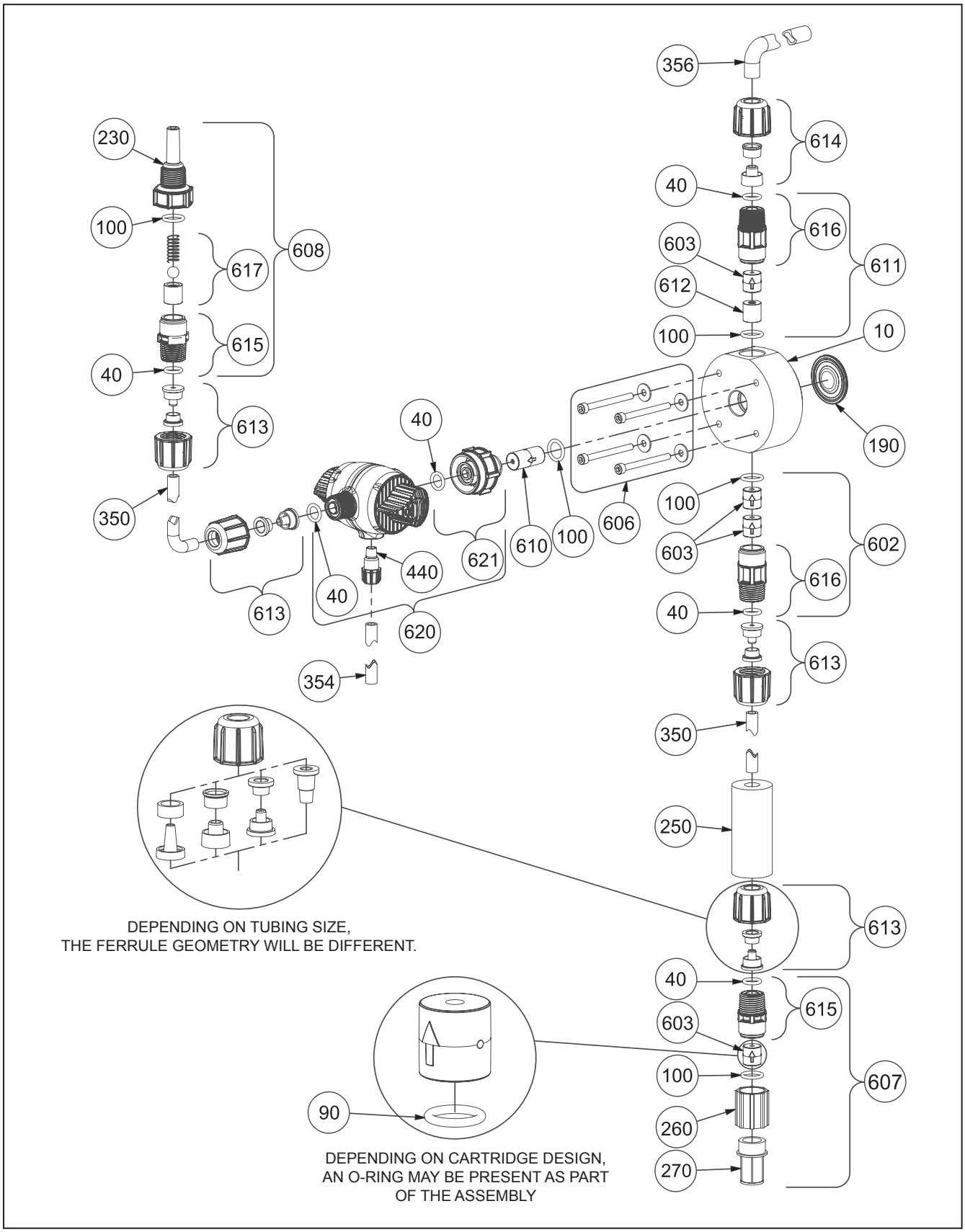


Figure 21. AUTOPRIME™ Liquid End Assembly

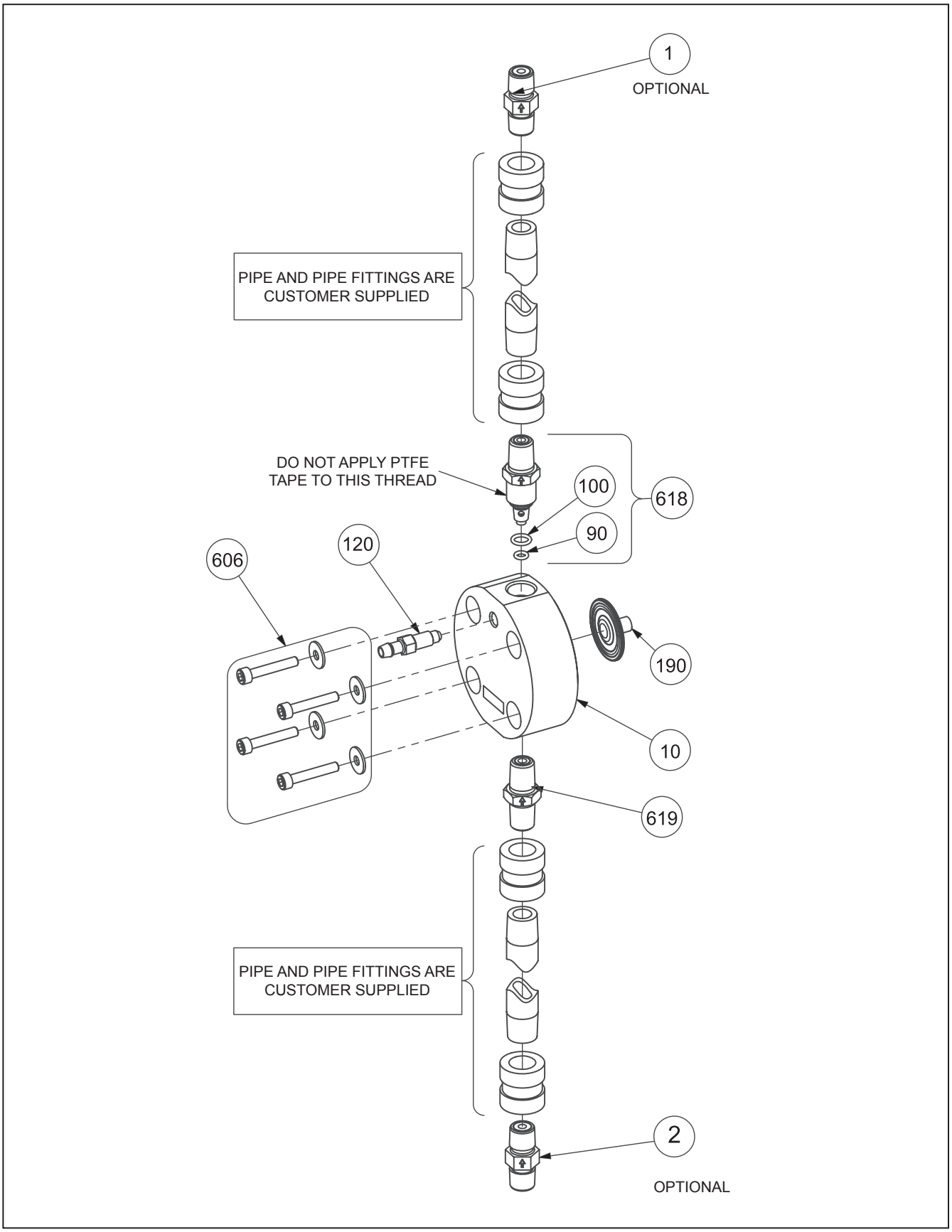
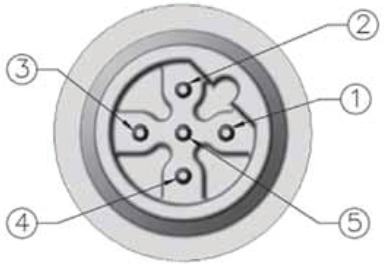


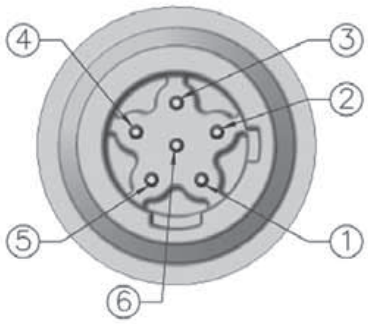
Figure 22. Stainless Steel Liquid End Assembly



5 PIN CONNECTOR

USE 5 PIN CABLE (LMI P/N 48414)

PIN	WIRE	SIGNAL
1	Brown	Remote On-Off
2	White	Ground-Return
3	Blue	External Pulse Input
4	Black	Power Supply, 24V 75 mA
5	Green-Yellow	4-20 mA Input



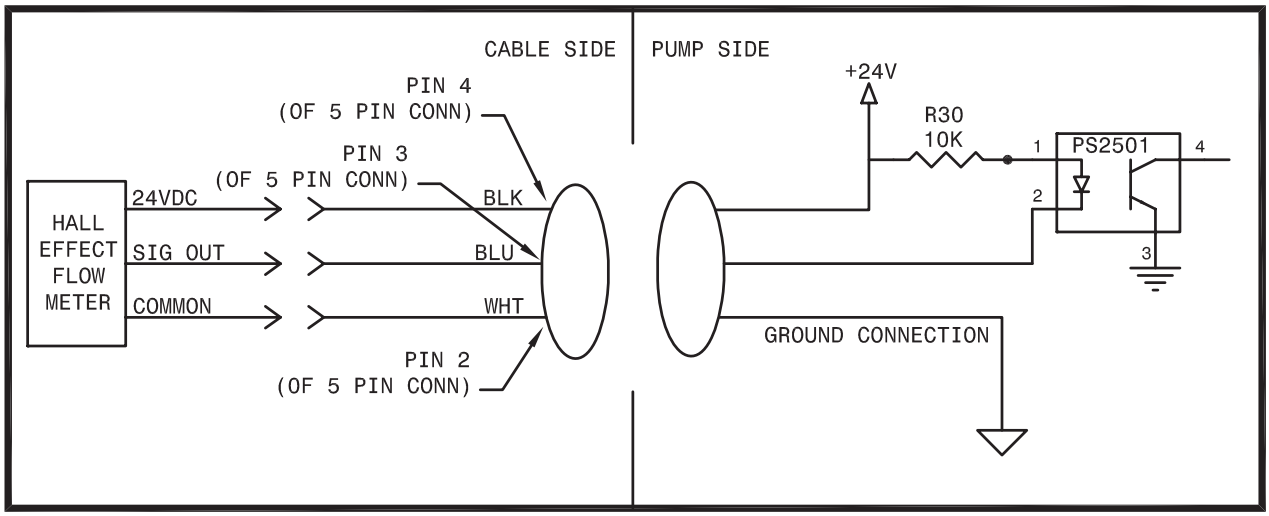
6 PIN CONNECTOR

USE 6 PIN CABLE (LMI P/N 49035)

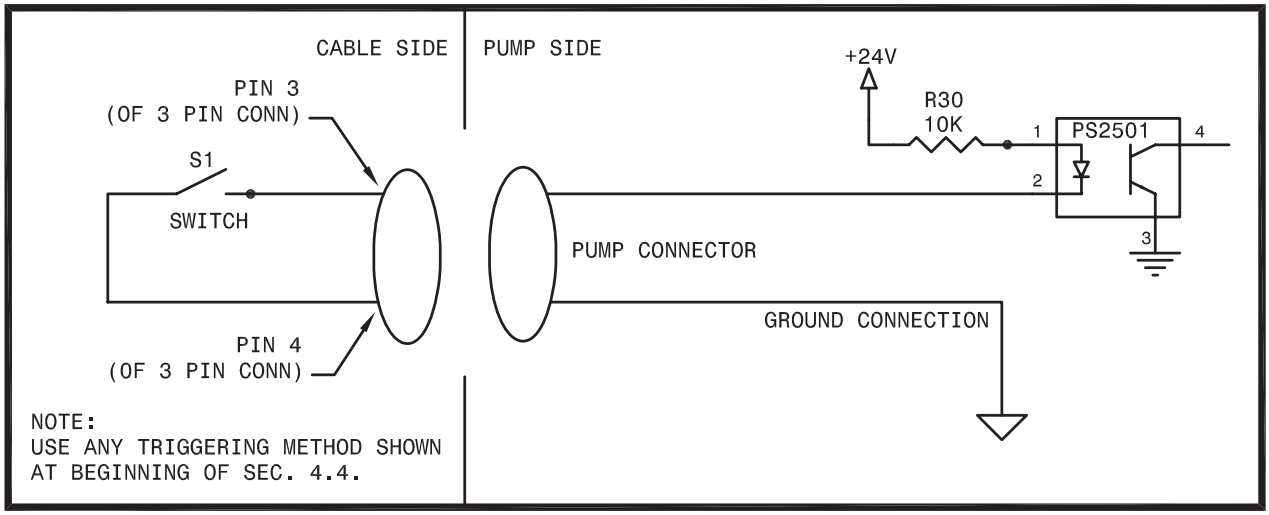
PIN	WIRE	SIGNAL
1	Red-White	Alarm Output or Internal-External indicator
2	Red	Alarm Return
3	Green	Remote Internal-External mode
4	Red-Yellow	Pulse Output
5	Red-Black	4-20 mA Output
6	Red-Blue	Ground-Return

INPUT WIRING DIAGRAM

HALL EFFECT FLOWMETER
INPUT CONNECTION REFERENCE:



TANK ON
INPUT CONNECTION REFERENCE:

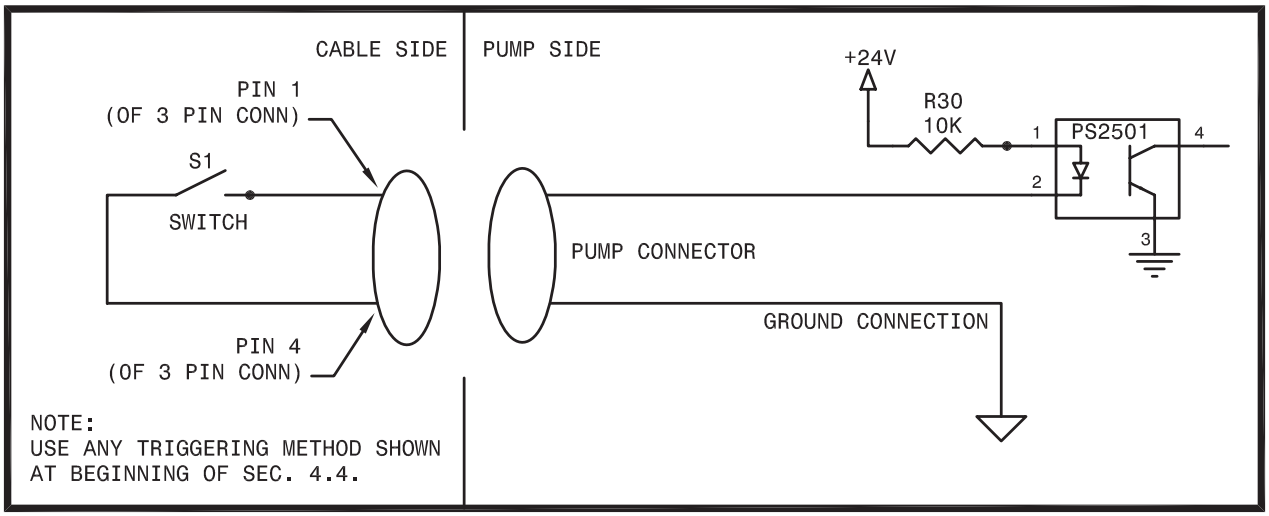


NOTE:

A Cable Cord set for this application is included with an optional LMI® dual switch assembly P/N 49249.

INPUT WIRING DIAGRAM

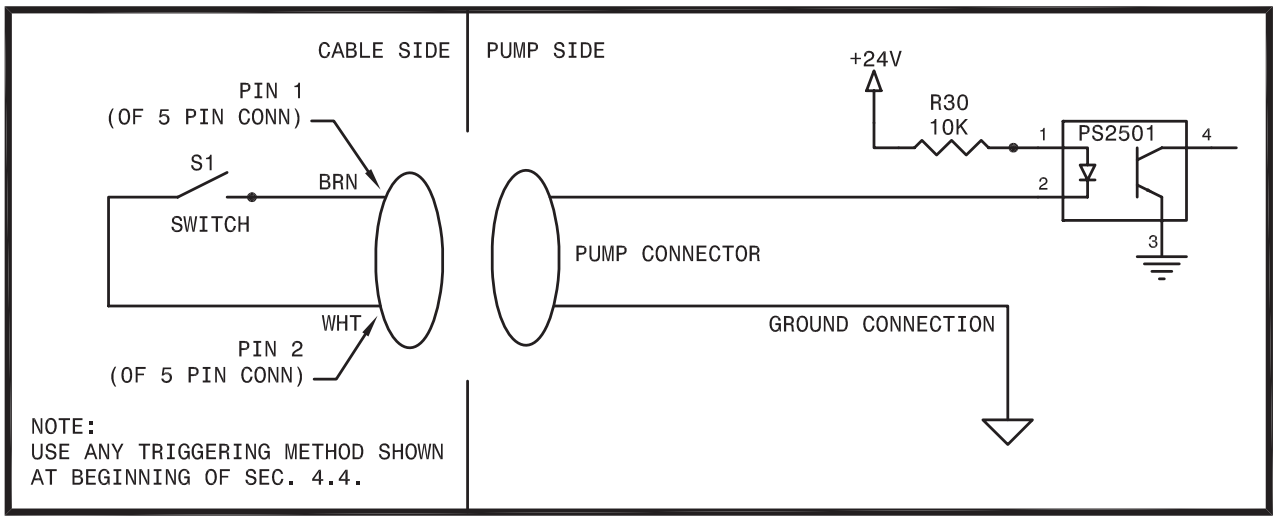
TANK EMPTY
INPUT CONNECTION REFERENCE:



NOTE:

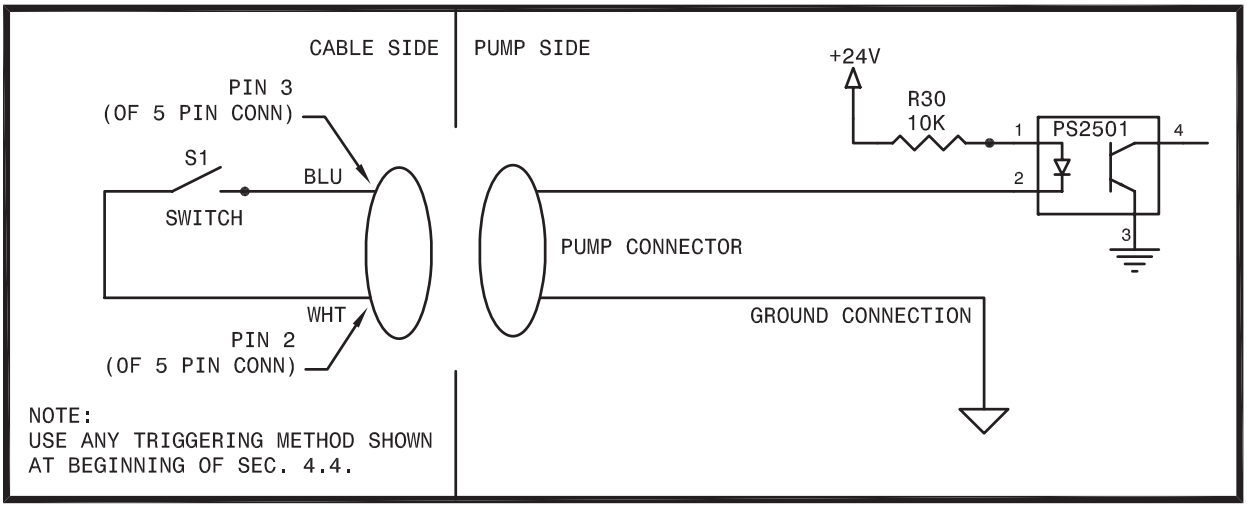
A Cable cord set for this application is included with an optional LMI® low level switch assembly P/N 49246 or a LMI® dual level switch assembly P/N 49249.

REMOTE ON-OFF
INPUT CONNECTION REFERENCE:

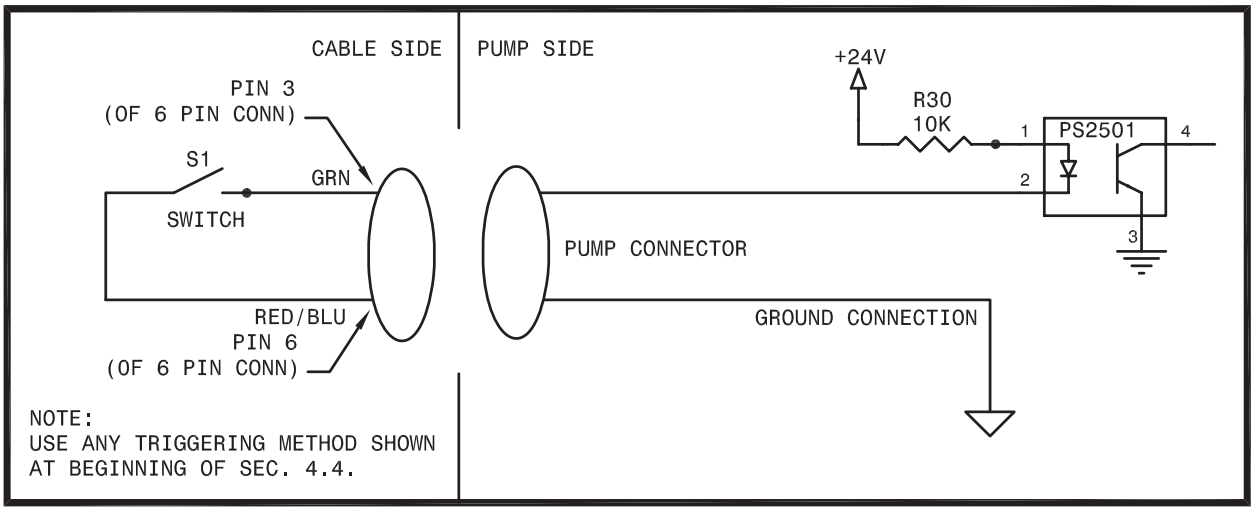


INPUT WIRING DIAGRAM

EXTERNAL PULSE INPUT CONNECTION REFERENCE:

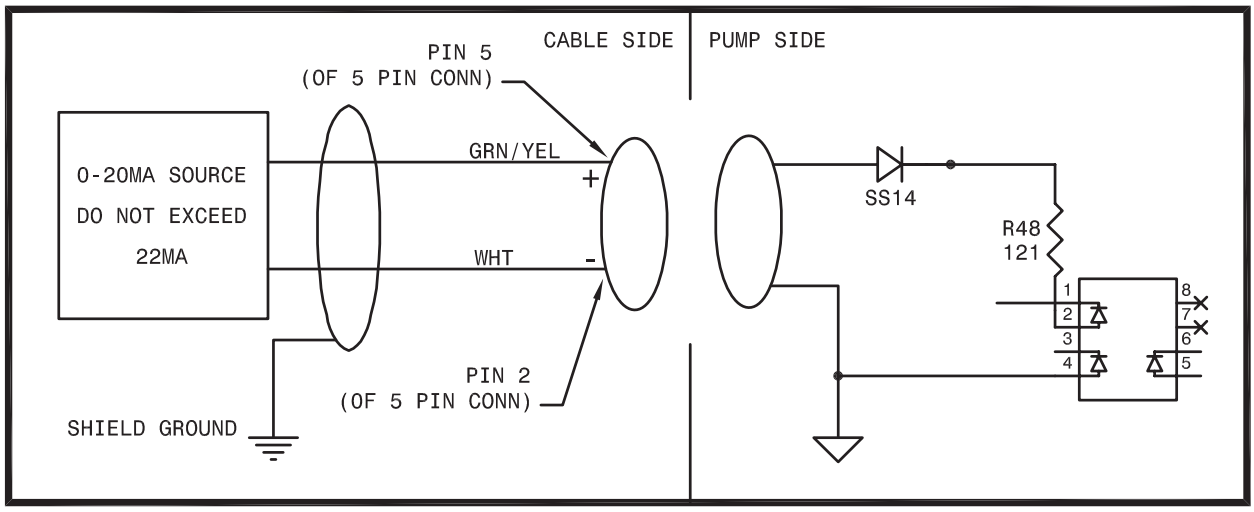


INTERNAL / EXTERNAL CONTROL INPUT CONNECTION REFERENCE:



INPUT WIRING DIAGRAM

4 - 20 MA
INPUT CONNECTION REFERENCE:

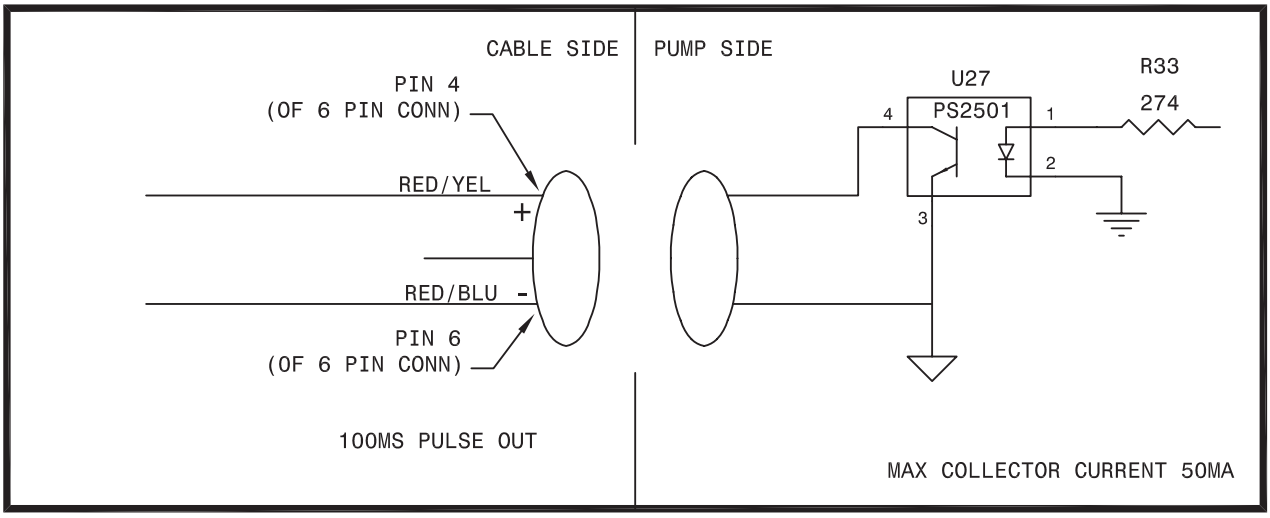


NOTE:

0 to 20 input impedence is dynamic and will work with supply currents needing 130 Ohm or above impedence.

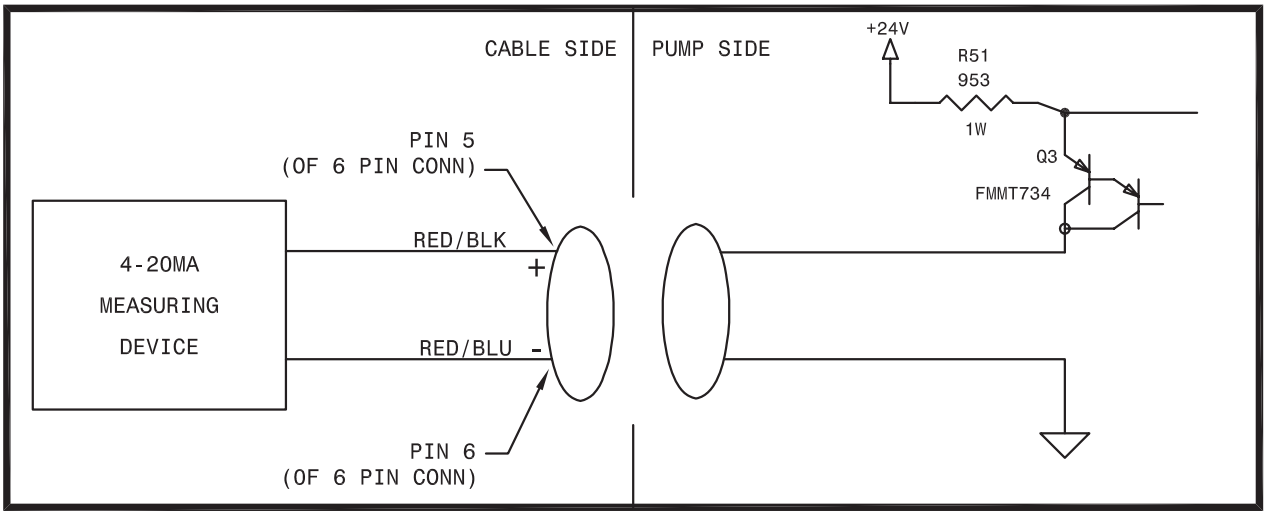
OUTPUT WIRING DIAGRAM

PULSE
OUTPUT CONNECTION REFERENCE:



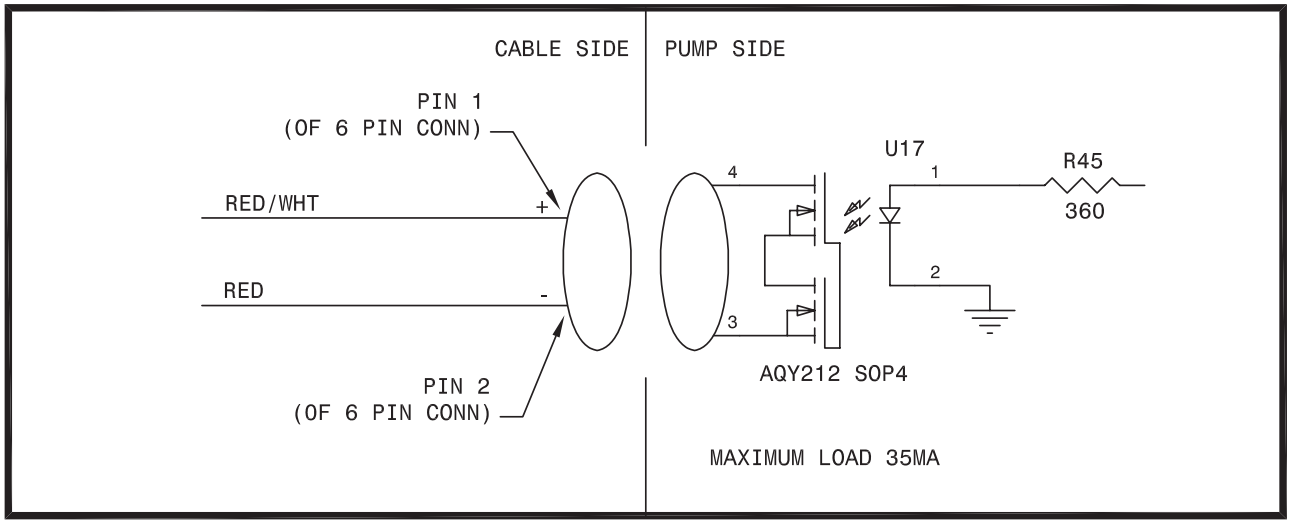
NOTE:
When using a "PULL UP" option use a 10K resistor and a 24VDC source (can be used with Pin 5 of 5 Pin CONN).

4 TO 20 MA
OUTPUT CONNECTION REFERENCE:



OUTPUT WIRING DIAGRAM

ALARM
OUTPUT CONNECTION REFERENCE:



NOTE:

Use to switch on 24V source or less. Do not use to switch on AC line Voltage without Relay. Relay coils should be 24VDC or less with maximum Current of 35 mA.

SECTION 6 - TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
Pump Will Not Prime	1. Pump not turned on or plugged in.	1. Turn on pump/plug in pump.
	2. Output dials not set properly.	2. Always prime pump with speed and stroke at 100%.
	3. Foot Valve not in vertical position on bottom of tank.	3. Foot Valve must be vertical *(see Foot Valve Installation, Section 2.7)*.
	4. Pump suction lift too high.	4. Maximum suction lift is 5 ft (1.5 m). Pumps with High Viscosity Liquid Handling Assemblies require flooded suction.
	5. Suction tubing is curved or coiled in tank.	5. Suction tubing must be vertical. Use LMI® ceramic weight supplied with pump *(see Section 2.7)*.
	6. Fittings are over tightened.	6. Do not overtighten fittings. This causes seal rings to distort and not seat properly which causes pump to leak back or lose prime.
	7. Air trap in suction valve tubing.	7. Suction tubing should be as vertical as possible. AVOID FALSE FLOODED SUCTION! *(see Section 2.2.1)*.
	8. Too much pressure at discharge (Pumps without multi-function valve.)	8. Shut off valves in pressurized line. Disconnect tubing at injection check valve *(see Priming Section 3.2)*. When pump is primed, reconnect discharge tubing.
	9. Air leak around fitting.	9. Check for missing or damaged O-rings at ends of fittings.
Pump Loses Prime	1. Solution container ran dry.	1. Refill container with solution and reprime *(see Section 3.2)*.
	2. Foot Valve is not in a vertical position on the bottom of the tank.	2. Foot Valve must be vertical *(see Foot Valve Installation, Section 2.7)*.
	3. Pump suction lift is too high.	3. Maximum suction lift is 5 ft (1.5 m). Pumps with High Viscosity Liquid Handling Assemblies require flooded suction.
	4. Suction tubing is curved or coiled in tank.	4. Suction tubing must be vertical. Use LMI® ceramic weight supplied with pump *(see Section 2.7)*.
	5. Fittings are over tightened.	5. DO NOT OVERTIGHTEN FITTINGS. This causes seal rings to distort and not seat properly which causes pump to leak back or lose prime.
	6. Air trap in suction valve tubing.	6. Suction tubing should be as vertical as possible. AVOID FALSE FLOODED SUCTION! *(see Section 2.2.1)*.
	7. Air leak on suction side.	7. Check for pinholes, cracks. Replace if necessary.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Leakage at tubing	1. Worn tubing ends.	1. Cut about 1 in (25 mm) off tubing and then replace as before.
	2. Loose or cracked fitting.	2. Replace fitting if cracked. Carefully hand tighten fittings. **DO NOT USE PIPE WRENCH**. An additional 1/8 or 1/4 turn may be necessary.
	3. Worn seal rings.	3. Replace balls and seal rings*(see Section 4.4*).
	4. Solution attacking Liquid Handling Assembly.	4. Consult your local distributor for alternate materials.
Low Output or Failure to Pump Against Pressure	1. Pump's maximum pressure rating is exceeded by injection pressure.	1. Injection pressure cannot exceed pump's maximum pressure. See pump data plate.
	2. Worn Seal Rings.	2. Worn seal rings or cartridge valves may need replacement *(see Section 4.4)*.
	3. Ruptured LIQUIFRAM™.	3. Replace LIQUIFRAM™ *(see Section 4.3)*.
	4. Incorrect stroke length.	4. Recalibrate Output *(see Section 3.3.2)*.
	5. Tubing run on discharge may be too long.	5. Longer tubing runs may create frictional losses sufficient to reduce pump's pressure rating Consult factory for more information.
	6. Clogged Foot Valve strainer.	6. Remove Foot Valve strainer when pumping slurries or when solution particles cause strainer to clog.
Failure to Run	1. Pump not turned on or plugged in.	1. Turn on or plug in pump.
	2. EPU failure.	2. Disassemble pump and measure resistance across the EPU terminals. If this measures as an open circuit then the EPU should be replaced. *(see Section 4.8)*.
	3. Pulser failure.	3. The pulser should be replaced if EPU checks out OK. Consult supplier or factory.
Excessive Pump Output	1. Syphoning. (Pumping downhill without a multi-function valve).	1. Move injection point to a pressurized location or install an LMI® 4-FV *(see Section 2.4)*.
	2. Little or no pressure at injection point.	2. If pressure at injection point is less than 25 psi (1.7 Bar), an LMI® 4-FV should be installed *see Section 2.4)*.
	3. Excessive strokes per minute.	3. Replace pulser or resistor. Consult factory.

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ROYTRONIC EXCEL™
Series AD9 Programming Guide
Electronic Metering Pumps
Instruction Manual

Manual No : 2032
Rev. : D
Rev. Date : 11/2015

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SECTION 1 - INTRODUCTION

The Series AD9 electronic metering pump offers an extensive range of features, including microprocessor control for accurate and flexible automation in response to instrument signals. The microprocessor design employs a graphical display and tactile response keypad. All external inputs and outputs are opto-isolated from the microprocessor.

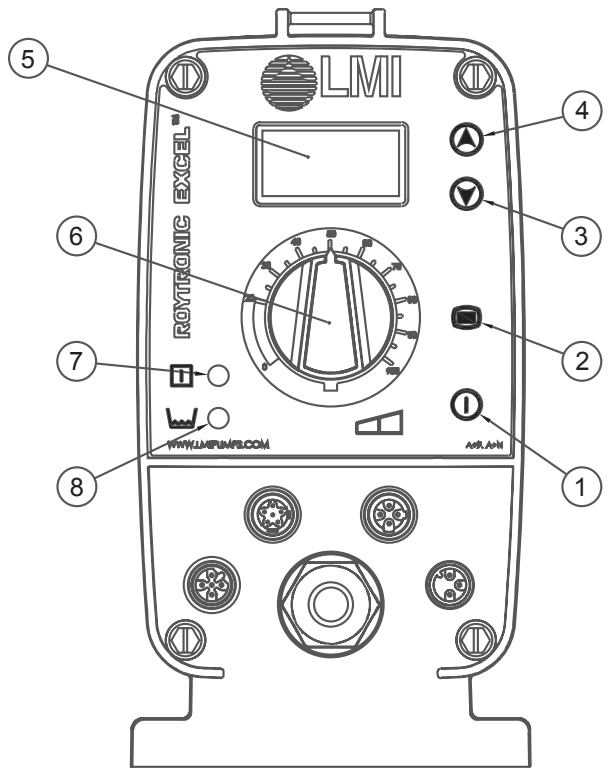
This manual is a supplement which describes programming and operation for the AD9 series. For complete details on Installation, Maintenance and Troubleshooting, please refer to the ROYTRONIC EXCEL™ Instruction Manual (P/N 2024).

⚠ CAUTION **SPECIFIC PRECAUTIONS SHOULD BE TAKEN WHEN WORKING WITH ALL LMI® METERING PUMPS. PLEASE REFER TO THE PRECAUTIONS SECTION, SEC. 1.0, OF THE ROYTRONIC EXCEL™ INSTRUCTION MANUAL (P/N 2024).**

SECTION 2 - FEATURES

1. Stroke speed adjustment 1-59 SPH (strokes per hour) to 1-120 SPM (strokes per minute).
2. Operating mode selection.
3. Flexible slope adjustable response to mA input signals.
4. Divide or multiply (batch) incoming pulses (1 to 9999).
5. Batch accumulation option.
6. Timed event mode for internal operation.
7. Percent-of-time operation for internal and external modes.
8. Keypad locking.
9. Low-level warning and empty-level shutoff with alarm output.
10. Programmable flow monitoring with alarm output (with FM-ROY-9 DIGI-PULSE™).
11. Continuous non-volatile memory (EEPROM)-no battery required.
12. Remote ON/OFF control.
13. Remote Internal/External mode control.
14. Pulse (pacing) output.
15. Universal voltage input (95-240V) with automatic line voltage compensation and over voltage protection.
16. Programmable menu for optional features parameters.
17. Theoretical flow display.
18. Single-Point and Two-Point calibration.
19. Fixed-time priming mode.
20. Configurable output alarms.
21. 4-20mA output for remote monitoring of stroke speed.

SECTION 3 - KEYPAD/DISPLAY: DESCRIPTION AND FUNCTION



1. POWER Button
2. MODE Button
3. DOWN Button
4. UP Button
5. Graphical Display
6. Stroke Adjustment Knob
7. Pump ON/OFF LED
8. Low-Level Indicator LED

Figure 1. ROYTRONIC EXCEL™ Series AD9 Control Panel

3.1 POWER BUTTON

The POWER button turns the pump ON or OFF. If the pump is not running, pressing this button will cause the pump to start running. If the pump is running, pressing the POWER button will stop the pump. The POWER button is also used to prime the pump as described in *Sec. 4.3.* When in a programming screen or a selection menu, the POWER button is generally used to enter/select the associated item.

3.2 MODE SELECTION BUTTON

The MODE button is used to enter the main selection menu. The MODE button can also often be used to exit the current programming menu. Details of its use will be covered in greater detail later in this supplement.

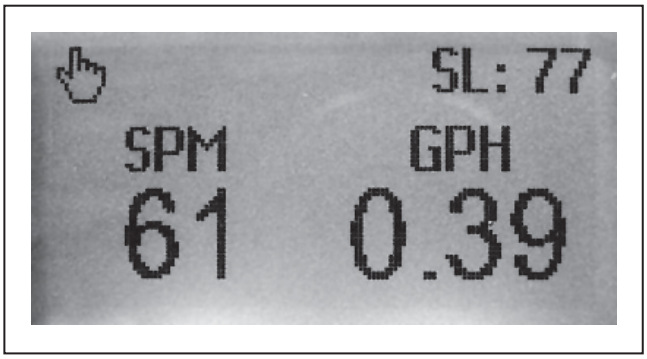
3.3 UP AND DOWN BUTTONS

The UP and DOWN buttons are used to change parameters (i.e. stroke frequency) as well as to navigate the selection menus. These functions are covered in greater detail later in this supplement.

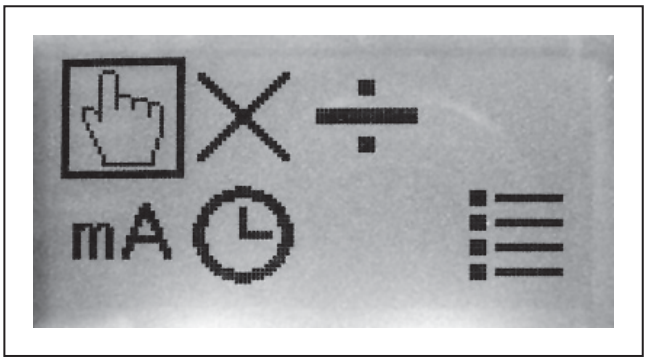
SECTION 3 - KEYPAD/DISPLAY: DESCRIPTION AND FUNCTION

3.4 GRAPHICAL DISPLAY

A graphical display is used to show the current operational state of the pump as well as a variety of specialized programming menus.



Manual Operating Mode Display



Control Mode Selection Display

3.5 STROKE ADJUSTMENT KNOB

The Stroke Adjustment Knob is used to adjust the stroke length of the pump. As this knob is adjusted, the stroke length and associated flow will be displayed on the current operating mode display.

3.6 PUMP ON/OFF LED

When the pump is started, the Pump ON/OFF LED will be green when in internal mode and yellow when in an external mode. The LED will also briefly pulse OFF during an actual pump stroke. When the pump is not running, the Pump ON/OFF LED will be OFF.

3.7 LOW LEVEL INDICATOR LED

The Low Level Indicator LED will normally be OFF. However, in the event that an external level sensor is connected to the pump, the LED will turn yellow if a Tank Low input signal is detected or red if a Tank Empty input signal is detected. If both Tank Low and Tank Empty conditions are present, the Tank Empty takes priority. The pump will not stroke when in a Tank Empty condition.

This pump features EEPROM nonvolatile memory. The pump will always power up in the last used mode. When shipped from the factory the pump will power up in the Manual mode (*see Sec. 5.1*), with the pump OFF and a speed setting of 120 SPM.

NOTE:

If the power to the pump is cut less than 15 seconds after the last programmed values have been set, the latest changes will NOT be stored in nonvolatile memory. Allow at least 15 seconds before disconnecting from power to ensure that the latest changes are stored.

4.1 PUMP START/STOP

Press the ⏻ POWER button to start or stop the pump. When the pump is OFF, the [I] Pump ON/OFF LED will be OFF. When the pump is ON, the [I] Pump ON/OFF LED will illuminate. Each time the pump strokes, the [I] Pump ON/OFF LED will flash OFF.

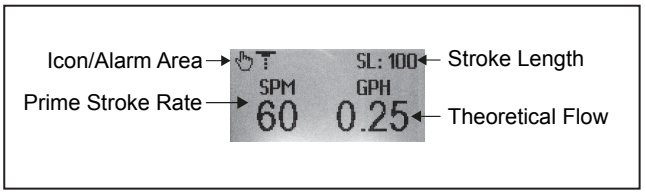
4.2 PUMP SPEED

The speed may be changed with the pump ON or OFF. To increase or decrease the speed, press or hold the ▲ UP or ▼ DOWN button. The range runs from 0 SPH to 120 SPM. While normally the speed will be set in SPM, if settings of SPH are desired, hold the ▼ DOWN button until the display reads 1 SPM, then continue to hold it down. The display will then show SPH 59. The speed can be further reduced to 1 SPH with the ▼ DOWN button.

4.3 PRIMING THE PUMP

The priming function allows a fixed-time prime period of 60 seconds and enables priming of the pump in any control mode. To begin priming, hold down the ⏻ POWER button for approximately 5 seconds. The pump will begin operating. Use the ▲ UP and ▼ DOWN buttons to vary the stroking speed. To stop priming before the priming cycle is complete, push the ⏻ POWER button. The pump will automatically stop after 60 seconds, and revert to the last used control mode.

Display Overview:



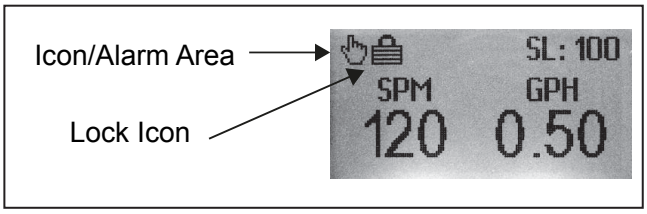
1. **Icon/Alarm Area:** The T icon indicates the pump is in prime mode. Depending on advanced pump configuration options and any alarms alerts detected, other icons may be present as well (*see Sec. 4.5*).
2. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
3. **Prime Stroke Rate:** Indicates the stroke speed of the pump while priming (1-120 SPM).
4. **Theoretical Flow:** The theoretical flow based on stroke speed, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

NOTE:

The prime stroke rate is independent of the current control mode stroke rate.

4.4 LOCKING/UNLOCKING THE PUMP

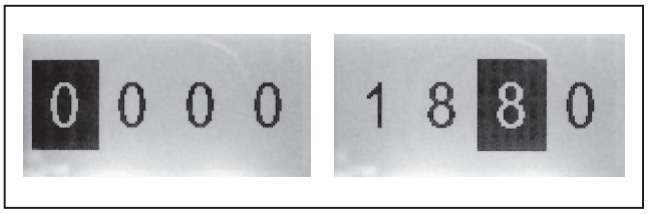
The pump has several lock modes to prevent casual tampering. For a complete description of the lock modes and how to configure them, *see Sec. 6.4*. A Lock Icon in the Icon/Alarm Area indicates that the pump has been locked.



To activate the pump lock, depress the ⓓ DOWN and ⓜ MODE buttons simultaneously for about 1 second until the Lock Icon appears in the Icon/Alarm area.

To unlock a locked pump, depress the ⓓ DOWN and ⓜ MODE buttons simultaneously for about 1 second until the Lock Icon disappears in the Icon/Alarm area or until prompted for the unlock pass code (*see below*).

To enter the unlock pass code, use the ⓤ UP and ⓓ DOWN buttons to edit each digit. Use the ⏻ POWER button to advance to the next digit. If the pass code is incorrect, the pump will remain locked.



Example of entering an unlock pass code

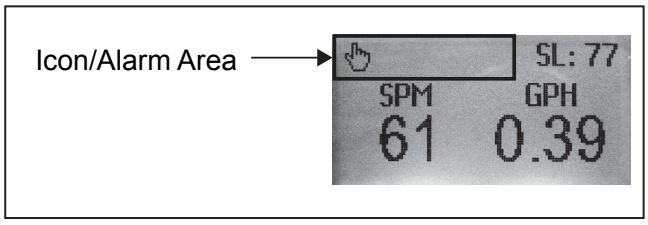
NOTE:

Activating the pump lock is effective immediately. Do not activate unless you have made note of the unlock pass code, which is configured in Sec. 6.4. If the pass code is misplaced while the lock is active, the pump must be returned to the factory in order to be reset.

After approximately 2 minutes of inactivity, the unlock pass code display will close and revert back to the current control mode display.

4.5 ALARM/ICON AREA

The upper left portion of every Control Mode Display contains an icon/alarm notification area, which graphically displays operational information. If no alarm conditions exist, the display will only show configuration information. If one or multiple alarm conditions exist, the display will alternate every few seconds between showing configuration information and showing alarm information. Alarm information will always be preceded by the ⚠ icon.



Configuration Icon Definitions:

ICON	NAME	DESCRIPTION
	Manual Control Mode	Pump is in Manual Control Mode (See Sec. 5.1)
	Pulse Multiply Control Mode	Pump is in Pulse Multiply Control Mode (See Sec. 5.2)
	Pulse Divide Control Mode	Pump is in Pulse Divide Control Mode (See Sec. 5.3)
	Analog Control Mode	Pump is in Analog Control Mode (See Sec. 5.4)
	Timed Event Control Mode	Pump is in Timed Event Control Mode (See Sec. 5.5)
	Prime	The pump is priming (See Sec. 4.3)
	Keypad Locked	The keypad is locked (See Sec. 4.4)
	Digi-Pulse™ Flow Monitoring	Digi-Pulse™ flow switch monitoring is enabled (See Sec. 6.9)
	Percent-of-Time	Percent-of-Time Functionality Enabled (See Sec. 6.10)
	Batch Mode	Batch Mode Enabled (See Sec. 6.2)
	1-Point Calibration	Pump user-calibrated : 1-point (See Sec. 6.6.1)
	2-Point Calibration	Pump user-calibrated : 2-point (See Sec. 6.6.2)

Table1. Configuration Icon Definitions

Alarm Icon Definitions:

ICON	NAME	DESCRIPTION
SL	Stroke length alarm	The pump is user-calibrated and the stroke length is operating outside the allowable range
	Digi-Pulse™ flow switch alarm **	Digi-Pulse™ Flow Monitoring is enabled and the missed strokes threshold has been reached
>mA	Analog input alarm	The 4-20ma input current exceeds 21.5 mA
	Incoming pulse rate alarm	The input pulse rate results in a stroke rate exceeding 120 SPM
	Batch alarm	Pulses are received before current batch action is completed
L	Low tank alarm	Corresponds to the external Tank Level Low input
E	Empty tank alarm**	Corresponds to the external Tank Empty input

*** = The pump will stop stroking in this condition*

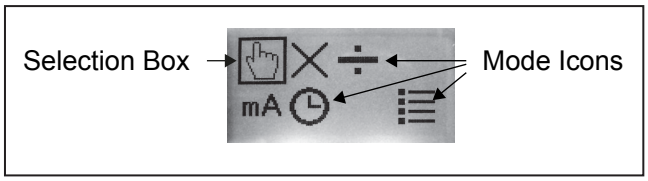
Table 2. Alarm Icon Definitions

SECTION 5 - CONTROL MODE SELECTION MENU

This menu is used to select the control mode or enter into the advanced configuration menu. There are 2 internal control modes and 3 external control modes. In order to operate the pump in an external control mode, a remote device must be connected to the pump through the 5-Pin connector.

With the pump turned OFF, push the ▭ MODE button to bring up the Control Mode Selection Menu. Use the ▲ UP and ▼ DOWN buttons to scroll through the modes. Once the desired mode is selected, use the ⏻ POWER button to enter that mode. Push and hold the ▭ MODE button for approximately 2 seconds to exit the menu.

Display Overview:



Control Mode Selection Menu

1. **Mode Icons:** Each icon represents a different control mode, as follows:
   - = Manual Mode - Internal (*Sec. 5.1*).
   - = Pulse Multiply Mode - External (*Sec. 5.2*).
   - = Pulse Divide Mode - External (*Sec. 5.3*).
   - mA = Analog mA Mode - External (*Sec. 5.4*).
   - = Timed Event Mode - Internal (*Sec. 5.5*).
   - = Advanced Configuration Options (*Sec. 6.0*).
2. **Selection Box:** Indicates the currently selected item.

NOTE:

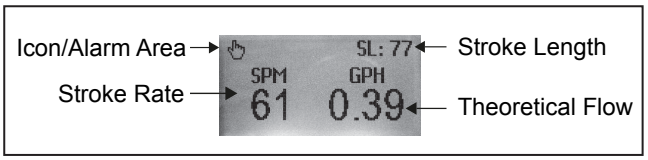
After approximately 2 minutes of inactivity, the mode selection menu will automatically close and revert back to the prior display.

While in this menu, all external outputs will return to their default "OFF" state and all external inputs will be ignored.

5.1 MANUAL MODE (INTERNAL)

This mode is used when external devices are not being used to control the pump. While in manual mode, the stroke speed is varied by using the ▲ UP and ▼ DOWN buttons. To turn the pump ON or OFF, push the ⏻ POWER button or toggle the remote ON/OFF. The I Pump ON/OFF LED will illuminate green when the pump is ON.

Display Overview:



Manual Mode Display

1. **Icon/Alarm Area:** The ☝ icon indicates the pump is in the manual mode. Depending on advanced pump configuration options and any alarms alerts detected, other icons may be present as well (*see Sec. 4.5*).
2. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
3. **Stroke Rate:** Indicates the stroke speed of the pump (1-59SPH or 1-120 SPM).
4. **Theoretical Flow:** The theoretical flow based on stroke speed, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

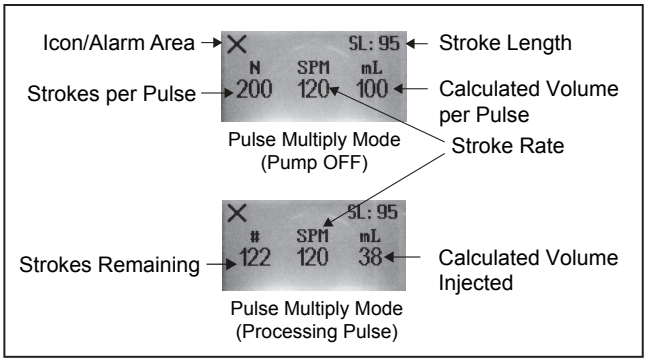
5.2 PULSE MULTIPLY MODE (EXTERNAL)

This mode is used to control the pump with an external device connected to the appropriate contacts of the 5-Pin connector. With the pump OFF, use the ▲ UP and ▼ DOWN buttons to vary the strokes-per-pulse parameter. To turn the pump ON or OFF, push the ⏻ POWER button, or toggle the remote ON/OFF. The I Pump ON/OFF LED will illuminate yellow when the pump is ON. With the pump turned ON, and a pulse is received, the pump will begin running, with the remaining pulses counting down on the display.

If a pulse is received before the countdown is complete and Batch Mode is OFF (*see Sec. 6.2*), the error code (*see Sec. 4.5*) is displayed and the pump batch count then restarts from the strokes-per-pulse setpoint. The fault will be corrected when the pump completes the current batch OR the pump is stopped.

If a pulse is received before the countdown is complete and Batch Mode is ON (*see Sec. 6.2*), the pump will accumulate strokes (up to a maximum of 9999), allowing all strokes to be accounted for.

Display Overview:

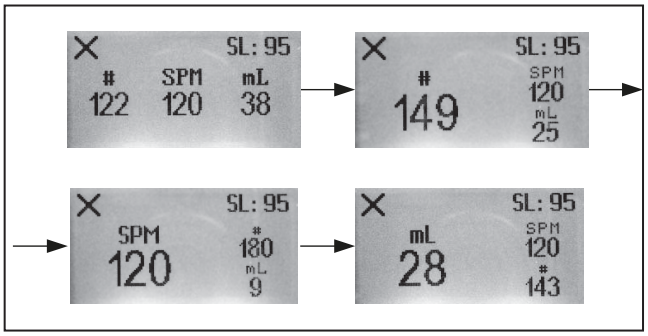


1. **Icon/Alarm Area:** The ✕ icon indicates the pump is in the pulse multiply mode. Depending on advanced pump configuration options and any alarms/alerts detected, other icons may be present as well (*see Sec. 4.5*).
2. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
3. **Stroke Rate:** Indicates the stroke speed of the pump (1-59 SPH or 1-120 SPM). To allow true flow proportioning, this is set in manual mode (*see Sec. 5.1*).
4. **Strokes per Pulse (Pump OFF only):** Number of strokes (1-9999) to occur for each valid pulse input. *See Sec. 6.3* to define a valid pulse.
5. **Strokes Remaining (Pump ON only):** Number of strokes remaining for the current batch cycle.
6. **Calculated Volume per Pulse (Pump OFF only):** The calculated flow based on stroke count, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).
7. **Calculated Volume Injected (Pump ON only):** The calculated flow based on strokes made, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

NOTE:

The pump will ignore the pulse input while the pump is OFF.

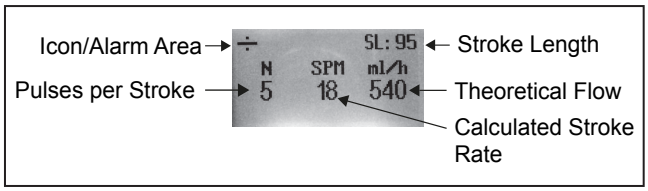
Depressing the ▲ UP and ▼ DOWN buttons simultaneously will cycle through alternate display formats , as shown below:



5.3 PULSE DIVIDE MODE (EXTERNAL)

This mode is used to control the pump with an external device connected to the appropriate contacts of the 5-Pin connector. With the pump OFF, use the ▲ UP and ▼ DOWN buttons to vary the pulses-per-stroke parameter. To turn the pump ON or OFF, push the ⏻ POWER button or toggle the remote ON/OFF. The I Pump ON/OFF LED will illuminate yellow when the pump is ON. With the pump turned ON, the pump will pulse after the programmed number of pulses has been received.

Display Overview:



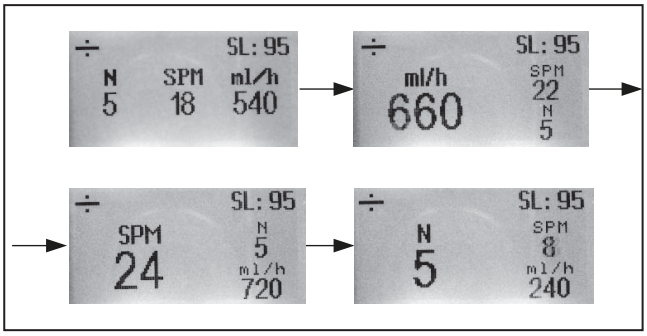
1. **Icon/Alarm Area:** The ÷ icon indicates the pump is in the pulse divide mode. Depending on advanced pump configuration options and any alarms/alerts detected, other icons may be present as well (*see Sec. 4.5*).
2. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
3. **Calculated Stroke Rate:** Indicates the calculated stroke rate of the pump (0-120 SPM) based on the rate of incoming pulses and the divide value.
4. **Pulses per Stroke:** Number (1-9999) of valid pulses to detect before performing a pump stroke. *See Sec. 6.3* to define a valid pulse.
5. **Theoretical Flow:** The theoretical flow based on stroke speed, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

NOTE:

The pump will display the calculated stroke rate and theoretical flow with the pump ON and OFF.

A ⚠ fault will be indicated if the calculated stroke rate exceeds 120 SPM (see Sec. 4.5).

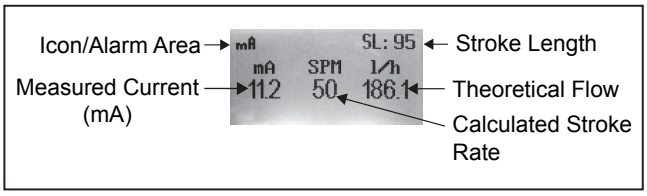
Depressing the ▼ UP and ▲ DOWN buttons simultaneously will cycle through alternate display formats, as shown below:



5.4 ANALOG MODE (EXTERNAL)

This mode is used to control the pump with an external device connected to the appropriate contacts of the 5-Pin connector. With the pump OFF, press the ▲ UP or ▼ DOWN button to change the response curve (*see Sec. 5.4.1*). To manually turn the pump ON or OFF, push the ⏻ POWER button or toggle the remote ON/OFF. The I Pump ON/OFF LED will illuminate yellow when the pump is ON.

Display Overview:



1. **Icon/Alarm Area:** The **mA** icon indicates the pump is in the analog mode. Depending on advanced pump configuration options and any alarms/alerts detected, other icons may be present as well (*see Sec. 4.5*).
2. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
3. **Calculated Stroke Rate:** Indicates the calculated stroke speed of the pump (0-59 SPH, 0-120 SPM) based on the analog set points and measured current.
4. **Measured Current:** Measured current value (0-24.0 mA).
5. **Theoretical Flow:** The theoretical flow based on calculated stroke speed, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

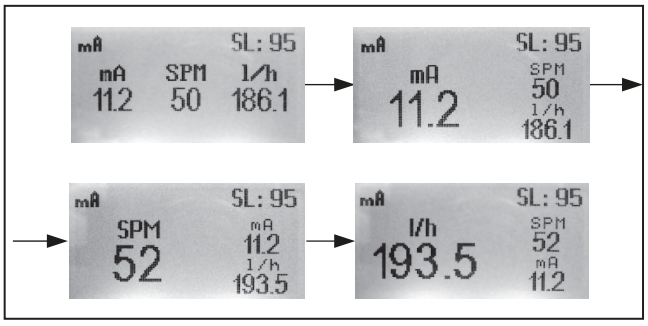
NOTE:

The pump will display the calculated stroke rate and theoretical flow with the pump ON and OFF.

A >mA fault (see Sec. 4.5) will be indicated if the 4-20mA input exceeds 21.5mA.

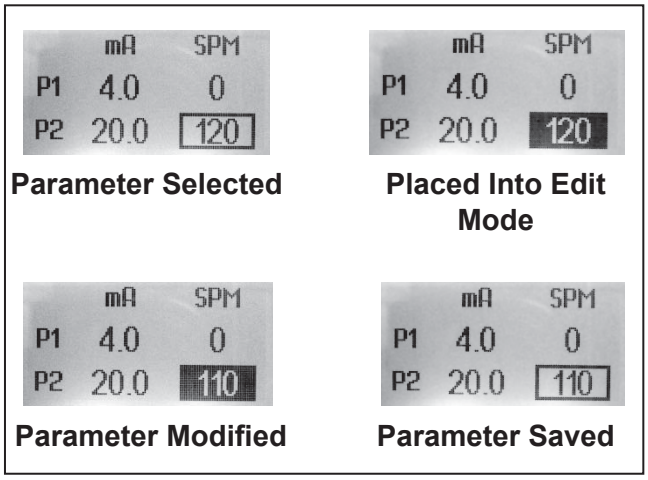
The pump will not stroke if the 4-20ma input signal is 0.5mA or less.

Depressing the ▲ UP and ▼ DOWN buttons simultaneously will cycle through alternate display formats, as shown below:



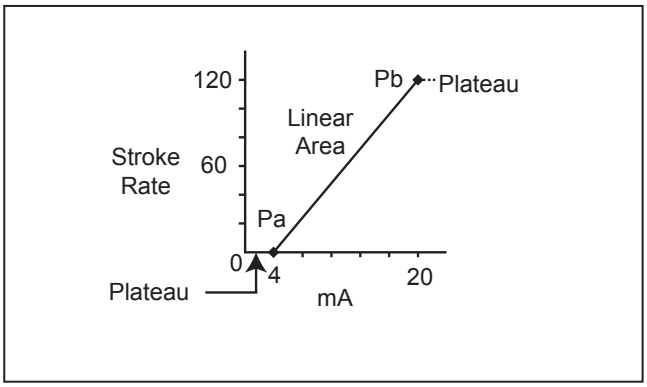
5.4.1 Programming the Analog Mode Response Curve

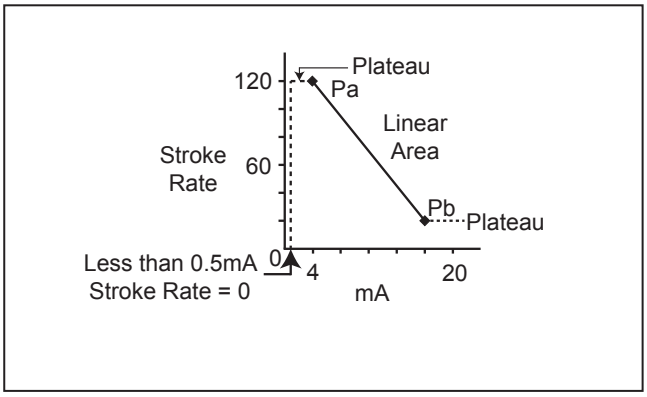
Use the ▲ UP or ▼ DOWN button to move the selection box to the parameter you wish to change. Use the ⏻ POWER button to toggle to the parameter's edit mode - a black background indicates the parameter is in edit mode. While in edit mode, use the ▲ UP and ▼ DOWN buttons to set the value. Use the ⏻ POWER button to exit edit mode and save the setting.



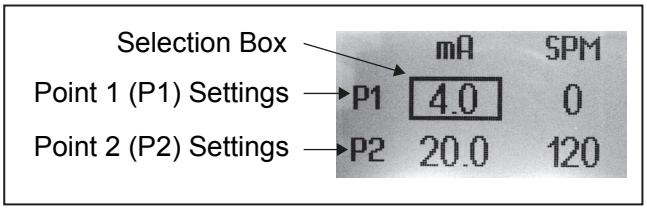
Use either the ▭ MODE button or navigate using the ▲ UP or ▼ DOWN buttons to exit the programming mode. The valid range for the mA value is 0.0 to 20.0 mA. The valid range for the SPM value is 0 to 120 SPM or 0-59 SPH.

The programming of points P1 and P2 when plotted will result in a graph similar to one of the 2 charts below (Pa = lowest programmed mA value; Pb = highest programmed mA value). The pump will vary its stroke speed linearly between points Pa and Pb based on the mA input signal. If the mA input signal exceeds Pb, the stroke speed will remain (plateau) at the speed corresponding to Pb. If the mA input drops to less than Pa, the stroke speed will remain (plateau) at the speed corresponding to Pa. Regardless of settings, if the mA input drops to 0.5 mA or below, the pump will stop stroking.





Display Overview:



1. **Selection Box:** indicates the currently selected item.
2. **Point 1 (P1) Settings:** the settings (mA and stroke rate) corresponding to set point P1.
3. **Point 2 (P2) Settings:** the settings (mA and stroke rate) corresponding to set point P2.

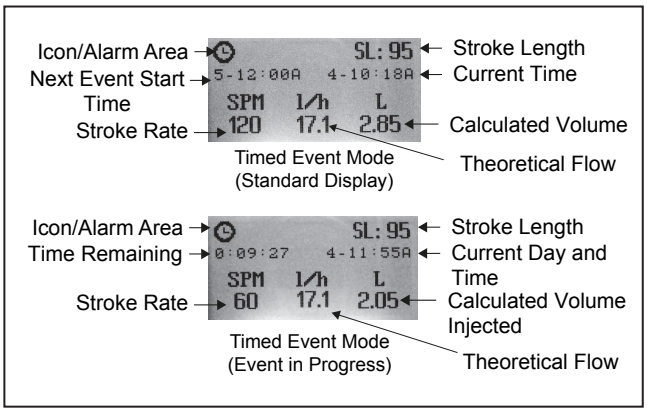
NOTE :

Parameter changes are saved when editing is complete and go into effect immediately.

5.5 TIMED EVENT MODE (INTERNAL)

With the pump OFF, press the ▲ UP or ▼ DOWN button to view and/or program the timed events (*see Section. 5.5.1*). To turn the pump ON or OFF, push the ⏻ POWER button or toggle the remote ON/OFF. The I Pump ON/OFF LED will illuminate green when the pump is ON.

Display Overview:



1. **Icon/Alarm Area:** The ◷ icon indicates the pump is in the Timed Event mode. Depending on advanced pump configuration options and any alarms/alerts detected, other icons may be present as well (*see Sec. 4.5*).
2. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
3. **Next Event Start Day and Time:** The Day and Time of the next timed event. See below for the displayed format. The '*' character in this field indicates that no events are enabled (*see Sec. 5.5.1 for event programming information*).
4. **Current Day and Time:** The current Day and Time (*see below for time format description*).
5. **Stroke Rate:** Indicates the stroke speed of the pump (1-59SPH or 1-120 SPM) for the currently running event or the next scheduled event.
6. **Theoretical Flow:** The theoretical flow based on stroke speed, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).
7. **Calculated Volume:** The calculated volume based on event duration, stroke rate, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).
8. **Time Remaining (Event in Progress Only):** Remaining time of event.
9. **Calculated Volume Injected (Event in Progress Only):** The calculated volume based on strokes made, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

NOTE:

The displayed format for time is: D – H:MMx, where D = Day of Week (1-7), H = Hour (1-12), MM = Minute (0-59), x = A for AM or P for PM.

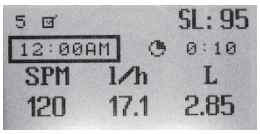
5.5.1 Programming Timed Events

One timed event may be programmed to execute for each of 7 days. Each event has a uniquely programmable start time, duration, and stroke rate.

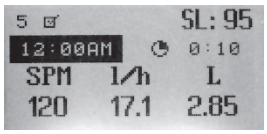
Use the ▲ UP or ▼ DOWN button to move the selection box to the parameter you wish to change. Use the ⏻ POWER button to toggle the parameter's edit mode. A black background indicates the parameter is in edit mode. The Event Enabled parameter will be toggled ON/OFF rather than going into an edit mode.

While in edit mode, use the ▲ UP and ▼ DOWN buttons to set the value. The valid range for the day value is 1-7. As the day value is changed, the start time, duration, and stroke rate will be updated to reflect the programming for the selected day. A checked event enabled box indicates that the currently displayed event is enabled. The valid range for the duration value is 1 minute to 24 hours. The valid range for the SPM value is 0 to 120 SPM or 0-59 SPH.

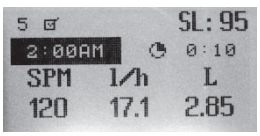
Use the ⏻ POWER button to exit the edit mode and save the setting. Use the ▭ MODE button to exit the programming mode.



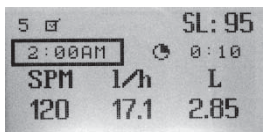
Parameter Selected



Placed Into Edit Mode

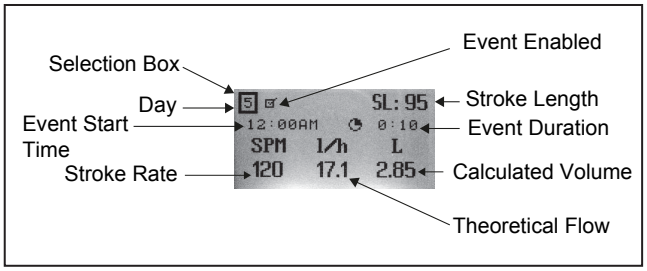


Parameter Modified



Parameter Saved

Display Overview:



1. **Selection Box:** Indicates the currently selected item.
2. **Day:** Day of currently displayed event.
3. **Event Enabled:** Indicates whether currently displayed event is enabled (checked = enabled).
4. **Stroke Length:** The numeric stroke length value indicates the current stroke length setting (in percent).
5. **Event Start Time:** The Day and Time of the next timed event (*see Sec. 5.5 for time format*).
6. **Event Duration:** Duration / Run-Time of currently displayed event (format Hours:Minutes).
7. **Stroke Rate:** Indicates the stroke speed of the pump (1-59SPH or 1-120 SPM) for the currently running event or the next scheduled event.
8. **Theoretical Flow:** The theoretical flow based on stroke speed, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).
9. **Calculated Volume:** The calculated based on event duration, stroke rate, stroke length, and calibration settings (*see Sec. 6.6 for calibration information*).

NOTE:

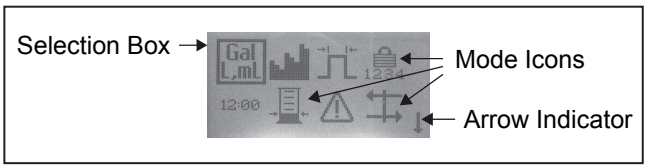
Parameter changes are saved when editing is complete and go into effect immediately.

After approximately 2 minutes of inactivity, the programming menu will automatically close and revert back to the main analog mode display.

SECTION 6 - ADVANCED CONFIGURATION MENU

Use the ▲ UP and ▼ DOWN buttons to select the desired mode. Push and hold the ⏻ POWER button for approximately 1 second to select the desired mode. Push and hold the MODE button for approximately 2 seconds to exit the menu.

Display Overview:



1. **Mode Icons:** Each icon represents a different control mode, as follows:
   - = Set Units (Sec. 6.1)
   - = Set Batch Mode (Sec. 6.2)
   - = Set Pulse Width (Sec. 6.3)
   - = Set Lock Mode Configuration (Sec. 6.4)
   - = Set Clock (Sec. 6.5)
   - = Calibrate Pump (Sec. 6.6)
   - = Set Alarm / Internal-External Output (Sec. 6.7)
   - = Set Remote Internal-External Mode Input (Sec. 6.8)
   - = Digi-Pulse™ Setup (Sec. 6.9)
   - = Set Percent-of-Time Operation (Sec. 6.10)
   - = Load Factory Defaults (Sec. 6.11)
   - = View Pump Information (Sec. 6.12)
2. **Selection Box:** Indicates the currently selected item.
3. **Arrow Indicator:** An arrow appearing on the upper or lower right of the display indicates that more icons are available via scrolling.

NOTE:

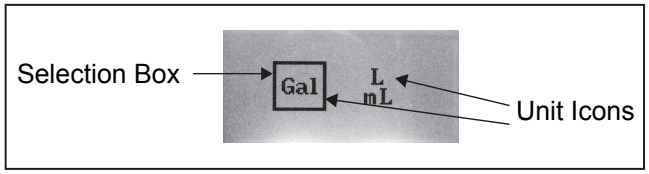
Parameter changes are saved when editing is complete and go into effect immediately.

After approximately 2 minutes of inactivity, the mode selection menu will automatically close and revert back to the most recent control mode display.

6.1 SET UNITS

Use the ▲ UP and ▼ DOWN buttons to select the desired units. Push the ⏻ POWER button to selected the item and return to the advanced configuration menu.

Display Overview:

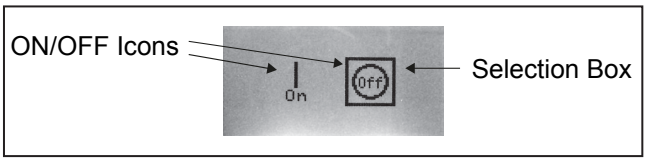


1. **Unit Icons:**
   - Gal = English Units (i.e. Gallons per hour - GPH).
   - L / mL = Metric Units (i.e. Liters, milliliters).
2. **Selection Box:** Indicates the currently selected item.

6.2 SET BATCH MODE

Batch mode applies only to the Pulse Multiply Mode (*see Section. 5.2*). Use the ▲ UP and ▼ DOWN buttons to select On or Off. Push the ⏻ POWER button to select the item and return to the advanced configuration menu. Use the ▭ MODE button to return to the advanced configuration menu without saving changes.

Display Overview:

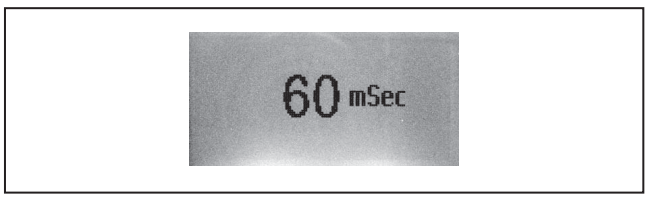


1. **ON/OFF Icons:**
   - On = Batch Mode ON (Stroke counter will accumulate when pulses are detected during an existing pump cycle)
   - Off = Batch Mode OFF (Stroke counter will reset if a pulse is detected during an existing pump cycle)
2. **Selection Box:** Indicates the currently selected item.

6.3 SET PULSE WIDTH

Use the ▲ UP and ▼ DOWN arrows to change the value for the pulse width. The valid range is 4 mSec - 60 mSec (in 4 mSec increments). Push the ⏻ POWER button to save the value and return to the advanced configuration menu. Use the ▭ MODE button to return to the advanced configuration menu without saving changes.

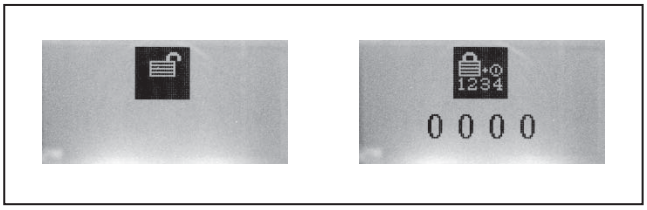
Display Overview:



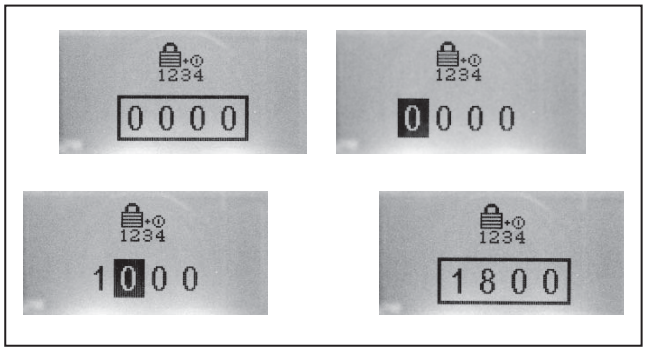
Pulse width (in milliseconds)

6.4 SET LOCK MODE CONFIGURATION

This menu is used to select the desired lock mode and to set the pass code; when you exit this menu, the lock is not activated (*see Sec. 4.4 to activate the lock*). Use the ▲ UP or ▼ DOWN button to select the desired parameter. Use the ⏻ POWER button to toggle to parameter's edit mode. A black background indicates the parameter is in edit mode. While in edit mode, use the ▲ UP and ▼ DOWN buttons to set the value. While setting the unlock pass code, use the POWER button to advance to the next digit, and the ▭ MODE button to go back to the prior digit. Use the ▭ MODE button to return to the advanced configuration menu.



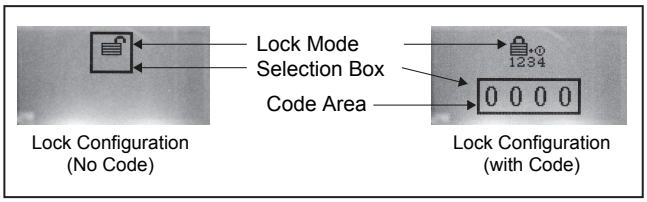
Example: Editing Lock Mode



Example: Editing Unlock Pass Code

SECTION 6 - ADVANCED CONFIGURATION MENU

Display Overview:



1. Lock Mode:

The icon corresponding to the current lock mode configuration.

= Always unlocked (default).

= All buttons locked out except the ⏻ POWER button.

= All buttons locked out.

= All buttons locked out except the ⏻ POWER button and an unlock pass code required to unlock pump.

= All buttons locked out and an unlock pass code required to unlock pump.

2. Code Area (on appropriate lock modes only): Displays 4-digit unlock pass code.

3. Selection Box: Indicates the currently selected item.

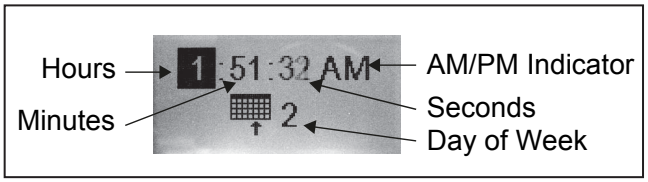
NOTE:

Make note of the pass code you have selected. This will be required to unlock the pump. If the pass code is misplaced and the lock is activated, the pump must be returned to the factory in order to be reset (see Section 4.4 to unlock the pump).

6.5 12:00 SET CLOCK

The clock will only be displayed when operating in Timed Event Mode (*see Sec. 5.5*). Use the ▲ UP or ▼ DOWN button to edit the highlighted parameter. Use the ⏻ POWER button to advance to the next parameter. Use the ▭ MODE button to go back to the prior parameter.

Display Overview:



1. Hours (1-12).
2. Minutes (0-59).
3. Seconds (0-59).
4. AM/PM Indicator (AM or PM).
5. Day of Week (1-7).

6.6 PUMP CALIBRATION

Pump calibration will increase the accuracy of the various displayed flow rates and volumes. In Single-Point Calibration (*see first diagram below*), the pump is calibrated to a specific stroke length and flow rate (P1), changing the slope of the flow line as indicated in the diagram. The "Calibration Region" extends to +/- 10% of the calibrated stroke length. As a result, the Single-Point Calibration should only be used if the stroke-length is to be maintained within 10% of the calibration setting.

In Two-Point Calibration (*see second diagram below*), the pump is calibrated to two specific stroke length and flow rate combinations (Pa and Pb), changing the slope and the offset of the flow line as indicated in the diagram. Pa and Pb stroke lengths must differ by at least 10%. The "Calibration Region" extends from -10% of Pa to +10% of Pb stroke lengths. The Two-Point Calibration will always result in a larger "Calibration Region" than the Single-Point Calibration.

When a pump has been calibrated, the 1 or 2 icon is displayed in the Icon/Alarm area of the display (*see Sec. 4.5*). If the stroke length is adjusted outside the calibration region, the **SL** alarm icon will be displayed in the Icon/Alarm area of the display.

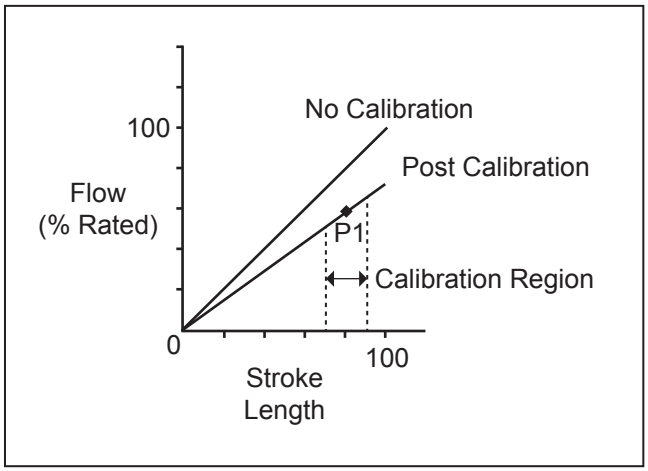


Figure 2. Single-Point Calibration

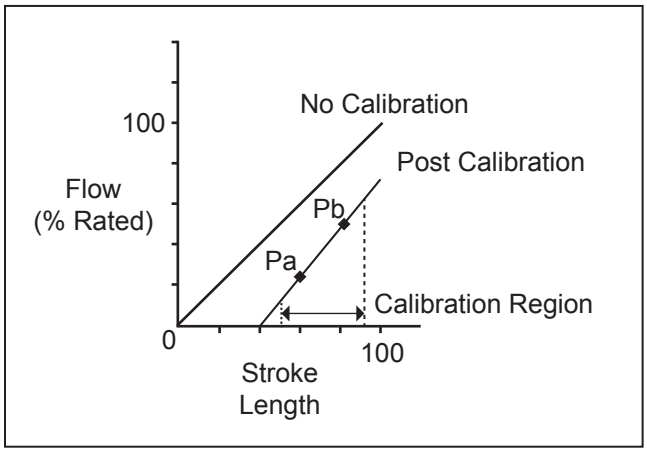
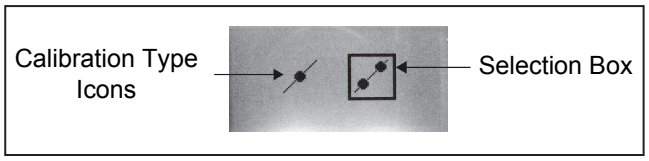


Figure 3. Two-Point Calibration

Use the ▲ UP or ▼ DOWN button to select the desired calibration mode. Use the ⏻ POWER button to select the mode (*see Sec. 6.6.1 for single-point calibration procedure or Sec. 6.6.2 for two-point calibration procedure*). Use the ▭ MODE button to return to the advanced configuration menu without making changes.

Display Overview:



1. **Calibration Type Icons:** The icons corresponding to the following calibration types:

   = Single-Point Calibration

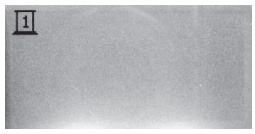
   = Two-Point Calibration
2. **Selection Box:** Indicates the currently selected item.

6.6.1 Single-Point Calibration Procedure

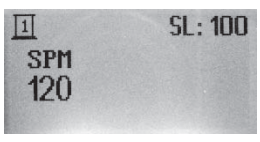
During calibration, accuracy improves as stroke count increases. As a result, a minimum of 100 strokes should be used to calibrate the pump. The maximum number of strokes in the calibration process is 9999. The stroke length cannot be changed during calibration step 3 below. If the stroke length is changed, a **SL** error icon will display, the pump will stop, and the stroke count and pump output will be reset to zero. Stroke speed may only be adjusted in step 2. In general, the ⊟ MODE button may be used to step back in the calibration procedure.

Procedure:

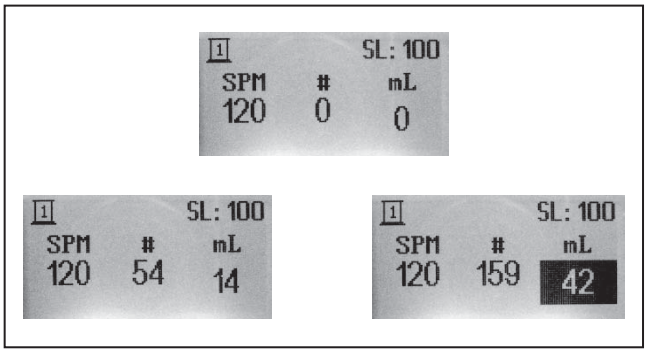
1. Upon selecting single-point calibration, the [1] icon will be displayed indicating that pump is ready to begin calibration.



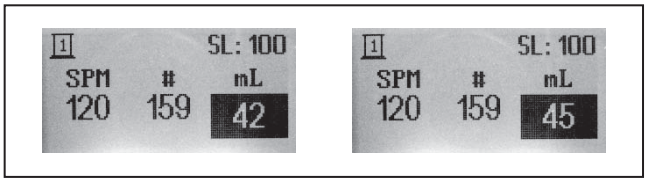
2. Press the ⏻ POWER button. The pump will begin pulsing. Adjust the stroke length knob to the desired setting for calibration. Use the ▲ UP or ▼ DOWN buttons to adjust the stroke speed to the desired setting for calibration. Press the ⏻ POWER button when adjustments are complete. The pump will stop pulsing.



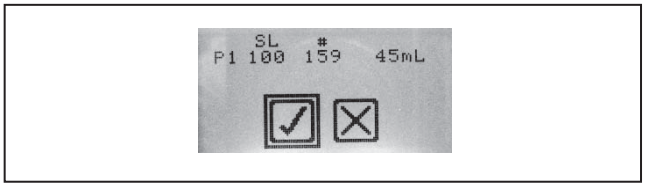
3. Press the ⏻ POWER button to begin calibration of the pump. The pump will start pulsing. The display will begin counting the strokes and displaying the accumulated volume. The volume displayed is based upon the pre-existing settings. Press the ⏻ POWER button when the desired number of strokes has occurred.



4. Use the ▲ UP or ▼ DOWN buttons to edit the highlighted volume as necessary. Press the ⏻ POWER button when complete.



5. Use the ▲ UP or ▼ DOWN buttons to select whether to ☑ (Save) or ☒ (abandon) the displayed calibration settings. Press the ⏻ POWER button to accept the selection and then return to the main calibration menu.

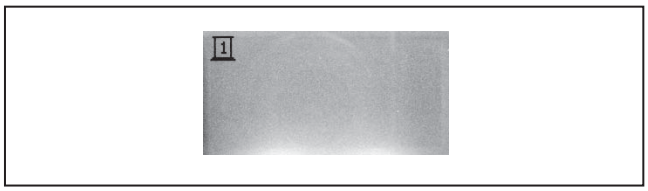


6.6.2 Two-Point Calibration Procedure

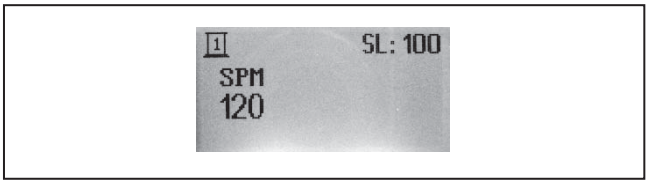
During calibration, accuracy improves as stroke count increases. As a result, a minimum of 100 strokes should be used to calibrate the pump. The maximum number of strokes in the calibration process is 9999. The stroke length cannot be changed during calibration steps 3 and 7. If the stroke length is changed, a **SL** error icon will display, the pump will stop, and the stroke count and pump output will be reset to zero. Stroke speed may only be adjusted in calibration steps 2 and 6. In general, the MODE button may be used to move back in the calibration procedure.

Procedure:

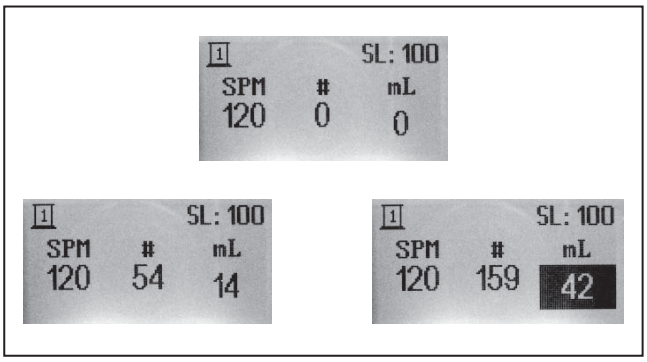
1. Upon selecting two-point calibration, the 1 icon will be displayed indicating that the pump is ready to begin calibration of point one.



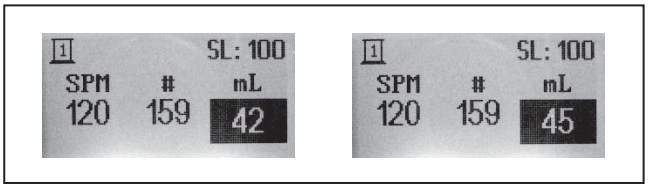
2. Press the POWER button. The pump will begin pulsing. Adjust the stroke length knob to the desired setting for calibration of point 1. Use the UP or DOWN buttons to adjust the stroke speed to the desired setting for calibration of point 1. Press the POWER button when adjustments are complete. The pump will stop pulsing.



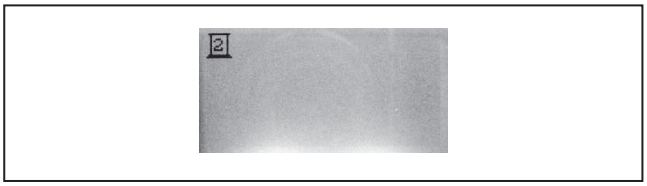
3. Press the POWER button to begin the calibration of point 1. The pump will start pulsing. The display will begin counting the strokes and displaying the accumulated volume. The volume displayed is based upon the pre-existing settings. Press the POWER button when the desired number of strokes has occurred.



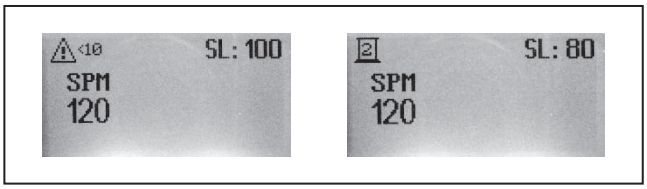
4. Use the UP or DOWN buttons to edit the highlighted volume as necessary. Press the POWER button when complete.



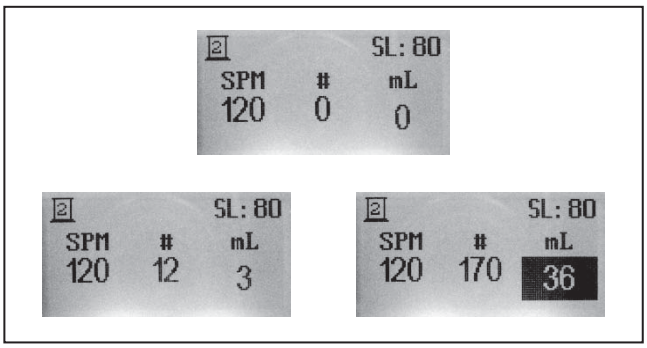
5. The 2 icon will now be displayed, indicating that the pump is ready to begin calibration of point two.



6. Press the ⏻ POWER button. The pump will begin pulsing. Adjust the stroke length knob to the desired setting for calibration of point 2. Use the ▲ UP or ▼ DOWN buttons to adjust the stroke speed to the desired setting for calibration of point 2. Press the ⏻ POWER button when adjustments are complete. The pump will stop pulsing. The two stroke length settings must be at least 10% apart. If not, a <10 error icon will display.



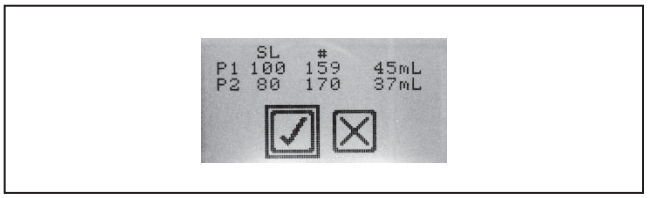
7. Press the ⏻ POWER button to begin calibration of point 2. The pump will start pulsing. The display will begin counting the strokes and displaying the accumulated volume. The volume displayed is based upon the pre-existing settings. Press the ⏻ POWER button when the desired number of strokes has occurred.



8. Use the ▲ UP or ▼ DOWN buttons to edit the highlighted volume as necessary. Press the ⏻ POWER button when complete.



9. Use the ▲ UP or ▼ DOWN buttons to select whether to ☑ (Save) or ☒ (abandon) the displayed calibration settings. Press the ⏻ POWER button to accept the selection and then return to the main calibration menu.

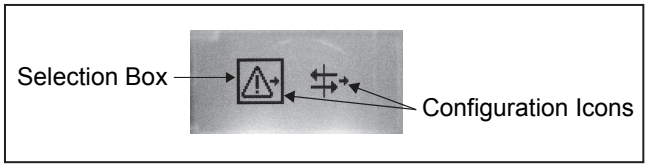


6.7 ⚠ CONFIGURE ALARM OUTPUT

This feature is used to configure the alarm output, which is indicated on the appropriate contacts of the 6-Pin connector. The alarm output can be configured in one of two ways: it can be used to indicate the alarm status or it can be used to indicate whether the pump is in an internal or external control mode. If the alarm output is configured to indicate the alarm status, then open contacts indicate that there is no alarm. When an alarm is active, the contacts will be closed. If the alarm output is configured to indicate the internal external mode status, then open contacts indicates the pump is in an internal mode; closed contacts indicates the pump is in an external mode.

Use the ▲ UP or ▼ DOWN button to select the desired configuration. Use the ⏻ POWER button to select the configuration. If alarm output indicates alarm status is selected, the Alarm Output Mask configuration menu will display next (*see Sec. 6.7.1*). Use the ▭ MODE button to return to the advanced configuration menu without making changes.

Display Overview:



1. **Configuration Icons:**

   ⚠→ = Alarm output indicates alarm status.

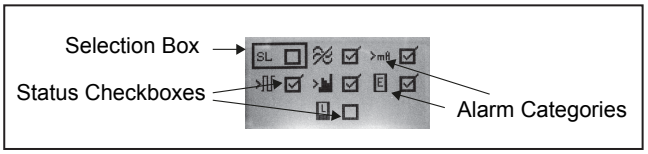
   ⇄→ = Alarm output indicates Internal/External Mode status.

2. **Selection Box:** Indicates the currently selected item

6.7.1 Configure Alarm Output Mask

Use the ▲ UP or ▼ DOWN button to select the desired alarm to enable/disable. Use the ⏻ POWER button to toggle the associated status check box. Use either the ▭ MODE button or navigate using the ▲ UP or ▼ DOWN buttons to save the data and return to the configure alarm output menu.

Display Overview:



1. **Alarm Categories** (*see Sec. 4.5 for descriptions of each alarm condition*)

   SL = Stroke length alarm.

   = DIGI-PULSE™ flow switch alarm.

   = Analog input alarm.

   = Incoming pulse rate alarm.

   = Batch alarm.

   E = Empty tank alarm.

   L = Low tank alarm.

2. **Status Check boxes:** Indicates if the alarm output will be enabled (checked) or ignored (unchecked) when the associated alarm condition is detected.
3. **Selection Box:** Indicates the currently selected item.

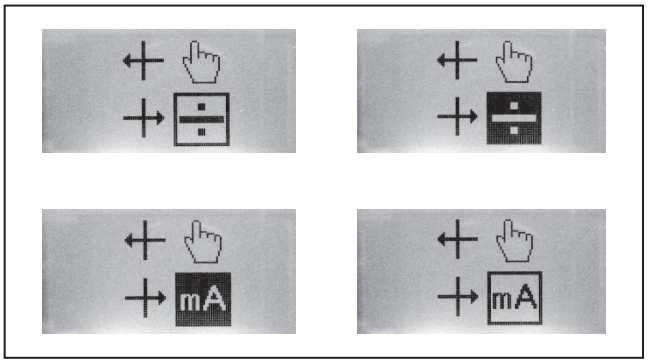
6.8 SET REMOTE INTERNAL-EXTERNAL MODE INPUT

This feature is used to switch from an internal control mode to an external control mode remotely by using the appropriate contacts of the 6-Pin connector. There are two internal control modes and 3 external control modes (*see Sec. 5.0*). The remote internal/external inputs are only monitored when the contacts are switched from open to closed, or vice versa. As a result, the control mode can always be changed from the pump, regardless of the closure status of these contacts.

If the pump is in an internal mode and the contacts on the remote internal/external input are closed, the pump will switch to the programmed external mode. If the pump is in an external mode and the contacts are opened, the pump will switch to the programmed internal mode.

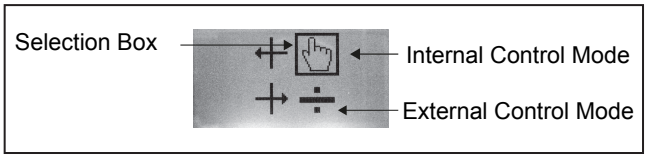
If the pump is in an internal mode and the contacts are opened, no action will be taken-the pump will remain in the pre-existing control mode. In this case, if the pre-existing control mode differs from the programmed control mode, the pre-existing control mode takes priority. Conversely, if the pump is in an external mode and the contacts are closed, no action will be taken.

Use the ⏻ POWER button to toggle to parameter's edit mode. A black background indicates the parameter is in edit mode. While in edit mode, use the ▲ UP and ▼ DOWN buttons to set the value. Use the POWER button to exit edit mode and save the setting. Use the ▭ MODE button to return to the advanced configuration menu.



Example: Editing the External Control Mode Parameter

Display Overview:

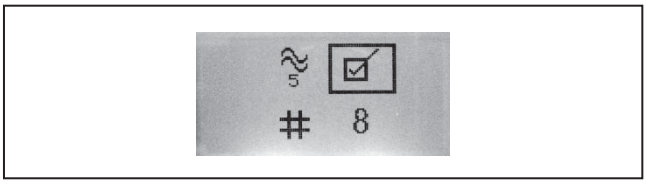


1. **Internal Control Mode:** The following are valid internal type control modes:
   - = Manual
   - = Timed Event
2. **External Control Mode:** The following are valid external type control modes:
   - = Pulse Multiply
   - = Pulse Divide
   - mA = Analog (mA)
3. **Selection Box:** Indicates the currently selected item.

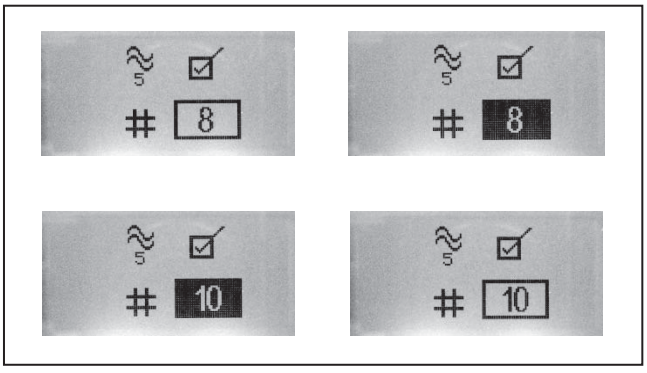
6.9 DIGI-PULSE™ FLOW MONITORING SETUP

This feature is used in conjunction with the LMI® Series FM-ROY-9 Digi-Pulse™ Flow Monitor (refer to DIGI-PULSE™ Flow Monitor Instructions P/N 1865). This device is designed to monitor the output flow from a pump. It may be set to deliver a pulse signal output for each successful pump stroke registered. If the flow stops or lessens, the pulse outputs will cease. With the FMROY- 9 connected to the 4-Pin connector, the presence or lack of pulses can be detected.

Use the ▲ UP or ▼ DOWN button to select the icon. Use the ⏻ POWER button to toggle the Function Enabled Indicator. Use the ⏻ POWER button to toggle the Missing Pulses parameter's edit mode. While in edit mode, use the ▲ UP and ▼ DOWN buttons to set the value. Use the ▭ MODE button to return to the advanced configuration menu.

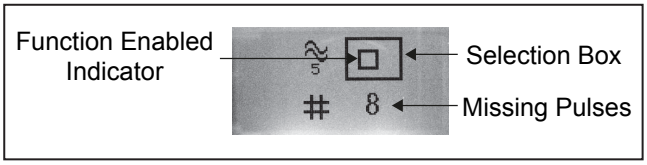


Example: Enabling the Function



Example: Editing the Missing Pulses Parameter

Display Overview:

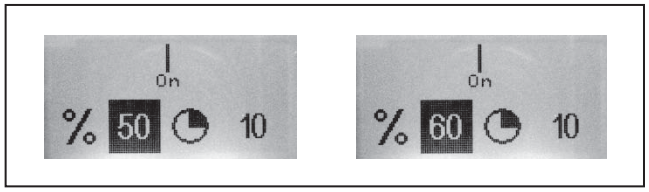


1. **Function Enabled Indicator:** Check box indicating if DIGI-PULSE™ Flow Monitoring functionality is enabled (checked=enabled).
2. **Missing Pulses:** Number of missing pulses to detect before issuing pump alarm. The valid range is 0-255. The factory default is 8. A setting of 1 is the most sensitive; a setting of 255 is the least sensitive.
3. **Selection Box:** Indicates the currently selected item.

When flow monitoring is enabled, the icon is displayed in the Icon/Alarm area of the display (*see Sec. 4.5*). If, for example, the Missing Pulses parameter is set to 5 and 5 strokes of the pump occur without any pulse being received from the FM-ROY-9, the alarm icon will be displayed in the Alarm/Icon area of the display (*see Sec. 4.5*). The pump will stop and the alarm outputs will be activated, if enabled (*see Sec. 6.7*). Pressing the ⏻ POWER button clears the alarm.

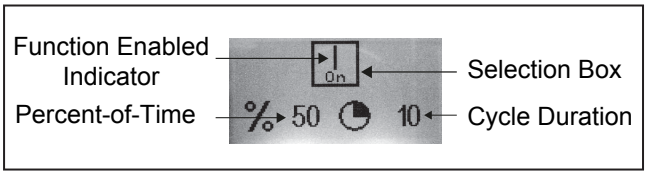
6.10 % SET PERCENT-OF-TIME OPERATION

This feature allows time-based cycling of the pump in Manual, Pulse Divide, and Analog Control Modes. The pump cycles on and off based on the configuration parameters. Use the ▲ UP or ▼ DOWN button to select the % icon. Use the ⏻ POWER button to toggle the Function Enabled Indicator. Use the ⏻ POWER button to toggle the parameter's edit mode (Percent of Time and Cycle Duration parameters). While in edit mode, use the ▲ UP and ▼ DOWN buttons to set the value. Use the ▭ MODE button to return to the advanced configuration menu.



Example: Editing Percent-of-Time Parameter

Display Overview:



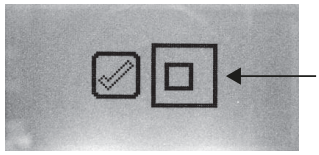
1. **Function Enabled Indicator:** Indicates if Percent-of-Time functionality is enabled.
   (Off) = Function OFF / Disabled.
   On = Function ON / Enabled.
2. **Percent of Time (Function ON only):** Percent of time cycle to enable pump stroking (0-100).
3. **Cycle Duration (Function ON only):** Total cycle time in minutes (1-1440).
4. **Selection Box:** Indicates the currently selected item.

For example, if % = 20 and ◔ = 10, then the pump will cycle continuously as follows: run for 2 minutes, stop for 8 minutes. When this feature is enabled, the % icon is displayed in the Icon/Alarm area of the display (*see Sec. 4.5*).

6.11 LOAD FACTORY DEFAULTS

This feature will return the pump parameters to their factory default settings. Push the ⏻ POWER button to highlight the confirmation box. Push the ▲ UP or ▼ DOWN button to check or uncheck the box. Push the ⏻ POWER button to load factory defaults and return pump to default state (*see Sec. 4.0*). Use the ▭ MODE button to return to the advanced configuration menu without saving changes.

Display Overview:

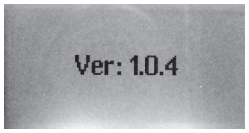


1. **Confirmation Box:** Check this box to confirm operation

6.12 VIEW PUMP INFORMATION

This feature displays the pump firmware version. Use the ▭ MODE button to return to the advanced configuration menu.

Display Overview:



We are a proud member of Accudyne Industries, a leading global provider of precision-engineered, process-critical, and technologically advanced flow control systems and industrial compressors. Delivering consistently high levels of performance, we enable customers in the most important industries and harshest environments around the world to accomplish their missions.

Accudyne INDUSTRIES LLC

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Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.

ZOELLER® PUMP COMPANY

Zoeller Family of Water Solutions™

SECTION: 2.15.020
FM2778
0515
Supersedes
0315

TECHNICAL DATA SHEET

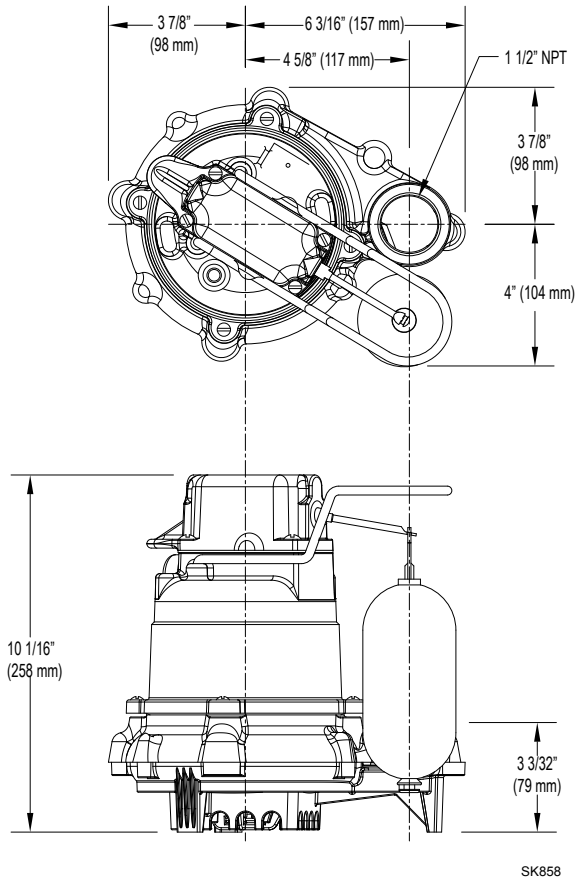
MIGHTY-MATE SERIES

Cast Iron Models 53, 57 and Bronze Models 55, 59
Submersible Effluent / Dewatering Pumps

PRODUCT SPECIFICATIONS

MOTOR	Horse Power	3/10
	Voltage	115 or 230
	Phase	1 Ph
	Hertz	60 Hz
	RPM	1550
	Type	Shaded pole
	Insulation	Class B
	Amps	4.8 - 9.7
PUMP	Operation	Automatic or nonautomatic
	Auto On/Off Points	7-1/4" (18.4 cm) / 3" (7.6 cm)
	Discharge Size	1-1/2" NPT
	Solids Handling	1/2" (12 mm) spherical solids
	Cord Length	9' (3 m) automatic, 15' (5 m) nonautomatic
	Cord Type	UL listed, 3-wire, grounded plug
	Max. Head	19.25' (5.9 m)
	Max. Flow Rate	43 GPM (163 LPM)
	Max. Operating Temp.	130° F (54° C)
	Cooling	Oil filled
	Motor Protection	Auto reset thermal overload
MATERIALS	Cap	Cast iron or bronze
	Motor Housing	Cast iron or bronze
	Pump Housing	Cast iron or bronze
	Base	Cast iron, bronze or engineered thermoplastic
	Upper Bearing	Sleeve bearing
	Lower Bearing	Sleeve bearing
	Mechanical Seals	Carbon and ceramic
	Impeller Type	Non-clogging vortex
	Impeller	Plastic, cast iron or bronze
	Hardware	Stainless steel
	Motor Shaft	AISI 1215 cold rolled steel
	Gasket	Neoprene

NOTE: See model comparison chart for specific details.



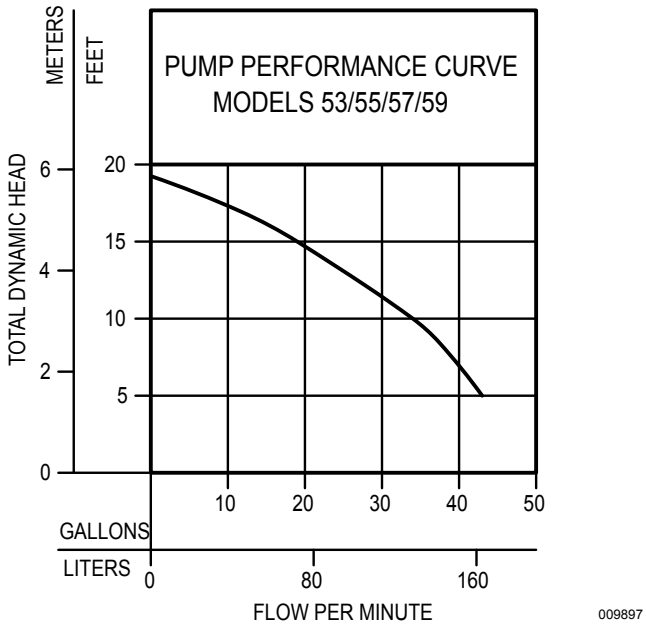
Tested to Standard UL778 and Certified to CSA Standard C22.2 No. 108

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502-778-2731 | 800-928-7867 | 3649 Cane Run Road | Louisville, KY 40211-1961 | www.zoeller.com

TOTAL DYNAMIC HEAD FLOW PER MINUTE

MODEL		53/55/57/59	
Feet	Meters	Gal.	Liters
5	1.5	43	163
10	3.0	34	129
15	4.6	19	72
Shut-off Head:		19.25 ft.(5.9m)	



Model	MODEL COMPARISON										
	Seal	Mode	Volts	Ph	Amps	HP	Hz	Lbs	Kg	Simplex	Duplex
M53/M55	Single	Auto	115	1	9.7	3/10	60	23	10	1	---
N53/N55	Single	Non	115	1	9.7	3/10	60	23	10	2	3 & 4
* BN53	Single	Auto	115	1	9.7	3/10	60	25	11	*	---
* BE53/BE57	Single	Auto	230	1	4.8	3/10	60	24 / 30	11 / 13	*	---
D53	Single	Auto	230	1	4.8	3/10	60	23	10	1	---
E53/E55	Single	Non	230	1	4.8	3/10	60	22	10	2	3 & 4
M57/M59	Single	Auto	115	1	9.7	3/10	60	29 / 33	13 / 15	1	---
N57/N59	Single	Non	115	1	9.7	3/10	60	28 / 29	12 / 13	2	3 & 4
* BN57	Single	Auto	115	1	9.7	3/10	60	30	13	*	---
D57/D59	Single	Auto	230	1	4.8	3/10	60	30 / 33	13 / 15	1	---
E57/E59	Single	Non	230	1	4.8	3/10	60	28 / 29	12 / 13	2	3 & 4
E59	Single	Non	230	1	4.8	3/10	60	29	13	2	3 & 4

* Single piggyback switch included.

SPECIAL MODEL FEATURES

Additional cord lengths are available in 15' (5 m), 25' (8 m) and 35' (11 m). 50' (15 m) cord lengths available for 230 V units only.

BE and BN models include a piggyback variable level pump switch.

Model 53: cast iron switch case, motor and pump housing, a plastic impeller and base. Model 57: all cast iron construction with a cast iron impeller. Model 55: bronze switch case, motor and pump housing, a plastic impeller and base. Model 59: bronze construction with a bronze impeller.

Optional pump stand (P/N 10-2421).

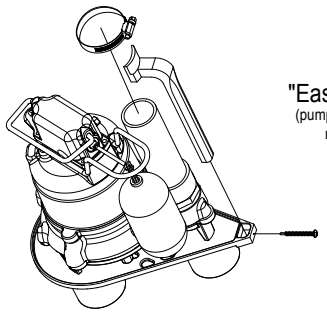
SELECTION GUIDE

1. Integral float-operated mechanical switch, no external control required.
2. Single piggyback variable level float switch or double piggyback variable level float switch. Refer to FM0477.
3. See FM0712 for correct model of Electrical Alternator.
4. Variable level control switch 10-0743 used as a control activator with electrical alternator (3) or (4) float system.

OPTIONAL PUMP STAND P/N 10-2421

- Reduces potential clogging by debris
- Replaces rocks or bricks under the pump
- Made of durable, noncorrosive ABS
- Raises pump 2" (5 cm) off bottom of basin
- Provides the ability to raise intake by adding sections of 1½" or 2" (DN40 or DN50) PVC piping
- Attaches securely to pump
- Accommodates sump, dewatering and effluent applications

NOTE: Make sure float is free from obstruction.



"Easy assembly"
(pump & discharge pipe not included.)

⚠ CAUTION All installation of controls, protection devices and wiring should be done by a qualified licensed electrician. All electrical and safety codes should be followed including the most recent National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

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Notice to installing contractor: Instructions must remain with installation.

Your Peace of Mind is Our Top Priority®

SECTION: 6.10.002
FM2676
1011
Supersedes
New

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.

ZOELLER®
PUMP COMPANY
Zoeller Family of Water Solutions™

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(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

visit our web site: www.zoeller.com

NOTICE: VENT HOLE FOR CHECK VALVE SEE #3 IN CAUTION SECTION BELOW AND #4 ON PAGE 3

INSTALLATION INSTRUCTIONS
RECOMMENDED MODELS

DATE INSTALLED:
MODEL NUMBER:

P/N 151797

EFFLUENT*/SUMP/DEWATERING	SEWAGE
49 / 53 / 57 Series, 98 Series	264 Series
137 Series, 151 / 152 / 153 Series	266 / 267 / 268 Series

* Effluent systems should specify that pumps should not handle solids exceeding ¾" in order to prevent large solids from entering leeching fields, mound systems, etc. (Model 49 and 70 Series have 3/8" solids capability. 50, 90, 140, 145/4145, 151, 371 and 372 Series have ½", 130 Series has 5/8", 152, 153 and 160/4160/180/4180 and 373 models have ¾".) Where code permits, sewage pumps can be used for effluent systems. Non-automatic pumps with external-level controls are recommended for septic tank effluent applications.

PREINSTALLATION CHECKLIST - ALL INSTALLATIONS

1. Inspect your pump. Occasionally, products are damaged during shipment. If the unit is damaged, contact your dealer before using. DO NOT remove the test plugs in the cover nor the motor housing.
2. Carefully read the literature provided to familiarize yourself with specific details regarding installation and use. These materials should be retained for future reference.

⚠ WARNING

SEE BELOW FOR LIST OF WARNINGS

1. Make certain that the receptacle is within the reach of the pump's power supply cord. DO NOT USE AN EXTENSION CORD. Extension cords that are too long or too light do not deliver sufficient voltage to the pump motor. But, more important, they could present a safety hazard if the insulation were to become damaged or the connection end were to fall into the sump.
2. Make sure the pump electrical supply circuit is equipped with fuses or circuit breakers of proper capacity. A separate branch circuit is recommended, sized according to the "National Electrical Code" for the current shown on the pump nameplate.
3. Testing for ground. As a safety measure, each electrical outlet should be checked for ground using an Underwriters Laboratory Listed circuit analyzer which will indicate if the power, neutral and ground wires are correctly connected to your outlet. If they are not, call a qualified licensed electrician.
4. For Added Safety. Pumping and other equipment with a 3-prong grounded plug must be connected to a 3-prong grounded receptacle. For added safety the receptacle may be protected with a ground-fault circuit interrupter. When a pump needs to be connected in a watertight junction box, the plug can be removed and spliced to the supply cable with proper grounding. For added safety this circuit may be protected by a ground-fault circuit interrupter. The complete installation must comply with the National Electrical Code and all applicable local codes and ordinances.
5. FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM ITS POWER SOURCE BEFORE HANDLING. Single phase pumps are supplied with a 3-prong grounded plug to help protect you against the possibility of electrical shock. DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE GROUND PIN. The 3-prong plug must be inserted into a mating 3-prong grounded receptacle. If the installation does not have such a receptacle, it must be changed to the proper type, wired and grounded in accordance with the National Electrical Code and all applicable local codes and ordinances. Three phase pumps require motor starting devices with motor overload protection. See FM0486 for duplex installations.
6. The tank is to be vented in accordance with local plumbing code. Pumps must be installed in accordance with the National Electrical Code and all applicable local codes and ordinances. Pumps are not to be installed in locations classified as hazardous in accordance with National Electrical Code, ANSI/NFPA 70.
7. "Risk of electrical shock" Do not remove power supply cord and strain relief or connect conduit directly to the pump.
8. Installation and servicing of electrical circuits and hardware should be performed by a qualified licensed electrician.
9. Pump installation and servicing should be performed by a qualified person.
10. Risk of electric shock - These pumps have not been investigated for use in swimming pool and marine areas.
11. According to the state of California (Prop 65), this product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

⚠ CAUTION

SEE BELOW FOR LIST OF CAUTIONS

1. Check to be sure your power source is capable of handling the voltage requirements of the motor, as indicated on the pump name plate.
2. The installation of automatic pumps with variable level float switches or nonautomatic pumps using auxiliary variable level float switches is the responsibility of the installing party and care should be taken that the tethered float switch will not hang up on the pump apparatus or pit peculiarities and is secured so that the pump will shut off. It is recommended to use rigid piping and fittings and the pit be 18" or larger in diameter.
3. Information - vent hole purpose. It is necessary that all submersible sump, effluent, and sewage pumps capable of handling various sizes of solid waste be of the bottom intake design to reduce clogging and seal failures. If a check valve is incorporated in the installation, a vent hole (approx. 3/16") must be drilled in the discharge pipe below the check valve and pit cover to purge the unit of trapped air. Trapped air is caused by agitation and/or a dry basin. Vent hole should be checked periodically for clogging. The 53 / 57, and 98 Series pumps have a vent located in the pump housing opposite the float, adjacent to a housing lug, but an additional vent hole is recommended. The vent hole on a High Head application may cause too much turbulence. You may not want to drill one. If you choose not to drill a vent hole, be sure the pump case and impeller is covered with liquid before connecting the pipe to the check valve and no inlet carries air to the pump intake. NOTE: THE HOLE MUST ALSO BE BELOW THE BASIN COVER AND CLEANED PERIODICALLY. Water stream will be visible from this hole during pump run periods.
4. Pump should be checked frequently for debris and/or build up which may interfere with the float "on" or "off" position. Repair and service should be performed by Zoeller Pump Company Authorized Service Station only.
5. Dewatering and effluent sump pumps are not designed for use in pits handling raw sewage.
6. Maximum operating temperature for standard model pumps must not exceed 130°F (54°C).
7. Pump models 266, 267, 268, and 137 must be operated in an upright position. Do not attempt to start pump when tilted or laying on its side.
8. Do not operate a pump in an application where the Total Dynamic Head is less than the minimum Total Dynamic Head listed on the Pump Performance Curves.

NOTE: Pumps with the "UL" mark and pumps with the "US" mark are tested to UL Standard UL778. CSA Certified pumps are certified to CSA Standard C22.2 No. 108.

REFER TO WARRANTY ON PAGE 2.

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Limited Warranty

Manufacturer warrants, to the purchaser and subsequent owner during the warranty period, every new product to be free from defects in material and workmanship under normal use and service, when properly used and maintained, for a period of three years from the date of original manufacture. Parts that fail within the warranty period, that inspections determine to be defective in material or workmanship, will be repaired, replaced or remanufactured at Manufacturer's option, provided however, that by so doing we will not be obligated to replace an entire assembly, the entire mechanism or the complete unit. No allowance will be made for shipping charges, damages, labor or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to and there shall be no warranty for any material or product that has been disassembled without prior approval of Manufacturer, subjected to misuse, misapplication, neglect, alteration, accident or act of God; that has not been installed, operated or maintained in accordance with Manufacturer's installation instructions; that has been exposed to outside substances including but not limited to the following: sand, gravel, cement, mud, tar, hydrocarbons, hydrocarbon derivatives (oil, gasoline, solvents, etc.), or other abrasive or corrosive substances, wash towels or feminine sanitary products, etc. in all pumping applications. The warranty set out in the paragraph above is in lieu of all other warranties expressed or implied; and we do not authorize any representative or other person to assume for us any other liability in connection with our products.

Contact Manufacturer at, 3649 Cane Run Road, Louisville, Kentucky 40211, Attention: Customer Service Department to obtain any needed repair or replacement of part(s) or additional information pertaining to our warranty.

MANUFACTURER EXPRESSLY DISCLAIMS LIABILITY FOR SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES OR BREACH OF EXPRESSED OR IMPLIED WARRANTY; AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND OF MERCHANTABILITY SHALL BE LIMITED TO THE DURATION OF THE EXPRESSED WARRANTY.

Some states do not allow limitations on the duration of an implied warranty, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

In those instances where damages are incurred as a result of an alleged pump failure, the Homeowner must retain possession of the pump for investigation purposes.

EASY DO'S & DON'T'S FOR INSTALLING A SUMP PUMP

1. DO read thoroughly all installation material provided with the pump.
2. DO inspect pump for any visible damage caused by shipping. Contact dealer if pump appears to be damaged.
3. DO clean all debris from the sump. Be sure that the pump will have a hard, flat surface beneath it. DO NOT install on sand, gravel or dirt.
4. DO be sure that the sump is large enough to allow proper clearance for the level control switch(es) to operate properly.
5. DO Always Disconnect Pump From Power Source Before Handling.
   DO always connect to a separately protected and properly grounded circuit.
   DO NOT ever cut, splice, or damage power cord (Only splice in a watertight junction box).
   DO NOT carry or lift pump by its power cord.
   DO NOT use an extension cord with a sump pump.
6. DO install a check valve and a union in the discharge line.
   DO NOT use a discharge pipe smaller than the pump discharge.
7. DO NOT use a sump pump as a trench or excavation pump, or for pumping sewage, gasoline, or other hazardous liquids.
8. DO test pump immediately after installation to be sure that the system is working properly.
9. DO cover sump with an adequate sump cover.
10. DO review all applicable local and national codes and verify that the installation conforms to each of them.
11. DO consult manufacturer for clarifications or questions.
12. DO consider a two pump system with an alarm where an installation may become overloaded or primary pump failure would result in property damages.
13. DO consider a D.C. Backup System where a sump or dewatering pump is necessary for the prevention of property damages from flooding due to A.C. power disruptions, mechanical or electrical problems or system overloading.
14. DO inspect and test system for proper operations at least every three months.

SERVICE CHECKLIST



⚠ WARNING ELECTRICAL PRECAUTIONS- Before servicing a pump, always shut off the main power breaker and then unplug the pump - making sure you are wearing insulated protective sole shoes and not standing in water. Under flooded conditions, contact your local electric company or a qualified licensed electrician for disconnecting electrical service prior to pump removal.

⚠ WARNING Submersible pumps contain oils which becomes pressurized and hot under operating conditions - allow 2½ hours after disconnecting before attempting service.

CONDITION	COMMON CAUSES
A. Pump will not start or run.	Check fuse, low voltage, overload open, open or incorrect wiring, open switch, impeller or seal bound mechanically, defective capacitor or relay when used, motor or wiring shorted. Float assembly held down. Switch defective, damaged, or out of adjustment.
B. Motor overheats and trips overload or blows fuse.	Incorrect voltage, negative head (discharge open lower than normal) impeller or seal bound mechanically, defective capacitor or relay, motor shorted.
C. Pump starts and stops too often.	Float tight on rod, check valve stuck or none installed in long distance line, overload open, level switch(s) defective, sump pit too small.
D. Pump will not shut off.	Debris under float assembly, float or float rod bound by pit sides or other, switch defective, damaged or out of adjustment.
E. Pump operates but delivers little or no water.	Check strainer housing, discharge pipe, or if check valve is used vent hole must be clear. Discharge head exceeds pump capacity. Low or incorrect voltage. Incorrect motor rotation. Capacitor defective. Incoming water containing air or causing air to enter pumping chamber.
F. Drop in head and/or capacity after a period of use.	Increased pipe friction, clogged line or check valve. Abrasive material and adverse chemicals could possibly deteriorate impeller and pump housing. Check line. Remove base and inspect.

If the above checklist does not uncover the problem, consult the factory - Do not attempt to service or otherwise disassemble pump. Service must be performed by Zoeller Authorized Service Stations. Go to www.zoellerpumps.com/servicestations **to find the Authorized Service Station in your area.**

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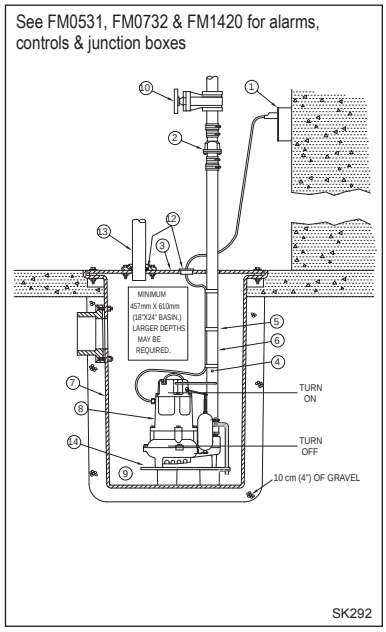
RECOMMENDED INSTALLATION FOR ALL APPLICATIONS

(1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.
(2) Install proper Zoeller unicheck (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head or below cover installation is required use 30-0164 on 1½" pipe, 30-0152 on 2" pipe and 30-0160 on 3" pipe. See (4) below.
(3) All installations require a basin cover to prevent debris from falling into the basin and to prevent accidental injury.
(4) When a Unicheck is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. *NOTE: THE HOLE MUST ALSO BE BELOW THE BASIN COVER AND CLEANED PERIODICALLY.* (High Head unit see #3 under "Caution" on front page). Water stream will be visible from this hole during pump run periods.
(5) Securely tape or clamp power cord to discharge pipe, clear of the float mechanism(s).
(6) Use full-size discharge pipe.
(7) Basin must be in accordance with applicable codes and specifications.
(8) Pump must be level and float mechanism(s) clear of sides of basin before starting pump.
(9) Basin must be clean and free of debris after installation.
(10) Gate Valve or Ball Valve to be supplied by installer and installed according to any and all codes.
(11) Locate float switches as shown in sketches. The best place for the "off" point is above the motor housing and positioned 180° from the inlet. Never put "off" point below discharge on pump (Sewage & Effluent only). *NOTE: FOR AUTOMATIC PUMPS, USE DEWATERING INSTALLATION SKETCH.*
(12) Gas tight seals required to contain gases and odors.
(13) Vent gases and odors to the atmosphere through vent pipe (Sewage & Dewatering only).
(14) Install Zoeller Pump Stand (Model 10-2421) under pump to provide a settling basin. (Effluent & Dewatering only.)

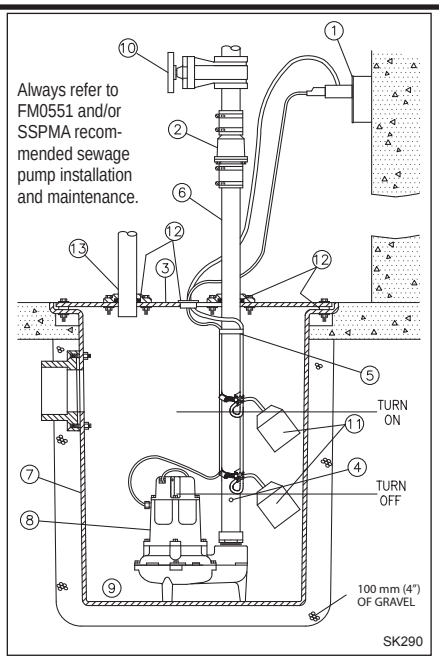
For Effluent Only:

(15) Wire pump to power through a Zoeller watertight junction box or watertight splice. ***NOTE: Watertight enclosure is a must in damp areas. See No. 8 on front page of FM0732.***
(16) Refer to SSPMA Effluent Sizing Manual for determining "on" - "off" switches.
(17) Septic tank risers must be used for easy pump and filter access.

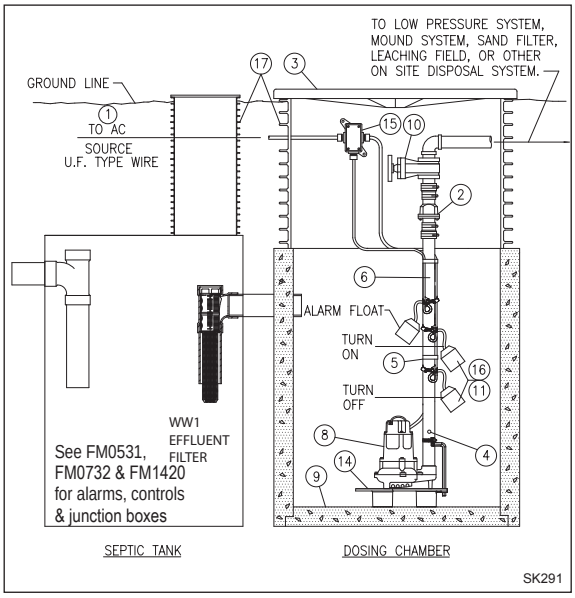
NOTE: Double seal pumps offer extra protection from damage caused by seal failure.



TYPICAL DEWATERING INSTALLATION



TYPICAL SEWAGE INSTALLATION



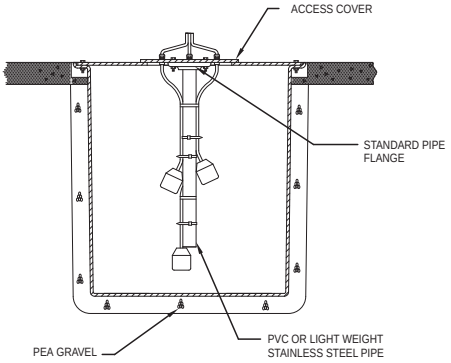
TYPICAL EFFLUENT INSTALLATION

All installations must comply with all applicable electrical and plumbing codes, including, but not limited to, National Electrical Code, local, regional, and/or state plumbing codes, etc. Not intended for use in hazardous locations.

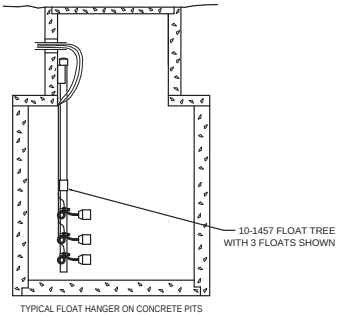
SUGGESTED METHODS OF FLOAT INSTALLATION

On some installations it may be desirable to install an independent hanger for the level control switches to avoid possible hang ups on the pumps, piping, valves, etc. Float hangers are available from Zoeller Company on Catalog Sheet FM0526 or can be fabricated from standard pipe and fittings.

TYPICAL FLOAT HANGER ON STEEL COVER PITS

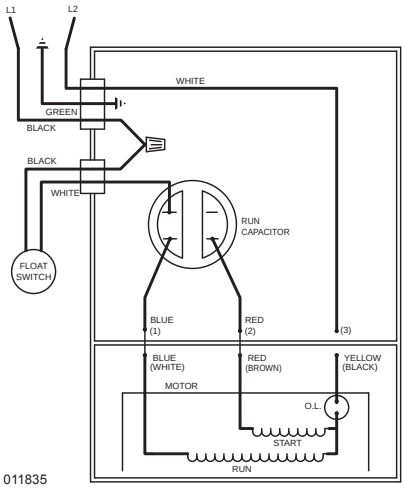


TYPICAL FLOAT HANGER ON CONCRETE PITS OR SEPTIC TANK RISERS



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WD & WH MODEL INSTALLATION



011835

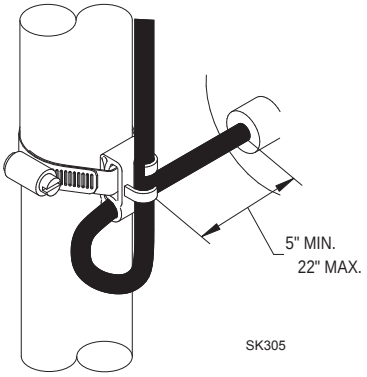
WIRING DIAGRAM FOR MODELS
WD - 230V, 1 Ph, 60 Hz.
WH - 200/208V, 1 Ph, 60 Hz.

Determining Pumping Range in Inches (1 inch - 2.5 cm)

Tether Length	5 min.	10	15	20	22 max.
Pumping Range	9	13.5	18	22	24

Use only as a guide. Due to weight of cable, pumping range above horizontal is not equal to pumping range below horizontal. Ranges are based on testing in nonturbulent conditions. Range may vary due to water temperature and cord shape. As tether length increases, so does the variance of the pumping range.

Models WD & WH are fully automatic. A float switch is included and factory wired in the pump circuit to provide automatic operation once the float switch is secured properly to the outlet pipe. Use the diagram above to secure the float switch properly and obtain the proper tether to customize the on-off cycle to each application.



20 AMP SWITCH (WD & WH MODELS)

Note: Failure to keep within proper tether limits may prevent reliable switch operation.

Note: Cable must be mounted in horizontal position.

SINGLE PHASE WIRING INSTRUCTIONS

⚠ WARNING FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM ITS POWER SOURCE BEFORE HANDLING. Single phase pumps are supplied with a 3-prong grounded plug to help protect you against the possibility of electrical shock. DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE GROUND PIN. The 3-prong plug must be inserted into a mating 3-prong grounded receptacle. If the installation does not have such a receptacle, it must be changed to the proper type, wired and grounded in accordance with the National Electrical Code and all applicable local codes and ordinances.

⚠ WARNING "Risk of electrical shock" Do not remove power supply cord and strain relief or connect conduit directly to the pump.

⚠ WARNING Installation and checking of electrical circuits and hardware should be performed by a qualified licensed electrician.

⚠ WARNING Units supplied without a plug (single and three phase) and single phase nonautomatic units with a 20 amp plug must have a motor control and liquid level control provided at time of installation. The control device should have suitable voltage, ampere, frequency, grounding and horsepower rating for the pump to which it is connected.

THREE PHASE WIRING INSTRUCTIONS

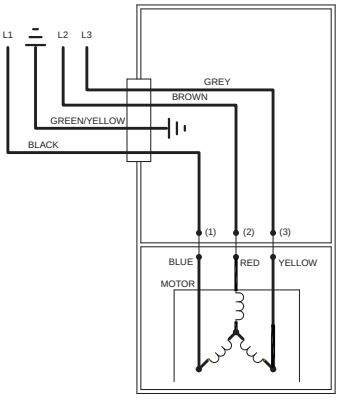
⚠ WARNING FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM ITS POWER SOURCE BEFORE HANDLING.

To automatically operate a nonautomatic three phase pump, a control panel is required. Follow the instructions provided with the panel to wire the system. For automatic three phase pumps see automatic 3 phase wiring diagram located to the far right.

Before installing a pump, check the pump rotation to ensure that wiring has been connected properly to power source, and that the green lead of power cord (See wiring diagram), is connected to a valid ground. Momentarily energize the pump, observing the directions of kick back due to starting torque. Rotation is correct if kick back is in the opposite direction of rotation arrow on the pump casing. If rotation is not correct, switching of any two power leads other than ground, should provide the proper rotation.

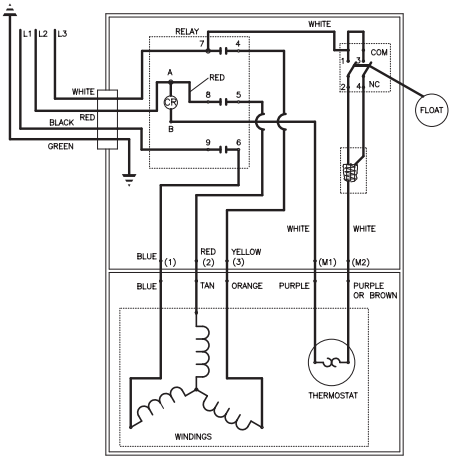
All three phase pumps require motor starting devices with motor overload protection. See FM0486 for duplex installations. Pumps must be installed in accordance with the National Electrical Code and all applicable local codes and ordinances. Pumps are not to be installed in locations classified as hazardous in accordance with National Electrical Code, ANSI/NFPA 70.

NONAUTOMATIC 3 PHASE



006848

AUTOMATIC 3 PHASE



013071

IMPORTANT NOTICE: Some insurance policies, both commercial and residential, extend coverage for damages incurred by product failure. You will need to have possession of the product to support your claim in most cases. Zoeller Pump Co. will exchange the unit or refund the original purchase price once the claim is settled with the insurer in the case where you need to retain possession of the product to support a damage claim you submit to your insurance company.

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Aviso al contratista instalador: Las instrucciones deberán permanecer con la instalación.

FM2676S

Your Peace of Mind is Our Top Priority®

La siguiente información sobre este producto refleja las condiciones existentes en la fecha de publicación. Se debe consultar a la fábrica cualquier discrepancia o inconsistencia que existiera.

ZOELLER® PUMP COMPANY

Zoeller Family of Water Solutions™

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FECHA DE INSTALACIÓN:
NÚMERO DE MODELO:

INSTRUCCIONES DE INSTALACIÓN

MODELOS RECOMENDADOS

AVISO: AGUJERO DE VENTILACIÓN PARA LA VÁLVULA DE RETENCIÓN, VEA EL NRO. 3 EN LA SECCIÓN DE PRECAUCIONES A CONTINUACIÓN Y EL NRO. 4 EN LA PÁGINA 3.

EFLUENTES*/SUMIDERO/ACHIQUE	AGUAS CLOACALES
49 / 53 / 57 Series, 98 Series	264 Series
137 Series, 151 / 152 / 153 Series	266 / 267 / 268 Series

LISTA DE VERIFICACIÓN DE PRE-INSTALACIÓN - TODAS LAS INSTALACIONES

1. Inspeccione su bomba. Ocasionalmente, los productos se dañan durante el envío. Si la unidad está dañada, comuníquese con su vendedor antes de usarla. NO quite los tapones de prueba de la cubierta ni del cárter del motor.
2. Lea cuidadosamente toda la literatura provista para familiarizarse con los detalles específicos relacionados con la instalación y uso. Estos materiales deberán guardarse para referencia futura.

⚠ ADVERTISSEMENT

VER ABAJO LA LISTA DE ADVERTENCIAS

1. Asegúrese de que el tomacorriente esté al alcance del cable de alimentación eléctrica de la bomba. NO USE UN CABLE DE EXTENSIÓN. Los cables de extensión que son demasiado largos o livianos no suministran voltaje suficiente al motor de la bomba. Más importante aún, presentan un peligro a la seguridad si el aislante se daña o el extremo de conexión cae dentro del sumidero.
2. Asegúrese de que el circuito de alimentación eléctrica de la bomba esté equipado con fusibles o interruptores de circuito de capacidad adecuada. Se recomienda un circuito auxiliar, del tamaño de acuerdo al "Código Eléctrico Nacional" para la corriente que se muestra en la etiqueta de nombre de la bomba.
3. Prueba de puesta a tierra. Como medida de seguridad, cada tomacorriente debe verificarse para puesta a tierra usando un analizador de circuitos aprobado por el Underwriters Laboratory, el cual indicará si los alambres de energía, neutrales y de puesta a tierra están conectados correctamente a su tomacorriente. Si no lo están, llame a un técnico electricista calificado.
4. Para mayor seguridad. El equipo de bombeo y otro equipo eléctrico con enchufes de 3 patillas deben conectarse a un tomacorriente para 3 patillas con puesta a tierra. Para mayor seguridad, el tomacorriente puede estar protegido con un interruptor de circuito de falla a tierra. Cuando una bomba necesita ser conectada a una caja de conexión hermética, el enchufe puede ser retirado y empalmado al cable de alimentación eléctrica propiamente conectado a tierra. Para mayor seguridad, este circuito puede ser protegido mediante un interruptor de circuito de falla a tierra. La instalación completa deberá cumplir con el Código Eléctrico Nacional y todas las ordenanzas y códigos locales aplicables.
5. PARA SU PROTECCIÓN, SIEMPRE DESCONECTE LA BOMBA DE LA FUENTE DE ALIMENTACIÓN ELÉCTRICA ANTES DE MANIPULARLA. Las bombas monofásicas se suministran con enchufes de 3 patillas con puesta a tierra para ayudar a protegerle contra la posibilidad de choque eléctrico. NO RETIRE BAJO NINGUNA CIRCUNSTANCIA LA CLAVIJA DE PUESTA A TIERRA. Los enchufes de 3 patillas se deben introducir en un tomacorriente para 3 patillas apropiado. Si la instalación no posee un tomacorriente de este tipo, se debe cambiar por uno apropiado, cableado y con puesta a tierra de acuerdo al Código Eléctrico Nacional y a todas las ordenanzas y códigos locales aplicables. Las bombas trifásicas requieren dispositivos de arranque del motor con protección contra sobrecarga. Vea FM0486 para instalaciones duplex.
6. El tanque se debe ventilar conforme a los códigos de plomería locales. Las bombas se deben instalar conforme al Código Eléctrico Nacional y a todos los códigos y ordenanzas locales que correspondan. Las bombas no se deben instalar en sitios peligrosos conforme a la clasificación del Código Eléctrico Nacional, ANSI/NFPA 70.
7. "Riesgo de choque eléctrico". No quite el cable de alimentación eléctrica ni el dispositivo de alivio de tensión y no conecte un conductor directamente a la bomba.
8. La instalación y verificación de los circuitos eléctricos y del equipo deberán llevarse a cabo por un técnico electricista calificado.
9. La instalación y verificación de la bomba deberá llevarse a cabo por una persona calificada.
10. Riesgo de choque eléctrico – No se ha investigado el uso de estas bombas en áreas marinas y en piscinas.
11. Este producto contiene sustancias químicas que de acuerdo al estado de California pueden causar cáncer y defectos congénitos u otros daños a la salud reproductiva.

REFIÉRASE A LA GARANTÍA EN LA PÁGINA 2.

⚠ PRECAUCIÓN

VER ABAJO LA LISTA DE PRECAUCIONES

1. Asegúrese de que la fuente de energía eléctrica sea capaz de manejar los requisitos de voltaje del motor, según se indica en la etiqueta de nombre de la bomba.
2. La instalación de bombas automáticas con interruptores de flotador de nivel variable o las bombas no automáticas que usan interruptores de flotador de nivel variable auxiliares es responsabilidad del instalador y deberá verificarse que el interruptor de flotador atado no se enganchará en el aparato de la bomba ni en las peculiaridades del foso y que está fijado de manera que permita la parada de la bomba. Se recomienda usar tubería y empalmes rígidos y que el foso tenga 45 cm (18 pulg.) o más de diámetro.
3. Información - Objetivo del agujero de ventilación. Es necesario que todas las bombas sumer-gibles de sumidero, efluentes y de aguas cloacales capaces de manejar residuos sólidos de varios tamaños tengan la entrada en la parte inferior para reducir el atascamiento y las fallas del sello. Si se incorpora a la instalación una válvula de retención, deberá perforarse un agujero de ventilación [de aprox. 5 mm (3/16 pulg.)] en la tubería de descarga debajo de la válvula de retención y de la tapa del foso a fin de purgar la unidad del aire atrapado. La causa de aire atrapado puede ser agitación y/o un estanque seco. Deberá revisarse periódicamente el agujero de ventilación para verificar que no esté atascado. Las bombas de las series 53, 57 ó 98 poseen una ventilación ubicada en la caja de la bomba del lado opuesto al flotador, junto a una aleta de la caja. Sin embargo, se recomienda un agujero de ventilación adicional. Un agujero de ventilación en una aplicación de carga elevada podría causar demasiada turbulencia. Es posible que usted prefiera no perforar uno. Si decide no perforar un agujero de ventilación, asegúrese de que la caja de la bomba y el impulsor estén cubiertos de líquido antes de conectar la tubería a la válvula de retención y que no haya ningún tipo de entrada de aire en la vía de entrada de la bomba. NOTA: EL AGUJERO TAMBIÉN DEBERÁ ESTAR POR DEBAJO DE LA TAPA DEL SUMIDERO Y SE DEBERÁ LIMPIARLO PERIÓDICAMENTE. Se verá un chorro de agua saliendo del agujero durante los períodos de bombeo.
4. Se debe revisar la bomba frecuentemente para asegurarse de que no hay escombros y/o acumulación que pueda interferir con la posición "on" (encendido) o "off" (apagado) del flotador. La reparación y servicio deberá hacerse solamente por personal de una Estación de servicio autorizada por Zoeller Pump Company.
5. Las bombas de achique y de efluentes no se diseñan para uso en fosos con aguas cloacales crudas.
6. La temperatura de funcionamiento máxima para bombas de modelo estándar no debe superar 54°C (130°F).
7. Las bombas modelos 266, 267, 268, y 137 se deben operar en posición vertical. No intente encender la bomba cuando esté inclinada o apoyada sobre uno de sus lados.
8. No opere la bomba en una aplicación donde la carga dinámica total sea menor que la carga dinámica total mínima que se indica en la Curva de rendimiento de la bomba.

AVISO: Las bombas con la marca "UL" y "US" han sido probadas de acuerdo al estándar UL778. Las bombas "aprobadas por CSA" están certificadas de acuerdo al estándar CSA C22.2 No. 108.

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GARANTÍA LIMITADA

El Fabricante garantiza, al comprador y el propietario subsiguiente durante el período de garantía, que cada producto nuevo está libre de defectos en materiales y mano de obra bajo condiciones de uso y servicio normales, cuando se usa y mantiene correctamente, durante un período de tres años a partir de la fecha de fabricación original del producto. Las partes que fallen durante el período de garantía, un año a partir de la fecha de compra por parte del usuario final, lo que ocurra primero, cuyas inspecciones determinen que presentan defectos en materiales o mano de obra, serán reparadas, reemplazadas o remanufacturadas a opción del Fabricante, con la condición sin embargo de que por hacerlo no estemos en la obligación de reemplazar un ensamblaje completo, el mecanismo entero o la unidad completa. No se dará concesión alguna por costos de envío, daños, mano de obra u otros cargos que pudieran surgir por falla, reparación o reemplazo del producto.

Esta garantía no aplica a y no se ofrecerá garantía alguna por ningún material o producto que haya sido desarmado sin aprobación previa del Fabricante, o que haya sido sometido a uso indebido, aplicación indebida, negligencia, alteración, accidente o acto fortuito; que no haya sido instalado, usado o mantenido según las instrucciones de instalación del Fabricante; que haya sido expuesto a sustancias foráneas que incluyen pero no se limitan a lo siguiente: arena, grava, cemento, lodo, alquitrán, hidrocarburos, derivados de hidrocarburos (aceite, gasolina, solventes, etc.), u otras sustancias abrasivas o corrosivas, toallas para lavar o productos sanitarios femeninos, etc. en todas las aplicaciones de bombeo. La garantía presentada en el párrafo anterior deja sin efecto cualquier otra garantía expresa o implícita; y no autorizamos a ningún representante u otra persona para que asuma por nosotros ninguna otra responsabilidad con respecto a nuestros productos.

Comuníquese con el Fabricante en 3649 Cane Run Road, Louisville, KY 40211 EE.UU., Attention: Customer Service Department, para obtener cualquier reparación necesaria o reemplazo de partes o información adicional sobre nuestra garantía.

EL FABRICANTE EXPRESAMENTE RECHAZA RESPONSABILIDAD POR DAÑOS ESPECIALES, EMERGENTES O INCIDENTALES O POR INCUMPLIMIENTO DE LA GARANTÍA EXPRESA O IMPLÍCITA; Y CUALQUIER GARANTÍA IMPLÍCITA DE IDONEIDAD PARA UN FIN PARTICULAR Y DE COMERCIALIZACIÓN SE LIMITARÁ A LA DURACIÓN DE LA GARANTÍA EXPRESA.

Algunos estados no permiten limitaciones en la duración de una garantía implícita, de forma que la limitación anterior podría no aplicar a usted. Algunos estados no permiten la exclusión o limitación de daños incidentales o emergentes, de forma que la limitación o exclusión anterior podría no aplicar a usted.

Esta garantía le otorga a usted derechos legales específicos y podría tener otros derechos que varían de un estado a otro.

En aquellas instancias en que haya daños causados por una presunta falla de la bomba, el propietario deberá conservar la bomba a fin de investigar dicha falla.

LO QUE DEBE Y NO DEBE HACER PARA INSTALAR UNA BOMBA DE SUMIDERO

1. LEA completamente todo el material sobre la instalación provisto con la bomba.
2. INSPECCIONE la bomba para ver si hay cualquier daño visible causado durante el envío. Comuníquese con el vendedor si la bomba está dañada.
3. RETIRE todos los escombros del sumidero. Asegúrese de que la bomba se apoyará sobre una superficie dura, plana y estable. NO LA INSTALE sobre arena, grava o tierra.
4. ASEGÚRESE de que el sumidero sea suficientemente grande para permitir el funcionamiento correcto de los interruptores de control de nivel.
5. SIEMPRE desconecte la bomba de la fuente de alimentación eléctrica antes de manipularla.
   SIEMPRE conecte la bomba a un circuito protegido separadamente y con puesta a tierra adecuado.
   JAMÁS corte, empalme o dañe el cable de alimentación eléctrica. (Empalme únicamente cuando hay una caja de conexión hermética.)
   JAMÁS transporte o levante la bomba por su cable de alimentación eléctrica.
   JAMÁS use un cable de extensión con una bomba de sumidero.
6. INSTALE una válvula de retención y una unión en la tubería de descarga.
   JAMÁS use una tubería de descarga de menor tamaño que la descarga de la bomba.
7. JAMÁS use una bomba de sumidero como una bomba excavadora o para zanjas, ni para bombear aguas cloacales, gasolina u otros líquidos peligrosos.
8. PRUEBE la bomba inmediatamente después de su instalación para asegurarse de que el sistema funciona correctamente.
9. CUBRA el foso con una tapa adecuada para sumidero.
10. EXAMINE todos los códigos nacionales y locales aplicables y verifique que la instalación esté de acuerdo a cada uno de ellos.
11. CONSULTE con el fabricante si necesita aclaraciones o tiene preguntas.
12. CONSIDERE un sistema de dos bombas con alarma en donde la instalación puede sobrecargarse o la falla de una bomba primaria causaría daños a la propiedad.
13. CONSIDERE un sistema de apoyo de CD en donde una bomba de achique o sumidero es necesaria para prevenir daños a la propiedad debido a inundación causada por interrupciones en el suministro de energía eléctrica, problemas mecánicos o eléctricos, o sobrecarga del sistema.
14. INSPECCIONE y pruebe el funcionamiento del sistema por lo menos cada 3 meses.

LISTA DE VERIFICACIÓN DE SERVICIO



⚠ ADVERTENCIA PRECAUCIONES ELÉCTRICAS - Antes de proporcionar algún servicio a la bomba, desactive siempre el interruptor principal de suministro de energía eléctrica y desenchufe la bomba. Asegúrese de usar zapatos protectores con suelas aislantes y de no estar parado en el agua. Bajo condiciones de inundación, llame a su compañía eléctrica local o a un técnico electricista calificado para desconectar el servicio eléctrico antes de quitar la bomba.



⚠ ADVERTENCIA Las bombas sumergibles contienen aceites que se presurizan y calientan bajo condiciones operativas. Deje que pasen 2½ horas después de apagarla antes de proceder con el servicio.

CONDICIÓN		CAUSAS COMUNES
A.	La bomba no arranca o no funciona.	Verifique el fusible, voltaje bajo, protección contra sobrecarga abierta, cableado abierto o incorrecto, interruptor abierto, impulsor o sello trabado mecánicamente, capacitor o relé defectuoso, motor o cableado eléctrico en corto circuito. Conjunto del flotador enganchado. Interruptor defectuoso, dañado o fuera de punto.
B.	El motor se sobrecalienta y activa la protección contra sobrecarga o desconecta el fusible.	Voltaje incorrecto, carga negativa (descarga abierta menos de lo normal), impulsor o sello trabado mecánicamente, capacitor o relé defectuoso, motor en corto circuito.
C.	La bomba se encienda y se apaga muy a menudo.	El flotador está apretado en la varilla, la válvula de retención está atascada o no hay una instalada en una línea de larga distancia, protección contra sobrecarga abierta, interruptores defectuosos, foso del sumidero demasiado pequeño.
D.	La bomba no se apaga.	Hay escombros debajo del conjunto del flotador, el flotador o la varilla del flotador están trabados por los lados del foso u otros, interruptor defectuoso, dañado o fuera de punto.
E.	La bomba funciona pero sin o con poca agua.	Verifique la caja del filtro y la tubería de descarga, o si se usa una válvula de retención, el agujero de ventilación debe estar abierto. La carga de descarga excede la capacidad de la bomba. Voltaje bajo o incorrecto. Rotación incorrecta del motor. Capacitor defectuoso. El agua de entrada contiene aire o hace que el aire entre en la bomba.
F.	Caída en la carga y/o capacidad después de un período de uso.	Aumento de fricción en la tubería, línea o válvula de retención atascada. Material abrasivo o productos químicos adversos podrían haber deteriorado el impulsor o el cárter de la bomba. Revise la línea. Quite la base e inspeccione.

Si la lista de verificación arriba mencionada no revela el problema, consulte con la fábrica. No intente proporcionar algún servicio o desarmar la bomba. Las Estaciones de servicio autorizadas por Zoeller deberán proporcionar dicho servicio.
Visite el sitio www.zoellerpumps.com/servicestations para encontrar la estación de servicio autorizada para su zona.

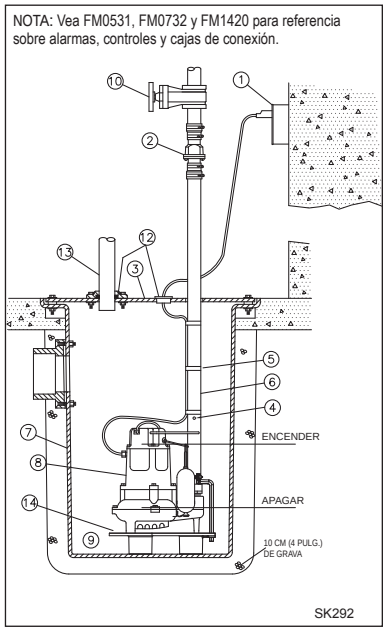
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INSTALACIÓN RECOMENDADA PARA TODAS LAS APLICACIONES

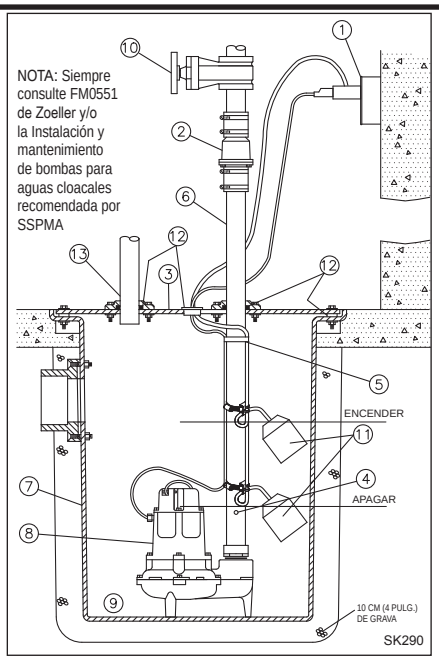
1. El cableado y la protección eléctrica deben estar de acuerdo con el Código Eléctrico Nacional y todos los otros requisitos eléctricos locales y estatales aplicables.
2. Instale el "Unicheck" (combinación de unión y válvula de retención) apropiado de Zoeller, luego arriba del estanque para que se pueda quitar fácilmente la bomba para su limpieza o reparación. Si los sistemas para aguas cloacales, efluentes o achique requieren instalación de carga elevada o por debajo de la tapa, use 30-0164 en tubería de 38 mm (1½ pulg.), 30-0152 en tubería de 51 mm (2 pulg.) y 30-0160 en tubería de 76 mm (3 pulg.). Vea el número 4 más abajo.
3. Todas las instalaciones requieren una tapa para prevenir que escombros caigan dentro del estanque y prevenir lesiones accidentales.
4. Cuando instale un "Unicheck", perfore un agujero de 5 mm (3/16 pulg.) de diámetro en la tubería de descarga al mismo nivel de la parte superior de la bomba. NOTA: EL AGUJERO TAMBIÉN DEBERÁ ESTAR POR DEBAJO DE LA TAPA DEL ESTANQUE Y SE DEBE LIMPIARLO PERIÓDICAMENTE. (Para unidades de carga elevada, ver el número 3 de la lista de "Precauciones" en la página 1.) Se verá un chorro de agua saliendo del agujero durante los períodos de bombeo.
5. Fije firmemente el cable de alimentación eléctrica al tubo de descarga con cinta o abrazadera.
6. Use tubería de descarga de tamaño completo.
7. El estanque debe estar de acuerdo con los códigos y las especificaciones aplicables.
8. La bomba debe estar nivelada y el mecanismo del flotador libre de los lados del estanque antes de encender la bomba.
9. El estanque debe estar limpio y libre de escombros después de la instalación.
10. El instalador deberá suministrar una válvula de paso directo o una válvula de bola y instalarla de acuerdo con cualesquiera y todos los códigos.
11. La ubicación de los interruptores de flotador es como se muestra en el esquema a la izquierda. El punto "off" (apagado) debe estar por encima del cárter del motor y a 180° de la entrada. NOTA: PARA BOMBAS AUTOMATICAS, UTILICE EL ESQUEMA PARA LA INSTALACION PARA ACHIQUE MÁS ABAJO.
12. Los sellos herméticos contra gases son necesarios en todas las instalaciones de aguas cloacales a fin de contener los gases y olores.
13. Ventile los gases y olores a la atmósfera a través del tubo de ventilación. (sólo para cloaca y achique).
14. Instale el soporte para bomba Zoeller (Modelo 10-2421) debajo de la bomba para proporcionar un sumidero de decantación (sólo para efluente y achique).

Para efluente solamente:

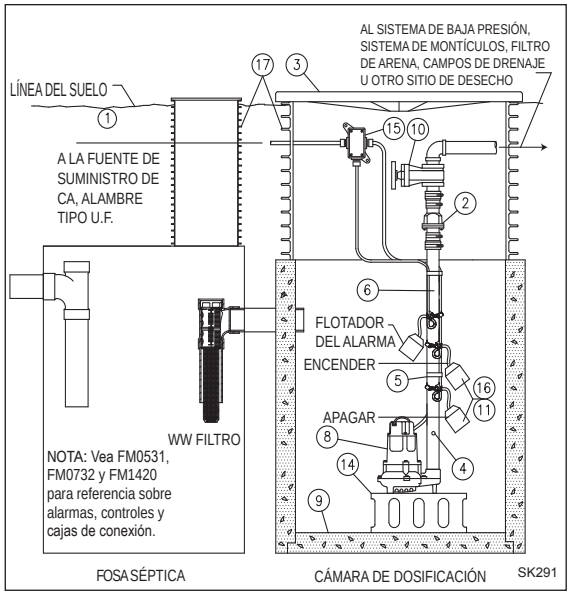
15. La conexión del cableado de la bomba a la fuente de alimentación eléctrica debe hacerse a través de una caja de conexión hermética Zoeller o un empalme hermético. NOTA: La caja hermética es obligatoria en áreas húmedas. Vea FM0732. Vea el número 8 en la página 1.
16. Consulte el Manual sobre tamaños de efluentes del SSPMA para determinar la posición de los interruptores "on-off" (encendido-apagado).
17. Se debe usar tubos verticales en el tanque séptico para tener fácil acceso a la bomba y al filtro.
    NOTA: Las bombas de sello doble ofrecen protección adicional contra los daños causados por falla del sello.



INSTALACIÓN TÍPICA PARA ACHIQUE



INSTALACIÓN TÍPICA PARA AGUAS CLOACALES



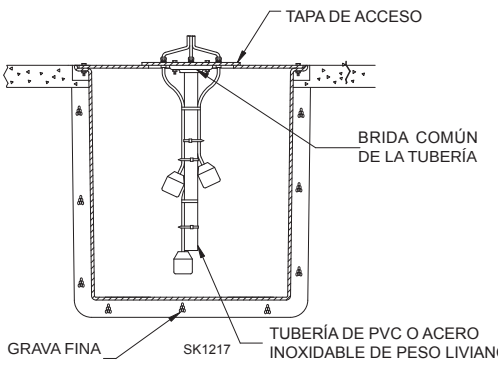
INSTALACIÓN TÍPICA PARA EFLUENTES

Todas las instalaciones deben cumplir con todos los códigos eléctricos y de instalación sanitaria aplicables, incluyendo, pero sin limitarse al Código Eléctrico Nacional, los códigos locales, regionales y/o los códigos estatales de instalación sanitaria, etc. No se debe usar las instalaciones en lugares peligrosos.

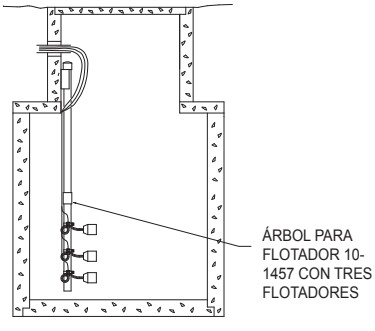
MÉTODOS SUGERIDOS PARA LA INSTALACIÓN DEL FLOTADOR

En algunas instalaciones es deseable instalar un soporte colgante independiente para los interruptores de control de nivel para evitar posibles enganches en las bombas, tubería, válvulas, etc. Los soportes colgantes del flotador se pueden comprar de Zoeller Company según la Hoja de catálogo FM0526, o fabricarse de tubería y empalmes comunes.

SOPORTE COLGANTE PARA FLOTADOR TÍPICO EN FOSOS CON TAPA DE ACERO



SOPORTE COLGANTE PARA FLOTADOR TÍPICO EN FOSOS DE CONCRETO O TUBOS VERTICALES PARA TANQUES SÉPTICOS



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INSTRUCCIONES PARA LA INSTALACIÓN DE LOS MODELOS WD Y WH

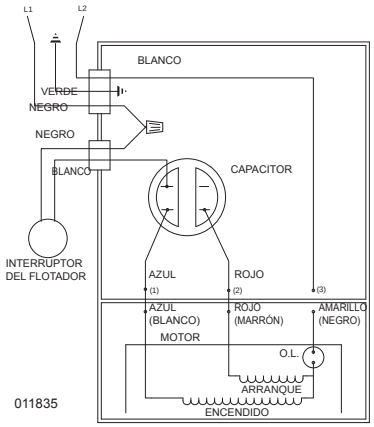


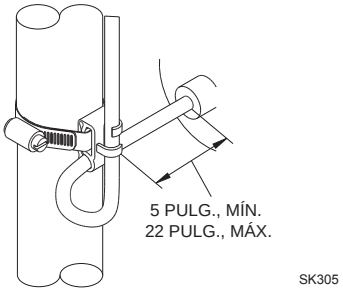
DIAGRAMA DE CABLEADO PARA LOS MODELOS:
WD-230V, 1 FASE, 60 CICLOS
WH-200/208V, 1 FASE, 60 CICLOS

Determinación del rango de bombeo en pulgadas
(1 pulg. = 2,5 cm)

Longitud de la atadura	5	10	15	20	22
	mín.				máx.
Rango de bombeo	9	13.5	18	22	24

Usar solamente como guía. Debido al peso del cable, el rango de bombeo sobre la horizontal no es igual al rango de bombeo debajo de la horizontal. Los rangos se basan en pruebas en condiciones no turbulentas. El rango puede variar debido a la temperatura del agua y a la forma del cable. A medida que aumenta la longitud de la atadura, también aumenta la variación en el rango de bombeo.

Los modelos WD y WH son completamente automáticos. Se incluye un interruptor de flotador con cableado de fábrica en el circuito de la bomba para proveer una operación automática una vez que el interruptor de flotador se haya atado correctamente a la tubería de salida. Use el diagrama de arriba para asegurar correctamente el interruptor de flotador y obtener la atadura apropiada para adecuar el ciclo de encendido-apagado a cada aplicación.



INTERRUPTOR DE 20 AMPERIOS
(MODELOS WD Y WH)

Nota: No tener en cuenta los límites adecuados de la atadura podría alterar el funcionamiento seguro del interruptor.
Nota: El cable debe ser instalado en posición horizontal.

INSTRUCCIONES PARA EL CABLEADO MONOFÁSICO

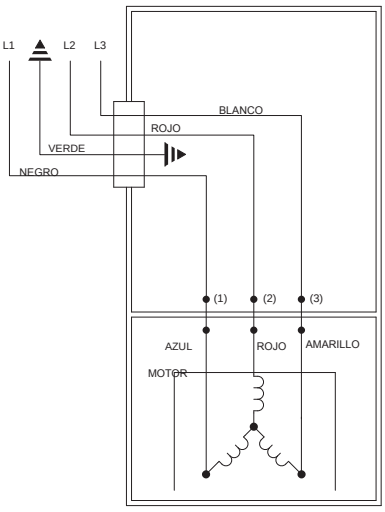
ADVERTENCIA PARA SU PROTECCIÓN, SIEMPRE DESCONECTE LA BOMBA DE LA FUENTE DE ALIMENTACIÓN ELÉCTRICA ANTES DE MANIPULARLA. Las bombas monofásicas se suministran con enchufes de 3 patillas con puesta a tierra para ayudar a protegerle contra la posibilidad de choque eléctrico. NO RETIRE BAJO NINGUNA CIRCUNSTANCIA LA CLAVIJA DE PUESTA A TIERRA. Los enchufes de 3 patillas se deben introducir en un tomacorriente para 3 patillas apropiado. Si la instalación no posee un tomacorriente de este tipo, se debe cambiar por uno apropiado, cableado y con puesta a tierra de acuerdo al Código Eléctrico Nacional y a todas las ordenanzas y códigos locales aplicables.

ADVERTENCIA "Riesgo de choque eléctrico". No quite el cable de alimentación eléctrica ni el dispositivo de alivio de tensión y no conecte un conductor directamente a la bomba.

ADVERTENCIA La instalación y verificación de los circuitos eléctricos y del equipo deberán llevarse a cabo por un técnico electricista calificado.

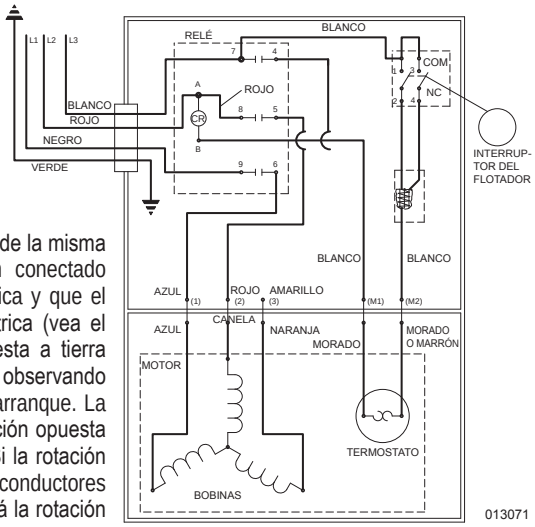
ADVERTENCIA A las unidades que se suministran sin enchufe (monofásico y trifásico) y a las unidades monofásicas no automáticas que poseen un enchufe de 20 amperios se les debe conectar un control de motor y un control de nivel de líquidos durante la instalación. Los niveles de voltaje, amperaje, frecuencia, puesta a tierra y potencia del dispositivo de control deben ser apropiados para la bomba a la cual se conecta.

INSTRUCCIONES PARA EL CABLEADO TRIFÁSICO



Las bombas trifásicas no son automáticas. Para operarlas automáticamente se requiere un panel de control. Siga las instrucciones provistas con el panel para completar el cableado del sistema. Para bombas trifásicas automáticas, ver el diagrama de cableado para bombas trifásicas automáticas a la derecha.

Antes de instalar una bomba, verifique la rotación de la misma para asegurarse de que los cables se hayan conectado correctamente a la fuente de alimentación eléctrica y que el conductor verde del cable de alimentación eléctrica (vea el diagrama de cableado) está conectado con puesta a tierra adecuada. Active momentáneamente la bomba, observando la dirección del retroceso debido a la torsión de arranque. La rotación es correcta si el retroceso está en dirección opuesta a la flecha de rotación en la caja de la bomba. Si la rotación no es correcta, cambiar dos de cualquiera de los conductores eléctricos, excepto el con puesta a tierra, proveerá la rotación apropiada.



Todas las bombas trifásicas requieren dispositivos de arranque del motor con protección contra sobrecarga. Vea FM0514 para instalaciones simplex o FM0486 para instalaciones duplex. Las bombas se deben instalar de acuerdo al Código Eléctrico Nacional y a todas las ordenanzas y códigos locales aplicables. Las bombas no se deben instalar en sitios clasificados como peligrosos según el Código Eléctrico Nacional ANSI/NFPA 70.

ADVERTENCIA PARA SU PROTECCIÓN, SIEMPRE DESCONECTE LA BOMBA DE LA FUENTE DE ALIMENTACIÓN ELÉCTRICA ANTES DE MANIPULARLA.

AVISO IMPORTANTE: Ciertas pólizas de seguro, tanto comerciales como residenciales, extienden la cobertura a los daños causados por la falla del producto. En la mayoría de los casos, usted deberá conservar el producto para respaldar su reclamo. Zoeller Pump Co. reemplazará la unidad o reembolsará el precio de compra original una vez que la compañía de seguros liquide el reclamo, en el caso de que usted necesite conservar el producto para respaldar un reclamo por daños que le haya presentado a su compañía de seguros.

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Avis à l'installateur - Les instructions doivent rester avec l'installation.

FM2676F

Your Peace of Mind is Our Top Priority®

Les renseignements présentés ici reflètent les conditions au moment de la publication. Consulter l'usine en cas de contradiction ou d'inconsistance.

PUMP COMPANY

Zoeller Family of Water Solutions™

ADRESSE POSTALE : P.O. BOX 16437 • Louisville, KY 40256-0347 USA
ADRESSE PHYSIQUE : 3649 Cane Run Road • Louisville, KY 40211-1961 USA
TÉL : +1 (502)778-2731 • FAX +1 (502) 774-3624

www.zoeller.com

AVIS : TROU D'ÉVENT POUR LE CLAPET DE SÉCURITÉ VOIR N° 3 CI-DESSOUS ET N° 4 PAGE 3.

DATE D'INSTALLATION :
NUMÉRO DE MODÈLE :

INSTRUCTIONS D'INSTALLATION
MODÈLES RECOMMANDÉS

EFFLUENTS* / PUISARD / ASSÈCHEMENT	ÉGOUT
Série 49 / 53 / 57	Série 264
Série 137, Série 151 / 152 / 153	Série 266 / 267 / 268

LISTE DE VÉRIFICATIONS AVANT L'INSTALLATION - TOUTES LES INSTALLATIONS

1. Inspecter la pompe. De temps en temps, la pompe est endommagée en cours d'expédition. Si la pompe est endommagée, contacter le distributeur avant de l'utiliser. NE PAS enlever les bouchons test du couvercle ni du compartiment moteur.
2. Il faut lire attentivement tous les documents fournis pour se familiariser avec les détails spécifiques de l'installation et de l'utilisation. Il faut conserver ces documents pour pouvoir les consulter ultérieurement.

⚠ ADVERTISSEMENT — **VOIR PLUS BAS POUR LA LISTE DES AVERTISSEMENTS**

1. Il faut vérifier que la prise est à portée du cordon d'alimentation de la pompe. NE PAS UTILISER DE RALLONGE. Les rallonges trop longues ou de trop faible capacité ne fournissent pas la tension nécessaire au moteur de la pompe, mais, encore plus important, elles peuvent être dangereuses si l'isolant est endommagé ou si l'extrémité avec le branchement tombe dans un endroit humide ou mouillé.
2. **Vérifier que le circuit d'alimentation de la pompe est équipé de fusibles ou de disjoncteurs de capacité appropriée.** Il est recommandé d'installer un circuit indépendant de capacité suffisante, conforme aux codes électriques nationaux pour la capacité indiquée sur la plaque d'identification de la pompe.
3. **Vérification de la mise à la terre.** Pour des raisons de sécurité, il faut vérifier la terre de chaque prise électrique en utilisant un analyseur de circuit sur la liste d'Underwriters Laboratory qui indique si les fils de phase, de neutre et de terre de la prise sont branchés correctement. S'ils ne sont pas branchés correctement, appeler un électricien agréé qualifié.
4. Pour des raisons de sécurité, les pompes et autre équipement équipés d'un fil à trois broches, avec mise à la terre, doivent être branchés sur une prise à trois broches. Pour des raisons de sécurité, la prise doit être protégée par un disjoncteur différentiel. Quand la pompe est branchée dans un boîtier de branchement étanche, il est possible d'enlever la fiche et de faire le branchement directement sur l'alimentation avec mise à la terre appropriée. Pour des raisons de sécurité, ce circuit peut être protégé par un disjoncteur différentiel. L'installation doit être conforme au code national d'électricité et tous les règlements locaux.
5. POUR DES RAISONS DE SÉCURITÉ, IL FAUT TOUJOURS DÉBRANCHER L'ALIMENTATION DE LA POMPE AVANT DE LA MANIPULER. Les pompes monophasées sont équipées d'un cordon avec fiche à trois broches de mise à terre pour protéger contre les électrocutions. IL NE FAUT JAMAIS ENLEVER LA BROCHE DE MISE À TERRE. Il faut brancher la fiche à trois broches dans une prise à trois broches de mise à terre. Si le circuit n'est pas équipé d'une telle prise, il faut en installer une en respectant le code national d'électricité et toute la législation et réglementation locales en vigueur. Les pompes triphasées doivent être équipées d'un dispositif de mise en marche avec protection thermique du moteur. Consulter la norme FM0486 pour les installations duplex.
6. La ventilation du réservoir doit être conforme au code de plomberie local. Les pompes doivent être installées conformément au code national d'électricité et à toute la législation et réglementation locales en vigueur. Les pompes ne doivent pas être installées dans des endroits classifiés à risque, conformément à la norme ANSI/NFPA 70 du Code national américain de l'électricité.
7. Risque d'électrocution. Ne pas enlever le cordon d'alimentation ni le distributeur de tension mécanique, ni brancher le conduit directement à la pompe.
8. L'installation et la vérification de l'équipement électrique doivent être faites par un électricien qualifié.
9. L'installation et la vérification de la pompe doivent être faites par une personne qualifiée.
10. Risque d'électrocution. L'usage de ce type de pompe dans une piscine de natation et des zones marines n'a pas été étudié.
11. Ce produit contient des produits chimiques dont l'état de la Californie a déterminer comme étant la cause de cancer et de déficiences à la naissance ou autres dommages reproductifs.

⚠ MISE EN GARDE — **VOIR PLUS BAS POUR LA LISTE DES MISES EN GARDE**

1. Vérifier que le circuit d'alimentation a une capacité suffisante pour alimenter le moteur, comme indiqué sur la pompe ou sur la plaque d'identification de l'appareil.
2. L'installateur est responsable de l'installation des pompes automatiques avec des interrupteurs à niveau variable ou des pompes non-automatiques utilisant des interrupteurs auxiliaires à niveau variable et il doit s'assurer que l'interrupteur à flotteur est installé fermement pour qu'il n'accroche pas à la pompe ni au puits pour permettre l'arrêt de la pompe. Il est recommandé d'utiliser du tuyau et des raccords rigides et le puits doit avoir un diamètre supérieur à 45 cm (18").
3. Renseignements sur le trou d'évent. Il est nécessaire que la pompe submersible, les pompes à effluents et d'égout capables de passer des solides de différentes tailles aient leur alimentation à la base pour réduire le colmatage et la défaillance des joints. Si l'installation comprend un clapet de sécurité, il faut percer un trou d'évent d'environ 5 mm (3/16") dans le tuyau de refoulement au-dessous du clapet de sécurité et le couvercle pour purger l'air de l'appareil. L'air emprisonné est causé par l'agitation et / ou un puits sec. Il faut vérifier périodiquement que le trou d'évent n'est pas colmaté. Les carters de pompe de la série 53 / 57 et 98 sont équipés d'un trou d'évent à l'opposé du flotteur, près du goujon du carter, du goujon du carter, mais un trou d'évent est recommandé. Le trou d'évent de l'application à une hauteur de refoulement dynamique élevée peut causer une turbulence trop élevée. Il peut être désirable de ne pas le percer. S'il est décidé de ne pas percer de trou d'évent, il faut s'assurer que le carter et le rotor de la pompe sont couverts de liquide avant de brancher le tuyau sur le clapet anti-retour et qu'aucune conduite d'aspiration n'amène de l'air à l'admission de la pompe. REMARQUE - LE TROU DOIT AUSSI ÊTRE AU-DESSOUS DU COUVERCLE DU PUITS ET IL FAUT LE NETTOYER RÉGULIÈREMENT. Un jet d'eau sera visible de cette orifice durant les périodes de fonctionnement de la pompe.
4. Il faut vérifier fréquemment qu'il n'y a pas de débris ni d'accumulation pouvant interférer avec le déplacement du flotteur de marche / arrêt. Les réparations ne doivent être faites que par un centre de réparation agréé par Zoeller Pump Company.
5. Les pompes d'assèchement mécanique et d'effluents sont conçues pour pompage d'eau usée non traitée dans un puits.
6. La température de fonctionnement maximale d'une pompe standard ne peut pas être plus de 54°C (130°F).
7. Il faut utiliser les pompes modèles 266, 267, et 137 en position verticale. Il ne faut pas essayer de mettre la pompe en marche quand elle est inclinée ou couchée sur le côté.
8. Il ne faut pas faire fonctionner la pompe dans une application où la hauteur de refoulement dynamique est inférieure à la hauteur de refoulement dynamique minimale donnée dans les courbes de refoulement et de capacité.

REMARQUE - Les pompes avec annotations "UL" et "US" sont vérifiées d'après la norme UL778. Les pompes certifiées CSA sont vérifiées d'après la norme C22.2 no 108.

SE RÉFÉRER À LA GARANTIE EN PAGE 2.

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GARANTIE LIMITÉE

Le fabricant garantit à l'acheteur et au propriétaire ultérieur pendant la période de garantie, tout produit neuf contre tout vice de matériel et de main-d'œuvre, en utilisation normale et quand utilisé et entretenu correctement, pendant une période de 3 ans de la date de fabrication initiale. Les pièces devenant défectueuses pendant la période de garantie, et que des inspections prouvent contenir des vices de fabrication ou de main-d'œuvre, seront réparées, remplacées ou rénovées au choix du Fabricant, à condition qu'en faisant cela nous ne soyons pas obligés de remplacer l'ensemble, le mécanisme complet ou l'appareil complet. Aucune provision n'est faite pour les frais d'expédition, les dégâts, la main-d'œuvre ni d'autres frais causés par la défaillance, la réparation ou le remplacement du produit.

Cette garantie ne s'applique pas et ne couvre aucun matériel ou produit qui a été démonté sans l'autorisation préalable du Fabricant, soumis à un usage abusif, des applications incorrectes, de la négligence, des modifications, des accidents ou un cas de force majeure ; qui n'a pas été installé, utilisé ou entretenu selon les instructions d'installation du Fabricant; qui a été exposé, y compris, mais non de façon limitative, à du sable, des gravillons, du ciment, de la boue, du goudron, des hydrocarbures ou des dérivés d'hydrocarbures (huile, essence, solvants, etc.) ou à d'autres produits abrasifs ou corrosifs, serviettes ou produits d'hygiène féminine etc., dans toutes les applications de pompage. La garantie mentionnée ci-dessus remplace toutes les autres garanties expresses ou implicites et nous n'autorisons aucun représentant ou autre personne à accepter la responsabilité en notre nom pour nos produits.
Prendre contact avec le Fabricant, 3649 Cane Run Road, Louisville, KY 40211, à l'attention du Service à la Clientèle, pour obtenir des réparations, des pièces de remplacement ou des renseignements supplémentaires concernant la garantie.

LE FABRICANT REFUSE EXPRESSÉMENT TOUTE RESPONSABILITÉ POUR LES DÉGÂTS SPÉCIAUX, INDIRECTS OU SECONDAIRES OU POUR LES RUPTURES DE GARANTIE EXPRESSES OU IMPLICITES; ET TOUTE GARANTIE IMPLICITE D'APPLICABILITÉ À UNE UTILISATION SPÉCIFIQUE OU DE COMMERCIALITÉ EST LIMITÉE À LA DURÉE DE LA GARANTIE EXPRESSE.

Certaines provinces ne permettent pas les limitations de la durée de la garantie implicite et il est possible que cette limitation ne s'applique pas. Certaines provinces ne permettent pas l'exclusion ou la limitation des dégâts secondaires ou indirects, et il est possible que cette limitation ou exclusion ne s'applique pas.

Cette garantie vous donne des droits spécifiques reconnus par la loi et vous pouvez également avoir d'autres droits qui varient d'une province à l'autre.

Lorsque des dégâts sont causés par une défaillance présumée de la pompe, le propriétaire doit garder la pompe en sa possession en vue d'enquête.

CONSEILS POUR L'INSTALLATION D'UNE POMPE DE PUISARD

1. IL FAUT lire toutes les instructions d'installation fournies avec la pompe.
2. IL FAUT vérifier que les appareils n'ont pas été endommagés en cours d'expédition. Contacter le distributeur si la pompe a été endommagée.
3. IL FAUT nettoyer tous les débris dans le puisard. Vérifier qu'il y a une surface dure et plate à l'emplacement désiré pour la pompe. NE PAS installer la pompe sur du sable, du gravier ou de la terre.
4. IL FAUT vérifier que le puisard est assez large pour avoir de l'espace suffisant pour le bon fonctionnement des interrupteurs de commande de niveau.
5. IL FAUT toujours débrancher l'alimentation de la pompe avant de la manipuler.
   IL FAUT toujours brancher la pompe sur un circuit séparé mis à la terre.
   IL NE FAUT JAMAIS couper, faire une épissure ou endommager un cordon d'alimentation. (Pour faire une raccordement, il faut utiliser un boîtier de raccordement étanche.
   IL NE FAUT PAS utiliser le cordon d'alimentation pour transporter ou soulever la pompe.
   IL NE FAUT PAS utiliser de rallonge pour une pompe de puisard.
6. IL FAUT installer un clapet de sécurité et un raccord sur la conduite de refoulement. IL NE FAUT PAS utiliser une conduite de refoulement de diamètre inférieur à celui du refoulement de la pompe.
7. IL NE FAUT PAS utiliser une pompe de puisard comme pompe de tranchée ou d'excavation, ou pour pomper des égouts, de l'essence ou tout autre liquide dangereux.
8. IL FAUT essayer la pompe immédiatement après l'installation pour être certain que le système fonctionne correctement.
9. IL FAUT recouvrir la pompe de puisard d'un couvercle de puisard approprié.
10. IL FAUT étudier tous les codes locaux et nationaux applicables et vérifier que l'installation est conforme.
11. IL FAUT consulter le fabricant pour obtenir des clarifications ou des réponses aux questions.
12. IL FAUT considérer un système à deux pompes avec une alarme quand l'installation peut être surchargée ou si une défaillance de la pompe primaire causait des dégâts importants.
13. IL FAUT considérer un système de secours en courant alternatif quand une pompe de puisard ou d'séchage mécanique est nécessaire pour éviter des dégâts matériels en cas d'inondation à la suite d'une panne d'alimentation secteur, de problème mécanique ou électrique ou de surcharge du système.
14. IL FAUT inspecter le système et vérifier son fonctionnement au moins tous les trois mois.

LISTE DE VÉRIFICATIONS POUR L'ENTRETIEN



⚠ ADVERTISSEMENT PRÉCAUTIONS AVEC LE SYSTÈME ÉLECTRIQUE – Avant de réparer la pompe, il faut toujours ouvrir le circuit et débrancher la pompe, en prenant soin de porter des chaussures à semelle isolante et de ne pas se tenir dans l'eau. En cas d'inondation, contacter la compagnie d'électricité ou un électricien agréé pour couper l'alimentation avant de déposer la pompe.

⚠ ADVERTISSEMENT Les pompes submersibles contiennent de l'huile qui peut être sous pression ou devenir chaude en cours de fonctionnement. Attendre 2 heures et demi après l'avoir débranchée avant de travailler sur la pompe.

CONDITION	CAUSES FRÉQUENTES
A. La pompe ne démarre pas ou ne fonctionne pas.	Vérifier que le fusible est en bon état, que la tension est normale, que le circuit n'est pas surchargé et que le câblage est correct, que l'interrupteur n'est pas ouvert, que le rotor ou le joint n'est pas bloqué, que le condensateur ou le relais n'est pas défectueux, si installé, qu'il n'y a pas de court-circuit dans le moteur ou le bobinage. Flotteur bloqué en position basse. Interrupteur défectueux, endommagé ou mal réglé.
B. Le moteur surchauffe et déclenche le disjoncteur ou la sécurité thermique.	Mauvaise tension, hauteur de refoulement négative (refoulement ouvert au-dessous de la normale), blocage mécanique du rotor ou du joint, moteur court-circuité.
C. La pompe se met en marche et s'arrête trop fréquemment.	Flotteur grippé sur la tige, clapet de sécurité coincé ou pas de clapet installé sur une conduite longue, clapet de sécurité ouvert, interrupteurs de niveau défectueux, puits trop petit.
D. La pompe ne s'arrête pas.	Débris sous le flotteur, flotteur ou tige du flotteur coincé contre la paroi du puits, interrupteur défectueux, endommagé ou mal réglé.
E. La pompe fonctionne mais son débit est faible ou non existant.	Vérifier le carter de crépine, le tuyau de refoulement ou, si un clapet de sécurité est installé, le trou d'évent. La hauteur de refoulement est supérieure à la capacité de la pompe. Mauvaise tension. Mauvaise direction de rotation de la pompe. Condensateur défectueux. L'eau d'alimentation contient de l'air ou provoque l'entrée d'air dans la chambre de la pompe.
F. Baisse de capacité ou de hauteur de refoulement après une période d'utilisation.	Augmentation de la friction dans le tuyau de refoulement, tuyau ou clapet de sécurité colmaté. Des produits abrasifs ou des produits chimiques peuvent détériorer le rotor et le carter de pompe. Inspecter la conduite. Déposer la base et inspecter.

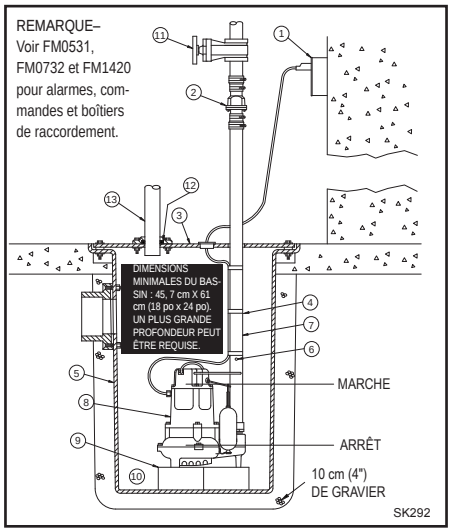
Si les vérifications ci-dessus ne résolvent le problème, consulter l'usine. Ne pas essayer de réparer ou de démonter la pompe. Toutes les réparations doivent être faites par un centre de réparation agréé par Zoeller. Visitez le site Web www.zoellerpumps.com/servicestations pour trouver le centre de service agréé le plus proche.

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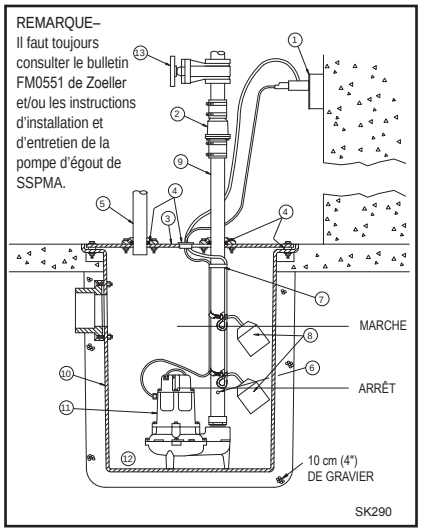
INSTALLATION RECOMMANDÉE POUR TOUTES APPLICATIONS

(1) Les circuits et les protections électriques doivent être conformes aux normes des codes électriques nationaux, provinciaux et locaux.
(2) Installer un Unicheck (raccord / clapet de sécurité combiné) de Zoeller approprié, de préférence juste au-dessus du puits pour permettre la dépose de la pompe pour le nettoyage ou les réparations. Pour les égouts, les effluents ou les eaux d'assèchement mécanique, utiliser le modèle 30-0164 avec des tuyaux de 1-1/2" (38 mm), modèle 30-0152 avec des tuyaux de 2" (51 mm) et le modèle 30-0160 avec des tuyaux de 3" (76 mm) s'il faut une grande hauteur de refoulement ou en cas d'installation sous un couvercle. Voir (4) ci-dessous.
(3) Tous les puits doivent avoir un couvercle pour empêcher les débris d'y tomber et éviter les chutes accidentelles.
(4) Quand un Unicheck est installé, percer un trou de 5 mm (3/16") dans le tuyau de refoulement, de niveau avec le dessus de la pompe. Les pompes de la série 50 et 90 ont un trou d'évent intégré. REMARQUE – LE TROU DOIT AUSSI ÊTRE AU-DESSOUS DU COUVERCLE DU PUITS ET IL FAUT LE NETTOYER RÉGULIÈREMENT (pompes à hauteur de refoulement élevée, voir n° 3 de la première page « MISE EN GARDE »). Un jet d'eau sera visible de cette orifice durant les périodes de fonctionnement de la pompe.
(5) Attacher fermement le cordon d'alimentation électrique sur le tuyau de refoulement en utilisant du chatterton ou des colliers.
(6) Utiliser un tuyau de refoulement de pleines dimensions.
(7) Le puits doit être conforme à tous les règlements applicables.
(8) Avant la mise en service, la pompe doit être de niveau et le mécanisme du flotteur ne doit pas toucher les bords du puits.
(9) Après l'installation, le puits doit être propre et ne doit pas contenir de débris.
(10) L'installateur doit fournir la vanne d'arrêt et l'installer en respectant tous les codes.
(11) Identifier les interrupteurs à flotteur indiqués dans les illustrations. Le point d'arrêt doit être au-dessus du carter du moteur et à 180° de l'admission. Le point d'arrêt ne se doit trouver jamais au-dessous du refoulement de la pompe (uniquement pour les systèmes d'eaux usées et d'effluent). REMARQUE - pour les pompes automatiques, utiliser le schéma d'installation pour l'assèchement ci-dessous.
(12) Pour éviter la propagation des gaz et des odeurs, toutes les installations doivent avoir des joints étanches.
(13) Les gaz et les odeurs sont évacués à l'atmosphère au moyen d'un tuyau d'évent. (uniquement pour les systèmes d'eaux usées et d'assèchement).
(14) Installer la base de pompe Zoeller (modèle 10-2421) sous la pompe pour former un bassin de décantation (uniquement pour les systèmes d'effluent et d'assèchement).
Uniquement pour les systèmes d'effluent :
(15) Brancher l'alimentation de la pompe par l'intermédiaire d'un boîtier étanche Zoeller ou d'une épissure étanche. ***REMARQUE – Le boîtier étanche est une nécessité absolue dans un milieu humide. Voir le n° 8 à la première page de FM0732.***
(16) Consulter le manuel de dimensions pour les égouts de SSPMA afin de déterminer le modèle d'interrupteur de marche / arrêt à utiliser.
(17) Un accès à la fosse septique doit être prévu pour l'entretien du filtre et de la pompe.

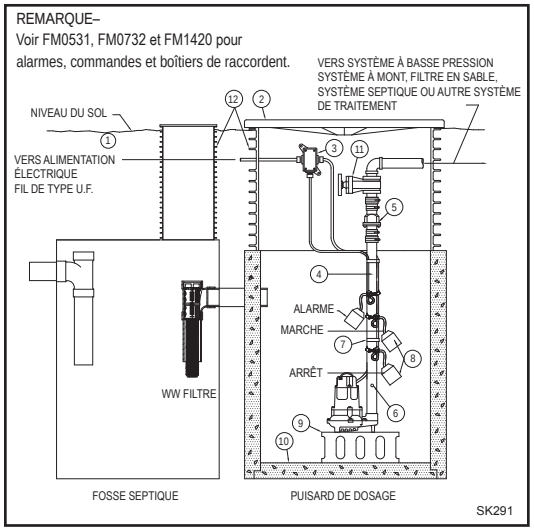
REMARQUE – Les pompes à joint double offrent une protection supplémentaire contre les dommages causés par la défaillance du joint.



INSTALLATION TYPIQUE
POUR L'ASSÈCHEMENT MÉCANIQUE



INSTALLATION TYPIQUE
POUR ÉGOUT

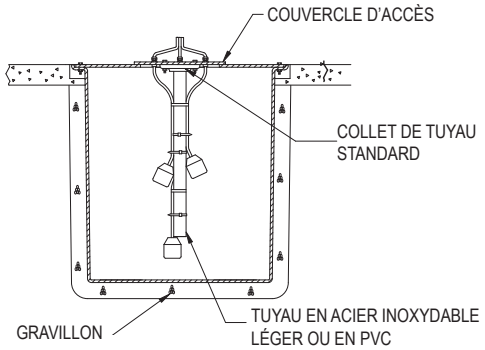


INSTALLATION TYPIQUE
POUR LES EFFLUENTS

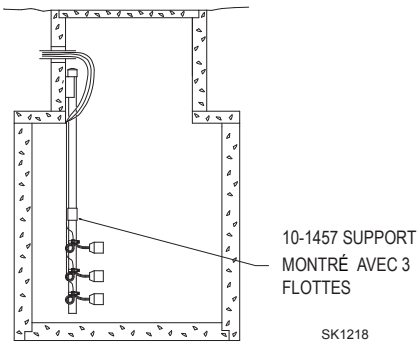
Toutes les installations doivent être conformes aux codes électriques et de plomberie applicables, y compris, mais pas limité aux codes électriques nationaux, locaux, régionaux et aux codes de plomberie provinciaux. Pas conçu pour utilisation dans les endroits dangereux.

MÉTHODES SUGGÉRÉES POUR L'INSTALLATION DU FLOTTEUR

Pour certaines installations, il peut être nécessaire d'installer un support indépendant pour les interrupteurs de commande de niveau pour éviter des accrochages possibles sur la pompe, la tuyauterie, les vannes, etc. Il est possible de fabriquer les supports de flotteur en utilisant des tuyaux et des raccords standard pour faciliter la dépose en cas de réparation. Les supports de flottes sont disponible chez Zoeller tel que décrit au feuillet FM0526 ou peuvent être fabriqué avec de la tuyauterie et des raccords standard.



SUPPORT TYPIQUE DE FLOTTEUR POUR
COUVERCLE DE PUITS EN ACIER



SUPPORT DE FLOTTES TYPIQUE POUR PUISARD EN
BÉTON OU POUR PUIT D' ACCÉS DE FOSSE SEPTIQUE

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Installation des modèles WD et WH

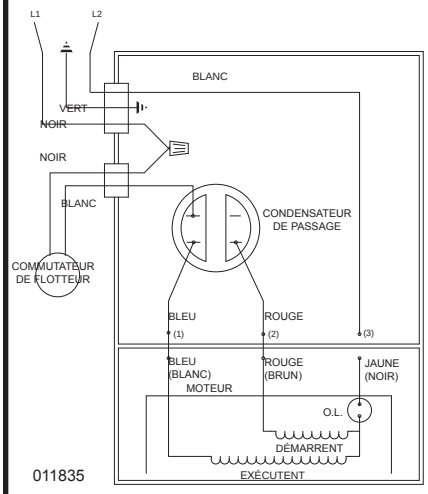
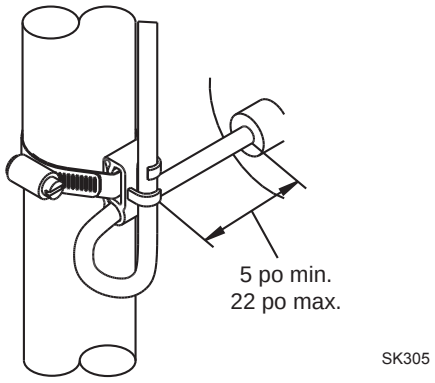


SCHÉMA ÉLECTRIQUE POUR LES MODÈLES
WD - 230 V, monophasé, 60 Hz
WH - 200/208, monophasé, 60 Hz

Définition de la plage de pompage en pouces (1 pouce = 2,5 cm)

Longueur du bras d'attache	5 min.	10	15	20	22 max.
Plage de pompage	9	13.5	18	22	24

Ce tableau ne doit être utilisé que comme guide. À cause du poids du câble, la plage de pompage au-dessus de l'horizontale n'est pas égale à la plage de pompage au-dessous de l'horizontale. Les plages sont basées sur des essais sans turbulence. La plage peut varier en fonction de la température de l'eau et de la forme du cordon. Plus le bras est long, plus les variations de plage de pompage sont importantes.



Interrupteur 20 amps (modèles WD et WH)

Les modèles WD et WH sont entièrement automatiques. Un interrupteur à flotteur est inclus et branché dans le circuit de la pompe pour permettre le fonctionnement automatique après avoir installé l'interrupteur à flotteur correctement sur le tuyau de refoulement. Il faut utiliser le schéma ci-dessus pour attacher correctement l'interrupteur à flotteur et obtenir un bras approprié pour modifier le cycle de marche-arrêt pour chaque application.

Remarque – L'interrupteur risque de mal fonctionner si le câble d'attache n'est pas maintenu dans les limites appropriées.

Remarque – Le câble doit être installé horizontalement.

Instructions de branchement monophasé

ADVERTISSEMENT POUR DES RAISONS DE SÉCURITÉ, IL FAUT TOUJOURS DÉBRANCHER L'ALIMENTATION ÉLECTRIQUE DE LA POMPE AVANT L'INTERVENTION. Les pompes monophasées sont fournies avec une fiche à trois broches pour aider à protéger contre les risques d'électrocution. IL NE FAUT JAMAIS ENLEVER LA BROCHE DE TERRE. La fiche à trois broches doit être branchée dans une prise à trois alvéoles correspondantes. Si le circuit d'alimentation n'a pas une telle prise, il faut installer une prise du type approprié, branchée et mise à la terre selon le code national de l'électricité et tous les codes et règlements locaux appropriés.

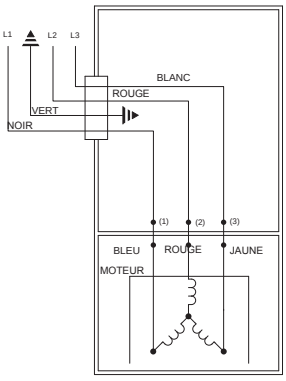
ADVERTISSEMENT « Risque d'électrocution ». Il ne faut pas enlever le cordon d'alimentation et le serre-câble ni brancher directement la pompe.

ADVERTISSEMENT L'installation et la vérification des circuits électriques et de la quincaillerie doivent être faites par un électricien qualifié.

ADVERTISSEMENT Les unités non équipées d'une fiche (monophasée et triphasée) et les unités non automatiques monophasées à fiche de 20 ampères doivent être dotées d'une commande de moteur et d'un régulateur de niveau de liquide lors de l'installation. La tension, l'intensité, la fréquence, la mise à la terre et la puissance du dispositif de commande doivent s'accorder à la pompe sur lequel il est branché.

Instructions de branchement triphasé

Pompe non-automatique triphasée

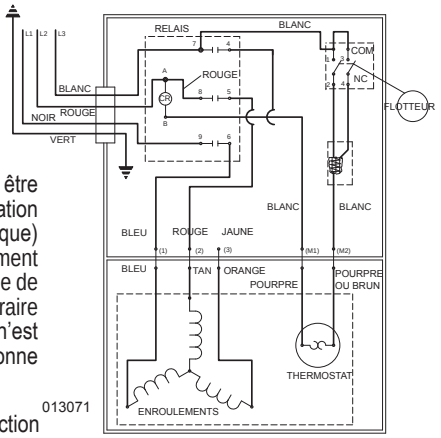


Les pompes triphasées ne sont pas automatiques. Pour qu'elles fonctionnent automatiquement, il faut installer un panneau de commande. Pour brancher le système, suivre les instructions fournies avec le panneau de commande. Pour trois phases automatique les pompes voient le diagramme de câblage automatique de 3 phases situé vers le droit.

Avant d'installer la pompe, vérifier la rotation de la pompe pour être certain que les fils ont été branchés correctement sur l'alimentation et que le fil vert du cordon d'alimentation (voir schéma électrique) est branché sur une bonne terre. Mettre la pompe momentanément sous tension et observer la direction du retour causé par le couple de démarrage. La rotation est correcte si le retour est en sense contraire à la flèche de rotation dans le carter de la pompe. Si la rotation n'est pas correcte, inverser deux des fils de phase pour obtenir la bonne direction de rotation.

Toutes les pompes triphasées doivent être équipées d'un dispositif de démarrage, avec dispositif de protection contre la surcharge. Voir FM0486 pour les installations duplex. La pompe doit être branchée conformément au code national de l'électricité et tous les codes et règlements locaux appropriés. Il ne faut pas installer les pompes dans un endroit classé dangereux conformément au code national de l'électricité, ANSI/NFPA 70.

Pompe automatique triphasée



ADVERTISSEMENT POUR DES RAISONS DE SÉCURITÉ, IL FAUT TOUJOURS DÉBRANCHER L'ALIMENTATION ÉLECTRIQUE DE LA POMPE AVANT L'INTERVENTION.

REMARQUE IMPORTANTE. – Certaines polices d'assurance commerciales et résidentielles couvrent les dommages résultant d'une défaillance du **produit. Dans la plupart des cas, vous devez être en possession du produit pour déposer une réclamation. Zoeller Pump Co. s'engage à remplacer l'appareil ou à rembourser le prix d'achat original après que l'assureur aura réglé la réclamation dans un cas où vous êtes tenu d'être en possession du produit pour documenter une réclamation soumise à votre assureur.**

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SECTION 4 - PROCESS VALVES

MOV-201, 401, 600 TRUE UNION 3-WAY BALL VALVE, PVC, 2 IN - HAYWARD TW1200ST-EK61

MOV-201, 401, 600 ELECTRIC ACTUATOR - MAXAIRTECH AE03-120VAC-LED

VRV-301 VACUUM RELIEF VALVE, 3 IN FNPT, ADJUSTABLE - FPZ VRL9

MOV-601,602 TRUE UNION BALL VALVE, PVC, 2 IN - HAYWARD TB1200ST-EK61

MOV-601,602 ELECTRIC ACTUATOR - MAXAIRTECH AE02-120VAC-LED

VRV-601,602 VACUUM RELIEF VALVE, 1 IN FNPT - PLASTOMATIC VBM100V-PV



TW Series Three-Way True Union Ball Valves

1/2" TO 6" PVC AND CPVC

KEY FEATURES

- PVC and CPVC
- Position Indicator
- Easily Actuated
- PTFE Seats
- FPM or EPDM O-Rings
- Double O-Ring Stem Seal

OPTIONS

- Lockouts Available
- Pneumatic and Electric Actuators
- Cross-Flow Ball
- NT Ball
- TP Ball

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

ACTUATED VALVE



SELECTION CHART

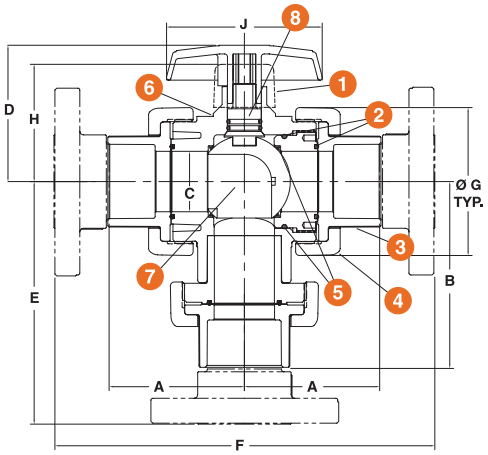
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/2" – 4" (DN15 – DN100)	PVC or CPVC	Socket, Threaded or Flanged	FPM or EPDM	150 PSI @ 70°F Non-Shock
6" * (DN150)		Flanged		

* 4" valve venturied to 6"

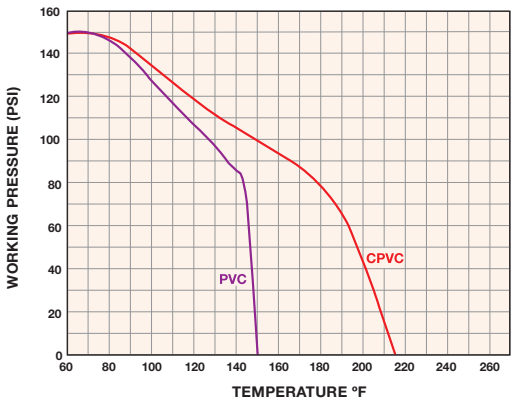
TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Actuation Mount
2. O-Ring Seals
3. End Connector
4. Assembly Nut
5. PTFE Seats
6. Body
7. Ball
8. Stem



OPERATING TEMPERATURE / PRESSURE



DIMENSIONS – INCHES / MILLIMETERS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in / mm	G in / mm	H in / mm	J in / mm
1/2 / 15	2.30 / 58	3.29 / 84	0.50 / 13	2.94 / 75	3.87 / 98	6.72 / 171	2.25 / 57	2.53 / 64	3.50 / 89
3/4 / 20	2.56 / 65	3.57 / 91	0.75 / 19	2.97 / 75	4.60 / 117	7.50 / 191	2.63 / 67	2.82 / 72	3.50 / 89
1 / 25	2.98 / 76	4.14 / 105	1.00 / 25	3.21 / 82	4.77 / 121	8.50 / 216	3.00 / 76	3.08 / 78	4.00 / 102
1-1/4 / 32	4.39 / 112	5.94 / 151	2.00 / 51	3.63 / 92	5.19 / 132	11.54 / 293	4.00 / 102	3.50 / 89	4.00 / 102
1-1/2 / 40	4.39 / 109	5.87 / 149	2.00 / 51	3.63 / 92	6.00 / 152	11.85 / 301	4.00 / 102	3.50 / 89	4.00 / 102
2 / 50	4.38 / 111	6.00 / 152	2.00 / 51	4.31 / 109	6.75 / 171	12.25 / 311	4.75 / 121	3.95 / 100	5.00 / 127
2-1/2 / 65	5.90 / 150	7.59 / 193	3.00 / 76	7.02 / 178	8.68 / 220	15.92 / 404	6.40 / 163	5.88 / 149	10.50 / 267
3 / 80	5.90 / 150	7.59 / 193	3.00 / 76	7.02 / 178	8.72 / 221	16.00 / 406	6.40 / 163	5.88 / 149	10.50 / 267
4 / 100	7.00 / 178	9.33 / 237	4.00 / 102	8.02 / 204	10.44 / 265	18.88 / 480	8.56 / 217	8.88 / 226	10.50 / 267
6 / 150	N/A	N/A	4.00 / 102	8.02 / 204	11.25 / 286	20.25 / 514	8.56 / 217	8.88 / 226	10.50 / 267

Dimensions are subject to change without notice – consult factory for installation information

Cv VALUES

SIZE in / DN	Cv VALUES GPM	SIZE in / DN	Cv VALUES GPM
1/2 / 15	3.0	2 / 50	58.0
3/4 / 20	7.0	3 / 80	190.0
1 / 25	10.0	4 / 100	450.0
1-1/2 / 40	30.0	6 / 150	340.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

FLOW SCHEMATICS – TOP VIEW

FLOW AT	NT OR TN BALL		
0°	Port A		Port B
45° *No Deadhead*	Port A		Port B
90°	Port A		Port B

FLOW AT	CROSS FLOW BALL		
0°	Port A		Port B
90°	Port A		Port B
180°	Port A		Port B

FLOW AT	TW BALL		
0°	Port A		Port B
90° *Center-Off*	Port A		Port B
180°	Port A		Port B

FLOW AT	TP BALL		
0°	Port A		Port B
90°	Port A		Port B

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HAYWARD INDUSTRIAL PRODUCTS
INSTALLATION OPERATION & MAINTENANCE
OF TRUE UNION THREE WAY BALL VALVE

PLEASE READ THE FOLLOWING INFORMATION PRIOR TO INSTALLING AND USING HAYWARD VALVES, STRAINERS, FILTERS, AND OTHER ASSOCIATED PRODUCTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS INJURY.

1. Hayward guarantees its products against defective material and workmanship only. Hayward assumes no responsibility for damage or injuries resulting from improper installation, misapplication, or abuse of any product.
2. Hayward assumes no responsibility for damage or injury resulting from chemical incompatibility between its products and the process fluids to which they are subjected. Compatibility charts provided in Hayward literature are based on ambient temperatures of 70 ºF and are for reference only. Customer should always test to determine application suitability.
3. Consult Hayward literature to determine operating pressure and temperature limitations before installing any Hayward product. Note that the maximum recommended fluid velocity through any Hayward product is eight feet per second. Higher flow rates can result in possible damage due to the water hammer effect. Also note that maximum operating pressure is dependent upon material selection as well as operating temperature.
4. Hayward products are designed primarily for use with non-compressible liquids. They should NEVER be used or tested with compressible fluids such as compressed air or nitrogen.
5. Systems should always be depressurized and drained prior to installing or maintaining Hayward products.
6. Temperature effect on piping systems should always be considered when the systems are initially designed. Piping systems must be designed and supported to prevent excess mechanical loading on Hayward equipment due to system misalignment, weight, shock, vibration, and the effects of thermal expansion and contraction.
7. Because PVC and CPVC plastic products become brittle below 40 ºF, Hayward recommends caution in their installation and use below this temperature.
8. Published operating torque requirements are based upon testing of new valves using clean water at 70 ºF. Valve torque is affected by many factors including fluid chemistry, viscosity, flow rate, and temperature. These should be considered when sizing electric or pneumatic actuators.
9. Due to differential thermal expansion rates between metal and plastic, transmittal of pipe vibration, and pipe loading forces DIRECT INSTALLATION OF METAL PIPE INTO PLASTIC CONNECTIONS IS NOT RECOMMENDED. Wherever installation of plastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameter in length of plastic pipe be installed upstream and downstream of the plastic valve to compensate for the factors mentioned above.

SOCKET CONNECTION:

Socket end connections are manufactured to ASTM D2467-94. Solvent cementing of socket end connections to pipe should be performed per ASTM specifications D2855-87. Cut pipe square. Chamfer and deburr pipe. Surfaces must be cleaned and free of dirt, moisture, oil and other foreign material. Remove assembly nuts and end connectors from valve body. Slide assembly nuts, with threads facing valve, onto pipe to which the end connector is to be cemented. Apply primer to inside socket surface of end connector. Never allow primer or cement to contact valve ball or end connector o-ring sealing surfaces, as leaking may result. Use a scrubbing motion. Repeat applications may be necessary to soften the surface of the socket. Next, liberally apply primer to the male end of the pipe to the length of the socket depth. Again apply to the socket, without delay apply cement to the pipe while the surface is still wet with primer. Next apply cement lightly, but uniformly to the inside of the socket. Apply a second coat of cement to the pipe, and assemble the end connector to the pipe, rotating the end connector 1/4 turn in one direction as it is slipped to full depth on to the pipe. The end connector should be held in position for approx. 30 seconds to allow the connection to "set". After assembly wipe off excess cement. Full set time is a minimum of 30 minutes at 60 to 100 ºF. Full cure time should be based on the chart below.

JOINT CURE SCHEDULE:

The cure schedules are suggested as guides. They are based on laboratory test data, and should not be taken to be the recommendations of all cement manufacturers. Individual manufacturer's recommendations for their particular cement should be followed.

	Test Pressures for Pipe Sizes ½" to 1-1/4"		Test Pressures for Pipe Sizes 1-1/2" to 3"		Test Pressures for Pipe Sizes 4" & 5"		Test Pressures for Pipe Sizes 6" to 8"	
Temperature Range During Cure Period(B) °F(°C)	Up to 180 PSI (1240 kPa)	Above 180 to 370 PSI (1240 to 2550 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)
60 to 100 (15 to 40)	1 hour	6 hours	2 hours	12 hours	6 hours	18 hours	8 hours	1 day
40 to 60 (5 to 15)	2 hours	12 hours	4 hours	1 day	12 hours	36 hours	16 hours	4 days
20 to 40 (-7 to 5)	6 hours	36 hours	12 hours	3 days	36 hours (A)	4 days (A)	3 days (A)	9 days (A)
10 to 20 (-15 to 7)	8 hours	2 days	16 hours	4 days	3 days (A)	8 days (A)	4 days (A)	12 days (A)
Colder than 10 (-15)	Extreme care should be exercised on all joints made where pipe, fittings or cement is below 10°F.							

A: It is important to note that at temperatures colder than 20°F on sizes that exceed 3 in., test results indicate that many variables exist in the actual cure rate of the joint. The data expressed in these categories represent only estimated averages. In some cases, cure will be achieved in less time, but isolated test results indicate that even longer periods of cure may be required.

B: These cure schedules are based on laboratory test data obtained on Net Fit Joints (NET FIT=in a dry fit the pipe bottoms snugly in the fitting socket without meeting interference).

THREADED CONNECTION:

Threaded end connections are manufactured to ASTM specifications D2464-88. F437-88 and ANSI B2.1. Wrap threads of pipe with Teflon tape of 3 to 3-1/2 mil thickness. The tape should be wrapped in a clockwise direction starting at the first or second full thread. Overlap each wrap by 1/2 the width of the tape. The wrap should be applied with sufficient tension to allow the threads of a single wrapped area to show through without cutting the tape. The wrap should continue for the full effective length of the thread. Pipe sizes 2" and greater will not benefit with more than a second wrap, due to the greater thread depth. To provide a leak proof joint, the pipe should be threaded into the end connection "hand tight". Using a strap wrench only. (Never use a stillson type wrench) tighten the joint an additional 1/2 to 1-1/2 turns past hand tight. Tightening beyond this point may induce excessive stress that could cause failure.

FLANGED CONNECTION:

Flange bolts should be tight enough to slightly compress the gasket and make a good seal, without distorting or putting excessive stress on the flanges. Suitable washers should be used between the bolt head and flange and the nut and flange. Bolts should be tightened in alternating sequence.

RECOMMENDED FLANGE BOLT TORQUE

FLANGE SIZE	BOLT DIA.	TORQUE FT. LBS.	FLANGE SIZE	BOLT DIA.	TORQUE FT. LBS.
1/2	1/2	10-15	2	5/8	15-25
3/4	1/2	10-15	2-1/2	5/8	20-25
1	1/2	10-15	3	5/8	20-25
1-1/4	1/2	10-15	4	5/8	20-25
1-1/2	1/2	10-15	6	3/4	30-40

NOTE: USE WELL LUBRICATED METAL BOLTS AND NUTS. USE SOFT RUBBER GASKETS.

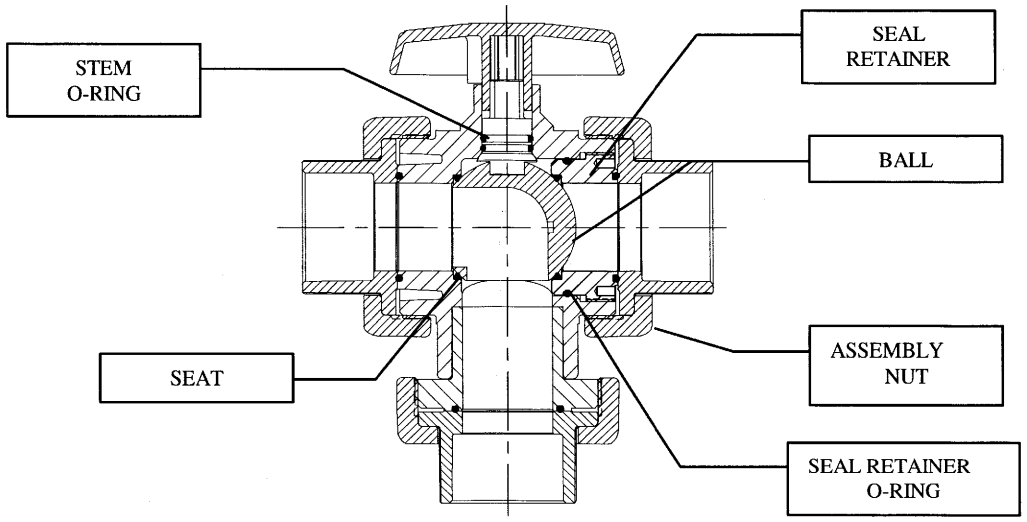
ADJUSTMENT:

EXTREME CAUTION MUST BE TAKEN WHEN WORKING ON THIS VALVE.
THE PIPING SYSTEM MUST BE DEPRESSURIZED AND DRAINED. PROPER CARE MUST BE TAKEN. CONSULT M.S.D.S. (MATERIAL SAFETY DATA SHEETS) INFORMATION REGARDING YOUR SPECIFIC APPLICATION.

Remove the assembly nut and end connector from the "adjust" end of the body which is always the right port as viewed from the top with the tab up; or the complete valve body from the piping system. The direction of rotation is right hand tightens (clockwise rotation), counterclockwise loosens. The assembly nut should be installed on the valve "hand tight". Using a strap wrench only the joint may be tightened 1/2 to 3/4 of a turn past hand tight.

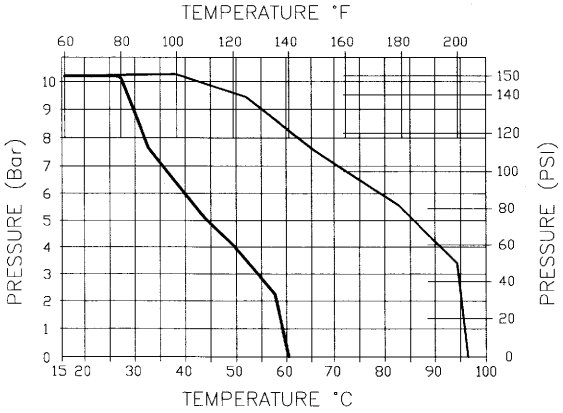
REPAIR:

Follow the adjustment sequence and information above, but rotating the seal retainer completely in the "loosen" direction and remove it from valve body. The o-rings and seals are now accessible for replacement using a "seal" repair kit. Carefully remove the o-rings from their respective locations taking care not to scratch their sealing surfaces. Insert o-rings and re-assemble. See table below.



OPERATION:

The valve flow pattern is in or out one side port and down through the bottom port. Ball pattern allows both side ports to be blocked at the same time.



Recommended valve stem torque to rotate the ball 360° when valve is reassembled.

VALVE SIZE	TORQUE IN*LB
1/2"	40
3/4"	50
1"	60
1 1/2"	70
2"	80
3" & 2 1/2"	140
4" & 6"	170

AE SERIES ELECTRIC ACTUATORS

AE Series electric actuators provide a highly reliable solution for your electric actuation requirements. With torque ranges from 300 in-lbs to over 5200 in-lbs, including optional handwheel overrides, fast acting solutions, as well as extra limit switches, LED position indication, internal space heaters, and modulation capability, the AE Series is designed to exceed your expectations.

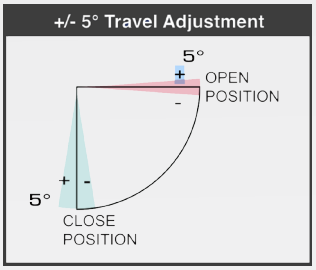


On/Off Control

- Multiple voltages available
- Fast acting and extended duty models available
- Easy wiring and setup
- Manual override standard

Proportional Control

- Selectable input/output signal (4-20mA, 0-10V, 0-5V)
- Available in 120VAC or 220VAC
- Easy Travel and sensitivity adjustment
- Manual override standard



Features:

- Compact design & direct ISO 5211 valve mounting
- Easy field wiring, setup and adjustment
- Multiple voltage options available (AC/DC)
- Open and close directions ±5° travel adjustment
- Standard manual override, hand wheel on larger models
- Standard auxiliary limit switches for open/close feedback
- Standard Open/Close LEDs for easy visual indication
- Standard internal space heater & thermal overload protection
- Selectable input/output signal on modulating models
- Optional 180° rotation for on/off models only up to AE03

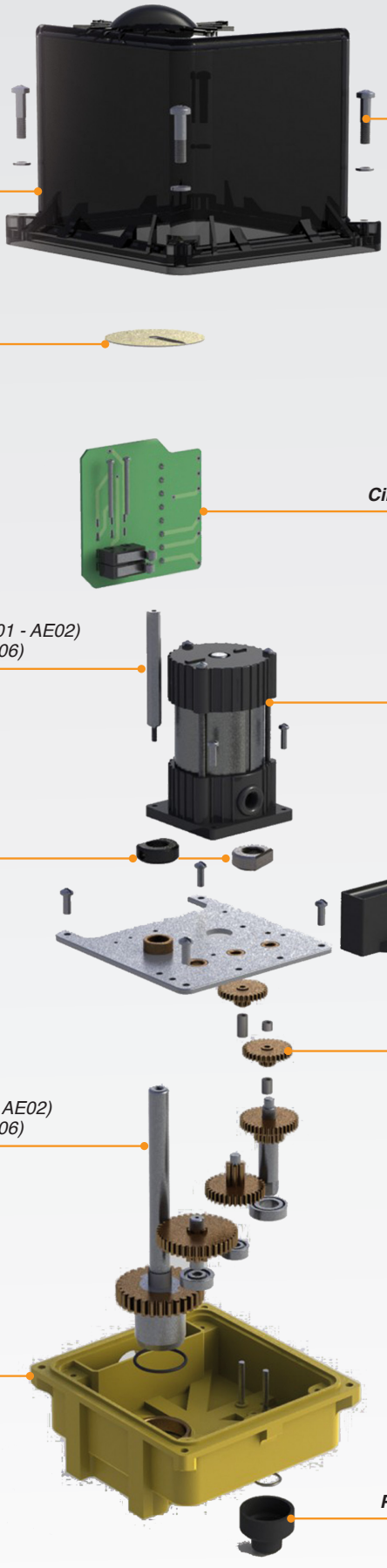
Configurations:

- Standard On/Off Control
  (120VAC, 220VAC, + more AC options)
- Extended Duty On/Off Control*
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Fast Acting On/Off Control
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Modulating Control
  (120VAC, 220VAC)

SPECIFICATIONS	
Rotation	90 Degrees ±5° Adjustment
Housing	Aluminum Alloy Base, Polycarbonate Cover
Gears	Heavy duty sintered metal
Back-Drive Resistance Method	High gearing ratio + back-drive resistant motor
Ambient Temp. Range	14°F to 140°F
Relative Humidity Range	30% to 95%
Enclosure Protection Rating	IP67 (Water and dust proof)
Switches	SPDT Mechanical Switches (2 Auxiliary)
Power Supply Voltage (AC/DC)	120VAC, 220VAC, 24VAC/DC dual voltage
3-Phase AC Power Supply Voltage	220VAC, 380VAC, 480VAC
Modulating Input Signal (Selectable)	4-20mA, 0-10V, 0-5V
Modulating Output Signal (Selectable)	4-20mA, 0-10V, 0-5V
Torque Range	75 to 5,290 in-lbs
Valve Mounting	ISO 5211
Manual Override	Included (hand wheel on larger sizes)

*100% Duty Cycle according to IEC60034-S4 duty type.

AE SERIES EXPLODED VIEW



Cover - *Polycarbonate*

Cover Screws - *Stainless steel*

Indicator - *Aluminum*

Circuit Board with Limit Switches - *FR*

Standoff - *Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Motor

Cams - *Metal*

Gears - *Sintered metal*

Shaft - *Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Lower Box - *Aluminum*

Protection for Manual Lever - *Rubber*

* NOTE: AE01/AE02 shown.

PART NUMBER BUILDER

1 Model [ ] - 2 Voltage [ ]

1 Select desired model

Torques shown in inch-lbs.

Standard On/Off Models

Model No.	Torque	Duty	Cycle	Description
AE01-XXXVAC-YY	301	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE02-XXXVAC-YY	434	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03-XXXVAC-YY	1478	50%	8s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03H-XXXVAC-YY	1797	50%	10s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE04H-XXXVAC-YY	3292	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE05H-XXXVAC-YY	4355	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE06H-XXXVAC-YY	5293	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override

Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. Torques shown in inch-lbs.

100% Duty Cycle On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01A-XXXVAC	283	100%	16s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-XXXVAC	443	100%	36s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-XXXVAC	867	100%	65s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override

100% Duty Cycle Models - DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01A-24VAC/24VDC	310	100%	11s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-24VAC/24VDC	443	100%	12s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03A-24VAC/24VDC	1239	100%	8s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-24VAC/24VDC	1381	100%	10s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override
AE04HA-24VAC/24VDC	2434	100%	27s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override

Fast Acting On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01FA-M1-XXXVAC	78	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-XXXVAC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-M2-XXXVAC	885	100%	5s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Fast Acting On/Off Models - 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01FA-M1-24VAC/24VDC	89	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-24VAC/24VDC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-24VAC/24VDC	443	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Modulating Models - 120VAC/240VAC

Model No.	Torque	Duty*	Board	Description
AEM01A-XXXVAC	221	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M1-XXXVAC	319	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M2-XXXVAC	443	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM03HA-M1-XXXVAC	1478	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM03HA-M2-XXXVAC	1797	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM04HA-XXXVAC	2673	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM05HA-XXXVAC	4355	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM06HA-XXXVAC	5293	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA

**Note - No load cycle time.
*Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.
Fast Acting models rated 100% duty in 30 min.

Torques shown in inch-lbs.

2 Select desired voltage

120 VAC	240 VAC	240-3PH VAC	380-3PH VAC	480-3PH VAC
√	√	-	-	-
√	√	-	-	-
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√
√	√
√	√
√	√
√	√
√	√

*12 VDC available as special order only.

Standard On/Off Models - For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.
Extended Duty Cycle On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage.
Modulating Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.
Fast Acting On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

TECHNICAL DATA

Standard On/Off Control Series, 120VAC/240VAC & 240VAC/380VAC/480VAC-3PHASE

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01-XXXVAC-YY	301	34	3.7	1.7	25%	10W	10s	0.7A	0.38A
AE02-XXXVAC-YY	434	49	4.0	1.8	25%	15W	10s	0.9A	0.5A
AE03-XXXVAC-YY	1478	167	9.7	4.4	50%	25W	8s	1.2A	0.72A
AE03H-XXXVAC-YY	1797	203	17.4	7.9	50%	25W	10s	1.2A	0.72A
AE04H-XXXVAC-YY	3292	372	19.0	8.6	50%	25W	30s	1.2A	0.72A
AE05H-XXXVAC-YY	4355	492	19.4	8.8	50%	40W	30s	2.0A	0.75A
AE06H-XXXVAC-YY	5293	598	20.1	9.1	50%	60W	30s	2.4A	0.8A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.

100% Duty Cycle On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01A-XXXVAC	283	32	3.7	1.7	100%	25W	16s	0.3A	0.15A
AE02A-XXXVAC	443	50	4.0	1.8	100%	25W	36s	0.2A	0.10A
AE03HA-XXXVAC	867	98	19.4	8.8	100%	25W	65s	0.2A	0.10A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage.

100% Duty Cycle On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01A-24VAC/24VDC	310	35	4.4	2	100%	7W	11s	1.5A	1.5A
AE02A-24VAC/24VDC	443	50	4.9	2.2	100%	7W	12s	1.5A	1.5A
AE03A-24VAC/24VDC	1239	140	9.7	4.4	100%	25W	8s	3.0A	3.0A
AE03HA-24VAC/24VDC	1381	156	17.4	7.9	100%	25W	10s	3.0A	3.0A
AE04HA-24VAC/24VDC	2434	275	19.0	8.6	100%	25W	27s	3.0A	3.0A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.

MODULATING Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Deg. Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AEM01A-XXXVAC-AMD	221	25	4.9	2.2	100%	25W	16s	0.2A	0.10A
AEM02A-M1-XXXVAC-AMD	319	36	5.5	2.5	100%	25W	16s	0.3A	0.15A
AEM02A-M2-XXXVAC-AMD	443	50	5.5	2.5	100%	25W	35s	0.2A	0.10A
AEM03A-M1-XXXVAC-AMD	885	100	7.1	3.2	100%	25W	36s	0.3A	0.15A
AEM03HA-M1-XXXVAC-BMD	1478	167	10.6	4.8	100%	25W	8s	1.2A	0.72A
AEM03HA-M2-XXXVAC-BMD	1797	203	18.3	8.3	100%	25W	10s	1.2A	0.72A
AEM04HA-XXXVAC-BMD	2673	302	19.8	9	100%	25W	30s	1.2A	0.72A
AEM05HA-XXXVAC-BMD	4355	492	20.3	9.2	100%	40W	30s	2.0A	0.75A
AEM06HA-XXXVAC-BMD	5293	598	20.9	9.5	100%	60W	30s	2.4A	0.80A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

FAST ACTING On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01FA-M1-XXXVAC	78	8.8	3.7	1.7	100%	15W	1s	0.7A	0.38A
AE01FA-M2-XXXVAC	221	25	3.7	1.7	100%	15W	3s	0.8A	0.60A
AE03FA-M2-XXXVAC	885	100	9.7	4.4	100%	25W	5s	1.2A	0.72A

Note - 100% duty in 30 min. Torques shown in inch-lbs. For "XXX", choose either 120 or 240 for required voltage.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

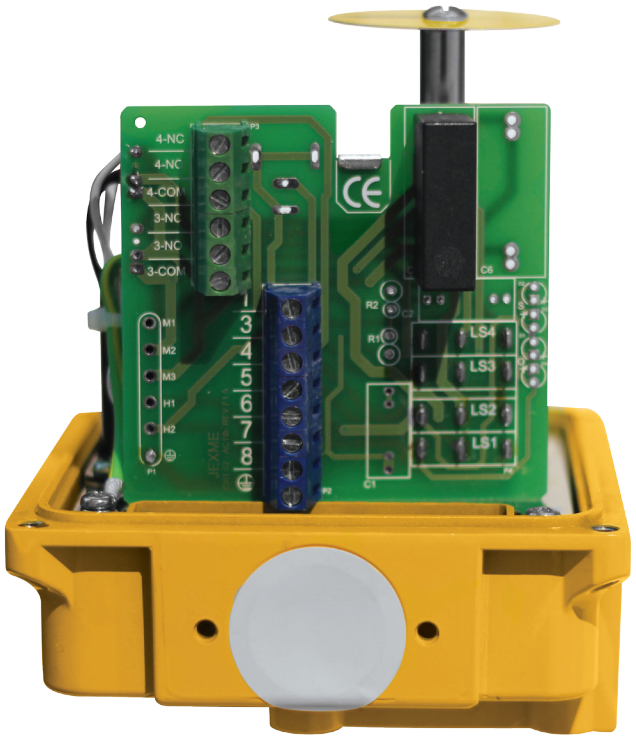
FAST ACTING On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

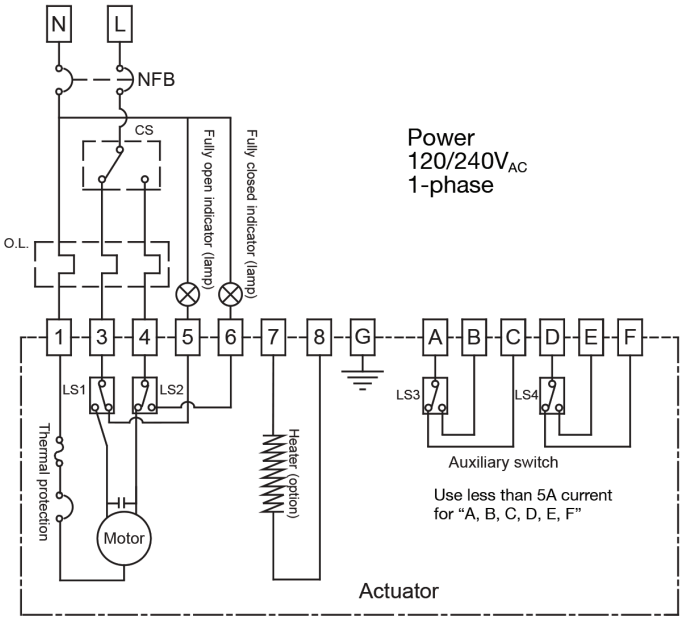
Model No. - Voltage	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01FA-M1-24VAC/24VDC	89	10	3.7	1.7	100%	7W	1s	2.0A	2.0A
AE01FA-M2-24VAC/24VDC	221	25	3.7	1.7	100%	7W	3s	1.6A	1.6A
AE03FA-24VAC/24VDC	443	50	9.7	4.4	100%	25W	3s	3.5A	3.5A

Note - 100% duty in 30 min. 1) Power is consumption at "no load". 2) Amps are based on "full load" at rated torque.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

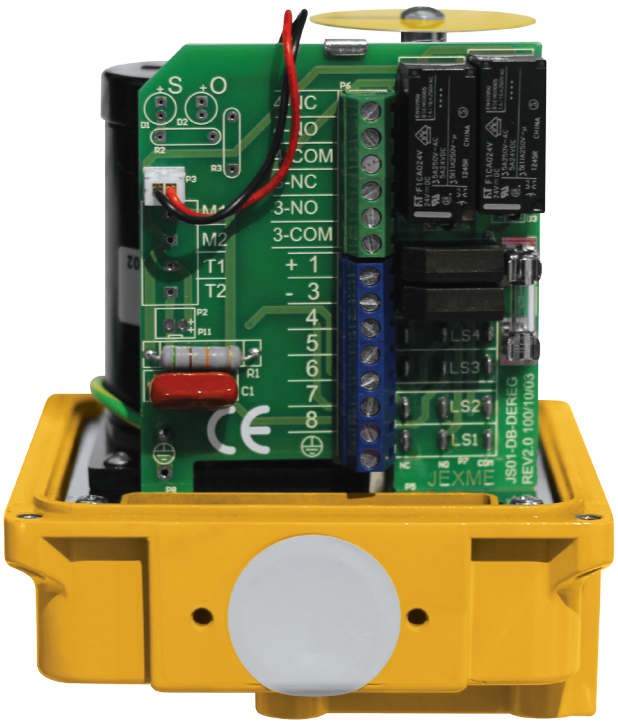
ON/OFF TYPE FOR 120/240 VAC

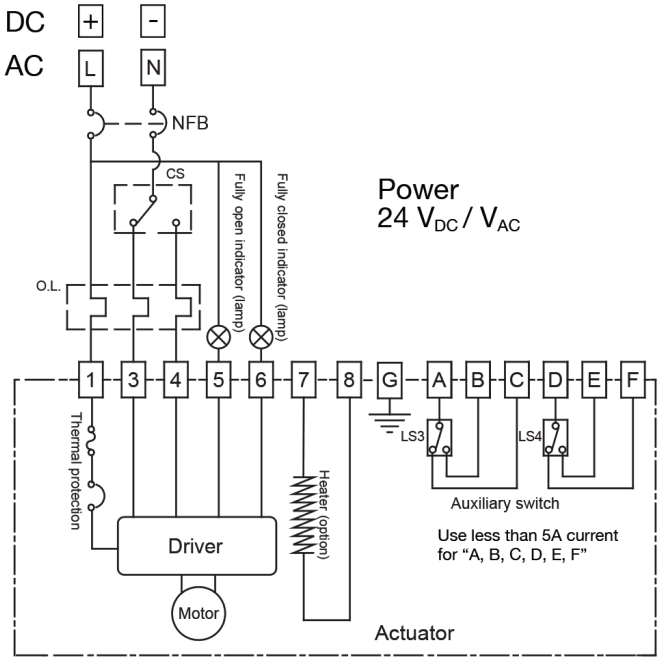
Single Phase



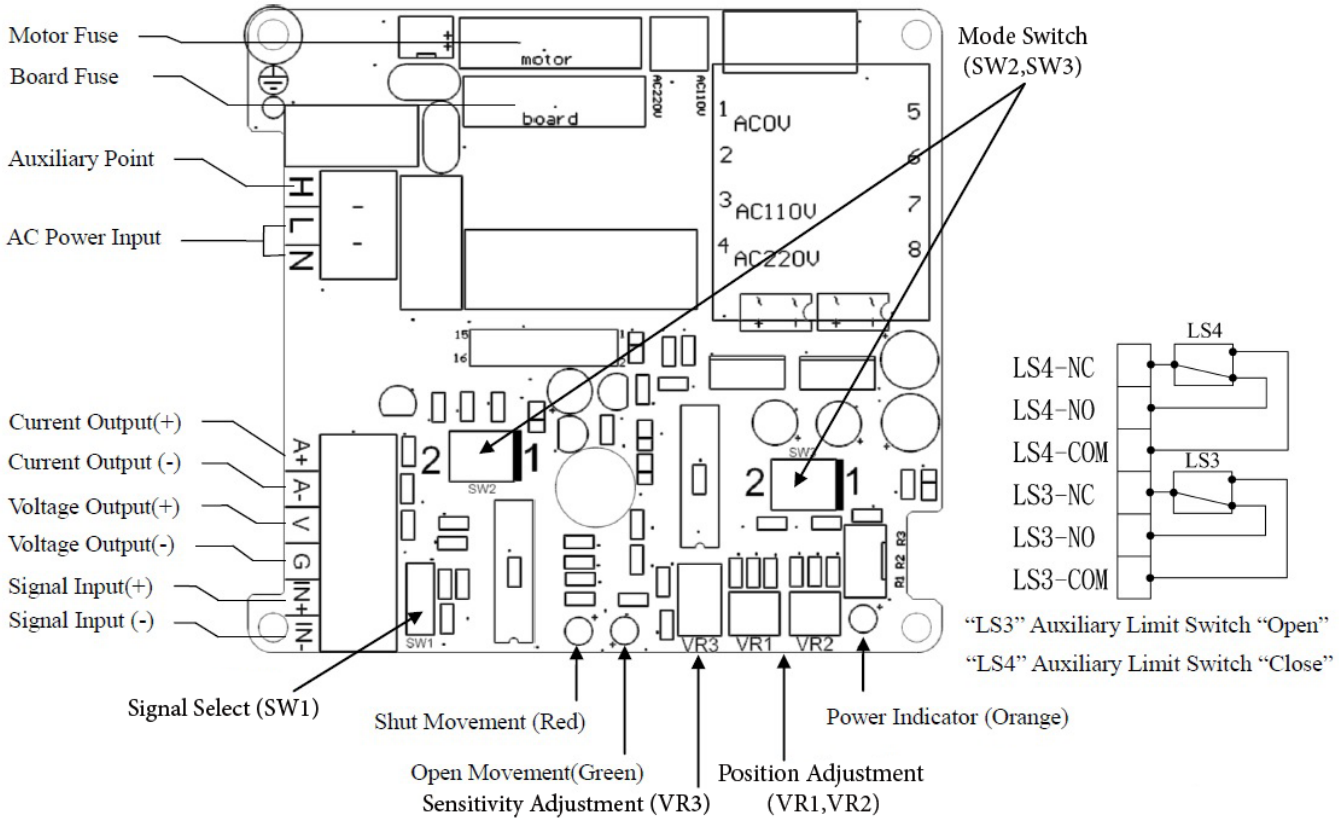


ON/OFF TYPE FOR 24VDC/VAC

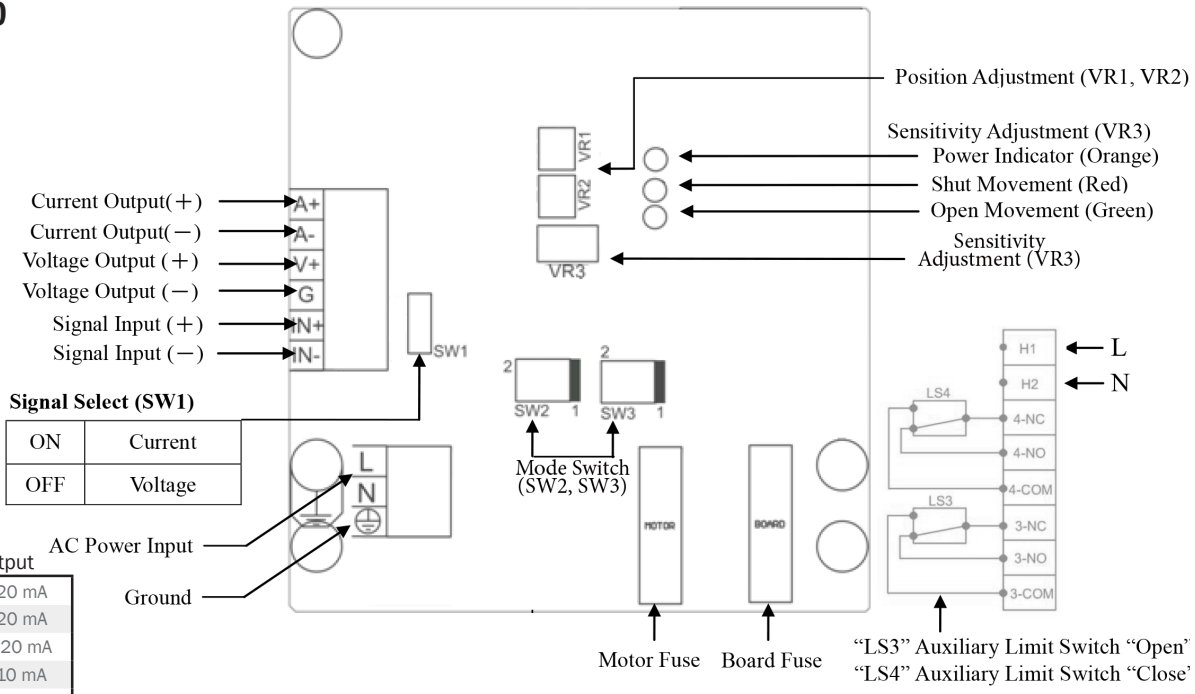




AMD BOARD



BMD BOARD



Signal Select (SW1)

ON	Current
OFF	Voltage

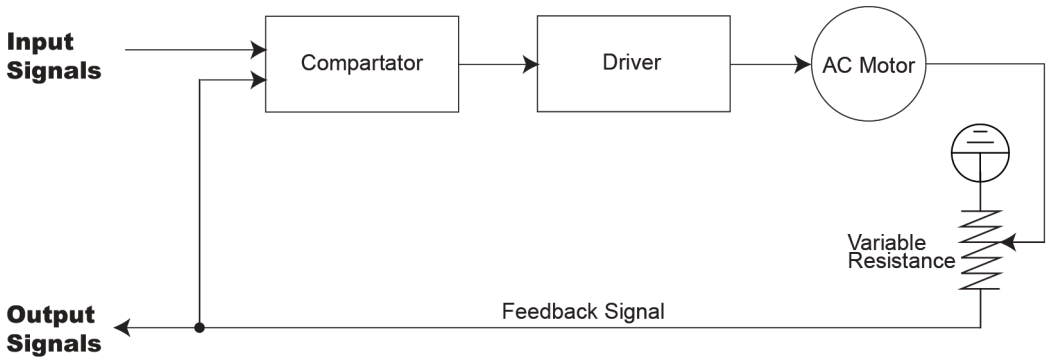
Signal Input	Signal Output
4 ~ 20 mA	2 ~ 10 V, 4~20 mA
2 ~ 10 V	2 ~ 10 V, 4~20 mA
0 ~ 10 V	0 ~ 10 V, 0 ~ 20 mA
1 ~ 5 V	1 ~ 5 V, 2 ~ 10 mA
0 ~ 5 V	0 ~ 5 V, 0 ~ 10 mA

Note - When using current signal, external resistant is under 500 Ω.

Differences between AMD and BMD:

BMD units should be used for higher torques and faster operating speeds. AMD units provide power usage efficiencies and should be used when power savings are a concern.

SIGNAL FLOW OF MODULATION TYPE

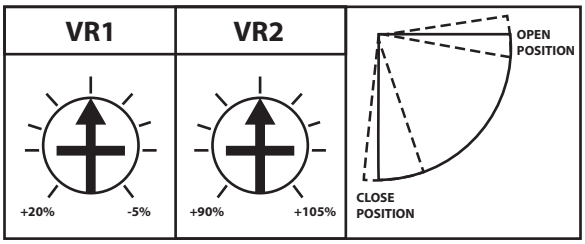


SWITCH & ADJUSTMENT SETTINGS

SW1 Input Signal Selection

	ON	OFF (1)
	Current Input Signal	Voltage Input Signal
SW1	4 ~ 20 mA	2~10 V 0~10 V 1~5 V 0~5 V

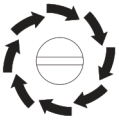
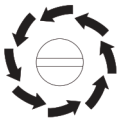
VR1 & VR2 Position Adjustment



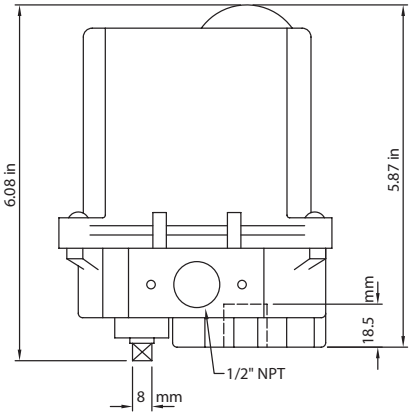
SW2 & SW3 Operation Selection

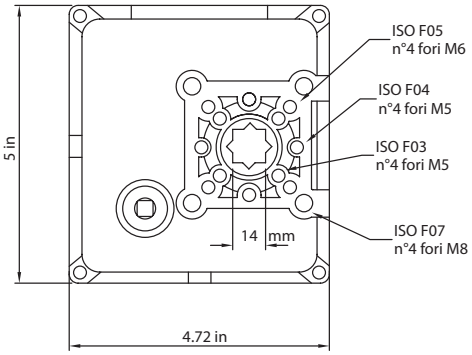
		SW2	
		1	2
SW3	1	MODE A Valve is fully closed when the input signal is 4mA, 2V, 1V, or 0V	X
	2	X	MODE B Valve is fully opened when the input signal is 4mA, 2V, 1V, or 0V

VR3 Sensitivity Adjustment

Rotation	Result
Clockwise	 Increase sensitivity
Counter-clockwise	 Decrease sensitivity

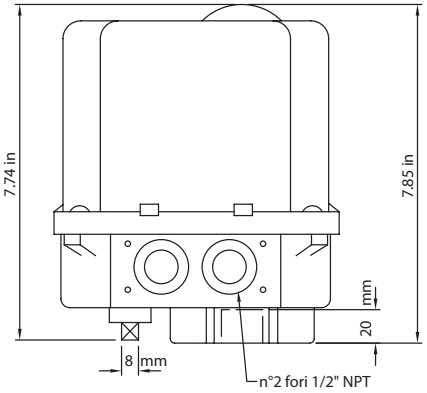
AE01 - AE02

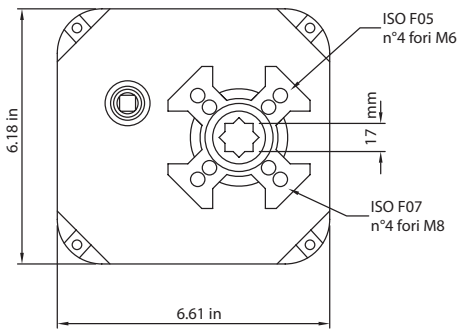






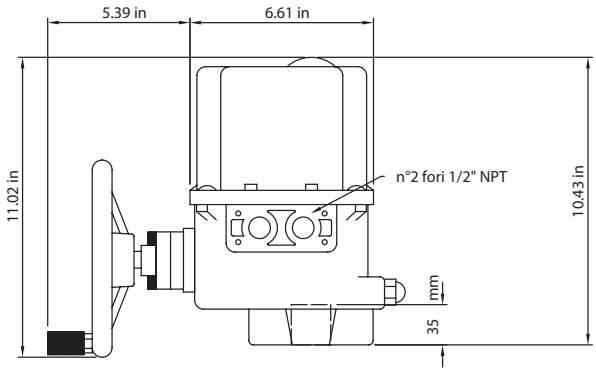
AE03

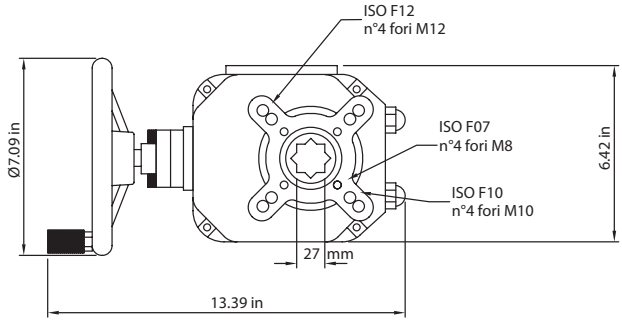






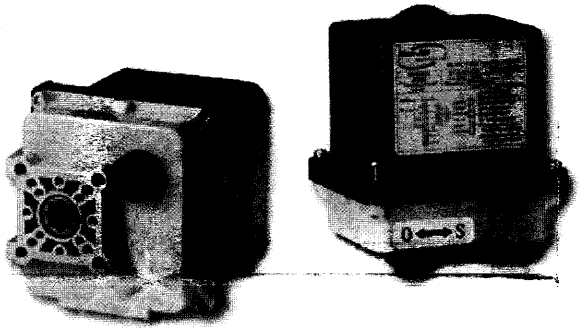
AE03H - AE06H







AE Series Electric Actuator Installation & Operation Manual



Technical Data	
OPERATION VOLTAGE	Standard Type, 110 / 220 / 380 VAC Standard Type, 12 VAC , 24 VDC , and 24 VAC / VDC "100% Duty Cycle" Type 110 / 220 VAC "Fast Acting" Type 110 / 220 VAC
POWER CONSUMPTION	10 to 60 watts (depending on model)
PROTECTION CLASS	IP 67 according to STD. IEC60529
RATED TORQUE	35 to 600 NM (310 to 5310 lbf*in)
TEMPERATURE RANGE	-10 to 60°C (14 to 140°F)
ROTATION ANGLE	90°(±5°)
CASE MATERIAL	Aluminum alloy
COVER MATERIAL	Polycarbonate
CERTIFICATION / TEST	Comply with CE directives of - The LOW Voltage Directive, 73/23/EEC, 93/68 EEC - The EMC Directive, 89/336/EEC

Operational Conditions & Safety Precautions

1. Follow the instruction manual to connect power – do not alter the electronic circuit. Tampering may result in electrical shock.
2. AE Series actuators should be operated and wired as single units – do not connect multiple units in parallel or in series.
3. If two or more actuators are used at the same time, please install a relay for each unit to ensure safety of operation.
4. Do not use this product in hazardous environments where there is a presence of explosive gas or other chemically active substances.
5. The 110VAC/220VAC motor has thermal overload protection.
6. 12VDC and 24VAC/DC motors do not have thermal overload protection. For PCB series, there is a fuse on the board.
7. AE01A, AE02A, AE03, AE03H-AE06H models can be used with a proportional controller.

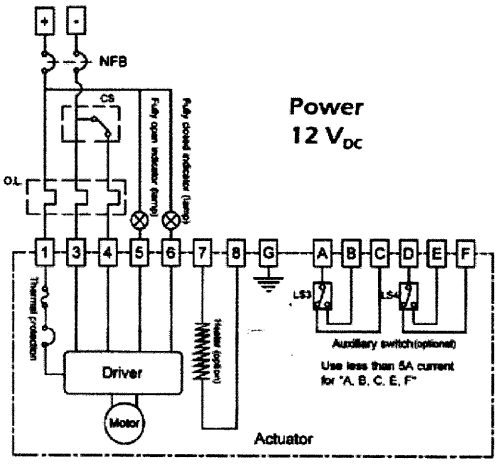
Installation & Wiring

Pre-Installation Procedure & Safety Precautions

1. Confirm the input voltage before powering up (120VAC, 220VAC, 3-PHASE, 24VAC/DC, etc.)
2. Ensure that the pipe line is clear before actuator installation.
3. During initial testing and position adjustment, there will be live wires. An experienced electrician should perform all electrical testing and wiring.

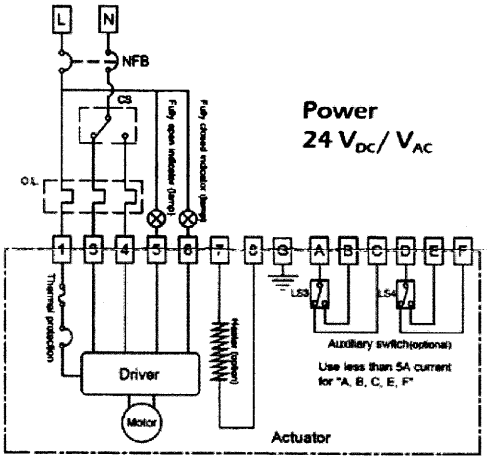
Part No	ISO Mounting	DSQ Drive (mm)
AE01-AE02	F03/F04/F05/F07	14
AE03	F05/F07	17
AE03H-AE06H	F07/F10/F12	27

ON/OFF TYPE FOR 12VDC

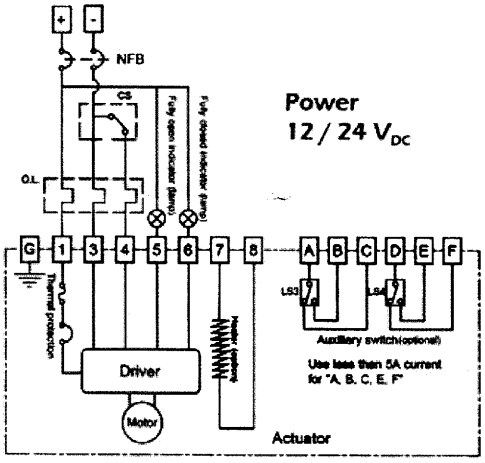


* Call factory for details on 12VDC units.

ON/OFF TYPE FOR 24VDC/VAC



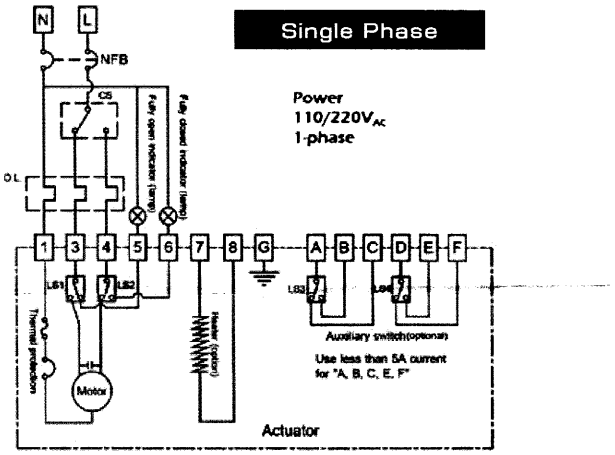
ON/OFF TYPE FOR 12/24VDC

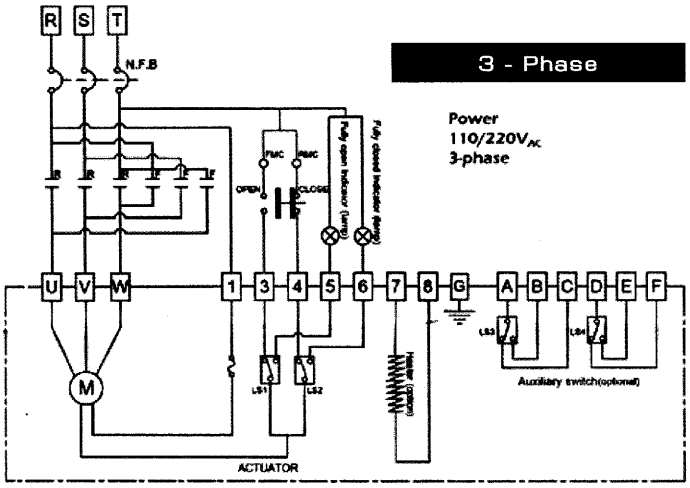


Max-Air Technology
751 Hoff Road
O'Fallon, MO 63366

Phone: 888.842.9998
www.maxairtech.com
Rev. July 16, 2014 R07162014

ON/OFF TYPE FOR 110/220 VAC





Installation Notes

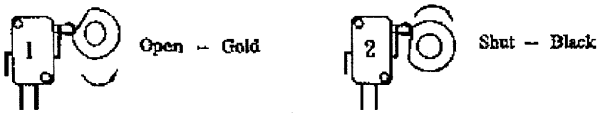
1. The indicator window shows the status of the valve [O=OPEN, S=SHUT]
2. When replacing the actuator cover, ensure that the O-ring is in the groove correctly before fastening to prevent ingress of water and dust.

Travel Stop Adjustment

1. Before adjusting the Open travel stop, turn the Open stop CCW to withdraw the screw about 1/8".
2. Signal the actuator to the open position (CAUTION: LIVE WIRES) and double-check to see if the valve is in the desired maximum open position. If not, adjust open travel stop accordingly, CCW for more open, CW for more closed.
3. Repeat steps 1 & 2 for the Shut travel stop.

Limit Switch Cam Adjustment

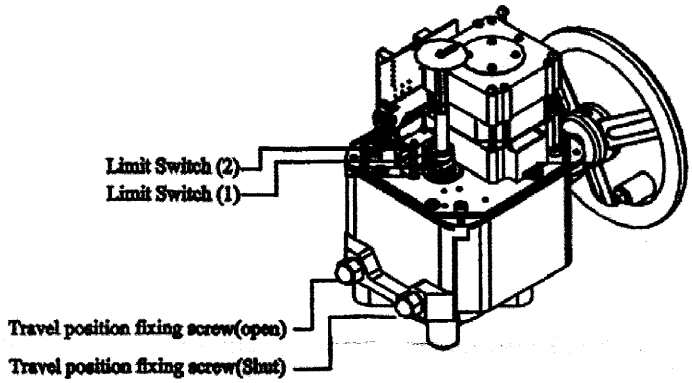
Cam Operation



1. Both Open and Closed cams are affixed to the transmission shaft.
2. The shaft turns CCW to open until the Open cam triggers the Open switch.
3. The shaft turns CW to close until the Closed cam triggers the Shut switch.

Cam Adjustment

Note: Set LS1 and LS2 so that the limit switches trip just BEFORE hitting the travel stops.



Manual Operation

1. Shut off power to actuator before manual operation or maintenance. Do not remove cover unless power is shutoff, and ensure that the cover is securely back on before powering up.
2. AE03H, AE04H, AE05H, & AE06H actuators need to have power shutoff before operating in manual mode. To operate in manual mode, push down on the handwheel to engage the shaft. It will automatically disengage when released.
3. In manual mode, if abnormal friction or resistance is felt while turning the valve, do not exert excessive force to avoid damaging internal parts.

Maintenance

1. Please contact Max-Air in case of malfunction.
2. If fuse replacement is necessary, use fuse specification as listed in the manual.
3. Do not dismount electric actuator & valve unless absolutely necessary, otherwise the limit switches will have to be recalibrated. Follow previous instructions for limit switch adjustment if necessary.
4. Three minutes rest is needed before restart.

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Safety Valves

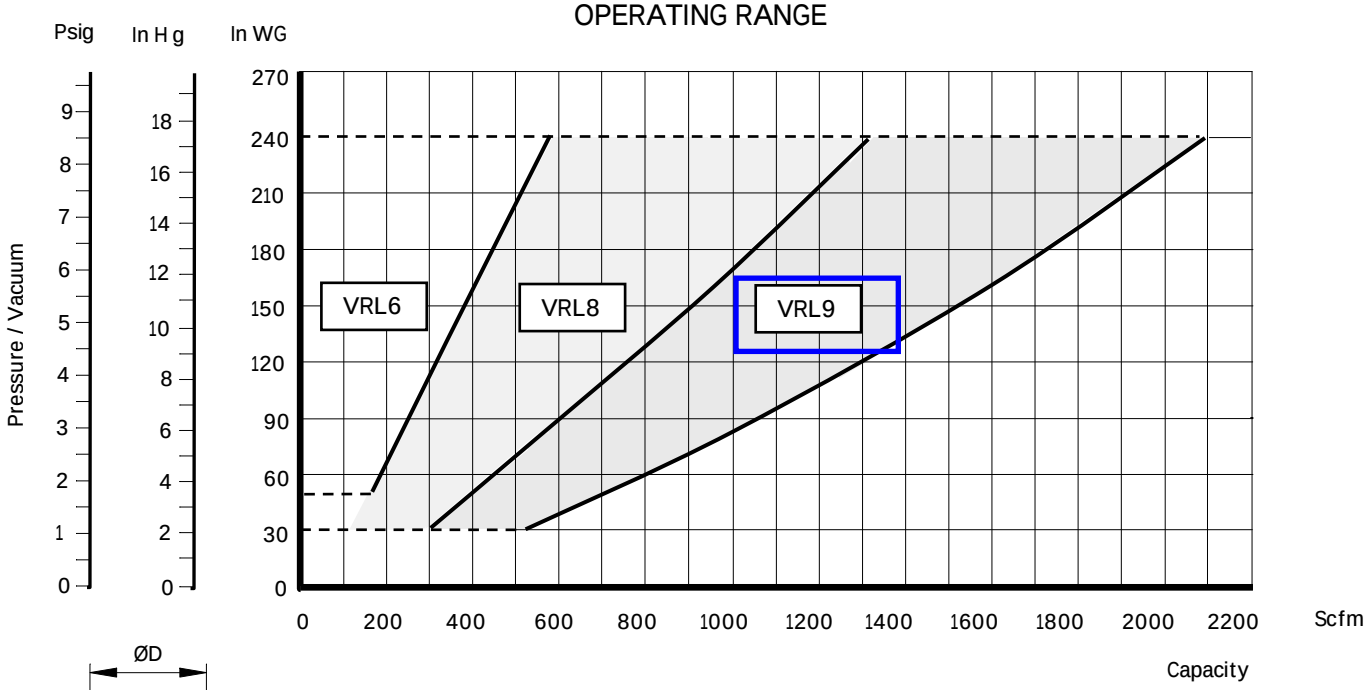
SN 1733 -5 1/1

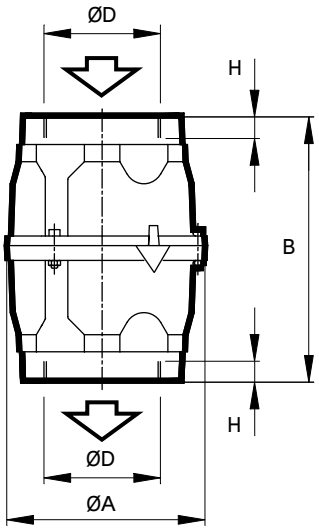
The VRL valves are designed to protect blowers and / or motors from over pressurization or excess vacuum. When there is over pressurization, the valve opens and discharges to the outside. When there is excess in vacuum, the valve opens and takes flow from outside.
The valves have been designed for low pressure / low vacuum, with minimal difference between the initial value at which the valve begins to open and its fully opened position. The valves are supplied with 2 different springs to maximize their efficiency.
These compact valves, made of aluminum alloy, are both easy to install and calibrate. The valves are designed to operate in a wide range of capacities. The VRL can be plumbed to divert excess primary flow through a secondary external outlet when working in pressure conditions or to pipe in a secondary flow when working in vacuum.
Maximum efficiency is achieved by keeping operating values (flow versus pressure or vacuum) within the operating range (shaded area on graph). Capacity refers to air having a density equal to 0.075 lbs./cu.ft .



VRL6 VRL8 VRL9

OPERATING RANGE





OVERALL DIMENSIONS

TYPE	ND	D	A	B	H	WEIGHT (Lbs)
VRL6	2”	2” NPT	4.02	6.90	0.47	1.9
VRL8	3”	3” NPT	5.31	7.48	0.59	4.2
VRL9	4”	4” NPT	6.30	8.11	0.71	5.7

- Dimensions in inches.
- Specifications subject to change without prior notice.

® **FPZ S.p.A.**
Via F.lli Cervi 16
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Tel. +39 039 69 09 811
Fax +39 039 60 41 296
www.fpz.com

I – GB – F – D – E **SN 1701-9**

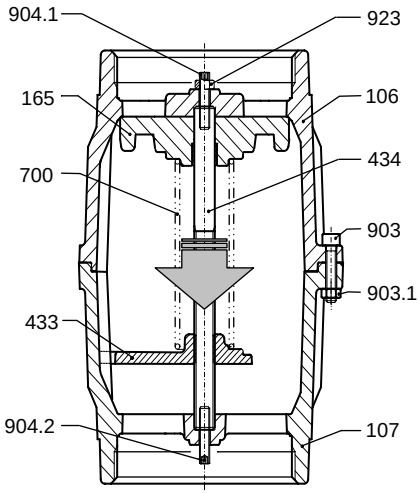
VALVOLA DI SICUREZZA VRL
SAFETY VALVE VRL
SOUPAPE DE SECURITE VRL
SICHERHEITSVENTIL VRL
VALVULA DE SEGURIDAD VRL

ISTRUZIONI D'USO
USE INSTRUCTIONS
INSTRUCTIONS D'UTILISATION
ANWENDUNGSHINWEISE
INSTRUCCIONES PARA EL USO

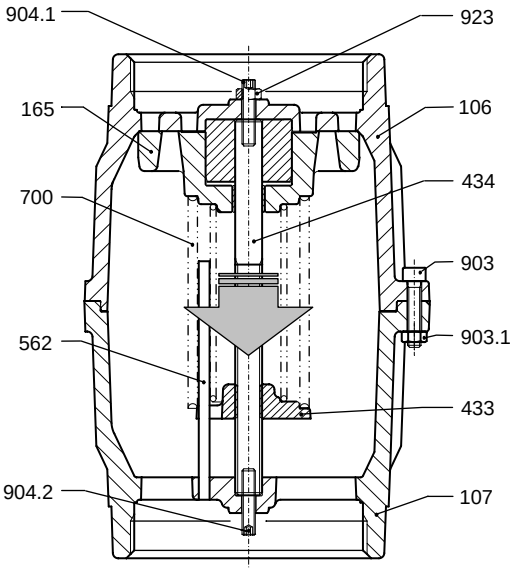
ATTENZIONE! LA VALVOLA E' FORNITA NON TARATA
CAUTION! THE VALVE IS SUPPLIED NOT CALIBRATED
ATTENTION ! LA SOUPAPE EST FOURNIE NON TAREE
ACHTUNG ! DAS VENTIL IST WERKSEITIG NICHT GEEICHT
ATENCION ! LA VALVULA NO ESTA GRADUADA



LEGGERE ATTENTAMENTE TUTTE LE ISTRUZIONI E CONSERVARLE
PLEASE READ CAREFULLY ALL INSTRUCTIONS AND KEEP THEM FOR FUTURE REFERENCE
LIRE ATTENTIVEMENT TOUTES LES INSTRUCTIONS ET LES CONSERVER
ALLE ANLEITUNGEN SIND SORGFÄLTIG ZU LESEN UND AUFZUBEWAHREN!
LEER ATENTAMENTE LAS INSTRUCCIONES Y CONSERVARLAS



VRL6
Fig. 1a



VRL8 - VRL9
Fig. 1b

ITEM	Denominazione - *Description* - Désignation - *Description* - Descripciòn
106	Corpo - *Housing* - Corps supérieur - *Gehäuse* - Cuerpo
107	Coperchio - *Cover* - Couvercle - *Abdeckung* - Cubierta
165	Otturatore - *Shutter* - Obturateur - *Verschluss* - Obturador
433	Piattello guida molla - *Spring guide disc* - Guide ressort - *Federführungsscheibe* - Disco guìa muelle
434	Asta - *Shutter guide* - Tige - *Schließführung* - Vastago
562	Spina cilindrica - Dowel pin -Goupille cylindrique - *Führungsstift* - Pin
700	Molla - *Spring* - Ressort - *Feder* - Muelle
903	Vite - *Screw* - Vis - *Schraube* - Tornillo
903.1	Dado - *Nut* - Ecrou - *Schraubenmutter* - Tuerca
904.1	Grano superiore - *Upper grub screw* - Tige de réglage supérieure – *Obere Einstellschraube* - Espàrrago superior
904.2	Grano inferiore - *Lower grub screw* - Tige de réglage inférieure - *Untere Einstellschraube* - Espàrrago inferior
923	Dado di fermo - *Nut* - Ecrou de blocage -*Schraubenmutter* - Contratuerca

I CONDIZIONI D'UTILIZZO

- **LE VALVOLE VRL SONO ADATTE AL CONVOGLIAMENTO DI ARIA E GAS NON ESPLOSIVI, NON INFIAMMABILI, NON AGGRESSIVI, IN ATMOSFERA NON ESPLOSIVA. LA TEMPERATURA DEL FLUIDO CONVOGLIATO È AMMESSA NEL CAMPO DI -15 A +160 °C.**
- **VALVOLE PROGETTATE E FABBRICATE PER LA LIMITAZIONE NEL CAMPO DELLE BASSE PRESSIONI / DEPRESSIONI, PER UN UTILIZZO SPECIFICO SU SOFFIANTI, ASPIRATORI E COMPRESSORI A BASSE PRESSIONI;**
- **NON SOPPORTANO PRESSIONI INTERNE ELEVATE, COMUNQUE NON SUPERIORI A 2.8 bar A;**
- **SONO SOGGETTE A PICCOLE PERDITE DEL FLUIDO CONVOGLIATO;**
- **CORPI SOLIDI ANCHE DI PICCOLE DIMENSIONI E SPORCIZIA POSSONO PROVOCARE GRAVI DANNI, VANNO QUINDI SEPARATI DAL FLUSSO MEDIANTE ADEGUATI FILTRI IN ASPIRAZIONE.**

GB *CONDITIONS OF USE*

- ***THE VRL VALVES ARE DESIGNED FOR THE HANDLING OF AIR OR NON-EXPLOSIVE, NON-HAZARDOUS AND NON-FLAMMABLE GASES IN NON-EXPLOSIVE ENVIRONMENTS. THE GAS INLET TEMPERATURE MUST BE IN THE RANGE OF -15 TO +160 °C.***
- ***RELIEF VALVES ARE DESIGNED AND MANUFACTURED TO LIMIT THE OPERATING PRESSURE IN LOW PRESSURE/VACUUM APPLICATIONS. THEY ARE FOR USE SPECIFICALLY ON LOW PRESSURE BLOWERS AND VACUUM PUMPS ONLY;***
- ***THE VALVE CANNOT WITHSTAND HIGH INTERNAL PRESSURE, DESIGN MAXIMUM OF 2.8 bar A;***
- ***THERE IS SMALL LOSS OF THE AIR/GAS BEING HANDLED;***
- ***SOLID PARTICULES, HOWEVER SMALL, INCLUDING DIRT CAN CAUSE SERIOUS DAMAGE; THEREFORE IT IS ESSENTIAL THAT SUCH SUBSTANCES SHOULD BE REMOVED FROM THE GAS BY SUITABLE FILTERS UPSTREAM OF THE INLET.***

F CONDITIONS D'UTILISATION

- **LES SOUPAPES VRL SONT ADAPTÉS À L'ACHEMINEMENT D'AIR ET DE GAZ NON EXPLOSIFS, ININFLAMMABLES, NON AGRESSIFS, DANS UNE ATMOSPHÈRE NON EXPLOSIVE. LA TEMPÉRATURE DU FLUIDE ACHEMINÉ EST ADMISE DANS UN ÉVENTAIL DE -15 À +160 °C.**
- **CES SOUPAPES ONT ETÉ DÉVELOPPÉES ET CONSTRUITES AFIN DE LIMITER LES VALEURS MAXIMALES VIDE/PRESSION ET LEUR UTILISATION EST SPÉCIFIQUEMENT RESERVÉE AUX ASPIRATEURS ET COMPRESSEURS BASSES PRESSION;**
- **NE SUPPORTENT PAS DES PRESSIONS INTERNES ÉLEVÉES, C'EST-À-DIRE DES PRESSIONS SUPÉRIEURES À 2.8 bar A;**
- **SONT SUJETTES À DE PETITES PERTES DU FLUIDE ACHEMINÉ;**
- **DES CORPS SOLIDES MÊME DE PETITES DIMENSIONS ET LÉGÈREMENT SALES PEUVENT PROVOQUER DE GRAVES DOMMAGES, ILS SONT PAR CONSÉQUENT SÉPARÉS DU FLUX PAR DES FILTRES ADÉQUANTS EN ASPIRATION.**

D *EINSATZBEDINGUNGEN*

- ***DIE VENTILE DER SERIE VRL SIND FÜR DEN DAUERBETRIEB IN NICHT-EXPLOSIVER UMGEBUNG ZUM ANSAUGEN UND VERDICHTEN VON LUFT ODER NICHT-EXPLOSIVEN, NICHT-BRENNBAREN UND NICHT-AGGRESSIVEN GASEN GEEIGNET. DIE ZULÄSSIGE ANSAUGTEMPERATUREN LIEGT ZWISCHEN -15 BIS +160 °C.***
- ***DIE SPEZIELL FÜR DEN NIEDERDRUCK- BZW. NIEDERVAKUUMBEREICH ENTWICKELTEN VENTILE SIND FÜR DIE SPEZIFISCHE ANWENDUNG IN VAKUUMPUMPEN UND KOMPRESSOREN GEEIGNET;***
- ***DIE GEHÄUSE WIDERSTEHEN KEINEN HOHEN INNENDRÜCKEN. UNTER KEINEN UMSTÄNDEN DARF DER MAX. BETRIEBSDRUCK VON 2.8 bar A ÜBERSCHRITTEN WERDEN;***
- ***DIE VENTILE SIND NICHT VOLLSTÄNDIG GASDICHT;***
- ***FREMDKÖRPER, AUCH GERINGER GRÖßE, UND VERUNREINIGUNGER KÖNNEN SCHWERE SCHÄDEN VERURSACHEN. SIE MÜSSEN DAHER AUS DEM FÖRDERMEDIUM MIT GEEIGNETEN ANSAUGFILTERN ENTFERNT WERDEN.***

E CONDICONES DE USO

- **LAS VALVULAS VRL SON ADAPTAS PARA EL MOVIMIENO DE AIRE O GASES NO EXPLOSIVOS, NO PELIGROSOS Y NO INFLAMABLES Y PARA SERVICIO EN AMBIENTES NO EXPLOSIVOS. LA TEMPERATURA DE ENTRADA DEL GAS DEBE ESTAR ENTRE LOS –15 Y +160 °C.**
- **VALVULAS PROYECTADAS Y FABRICADAS PARA LA LIMITACION EN EL SECTOR DE LAS BAJAS PRESIONES / VACIOS, PARA UN UTILIZO SOBRE ASPIRADORES, COMPRESORES A BAJAS PRESIONES.**
- **LA VALVULA NO PUEDE CONTENER PRESIONES INTERNAS ALTAS, NO MAYORES QUE 2.8 bar A;**
- **HAY UNA PECHEÑA PERDIDA DE FLUIDO MANEJADO;**
- **LAS PARTICULAS SOLIDAS, AUNQUE PEQUEÑAS, INCLUIDO EL POLVO, PUEDEN CAUSAR SERIOS DAÑOS. POR LO TANTO ES ESENCIAL QUE DICHAS SUSTANCIAS SEAN ELIMINADAS DEL GAS MEDIANTE FILTROS APROPIADOS ANTES DE LA ENTRADA.**

DIAGRAMMA DI SELEZIONE - ***SELECTION DIAGRAM***
SCHÉMA DE SÉLECTION – AUSWAHLDIAGRAMM
DIAGRAMA DE SELECCION

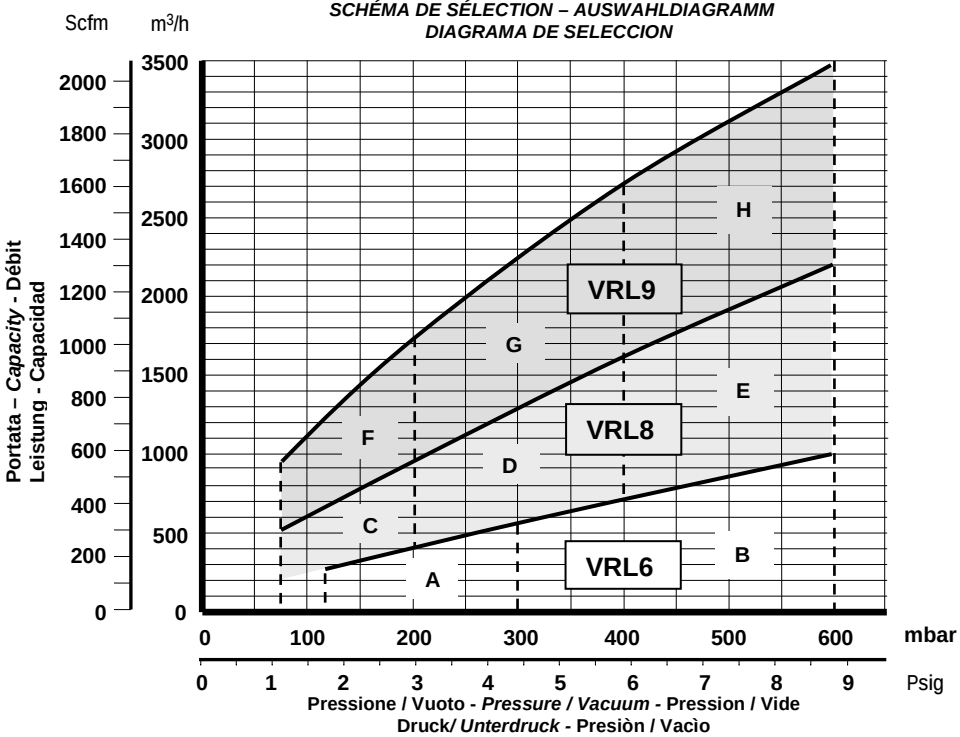


TABELLA DI SELEZIONE MOLLA - ***SPRING SELECTION CHART*** **- TABLEAU DE SÉLECTION RESSORT**
UEBERSICHTSTABELLE FEDERN **- TABLA DE SELECCION MUELLE**

RANGE	MOLLA *SPRING* RESSORT *FEDER* MUELLE N°	Pressione / Vuoto *Pressure / Vacuum* Pression / Vide *Druck / Underdruck* Presiòn / Vacìo MIN [mbar]	[psig]	Pressione / Vuoto *Pressure / Vacuum* Pression / Vide *Druck / Underdruck* Presiòn / Vacìo MAX [mbar]	[psig]	Colore di identificazione *Colour of identification* Couleur d' identification *Farbidentifizierung* Color de identificaciòn
VRL6						
A	I	120	1.763	300	4.408	-
B	II	300	4.408	600	8,820	VERDE - *GREEN* - VERT - *GRÜN* - VERDE
VRL8						
C	I	75	1.102	200	2.940	-
D	II	200	2.940	400	5.880	VERDE – *GREEN* VERT - *GRÜN* - VERDE
E	I + II	400	5.880	600	8,820	-
VRL9						
F	I	75	1.102	200	2.940	VERDE - *GREEN* - VERT - *GRÜN* - VERDE
G	II	200	2.940	400	5.880	-
H	I + II	400	5.880	600	8,820	-

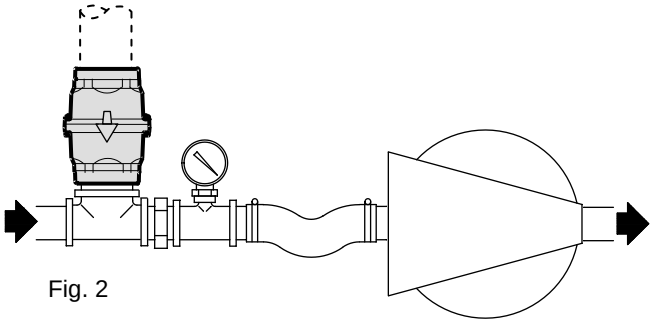


Fig. 2

SCHEMA DI INSTALLAZIONE – VALVOLA LIMITATRICE DI VUOTO
INSTALLATION SKETCH – VACUUM RELIEF VALVE
INSTALLATIONSSCHEMA – VAKUUMVENTIL
SCHÉMA DE INSTALLATION – SOUPAPE CASSE VIDE
ESQUEMA DE INSTALATIÒN – VALVULA LIMITADORA DE VACIO

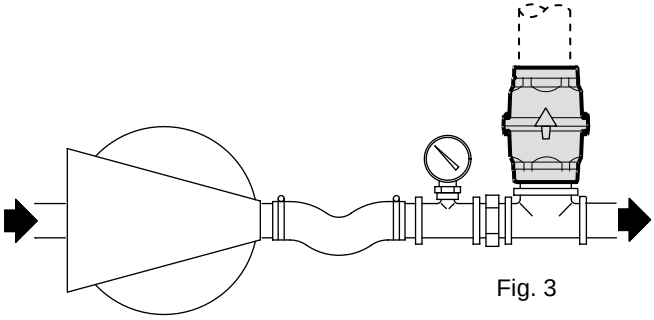


Fig. 3

SCHEMA DI INSTALLAZIONE – VALVOLA LIMITATRICE DI PRESSIONE
INSTALLATION SKETCH – PRESSURE RELIEF VALVE
INSTALLATIONSSCHEMA – DRUCKVENTIL
SCHÉMA DE INSTALLATION – SOUPAPE DE SÉCURITÉ
ESQUEMA DE INSTALATIÒN – VALVULA LIMITADORA DE PRESION

1. CHOICE OF SPRING

The valve is supplied with 2 different springs; each spring is to be used within a specific pressure-vacuum operating range. For the VRL8 and VRL9 there is the possibility to use both springs working in parallel.
Referring to the SELECTION DIAGRAM, check that the valve is correctly sized and depending where the operating point (area A, B,…H) is located, choose one or two springs according to SPRING SELECTION CHART.
The valve is supplied with spring # I installed. If spring needs to be replaced or a supplementary spring is needed to be added (for VRL8 / VRL9), proceed to point # 2 otherwise, adjust valve as per point #3.

2. INSTRUCTIONS FOR SPRING REPLACEMENT (OR MOUNTING ADITIONAL SPRING FOR VRL8 / VRL9)

- Remove the two plastic caps on valve.
- **Ensure stop-nut 923 is locked on the upper housing 106.**
- Unscrew screw 903 from nut 903.1.
- Remove cover 107 from housing 106.
- Unscrew spring guide disc 433 taking it out from shutter guide 434.
- Remove spring 700 (only in case of replacement).
- Install the appropriate spring into shutter 165.
- Compress spring and screw spring guide disc 433 on shutter guide 434 for at least 20 full thread terms.
- Check that both ends of the spring are properly positioned within their seats.
- Install the cover 107 on the housing 106 inserting:
  - for VRL6: the sliding guide on the slot in spring guide disc 433.
  - for VRL8 and VRL9: dowel pin 562 on the slot in spring guide disc 433.
- Tighten screw 903 on nut 903.1.

3. VALVE SETTING

A) Setting-up at allowed vacuum level

- Remove the two plastic caps on valve, if any.
- Position valve on the suction by-pass and connect a vacuum gage as close as possible to the exhauster inlet (Fig. 2).
- Unscrew nut 923.
- Relieve spring tension by backing off upper grub screw 904.1 with the fit key.
- Turn on exhauster. Induce highest attainable vacuum by throttling air intake upstream relief valve (normally reducing throttle to fully-closed).
- Adjust upper grub screw 904.1 until maximum allowable vacuum level is reached.
- Tighten nut 923 keeping blocked upper grub screw 904.1.
- Open suction line.

Double-check vacuum gauge to ensure no additional losses are induced by pipes or filters installed upstream relief valve.

B) Setting-up at allowed pressure level

- Remove the two plastic caps on valve, if any.
- Remove nut 923 from upper grub screw 904.1 and place it on to the lower grub screw 904.2. Do not tighten.
- Position valve on the discharge by-pass and connect a pressure gage as close as possible to the blower outlet (Fig. 3).
- Relieve spring tension by backing on lower grub screw 904.2 with the fit key.
- Turn on blower. Induce highest attainable pressure by throttling air discharge downstream of the valve (normally reducing throttle to fully-closed).
- Unscrew lower grub screw 904.2 until maximum allowable pressure level is reached.
- Tighten nut 923 keeping blocked lower grub screw 904.2.
- Open discharge line.

Double-check pressure gauge to ensure no additional losses are induced by pipes or filters installed downstream the valve

TB Series
True Union Ball Valves

1/4" TO 2" PVC AND CPVC



NSF

Sizes 1/4" – 2"

KEY FEATURES

- PVC and CPVC
- Full Port Design
- Reversible PTFE Seats
- Double O-Ring Stem Seals
- Easily Actuated
- NSF / ANSI 61 Listed

OPTIONS

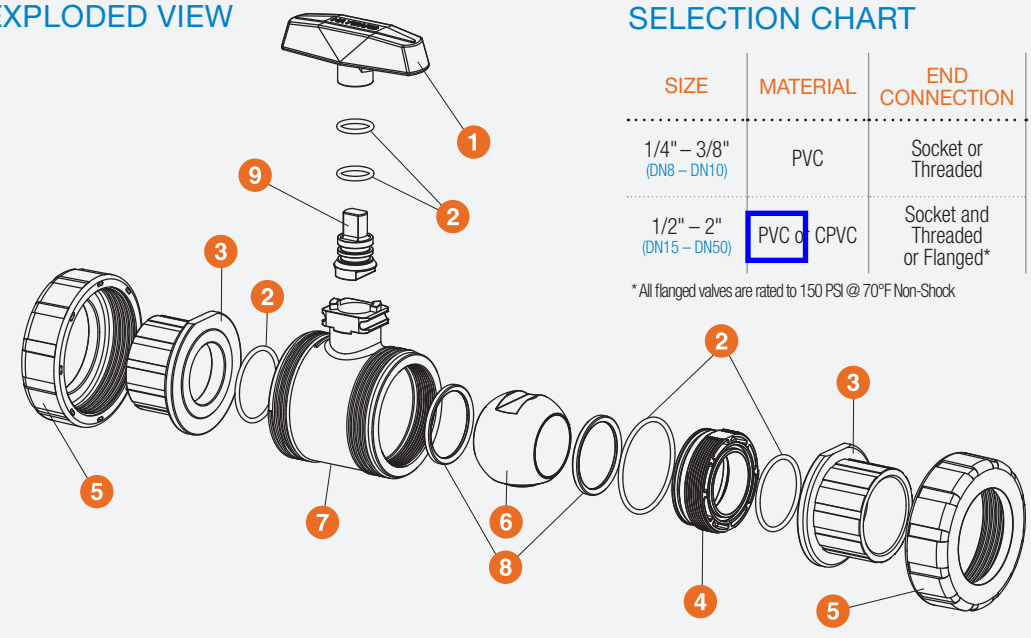
- Lockouts Available
- 2" Square Operating Nut
- Stem Extensions
- Pneumatic and Electric Actuated
- Spring Return Handle

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

EXPLODED VIEW



SELECTION CHART

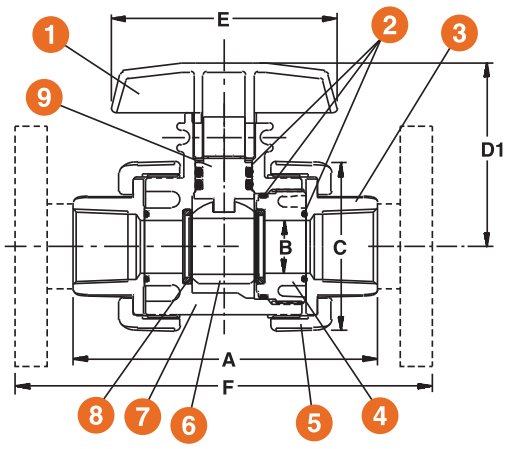
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/4" – 3/8" (DN8 – DN10)	PVC	Socket or Threaded	FPM or EPDM	250 PSI @ 70°F Non-Shock
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded or Flanged*		

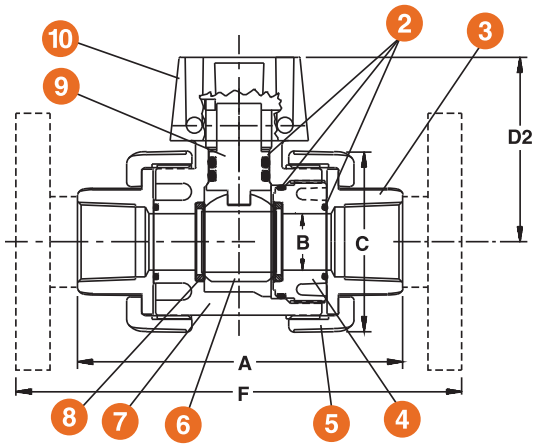
* All flanged valves are rated to 150 PSI @ 70°F Non-Shock

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Handle
2. O-Ring Seals
3. End Connector
4. Seal Retainer
5. Union Nut
6. Ball
7. Body
8. PTFE Seat
9. Stem
10. Actuator Mounting Pad





DIMENSIONS – INCHES / MILLIMETERS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D1 in / mm	D2 in / mm	E in / mm	F in / mm	WEIGHT lbs / kg SOC / THD	WEIGHT lbs / kg FLANGED
1/4 / 8	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
3/8 / 10	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
1/2 / 15*	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	6.75 / 171	.75 / .34	1.00 / .45
3/4 / 20*	4.85 / 123	.75 / 19	2.63 / 67	3.02 / 77	2.81 / 71	3.50 / 89	7.13 / 181	.75 / .34	1.00 / .45
1 / 25*	5.44 / 138	.93 / 24	3.00 / 76	3.26 / 83	3.05 / 77	4.00 / 102	8.09 / 205	1.15 / .52	2.15 / .98
1-1/4 / 32*	6.30 / 160	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.19 / 233	2.15 / .98	3.50 / 1.59
1-1/2 / 40*	6.85 / 174	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.88 / 251	2.15 / .98	3.75 / 1.70
2 / 50*	8.00 / 203	1.94 / 49	4.75 / 121	4.43 / 113	4.00 / 102	5.00 / 127	11.4 / 290	3.80 / 1.72	6.30 / 2.86

Dimensions are subject to change without notice – consult factory for installation information
* Metric End Connections Available In: BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Cv VALUES

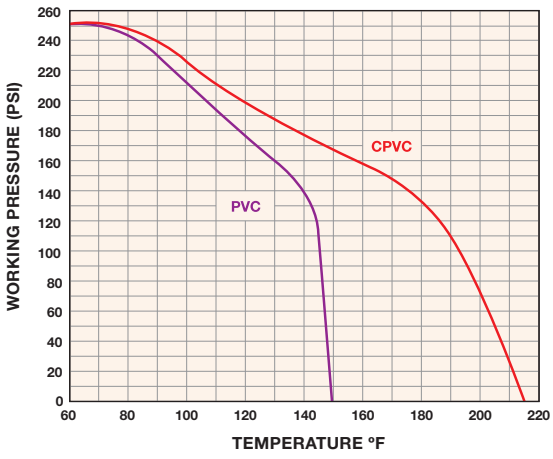
SIZE in / DN	Cv VALUES GPM	SIZE in / DN	Cv VALUES GPM
1/4 / 8	1.0	1 / 25	29.0
3/8 / 10	2.8	1-1/4 / 32	75.0
1/2 / 15	8.0	1-1/2 / 40	90.0
3/4 / 20	16.0	2 / 50	150.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

OPERATING TEMPERATURE / PRESSURE



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HAYWARD INDUSTRIAL PRODUCTS
INSTALLATION OPERATION & MAINTENANCE
OF TRUE UNION THREE WAY BALL VALVE

PLEASE READ THE FOLLOWING INFORMATION PRIOR TO INSTALLING AND USING HAYWARD VALVES, STRAINERS, FILTERS, AND OTHER ASSOCIATED PRODUCTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS INJURY.

1. Hayward guarantees its products against defective material and workmanship only. Hayward assumes no responsibility for damage or injuries resulting from improper installation, misapplication, or abuse of any product.
2. Hayward assumes no responsibility for damage or injury resulting from chemical incompatibility between its products and the process fluids to which they are subjected. Compatibility charts provided in Hayward literature are based on ambient temperatures of 70 ºF and are for reference only. Customer should always test to determine application suitability.
3. Consult Hayward literature to determine operating pressure and temperature limitations before installing any Hayward product. Note that the maximum recommended fluid velocity through any Hayward product is eight feet per second. Higher flow rates can result in possible damage due to the water hammer effect. Also note that maximum operating pressure is dependent upon material selection as well as operating temperature.
4. Hayward products are designed primarily for use with non-compressible liquids. They should NEVER be used or tested with compressible fluids such as compressed air or nitrogen.
5. Systems should always be depressurized and drained prior to installing or maintaining Hayward products.
6. Temperature effect on piping systems should always be considered when the systems are initially designed. Piping systems must be designed and supported to prevent excess mechanical loading on Hayward equipment due to system misalignment, weight, shock, vibration, and the effects of thermal expansion and contraction.
7. Because PVC and CPVC plastic products become brittle below 40 ºF, Hayward recommends caution in their installation and use below this temperature.
8. Published operating torque requirements are based upon testing of new valves using clean water at 70 ºF. Valve torque is affected by many factors including fluid chemistry, viscosity, flow rate, and temperature. These should be considered when sizing electric or pneumatic actuators.
9. Due to differential thermal expansion rates between metal and plastic, transmittal of pipe vibration, and pipe loading forces DIRECT INSTALLATION OF METAL PIPE INTO PLASTIC CONNECTIONS IS NOT RECOMMENDED. Wherever installation of plastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameter in length of plastic pipe be installed upstream and downstream of the plastic valve to compensate for the factors mentioned above.

SOCKET CONNECTION:

Socket end connections are manufactured to ASTM D2467-94. Solvent cementing of socket end connections to pipe should be performed per ASTM specifications D2855-87. Cut pipe square. Chamfer and deburr pipe. Surfaces must be cleaned and free of dirt, moisture, oil and other foreign material. Remove assembly nuts and end connectors from valve body. Slide assembly nuts, with threads facing valve, onto pipe to which the end connector is to be cemented. Apply primer to inside socket surface of end connector. Never allow primer or cement to contact valve ball or end connector o-ring sealing surfaces, as leaking may result. Use a scrubbing motion. Repeat applications may be necessary to soften the surface of the socket. Next, liberally apply primer to the male end of the pipe to the length of the socket depth. Again apply to the socket, without delay apply cement to the pipe while the surface is still wet with primer. Next apply cement lightly, but uniformly to the inside of the socket. Apply a second coat of cement to the pipe, and assemble the end connector to the pipe, rotating the end connector 1/4 turn in one direction as it is slipped to full depth on to the pipe. The end connector should be held in position for approx. 30 seconds to allow the connection to "set". After assembly wipe off excess cement. Full set time is a minimum of 30 minutes at 60 to 100 ºF. Full cure time should be based on the chart below.

JOINT CURE SCHEDULE:

The cure schedules are suggested as guides. They are based on laboratory test data, and should not be taken to be the recommendations of all cement manufacturers. Individual manufacturer's recommendations for their particular cement should be followed.

	Test Pressures for Pipe Sizes ½" to 1-1/4"		Test Pressures for Pipe Sizes 1-1/2" to 3"		Test Pressures for Pipe Sizes 4" & 5"		Test Pressures for Pipe Sizes 6" to 8"	
Temperature Range During Cure Period(B) °F(°C)	Up to 180 PSI (1240 kPa)	Above 180 to 370 PSI (1240 to 2550 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)
60 to 100 (15 to 40)	1 hour	6 hours	2 hours	12 hours	6 hours	18 hours	8 hours	1 day
40 to 60 (5 to 15)	2 hours	12 hours	4 hours	1 day	12 hours	36 hours	16 hours	4 days
20 to 40 (-7 to 5)	6 hours	36 hours	12 hours	3 days	36 hours (A)	4 days (A)	3 days (A)	9 days (A)
10 to 20 (-15 to 7)	8 hours	2 days	16 hours	4 days	3 days (A)	8 days (A)	4 days (A)	12 days (A)
Colder than 10 (-15)	Extreme care should be exercised on all joints made where pipe, fittings or cement is below 10°F.							

A: It is important to note that at temperatures colder than 20°F on sizes that exceed 3 in., test results indicate that many variables exist in the actual cure rate of the joint. The data expressed in these categories represent only estimated averages. In some cases, cure will be achieved in less time, but isolated test results indicate that even longer periods of cure may be required.

B: These cure schedules are based on laboratory test data obtained on Net Fit Joints (NET FIT=in a dry fit the pipe bottoms snugly in the fitting socket without meeting interference).

THREADED CONNECTION:

Threaded end connections are manufactured to ASTM specifications D2464-88. F437-88 and ANSI B2.1. Wrap threads of pipe with Teflon tape of 3 to 3-1/2 mil thickness. The tape should be wrapped in a clockwise direction starting at the first or second full thread. Overlap each wrap by 1/2 the width of the tape. The wrap should be applied with sufficient tension to allow the threads of a single wrapped area to show through without cutting the tape. The wrap should continue for the full effective length of the thread. Pipe sizes 2" and greater will not benefit with more than a second wrap, due to the greater thread depth. To provide a leak proof joint, the pipe should be threaded into the end connection "hand tight". Using a strap wrench only. (Never use a stillson type wrench) tighten the joint an additional 1/2 to 1-1/2 turns past hand tight. Tightening beyond this point may induce excessive stress that could cause failure.

FLANGED CONNECTION:

Flange bolts should be tight enough to slightly compress the gasket and make a good seal, without distorting or putting excessive stress on the flanges. Suitable washers should be used between the bolt head and flange and the nut and flange. Bolts should be tightened in alternating sequence.

RECOMMENDED FLANGE BOLT TORQUE

FLANGE SIZE	BOLT DIA.	TORQUE FT. LBS.	FLANGE SIZE	BOLT DIA.	TORQUE FT. LBS.
1/2	1/2	10-15	2	5/8	15-25
3/4	1/2	10-15	2-1/2	5/8	20-25
1	1/2	10-15	3	5/8	20-25
1-1/4	1/2	10-15	4	5/8	20-25
1-1/2	1/2	10-15	6	3/4	30-40

NOTE: USE WELL LUBRICATED METAL BOLTS AND NUTS. USE SOFT RUBBER GASKETS.

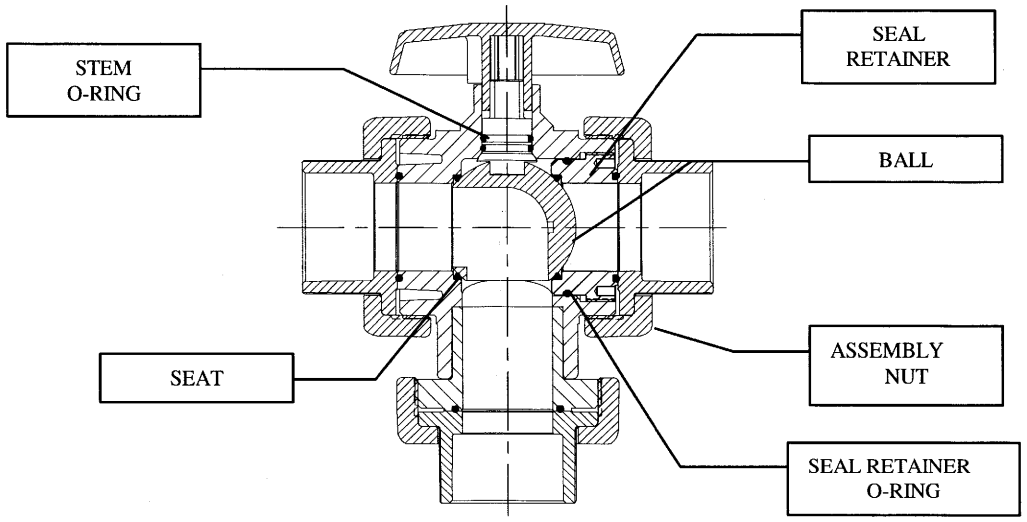
ADJUSTMENT:

EXTREME CAUTION MUST BE TAKEN WHEN WORKING ON THIS VALVE.
THE PIPING SYSTEM MUST BE DEPRESSURIZED AND DRAINED. PROPER CARE MUST BE TAKEN. CONSULT M.S.D.S. (MATERIAL SAFETY DATA SHEETS) INFORMATION REGARDING YOUR SPECIFIC APPLICATION.

Remove the assembly nut and end connector from the "adjust" end of the body which is always the right port as viewed from the top with the tab up; or the complete valve body from the piping system. The direction of rotation is right hand tightens (clockwise rotation), counterclockwise loosens. The assembly nut should be installed on the valve "hand tight". Using a strap wrench only the joint may be tightened 1/2 to 3/4 of a turn past hand tight.

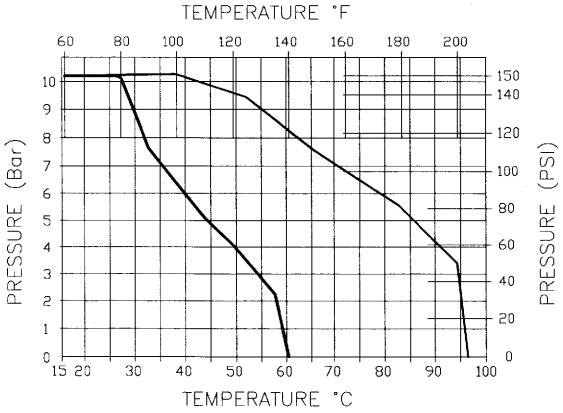
REPAIR:

Follow the adjustment sequence and information above, but rotating the seal retainer completely in the "loosen" direction and remove it from valve body. The o-rings and seals are now accessible for replacement using a "seal" repair kit. Carefully remove the o-rings from their respective locations taking care not to scratch their sealing surfaces. Insert o-rings and re-assemble. See table below.



OPERATION:

The valve flow pattern is in or out one side port and down through the bottom port. Ball pattern allows both side ports to be blocked at the same time.



Recommended valve stem torque to rotate the ball 360° when valve is reassembled.

VALVE SIZE	TORQUE IN*LB
1/2"	40
3/4"	50
1"	60
1 1/2"	70
2"	80
3" & 2 1/2"	140
4" & 6"	170

AE SERIES ELECTRIC ACTUATORS

AE Series electric actuators provide a highly reliable solution for your electric actuation requirements. With torque ranges from 300 in-lbs to over 5200 in-lbs, including optional handwheel overrides, fast acting solutions, as well as extra limit switches, LED position indication, internal space heaters, and modulation capability, the AE Series is designed to exceed your expectations.

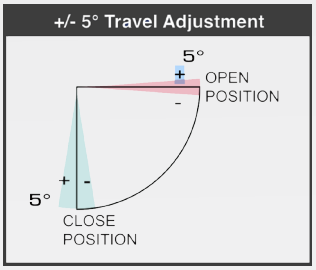


On/Off Control

- Multiple voltages available
- Fast acting and extended duty models available
- Easy wiring and setup
- Manual override standard

Proportional Control

- Selectable input/output signal (4-20mA, 0-10V, 0-5V)
- Available in 120VAC or 220VAC
- Easy Travel and sensitivity adjustment
- Manual override standard



Features:

- Compact design & direct ISO 5211 valve mounting
- Easy field wiring, setup and adjustment
- Multiple voltage options available (AC/DC)
- Open and close directions ±5° travel adjustment
- Standard manual override, hand wheel on larger models
- Standard auxiliary limit switches for open/close feedback
- Standard Open/Close LEDs for easy visual indication
- Standard internal space heater & thermal overload protection
- Selectable input/output signal on modulating models
- Optional 180° rotation for on/off models only up to AE03

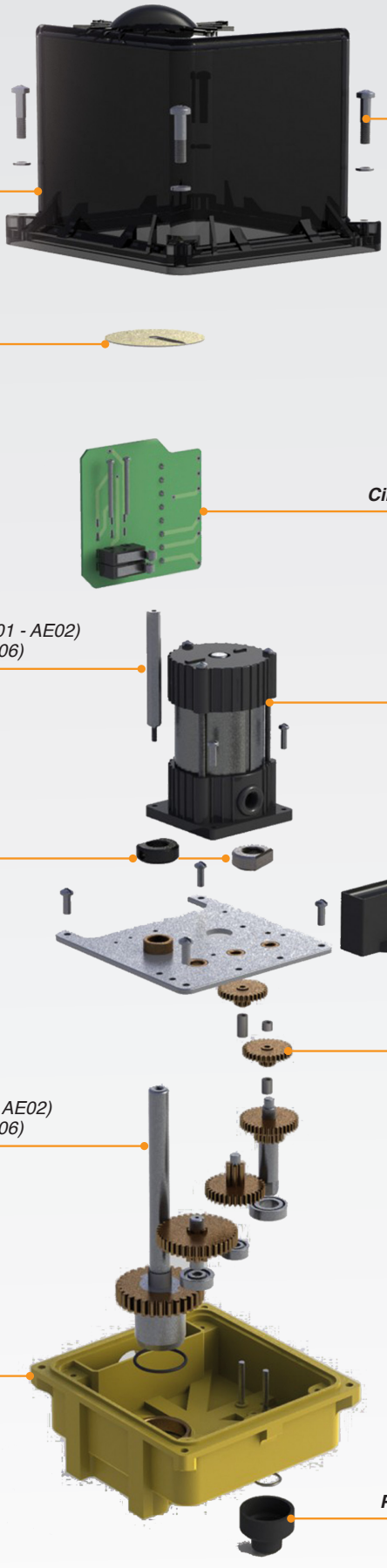
Configurations:

- Standard On/Off Control
  (120VAC, 220VAC, + more AC options)
- Extended Duty On/Off Control*
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Fast Acting On/Off Control
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Modulating Control
  (120VAC, 220VAC)

SPECIFICATIONS	
Rotation	90 Degrees ±5° Adjustment
Housing	Aluminum Alloy Base, Polycarbonate Cover
Gears	Heavy duty sintered metal
Back-Drive Resistance Method	High gearing ratio + back-drive resistant motor
Ambient Temp. Range	14°F to 140°F
Relative Humidity Range	30% to 95%
Enclosure Protection Rating	IP67 (Water and dust proof)
Switches	SPDT Mechanical Switches (2 Auxiliary)
Power Supply Voltage (AC/DC)	120VAC, 220VAC, 24VAC/DC dual voltage
3-Phase AC Power Supply Voltage	220VAC, 380VAC, 480VAC
Modulating Input Signal (Selectable)	4-20mA, 0-10V, 0-5V
Modulating Output Signal (Selectable)	4-20mA, 0-10V, 0-5V
Torque Range	75 to 5,290 in-lbs
Valve Mounting	ISO 5211
Manual Override	Included (hand wheel on larger sizes)

*100% Duty Cycle according to IEC60034-S4 duty type.

AE SERIES EXPLODED VIEW



Cover - *Polycarbonate*

Cover Screws - *Stainless steel*

Indicator - *Aluminum*

Circuit Board with Limit Switches - *FR*

Standoff - *Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Motor

Cams - *Metal*

Gears - *Sintered metal*

Shaft - *Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Lower Box - *Aluminum*

Protection for Manual Lever - *Rubber*

* NOTE: AE01/AE02 shown.

PART NUMBER BUILDER

1 Model [ ] - 2 Voltage [ ]

1 Select desired model

Torques shown in inch-lbs.

Standard On/Off Models

Model No.	Torque	Duty	Cycle	Description
AE01-XXXVAC-YY	301	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE02-XXXVAC-YY	434	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03-XXXVAC-YY	1478	50%	8s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03H-XXXVAC-YY	1797	50%	10s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE04H-XXXVAC-YY	3292	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE05H-XXXVAC-YY	4355	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE06H-XXXVAC-YY	5293	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override

Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. Torques shown in inch-lbs.

100% Duty Cycle On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01A-XXXVAC	283	100%	16s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-XXXVAC	443	100%	36s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-XXXVAC	867	100%	65s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override

100% Duty Cycle Models - DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01A-24VAC/24VDC	310	100%	11s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-24VAC/24VDC	443	100%	12s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03A-24VAC/24VDC	1239	100%	8s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-24VAC/24VDC	1381	100%	10s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override
AE04HA-24VAC/24VDC	2434	100%	27s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override

Fast Acting On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01FA-M1-XXXVAC	78	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-XXXVAC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-M2-XXXVAC	885	100%	5s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Fast Acting On/Off Models - 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01FA-M1-24VAC/24VDC	89	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-24VAC/24VDC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-24VAC/24VDC	443	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Modulating Models - 120VAC/240VAC

Model No.	Torque	Duty*	Board	Description
AEM01A-XXXVAC	221	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M1-XXXVAC	319	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M2-XXXVAC	443	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM03HA-M1-XXXVAC	1478	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM03HA-M2-XXXVAC	1797	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM04HA-XXXVAC	2673	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM05HA-XXXVAC	4355	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM06HA-XXXVAC	5293	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA

**Note - No load cycle time.
*Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.
Fast Acting models rated 100% duty in 30 min.

Torques shown in inch-lbs.

2 Select desired voltage

120 VAC	240 VAC	240-3PH VAC	380-3PH VAC	480-3PH VAC
√	√	-	-	-
√	√	-	-	-
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√
√	√
√	√
√	√
√	√
√	√

*12 VDC available as special order only.

Standard On/Off Models - For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.
Extended Duty Cycle On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage.
Modulating Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.
Fast Acting On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

TECHNICAL DATA

Standard On/Off Control Series, 120VAC/240VAC & 240VAC/380VAC/480VAC-3PHASE

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01-XXXVAC-YY	301	34	3.7	1.7	25%	10W	10s	0.7A	0.38A
AE02-XXXVAC-YY	434	49	4.0	1.8	25%	15W	10s	0.9A	0.5A
AE03-XXXVAC-YY	1478	167	9.7	4.4	50%	25W	8s	1.2A	0.72A
AE03H-XXXVAC-YY	1797	203	17.4	7.9	50%	25W	10s	1.2A	0.72A
AE04H-XXXVAC-YY	3292	372	19.0	8.6	50%	25W	30s	1.2A	0.72A
AE05H-XXXVAC-YY	4355	492	19.4	8.8	50%	40W	30s	2.0A	0.75A
AE06H-XXXVAC-YY	5293	598	20.1	9.1	50%	60W	30s	2.4A	0.8A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.

100% Duty Cycle On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01A-XXXVAC	283	32	3.7	1.7	100%	25W	16s	0.3A	0.15A
AE02A-XXXVAC	443	50	4.0	1.8	100%	25W	36s	0.2A	0.10A
AE03HA-XXXVAC	867	98	19.4	8.8	100%	25W	65s	0.2A	0.10A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage.

100% Duty Cycle On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01A-24VAC/24VDC	310	35	4.4	2	100%	7W	11s	1.5A	1.5A
AE02A-24VAC/24VDC	443	50	4.9	2.2	100%	7W	12s	1.5A	1.5A
AE03A-24VAC/24VDC	1239	140	9.7	4.4	100%	25W	8s	3.0A	3.0A
AE03HA-24VAC/24VDC	1381	156	17.4	7.9	100%	25W	10s	3.0A	3.0A
AE04HA-24VAC/24VDC	2434	275	19.0	8.6	100%	25W	27s	3.0A	3.0A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.

MODULATING Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Deg. Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AEM01A-XXXVAC-AMD	221	25	4.9	2.2	100%	25W	16s	0.2A	0.10A
AEM02A-M1-XXXVAC-AMD	319	36	5.5	2.5	100%	25W	16s	0.3A	0.15A
AEM02A-M2-XXXVAC-AMD	443	50	5.5	2.5	100%	25W	35s	0.2A	0.10A
AEM03A-M1-XXXVAC-AMD	885	100	7.1	3.2	100%	25W	36s	0.3A	0.15A
AEM03HA-M1-XXXVAC-BMD	1478	167	10.6	4.8	100%	25W	8s	1.2A	0.72A
AEM03HA-M2-XXXVAC-BMD	1797	203	18.3	8.3	100%	25W	10s	1.2A	0.72A
AEM04HA-XXXVAC-BMD	2673	302	19.8	9	100%	25W	30s	1.2A	0.72A
AEM05HA-XXXVAC-BMD	4355	492	20.3	9.2	100%	40W	30s	2.0A	0.75A
AEM06HA-XXXVAC-BMD	5293	598	20.9	9.5	100%	60W	30s	2.4A	0.80A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

FAST ACTING On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01FA-M1-XXXVAC	78	8.8	3.7	1.7	100%	15W	1s	0.7A	0.38A
AE01FA-M2-XXXVAC	221	25	3.7	1.7	100%	15W	3s	0.8A	0.60A
AE03FA-M2-XXXVAC	885	100	9.7	4.4	100%	25W	5s	1.2A	0.72A

Note - 100% duty in 30 min. Torques shown in inch-lbs. For "XXX", choose either 120 or 240 for required voltage.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

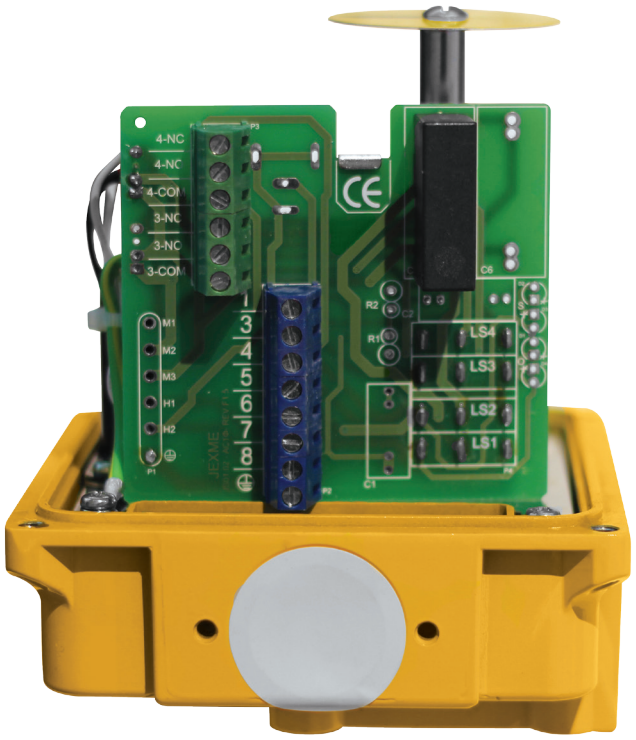
FAST ACTING On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

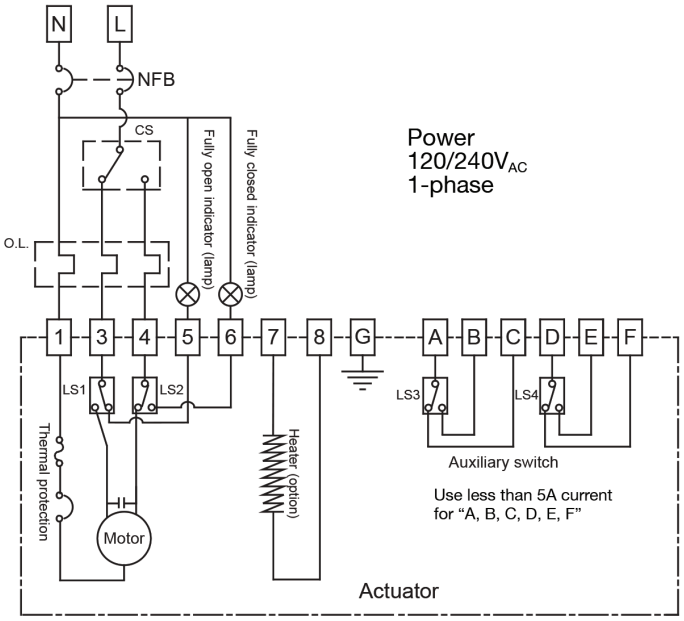
Model No. - Voltage	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01FA-M1-24VAC/24VDC	89	10	3.7	1.7	100%	7W	1s	2.0A	2.0A
AE01FA-M2-24VAC/24VDC	221	25	3.7	1.7	100%	7W	3s	1.6A	1.6A
AE03FA-24VAC/24VDC	443	50	9.7	4.4	100%	25W	3s	3.5A	3.5A

Note - 100% duty in 30 min. 1) Power is consumption at "no load". 2) Amps are based on "full load" at rated torque.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

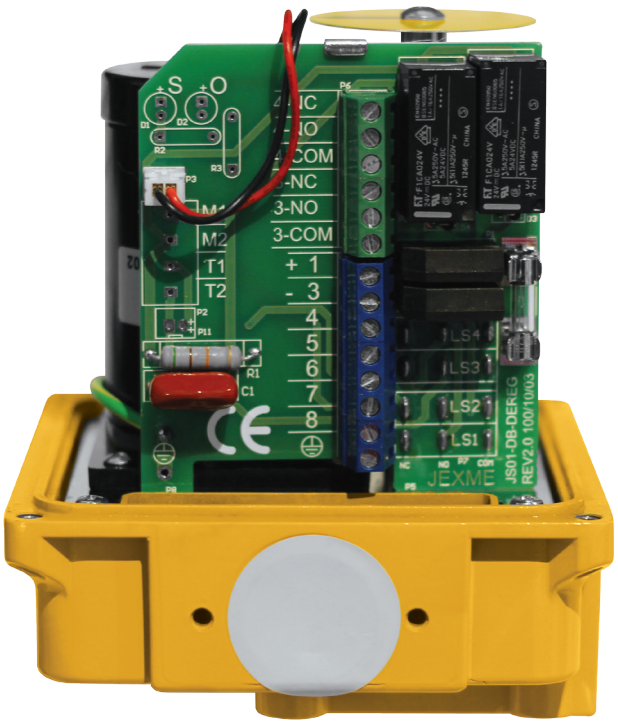
ON/OFF TYPE FOR 120/240 VAC

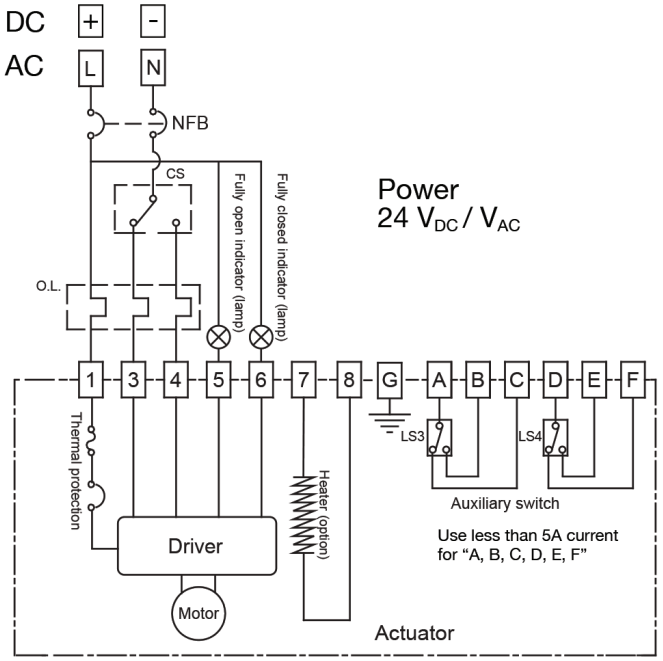
Single Phase



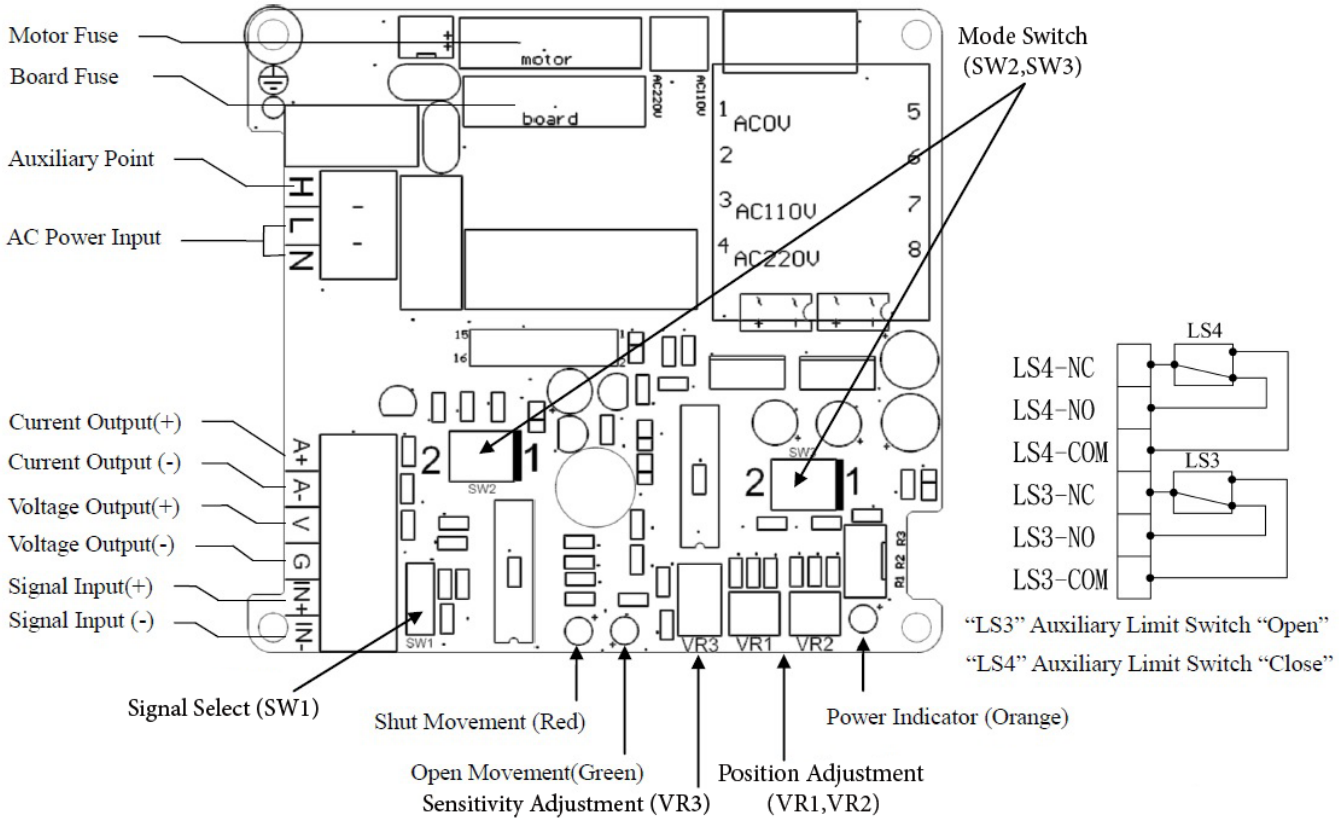


ON/OFF TYPE FOR 24VDC/VAC

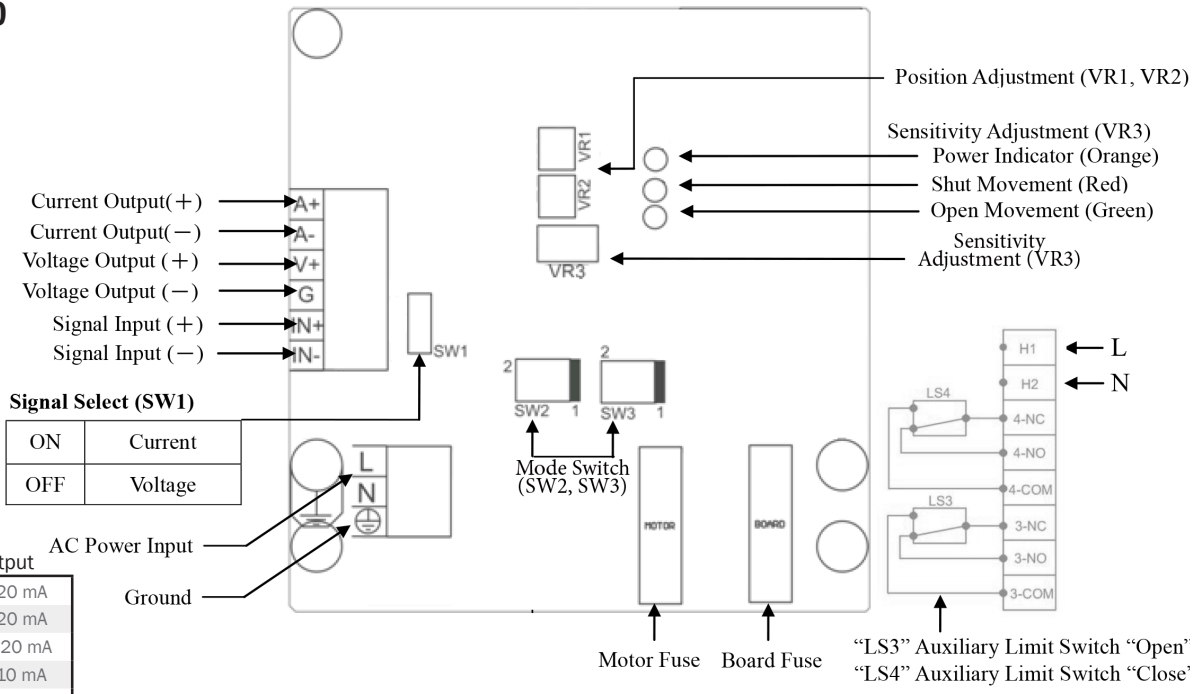




AMD BOARD



BMD BOARD



Signal Select (SW1)

ON	Current
OFF	Voltage

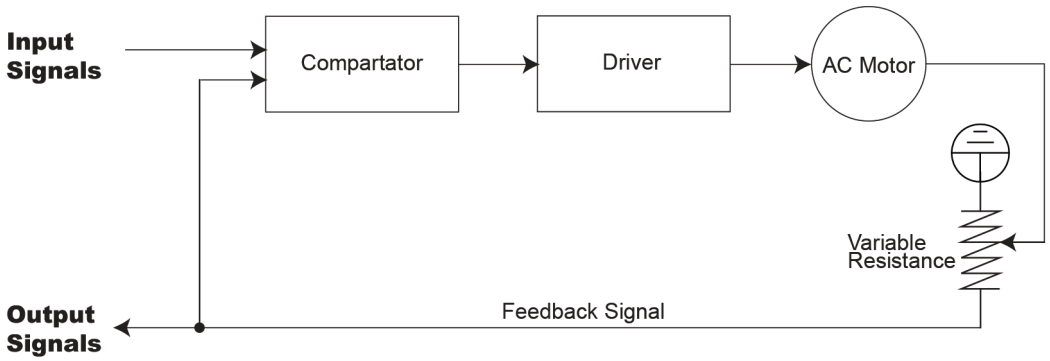
Signal Input	Signal Output
4 ~ 20 mA	2 ~ 10 V, 4~20 mA
2 ~ 10 V	2 ~ 10 V, 4~20 mA
0 ~ 10 V	0 ~ 10 V, 0 ~ 20 mA
1 ~ 5 V	1 ~ 5 V, 2 ~ 10 mA
0 ~ 5 V	0 ~ 5 V, 0 ~ 10 mA

Note - When using current signal, external resistant is under 500 Ω.

Differences between AMD and BMD:

BMD units should be used for higher torques and faster operating speeds. AMD units provide power usage efficiencies and should be used when power savings are a concern.

SIGNAL FLOW OF MODULATION TYPE

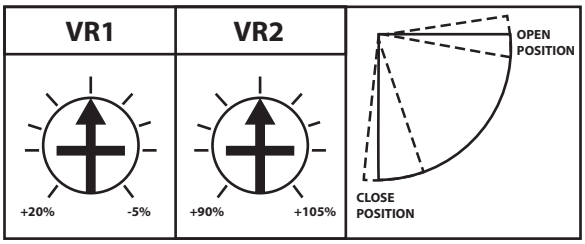


SWITCH & ADJUSTMENT SETTINGS

SW1 Input Signal Selection

	ON	OFF (1)
	Current Input Signal	Voltage Input Signal
SW1	4 ~ 20 mA	2~10 V 0~10 V 1~5 V 0~5 V

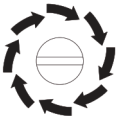
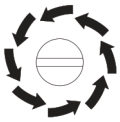
VR1 & VR2 Position Adjustment



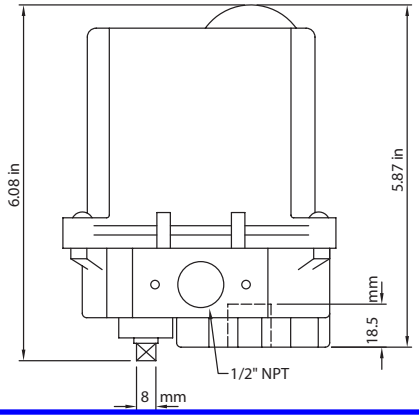
SW2 & SW3 Operation Selection

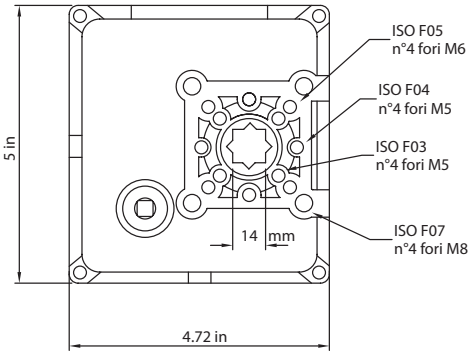
		SW2	
		1	2
SW3	1	MODE A Valve is fully closed when the input signal is 4mA, 2V, 1V, or 0V	X
	2	X	MODE B Valve is fully opened when the input signal is 4mA, 2V, 1V, or 0V

VR3 Sensitivity Adjustment

Rotation	Result
Clockwise	 Increase sensitivity
Counter-clockwise	 Decrease sensitivity

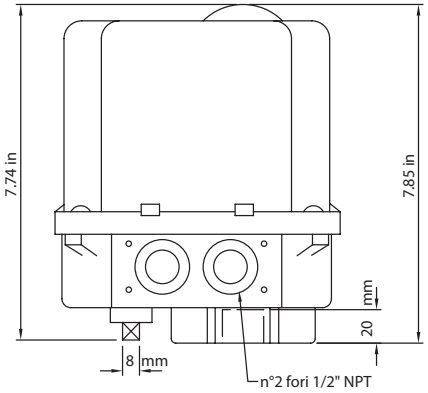
AE01 - AE02

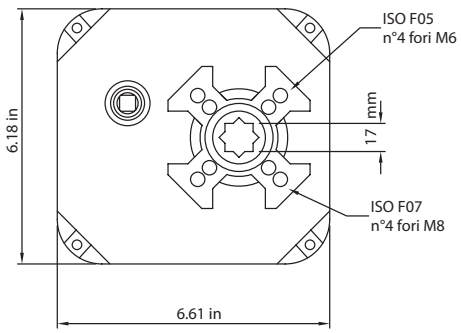






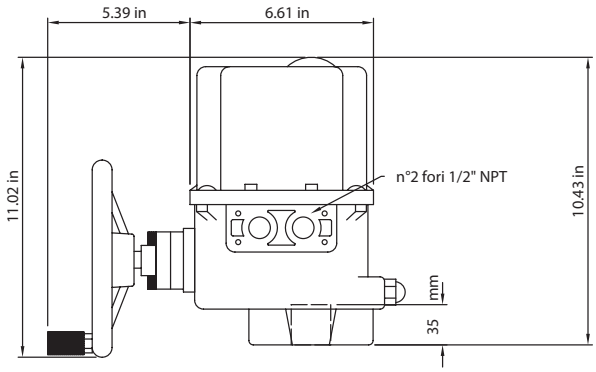
AE03

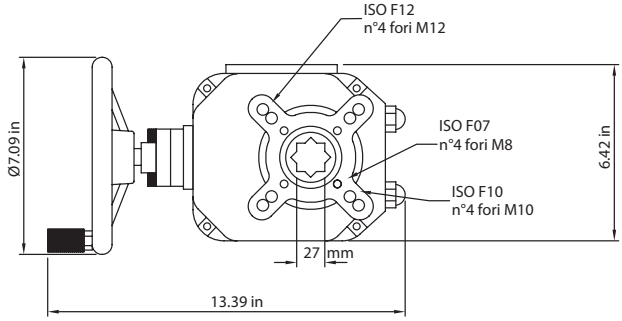






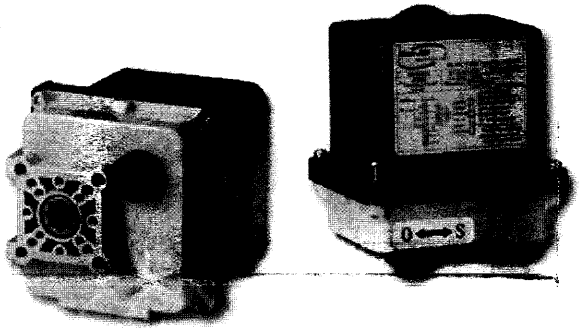
AE03H - AE06H







AE Series Electric Actuator Installation & Operation Manual



Technical Data	
OPERATION VOLTAGE	Standard Type, 110 / 220 / 380 VAC Standard Type, 12 VAC , 24 VDC , and 24 VAC / VDC "100% Duty Cycle" Type 110 / 220 VAC "Fast Acting" Type 110 / 220 VAC
POWER CONSUMPTION	10 to 60 watts (depending on model)
PROTECTION CLASS	IP 67 according to STD. IEC60529
RATED TORQUE	35 to 600 NM (310 to 5310 lbf*in)
TEMPERATURE RANGE	-10 to 60°C (14 to 140°F)
ROTATION ANGLE	90°(±5°)
CASE MATERIAL	Aluminum alloy
COVER MATERIAL	Polycarbonate
CERTIFICATION / TEST	Comply with CE directives of - The LOW Voltage Directive, 73/23/EEC, 93/68 EEC - The EMC Directive, 89/336/EEC

Operational Conditions & Safety Precautions

1. Follow the instruction manual to connect power – do not alter the electronic circuit. Tampering may result in electrical shock.
2. AE Series actuators should be operated and wired as single units – do not connect multiple units in parallel or in series.
3. If two or more actuators are used at the same time, please install a relay for each unit to ensure safety of operation.
4. Do not use this product in hazardous environments where there is a presence of explosive gas or other chemically active substances.
5. The 110VAC/220VAC motor has thermal overload protection.
6. 12VDC and 24VAC/DC motors do not have thermal overload protection. For PCB series, there is a fuse on the board.
7. AE01A, AE02A, AE03, AE03H-AE06H models can be used with a proportional controller.

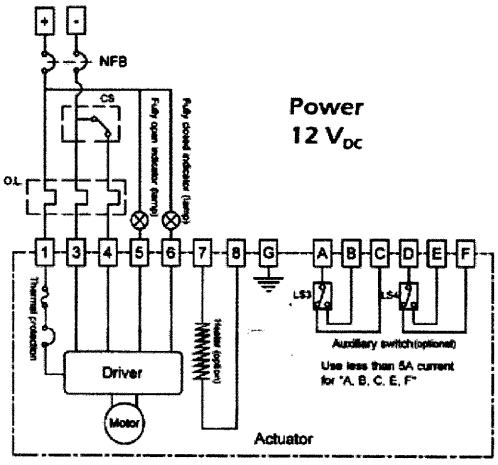
Installation & Wiring

Pre-Installation Procedure & Safety Precautions

1. Confirm the input voltage before powering up (120VAC, 220VAC, 3-PHASE, 24VAC/DC, etc.)
2. Ensure that the pipe line is clear before actuator installation.
3. During initial testing and position adjustment, there will be live wires. An experienced electrician should perform all electrical testing and wiring.

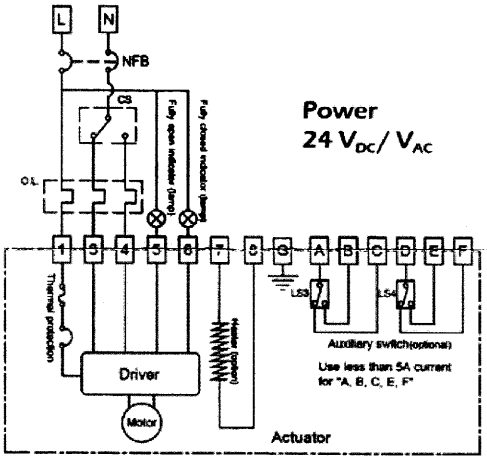
Part No	ISO Mounting	DSQ Drive (mm)
AE01-AE02	F03/F04/F05/F07	14
AE03	F05/F07	17
AE03H-AE06H	F07/F10/F12	27

ON/OFF TYPE FOR 12VDC

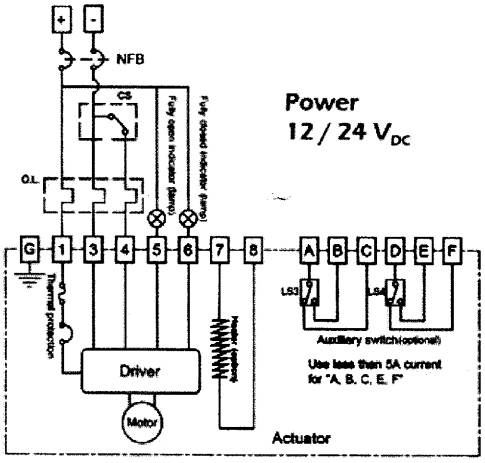


* Call factory for details on 12VDC units.

ON/OFF TYPE FOR 24VDC/VAC



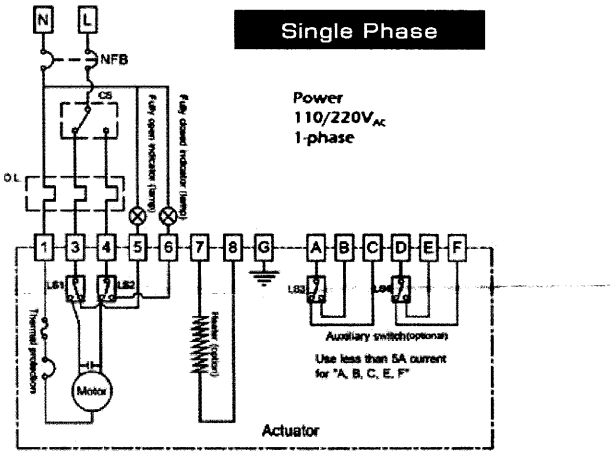
ON/OFF TYPE FOR 12/24VDC

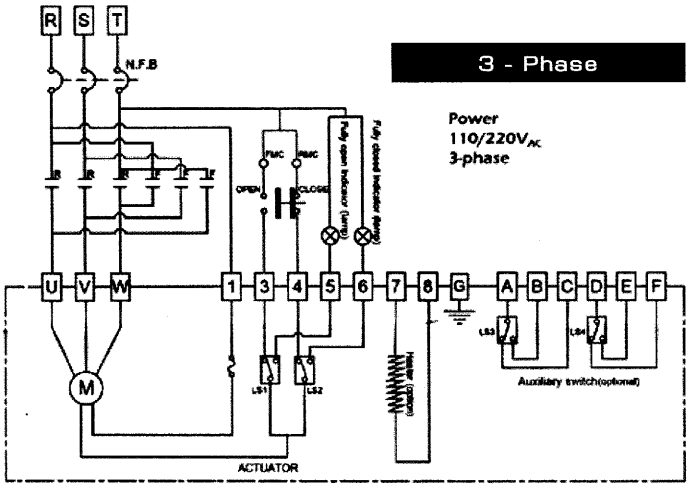


Max-Air Technology
751 Hoff Road
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Phone: 888.842.9998
www.maxairtech.com
Rev. July 16, 2014 R07162014

ON/OFF TYPE FOR 110/220 VAC





Installation Notes

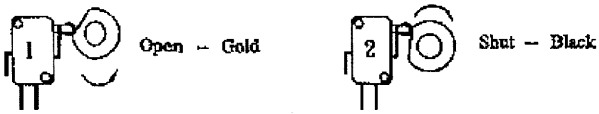
1. The indicator window shows the status of the valve [O=OPEN, S=SHUT]
2. When replacing the actuator cover, ensure that the O-ring is in the groove correctly before fastening to prevent ingress of water and dust.

Travel Stop Adjustment

1. Before adjusting the Open travel stop, turn the Open stop CCW to withdraw the screw about 1/8".
2. Signal the actuator to the open position (CAUTION: LIVE WIRES) and double-check to see if the valve is in the desired maximum open position. If not, adjust open travel stop accordingly, CCW for more open, CW for more closed.
3. Repeat steps 1 & 2 for the Shut travel stop.

Limit Switch Cam Adjustment

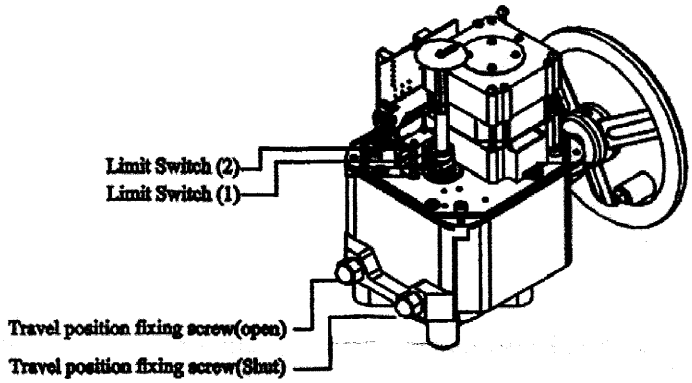
Cam Operation



1. Both Open and Closed cams are affixed to the transmission shaft.
2. The shaft turns CCW to open until the Open cam triggers the Open switch.
3. The shaft turns CW to close until the Closed cam triggers the Shut switch.

Cam Adjustment

Note: Set LS1 and LS2 so that the limit switches trip just BEFORE hitting the travel stops.



Manual Operation

1. Shut off power to actuator before manual operation or maintenance. Do not remove cover unless power is shutoff, and ensure that the cover is securely back on before powering up.
2. AE03H, AE04H, AE05H, & AE06H actuators need to have power shutoff before operating in manual mode. To operate in manual mode, push down on the handwheel to engage the shaft. It will automatically disengage when released.
3. In manual mode, if abnormal friction or resistance is felt while turning the valve, do not exert excessive force to avoid damaging internal parts.

Maintenance

1. Please contact Max-Air in case of malfunction.
2. If fuse replacement is necessary, use fuse specification as listed in the manual.
3. Do not dismount electric actuator & valve unless absolutely necessary, otherwise the limit switches will have to be recalibrated. Follow previous instructions for limit switch adjustment if necessary.
4. Three minutes rest is needed before restart.

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Rev. July 16, 2014 R07162014

PLAST-O-MATIC

PRODUCT DATA

CATALOG VBL

Compact, Self-Closing Vacuum Breakers Protect Against Hazards, Damage and Financial Losses Caused by Vacuum!



Series VBS



Series VBM

Features/Benefits with Proper Installation:

- Designed to protect enclosed tanks from collapse or structural damage during draining.
- Eliminates siphoning of dangerous fluids.
- Prevents vacuum which can cause damage to sensitive instruments and filters.
- Normally-closed design prevents fugitive emissions from leaving system.
- Insurance against replacement of damaged expensive equipment... avoids critical system downtime.
- Patented diaphragm design assures dependable, repetitive, bubble-tight sealing in VBM and VB; PFA encapsulated spring and special poppet provide identical performance in VBS design.
- For corrosive or ultra-pure liquid applications.
- Sizes: 1/2", 3/4", 1", 1 1/2", 2" and 3".

Materials of Construction:

Series VBM Vacuum Breakers are molded of type 1, grade 1, PVC (Polyvinyl Chloride), Glass-filled Polypropylene, Kynar® PVDF and Corzan® CPVC in sizes 1/2", 3/4" and 1". A machined version, Series VB is available in PTFE in sizes 3/4" and 1". Diaphragms are of EPDM or FKM (comparable to Viton® barnd). VBS Vacuum Breakers are available in standard PVC (Polyvinyl Chloride), Natural Polypropylene, Kynar® PVDF, and Corzan® CPVC in sizes 1 1/2", 2", and 3". Standard dust caps on PVDF models are natural polypropylene; PVDF is optional. Seals are EPDM or FKM. Threaded or socket connections are standard on all models.

Design:

The Plast-O-Matic VBM Vacuum Breakers have only one moving part – the patented self-sealing diaphragm, and this provides both design simplicity and maximum operating dependability. This normally-closed design seals in the identical location every time producing a very dependable, long-life seal. Series VBS Vacuum Breakers feature a corrosion resistant PFA encapsulated spring which acts on a poppet seal that neither sticks nor chatters. Maximum working pressure is 100 PSI @ 75°F (6,9 bar @ 24°C). See pressure/temperature ratings on reverse side.

Operation and Installation:

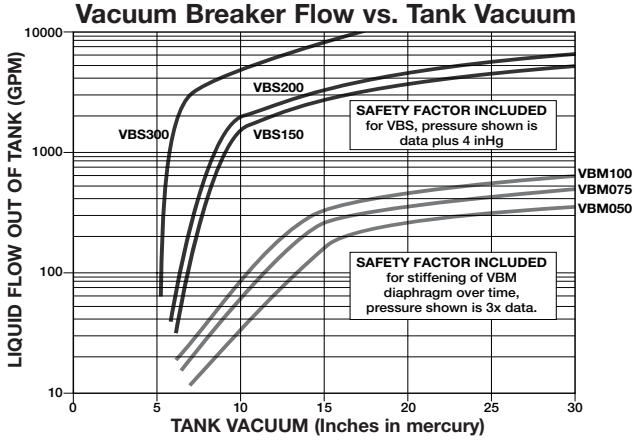
Plast-O-Matic Vacuum Breakers feature a patented, normally-closed, design that can be mounted in any position; however, upright is recommended. For enclosed tank applications, mounting should be at the highest point of the tank.

TRUE BLUE™

PLAST-O-MATIC VALVES, INC.
1384 Pompton Avenue, Cedar Grove, New Jersey 07009-1095
(973) 256-3000 • Fax (973) 256-4745 • www.plastomatic.com

These Vacuum Breakers will begin to break a vacuum at approximately 2 inches of mercury (1.0 PSI or 0,07 Bar negative pressure). Full vacuum is 29 inches of mercury. For applications either draining or pumping from enclosed tanks, the tanks must be able to withstand much more than 2 inches of mercury of vacuum, as illustrated in the chart below. The chart is based upon a 3.5 times safety factor, and it clearly shows that as the rate of liquid flow leaving the tank increases, the resulting vacuum in the tank also increases.

Vacuum Breaker Flow vs. Tank Vacuum



Explanation of Graph:

1. The above graph relates liquid flow leaving an enclosed tank to the resulting vacuum created in the tank as air is entering the tank through the Vacuum Breakers. A safety factor of 3.5 times is used in constructing the graph.
2. To use the graph determine the rate of flow when draining the tank and from that location on the vertical axis read across to the graph of the proper vacuum breaker size. At this intersection of the graph read down to the horizontal axis and determine the vacuum for the tank. This is the recommended vacuum rating of the tank which must be checked with the tank manufacturer's rating to be sure the tank is strong enough.

Anti-Siphon Applications:

For these applications the Vacuum Breakers must be installed in a "U-bend" at least 30 inches (2½ feet or 76 cm) above the highest liquid level. Depending on the safety factor desired for Anti-Siphoning this height would become 60 inches (5 feet or 152 cm) at 2 times safety factor which is recommended by Plast-O-Matic.

Use Caution in Dangerous Applications:

In the event a diaphragm failure could cause spraying of a dangerous liquid onto nearby equipment or personnel, or simply into the atmosphere where breathing the vapors would be dangerous, it is strongly advised to use a Plast-O-Matic Check Valve in lieu of the Vacuum Breaker, and pipe the vent or inlet side of the check valve to a safe remote location. The Check Valve will have the same flow capabilities of the Vacuum Breaker, and contains the same design.

Elimination of Vacuum in a System:

To prevent instrument or system malfunction, the same considerations are involved as in the tank application. The vacuum breaker should be installed at the highest location in the system. Plast-O-Matic Vacuum Breakers can be mounted in any position since they are self-sealing and do not rely on gravity to operate; however, upright is preferred. Also see Anti-Siphon section.

AUTHORIZED PLAST-O-MATIC DISTRIBUTOR

TRUE BLUE™

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1384 Pompton Avenue, Cedar Grove, NJ 07009-1095
(973) 256-3000 • Fax (973) 256-4745 • www.plastomatic.com

Dimensions and Material Availability:

Series VBM – Molded Models: PVC, GPP, PVDF & CPVC

Pipe Size	A		B		C		D	
	In.	mm	In.	mm	In.	mm	In.	mm
1/2	4.3	110	1.3	33	2.4	62	1.9	48
3/4	4.6	117	1.6	39	2.8	72	2.3	59
1	5.1	130	1.9	48	2.8	72	2.5	64

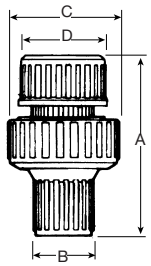
Series VB – Machined Models: PTFE

3/4	4.5	114	1.9	48	3.0	76	2.0	51
1	4.5	114	1.9	48	3.0	76	2.0	51

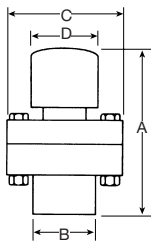
Series VBS – PVC, PP, PVDF & CPVC

1-1/2	7.9	193	2.5	64	4.1	104	3.5	89
2	8.5	209	3.0	76	4.1	104	3.5	89
3	10.5	267	4.3	109	5.5	140	5.5	140

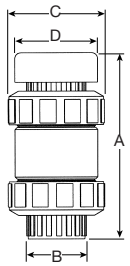
Series VBM



Series VB



Series VBS



Pressure/Temperature Rating:

Series VBM – Molded Models: PVC, GPP, PVDF & CPVC

Valve Body Material	Valve Diaphragm Material	Maximum Working Pressure						
		75°F (24°C)	110°F (43°C)	140°F (60°C)	180°F (82°C)	220°F (104°C)	240°F (115°C)	284°F (140°C)
PVC	EPDM	100	100	40	NR	NR	NR	NR
	FKM	100	100	40	NR	NR	NR	NR
GPP	EPDM	100	100	100	80	NR	NR	NR
	FKM	100	100	100	80	NR	NR	NR
PVDF	EPDM	100	100	100	100	NR	NR	NR
	FKM	100	100	100	100	60	30	10
CPVC	EPDM	100	100	80	40	NR	NR	NR
	FKM	100	100	80	40	NR	NR	NR

Series VB – Machined PTFE Models

PTFE	EPDM	100	90	80	70	NR	NR	NR
	FKM	100	90	80	70	40	20	10

Series VBS – PVC, PP, PVDF, & CPVC

PVC	EPDM	100	100	40	NR	NR	NR	NR
	FKM	100	100	40	NR	NR	NR	NR
PP	EPDM	100	80	50	30	NR	NR	NR
	FKM	100	80	50	30	NR	NR	NR
PVDF	EPDM	100	100	100	100	NR	NR	NR
	FKM	100	100	100	100	60	30	10
CPVC	EPDM	100	100	80	40	NR	NR	NR
	FKM	100	100	80	40	NR	NR	NR

Ordering Information for Series VBM & VB

Pipe Size	Series VBM-PVC FKM Seals	Series VBM-GPP FKM Seals	Series VBM-PVDF FKM Seals	Series VBM-CPVC FKM Seals	Series VB-TF FKM Seals
1/2"	VBM050V-PV	VBM050V-PP	VBM050V-PF	VBM050V-CP	N.A.
3/4"	VBM075V-PV	VBM075V-PP	VBM075V-PF	VBM075V-CP	VB075V-TF
1"	VBM100V-PV	VBM100V-PP	VBM100V-PF	VBM100V-CP	VB100V-TF

Ordering Information for Series VBS

Pipe Size	PVC FKM Seals	Natural Polypro FKM Seals	Corzan CPVC FKM Seals	Kynar PVDF FKM Seals
1-1/2"	VBS150V-PV	VBS150V-PP	VBS150V-CP	VBS150V-PF
2"	VBS200V-PV	VBS200V-PP	VBS200V-CP	VBS200V-PF
3"	VBS300V-PV	VBS300V-PP	VBS300V-CP	VBS300V-PF

Notes: Threads are standard. Socket ends available on VBM models in PVC.
For other body material consult factory. Above shown with FKM seals.
For EPDM Seals, change "V" to "EP" (ex. VBS150EP-PV).

1. For socket end connectors specify "S" in part number (ex. VBS150VT-PV).
2. For threaded ends connectors specify "T" in part number (ex. VBS150VT-PV).* Natural Polypro is non-filled, non-pigmented 100% virgin resin

ASSEMBLY, INSTALLATION & OPERATING INSTRUCTIONS

SERIES VB, VBM, VBS VACUUM BREAKERS

1. IMPORTANT - BEFORE INSTALLING

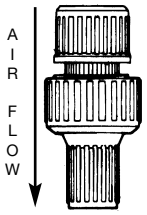
Vacuum Breakers will open to allow air into a pipeline or vessel preventing siphoning, cavitation, or vacuum, when properly installed and used within the recommended ranges of pressure, temperature, and chemical compatibility. The ultimate determination of material compatibility is previous successful use in the same application. MINIMUM SERVICE TEMPERATURE IS 40°F. Call our Technical Support for information about your application.

Caution: Plastic materials will degrade in ultraviolet (UV) light or sunlight.

Caution: Polypropylene and PVDF (Kynar) often look similar. Do not install in your system if you are not sure.

2. INSTALLATION

For best results, Plast-O-Matic recommends placing vacuum breakers upright (see illustration) at the highest point in the piping system. The vacuum breaker will operate mounted in any direction. for anti-siphon applications, Plast-O-Matic recommends locating the vacuum breaker on a U-bend 5 feet above the liquid level to assure opening, because the vacuum breaker will begin to open when he pressure in the pipe drops below minus 1.0 to 1. PSIG.



Caution: A diaphragm failure under pressure, combined with a hazardous liquid, could cause dangerous spraying through the vacuum breaker, or hazardous fumes. Plast-O-Matic suggests Series CK, CKM or CKS check valves instead of VBM or VBS, with the inlet piped to an open drain or containment, for these applications.

Threaded Connections – A suitable thread sealant (ex. Teflon® tape) should be applied to male tapered threads to assure a "leak-tight" seal. The assembly need only be made "hand-tight" followed by a quarter (1/4) turn with a strap wrench. Do not over tighten or use pipe wrenches on plastic pipe and components.



Caution: Teflon® tape will "string" as pipe threads are jointed. Loose "strings" could lay across the seating surface ad prevent the valve from completely closing. To avoid this problem, clean out old tape, and do not apply tape to the first thread.

Caution: Connections should be made only to plastic fittings; metal pipe should only be installed with an intervening plastic nipple. Metal pipe and straight threaded pipe tend to cut, stretch, and distort the plastic bodies, which could result in cracking or leaking over time.

Non-Threaded Connections – For solvent cementing or heat fusion, follow instructions supplied with the cement or fusion equipment, or contact your distributor.

Caution: When using solvent cement for socket connections on PVC and CPVC check valves care should be taken. If primer or cement gets past welding area of the socket it can cause the valve to malfunction. The primer or cement may cause the seals to fail or moving parts to bind and restrict proper movement of internal parts.

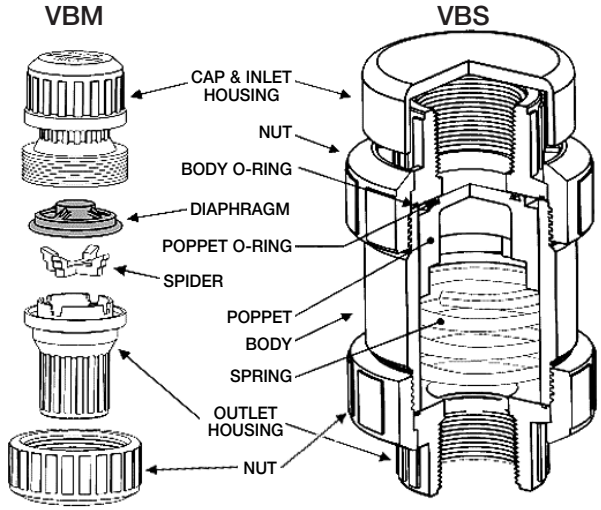
Never trim the flat-end of the Teflon encapsulation on the spring. This may cause spring to be wetted by the process fluid.

3. MAINTENANCE

Plast-O-Matic recommends keeping a spare diaphragm or o-ring set available for repairs. Seal life will vary with applications due to cycles, temperature, pressures, chemicals and concentrations. Based on the application, a periodic inspection and maintenance plan should be established.

Note: **Disassembly will void warranty.**

4. PARTS AND ILLUSTRATION

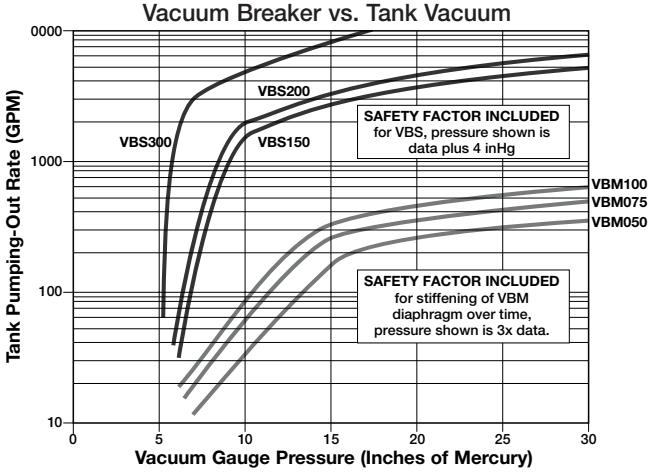


Series VB, not shown, has no SPIDER or NUT, and six (6) screws and nuts are used for assembly.

PART NUMBERS

VBM and VB Diaphragm - *one required per valve*			
VBM050 1/2"	VBM 3/4" & 1"	VB 3/4" & 1"	Diaphragm Material
1021EP	4054 EP	0721 EP	EPDM
1021V	4054 V	0721 V	Viton
VBS O-RINGS- *2nd Number requires two per valve*			
VBS050 1/2"	VBS200 2"	VBS300 3"	O-Ring Material
0224EP 0040EP	0224 EP 0040EP	0230EP 0155EP	EPDM
0224V 0040V	0224 EP 0040V	0230EP 0155V	Viton

5. PERFORMANCE CHART



TRUE BLUE™

PLAST-O-MATIC VALVES, INC.

1384 Pompton Avenue, Cedar Grove, NJ 07009 USA

(973) 256-3000 • Fax: (973) 256-4745 • www.plastomatic.com • info@plastomatic.com

SERIES VB, VBM & VBS VACUUM BREAKERS DATA SHEET

04/12

SECTION 5 - PROCESS INSTRUMENTATION

PI-101 / 106 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

FIT-101 / 106 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-101 / 106 FLOW SENSOR INSTALLATION FITTING, 0.75 IN - GF SIGNET PV8T007

PSH-101 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

PI-107,108 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

FIT-107 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-107 FLOW SENSOR INSTALLATION FITTING, 2 IN - GF SIGNET PV8T020

LT-201 EQ TANK ULTRASONIC LEVEL TRANSMITTER - FLOWLINE - ECHOSPAN LU80-5101

LSHH-200 EQ TANK EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

PI-200 / 204 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

PSH-201 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

TI-300 TEMPERATURE INDICATOR, (-20) TO 120 F - AV 1NFY8

PI-301 PRESSURE INDICATOR, 0 - 15 PSI - AV 4FLC1

LT-301 TRAY STRIPPER LEVEL TRANSMITTER - FPI SENSOR L500-TRANS

LSHH-300 TRAY STRIPPER EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

LSHH-301 POST-TRAY STRIPPER MS LEVEL SWITCH HIGH-HIGH - DWYER F6-HPS-31

VSL-301 VACUUM SWITCH - LOW, 4 TO 20 IWC - DWYER 1950-20-2F

VI-301, 302 VACUUM INDICATOR, (-) 60 - 0 IWC(V) - DWYER LPG4-D7522N

VI-303 VACUUM INDICATOR, (-) 100 - 0 IWC(V) - DWYER LPG4-D7722N

TI-301 TEMPERATURE INDICATOR, 0 TO 250 F - AV 1NFY4

FE-301 FLOW ELEMENT PITOT TUBE, 6 IN - DWYER DS-300-6

FI-301 PITOT TUBE MAGNEHELIC GAUGE, 0-3 IWC - DWYER 2003

PI-303 PRESSURE INDICATOR, 0 - 60 IWC - DWYER LPG4-D8422N

PSH-301 PRESSURE SWITCH - HIGH, 0.5 TO 2 PSID - DWYER 1950P-2-2F

PI-302 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

PI-401 / 404 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

DPT-401 PRESSURE TRANSMITTER, 0 - 25 PSID - DWYER 629-03-CH-P2-E5-S1

PSH-501 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

PI-501 / 506 PRESSURE INDICATOR, 0 - 100 PSI - DWYER SGZ-D10522N-GF

PSH-600 PRESSURE SWITCH - HIGH, 4 - 75 PSI - DWYER A1F-PC-SS-1-2

FIT-601, 602 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-601 FLOW SENSOR INSTALLATION FITTING, 1.5 IN - GF SIGNET PV8T015

LSHH-700 BACKWASH SUPPLY TANK EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

LSH-700, LSL-700 BACKWASH SUPPLY TANK HIGH & LOW LEVEL SWITCH - GEMS MBLU40T

PI-701 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

FIT-701 MAGNETIC FLOW SENSOR TRANSMITTER - GF SIGNET 3-2551-P0-22

FIT-701 FLOW SENSOR INSTALLATION FITTING, 3 IN - GF SIGNET PV8T030

LSHH-800 BACKWASH SUPERNATANT TANK EMERGENCY HIGH LEVEL SWITCH - GEMS MYEL40T

PI-801 / 803 PRESSURE INDICATOR, 0 - 60 PSI - DWYER SGZ-D10422N-GF

LSL, 1001, 1002 CHEMICAL DRUM LOW LEVEL SWITCH - DWYER F7-SS2

LSHH-1200 BUILDING SUMP HIGH LEVEL SWITCH - DWYER F7-SB

LSHH-1201 CONTAINMENT PAD SUMP HIGH LEVEL SWITCH - DWYER F7-SB

TSL-1200 PROCESS AREA TEMPERATURE SWITCH LOW - DAYTON 2NNR6

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

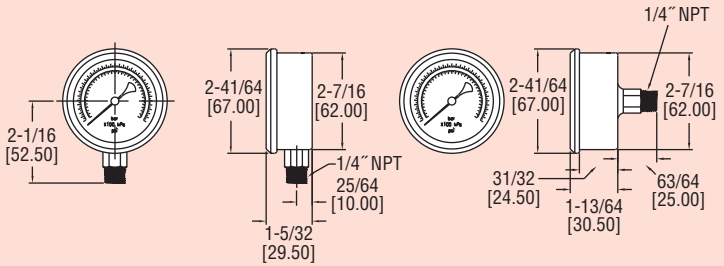
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

FIT 101

Georg Fischer Signet LLC
Signet 2551 Magmeter

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Test Certificate

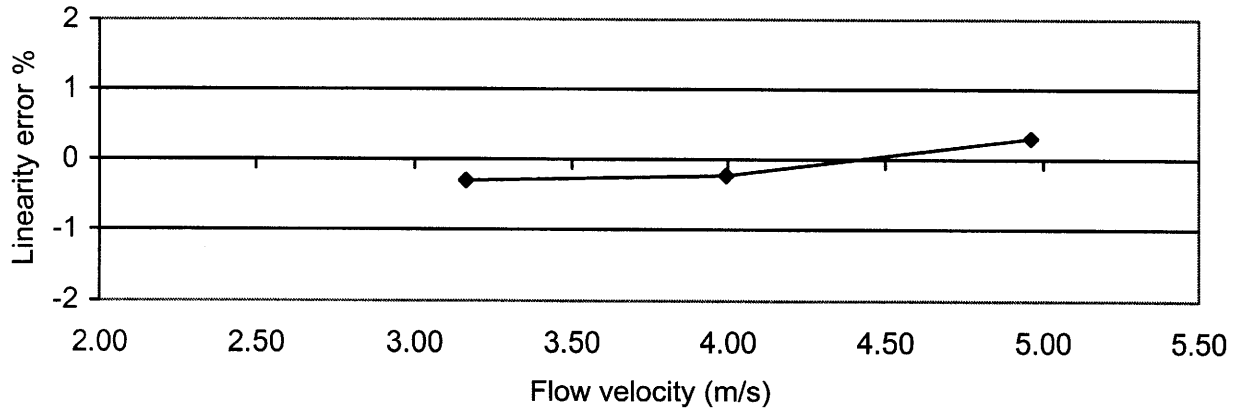
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140326
Calibration date: March 14, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.37 (3.16)	126674.23	-0.30
13.10 (3.99)	161131.27	-0.23
16.28 (4.96)	200356.25	0.30



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

Georg Fischer Signet LLC certifies that the reference used in the calibration of this product is traceable to NIST (National Institute of Standards and Technology). Improper handling may adversely affect the accuracy.

Georg Fischer Signet LLC products are manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management.

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FIT - 102

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Signet 2551 Magmeter

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Test Certificate

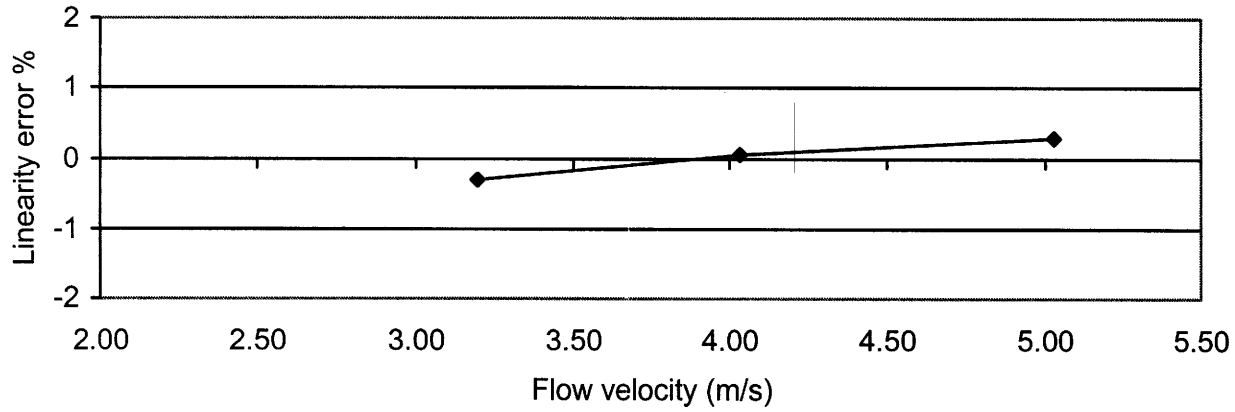
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140333
Calibration date: March 14, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.48 (3.19)	0.00	-0.30
13.23 (4.03)	0.00	0.06
16.49 (5.03)	0.00	0.30



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

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(12/2014)

FIT - 102

FIT- 103

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Signet 2551 Magmeter

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Test Certificate

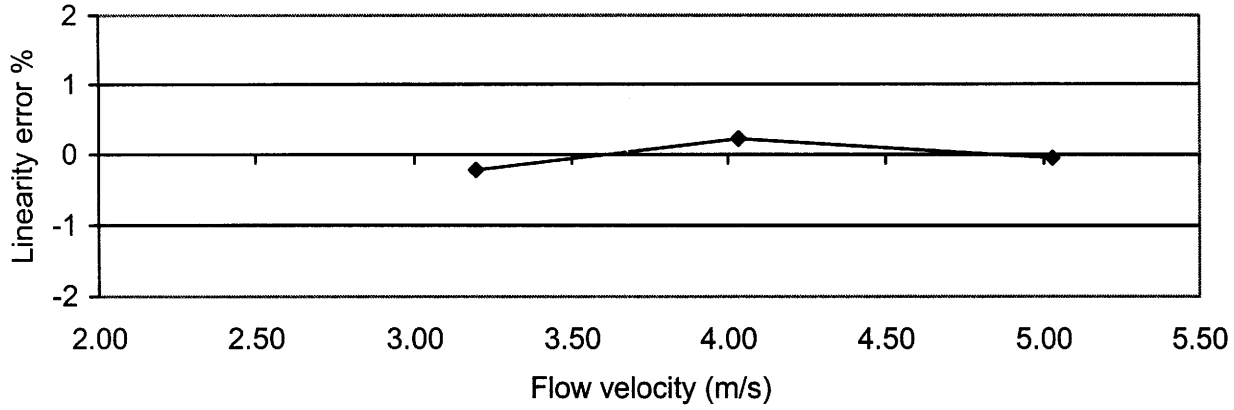
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140336
Calibration date: March 14, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.48 (3.19)	0.00	-0.22
13.23 (4.03)	0.00	0.22
16.49 (5.03)	0.00	-0.05



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

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Signet 2551 Magmeter

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Test Certificate

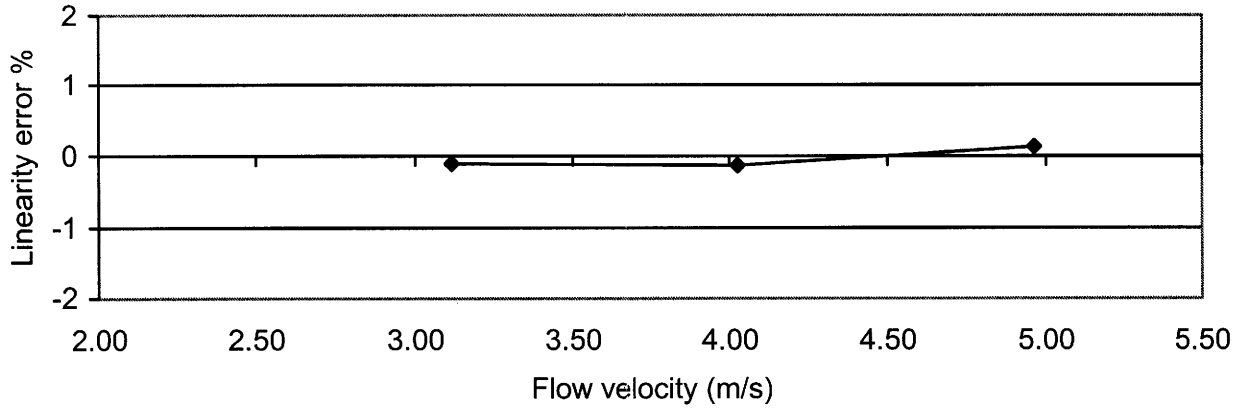
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61604130278
Calibration date: April 13, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.22 (3.11)	139002.79	-0.11
13.21 (4.03)	179707.50	-0.13
16.28 (4.96)	221446.51	0.13



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

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FIT- 105

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Test Certificate

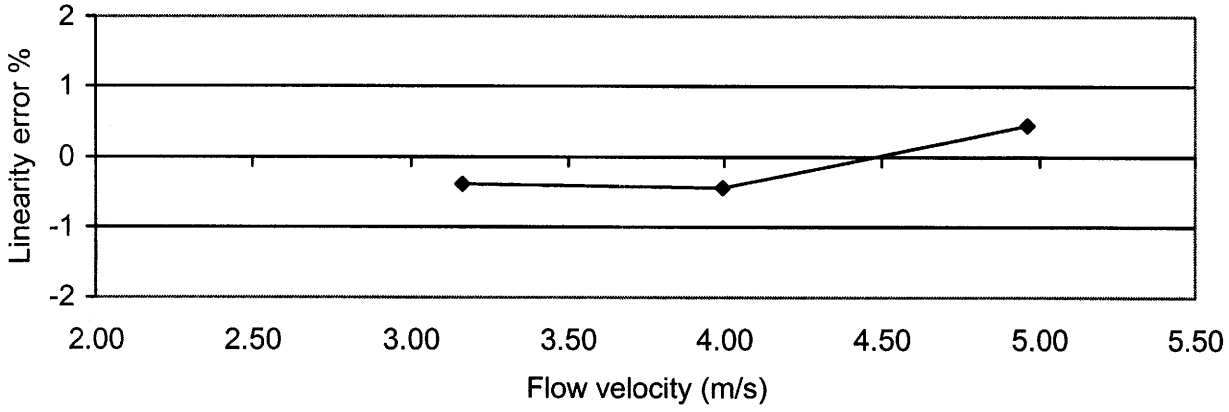
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140328
Calibration date: March 14, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.37 (3.16)	126170.37	-0.39
13.10 (3.99)	160755.75	-0.44
16.28 (4.96)	200309.58	0.44



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

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Georg Fischer Signet LLC
Signet 2551 Magmeter

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Test Certificate

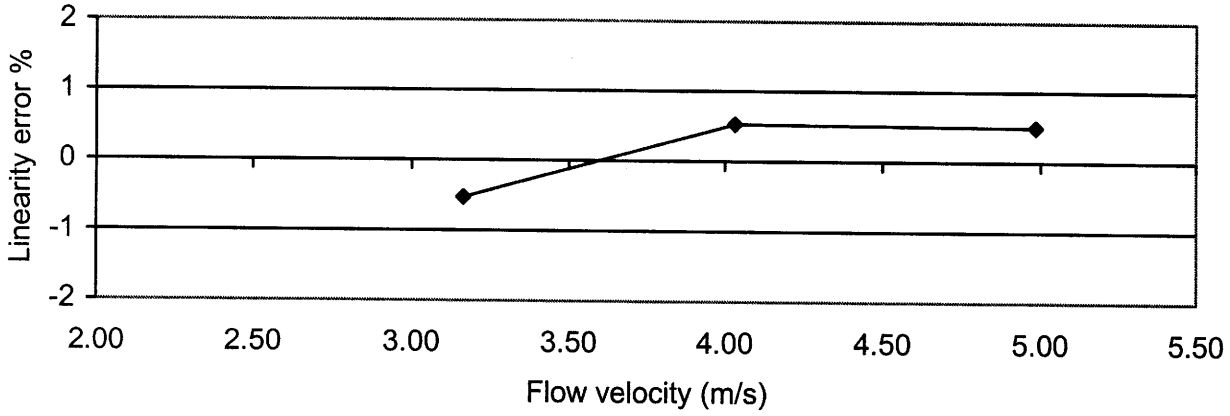
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140331
Calibration date: March 14, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.38 (3.16)	127813.29	-0.53
13.23 (4.03)	163189.28	0.53
16.35 (4.98)	201844.24	0.50



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

Georg Fischer Signet LLC certifies that the reference used in the calibration of this product is traceable to NIST (National Institute of Standards and Technology). Improper handling may adversely affect the accuracy.

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English

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

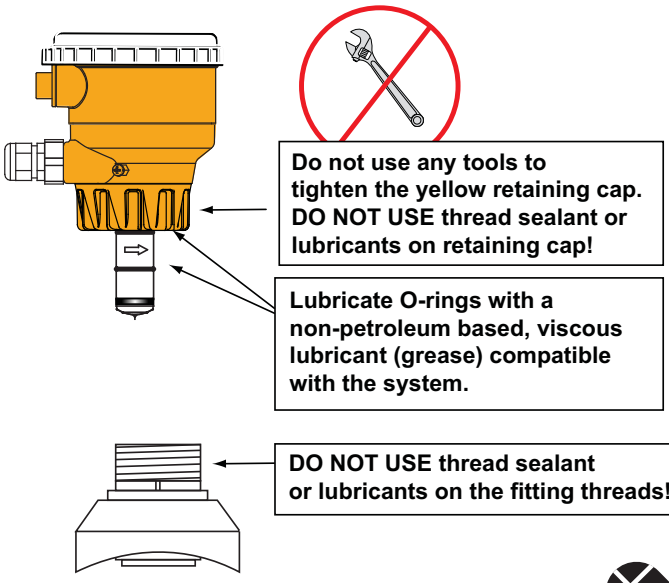
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

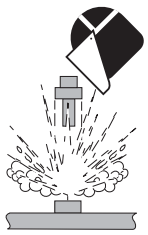
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

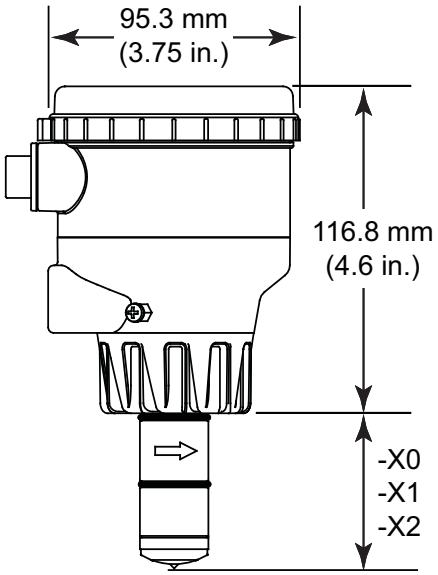


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary .....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance ....300 Ω
Loop Accuracy .....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

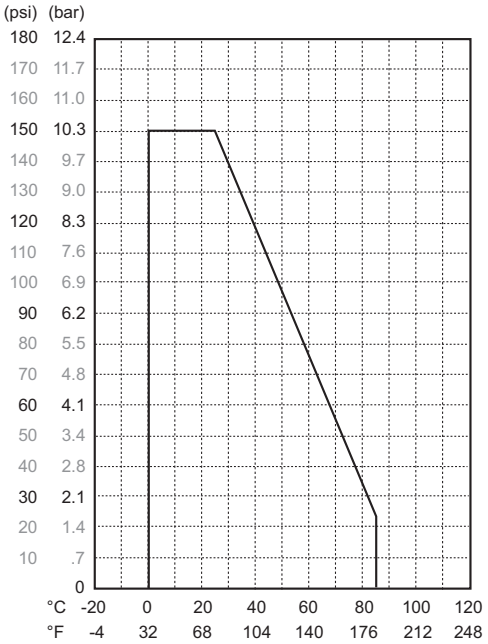
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



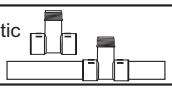
Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant
- China RoHS (visit gfsignet.com for details)
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

Pipe Fittings

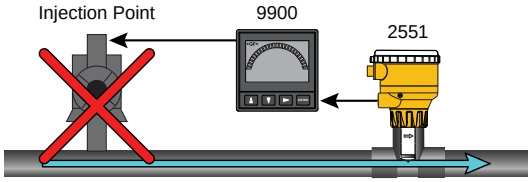
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

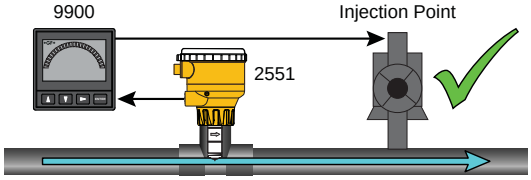
Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

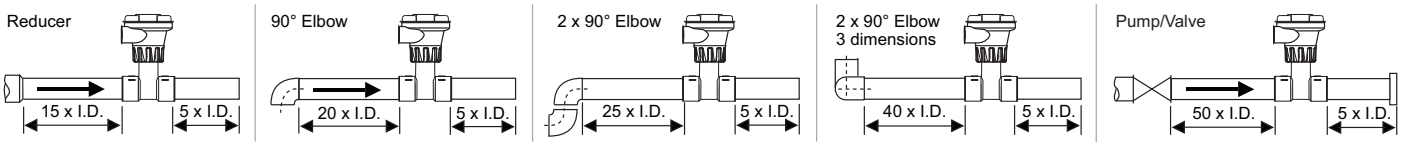
Selecting a Location

- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

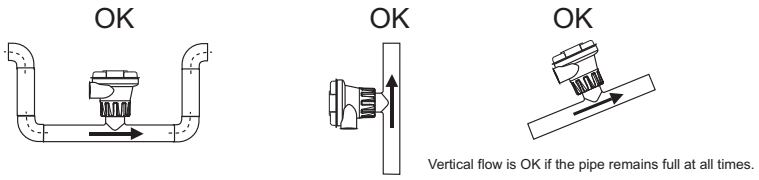




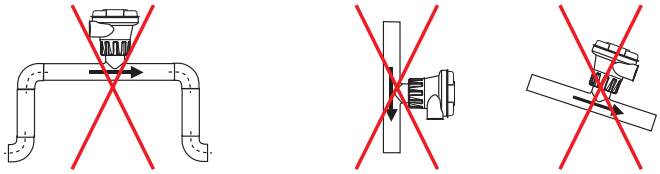
Select a location with sufficient distance of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.

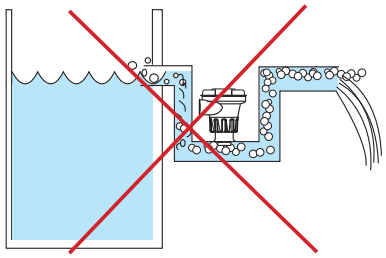


These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

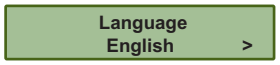
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



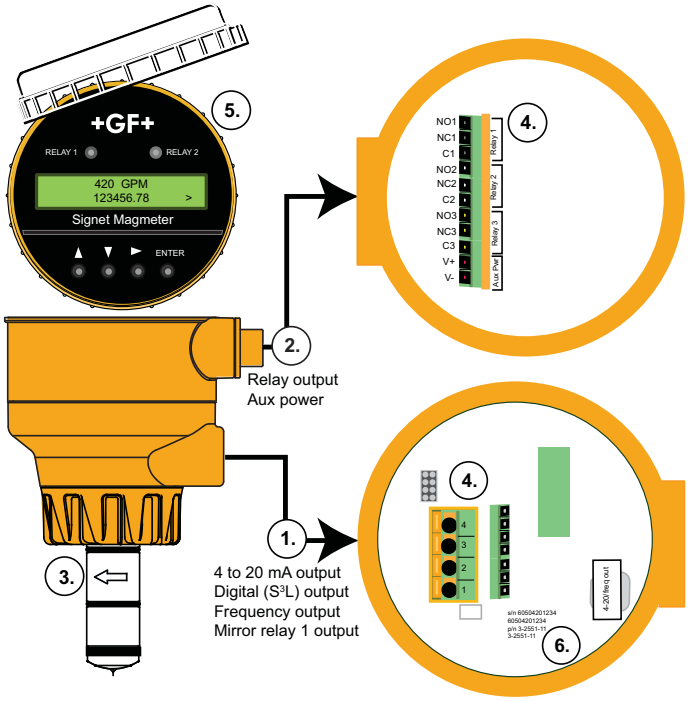
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

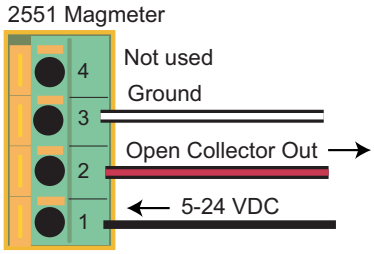


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

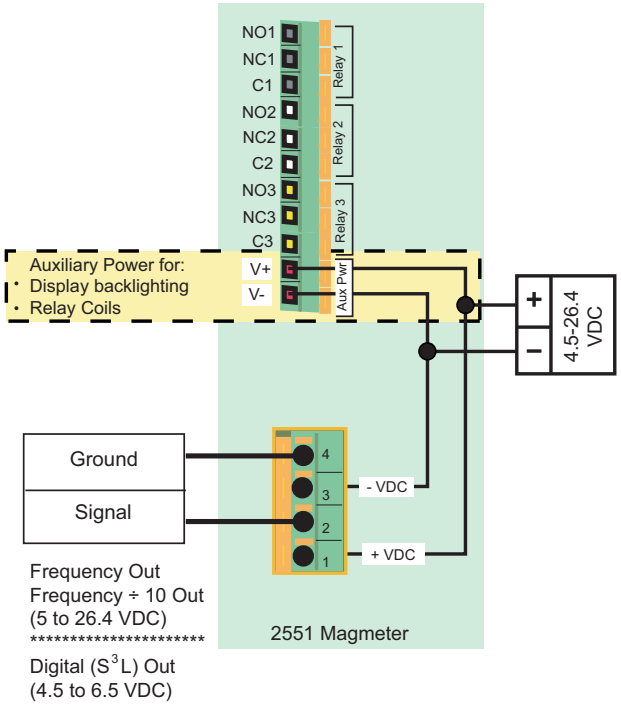
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

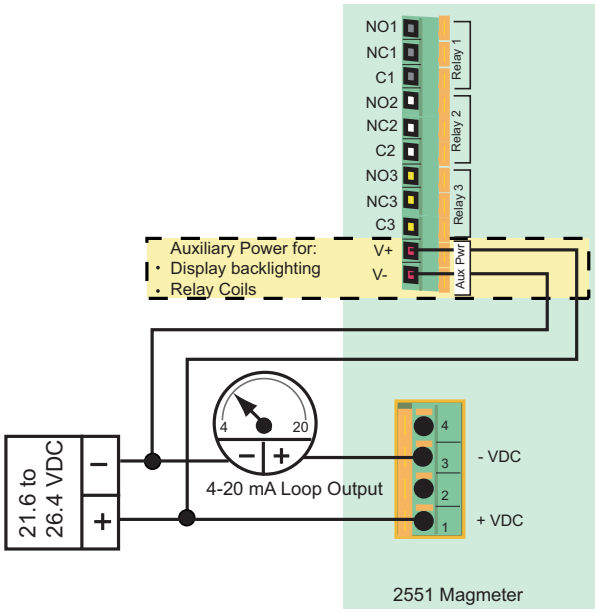
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

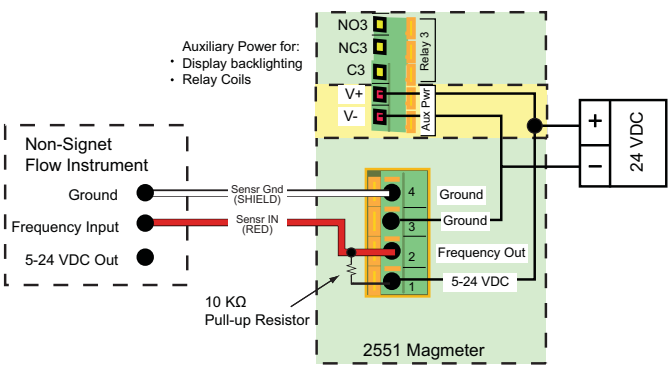
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

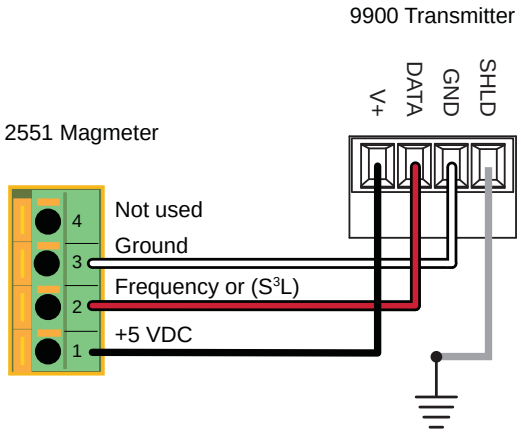


Wiring to Signet Flow Instruments

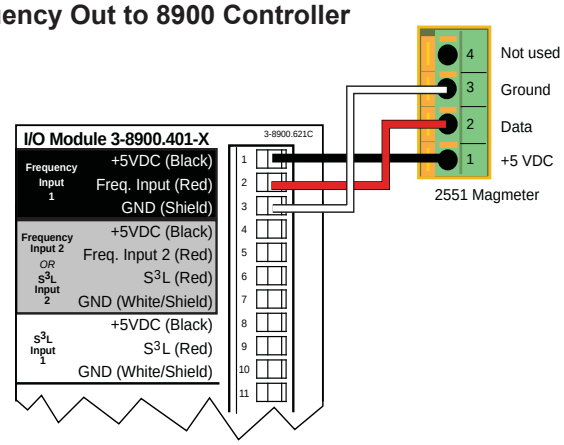
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S³L) output.

Frequency and Digital (S³L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

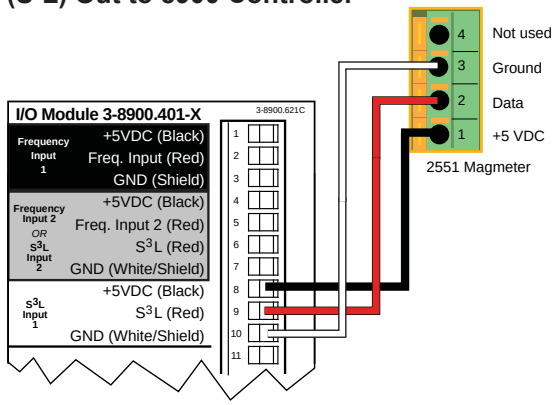
2551 Frequency or Digital (S³L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S³L) Out to 8900 Controller



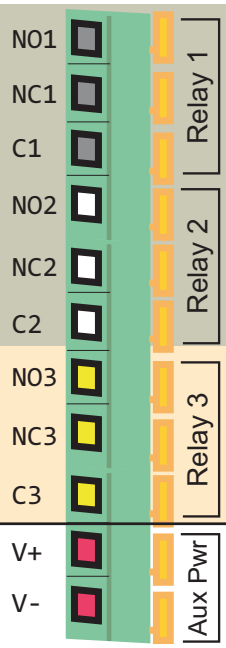
Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)



Mechanical Relays:
5A @ 250 VAC
5A @ 30 VDC

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Solid State Relay 3:
50 mA max @ 30 VDC
50 mA max @ 42 VAC

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.

Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

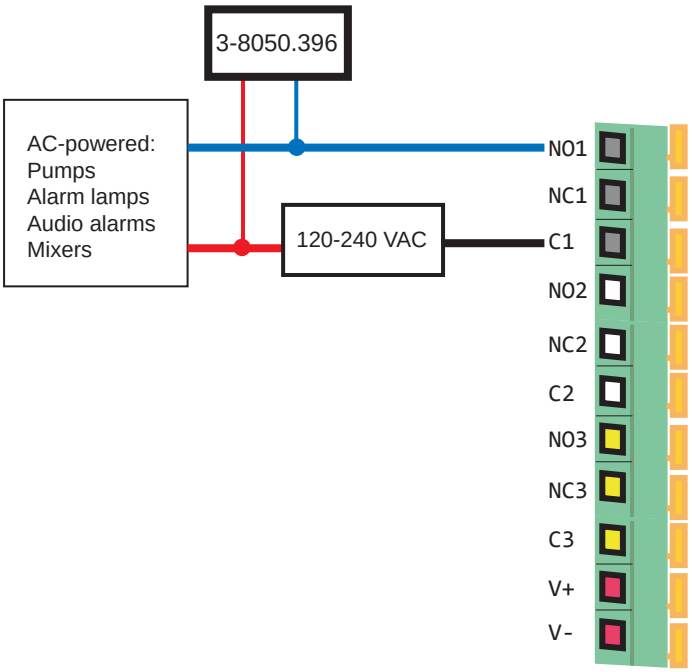
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.

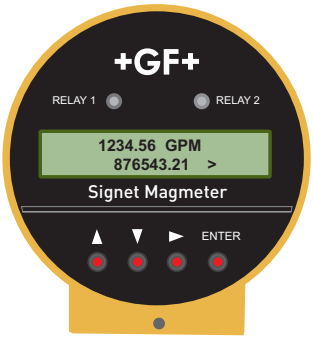


Navigating the Menus

Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

- All menu instructions in this manual assume that the instrument is showing this display.

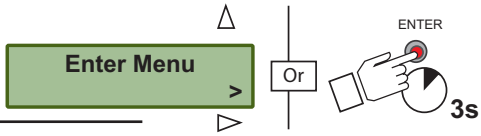


2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

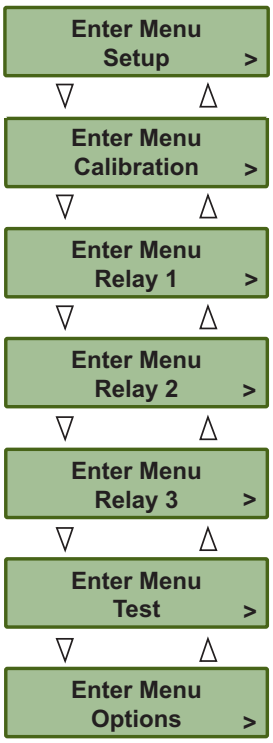
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.

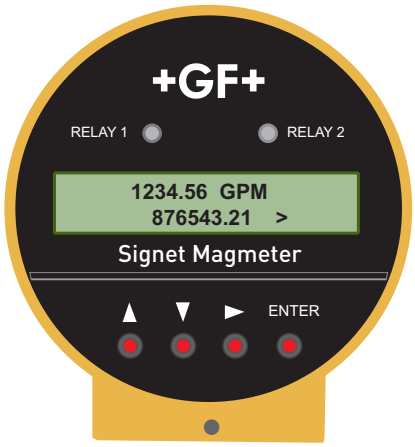


Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



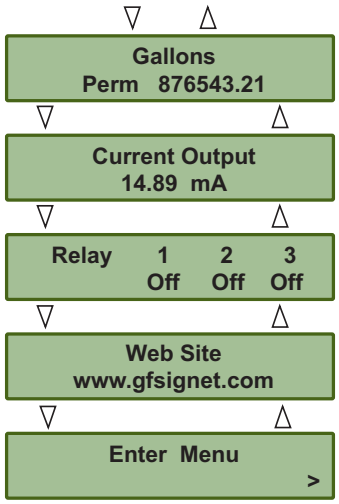
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

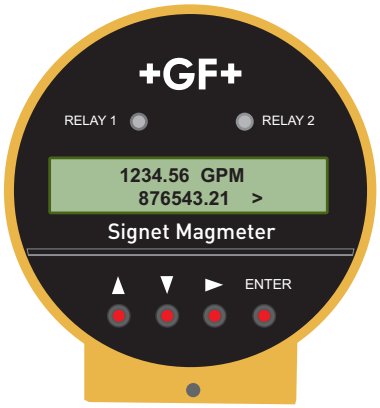
Relay States shown for units with a relay board.

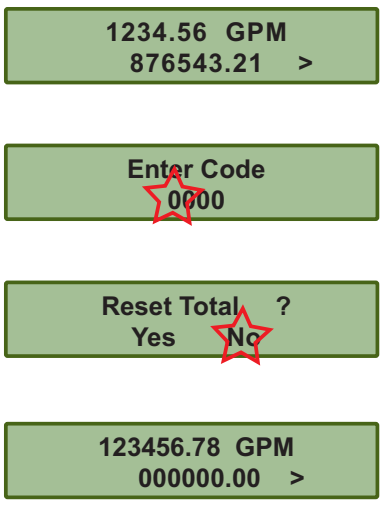
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..



Enter Code
0000

Use the keypad to navigate through each setting.

△ ▽ ▷ ENTER

The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.

K-Factor
060.000 >

Pipe Size: Select the pipe size that is nearest to the nominal pipe size.

Pipe Size
2" DN50 >

Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot)
- μ (micro)
- _ (blank)
- - (dash)
- / (slash)
- 3 (for cubic units)

The last character selects the timebase for the flow rate measurement. Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)

Flow Units
GPM >

Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

Set 4 mA
-100 GPM >

Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

Set 20 mA
100.00 GPM >

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.

Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)

Total Factor
1000.0 >

Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.

Totalizer Units
Gallons >

Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.

Low Flow Cutoff
0.5 GPM >

Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.

Averaging
25 secs >

Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.

Sensitivity
100% >

Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

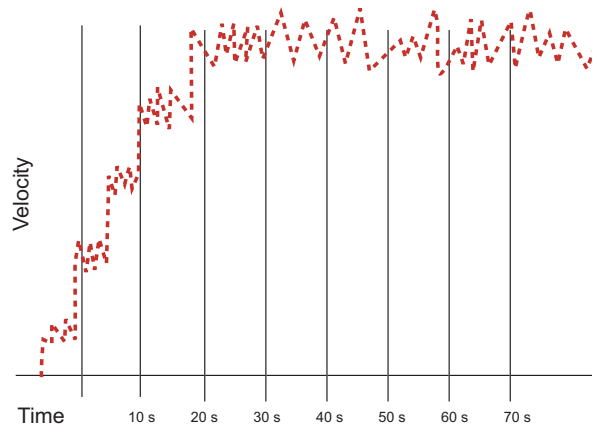
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

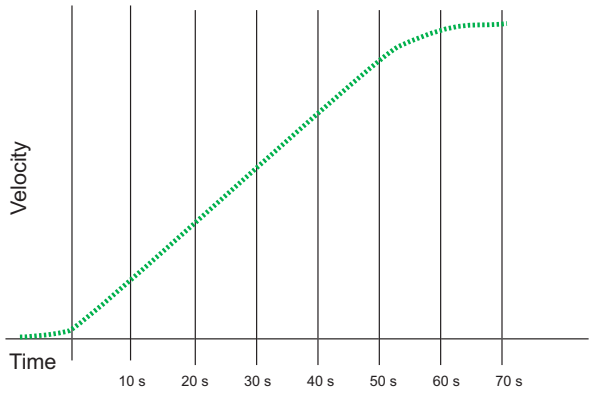
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



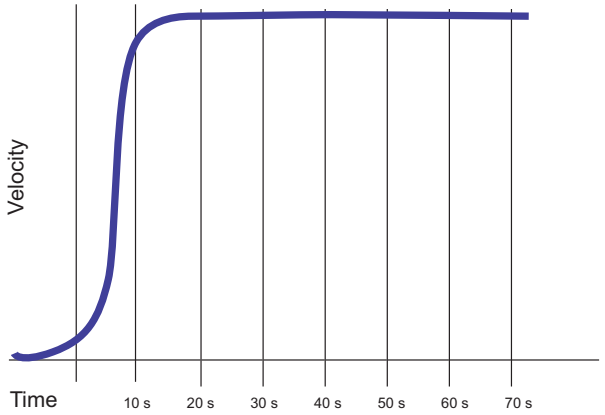
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



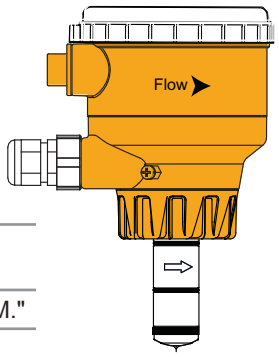
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

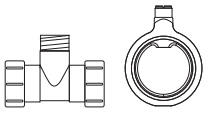
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

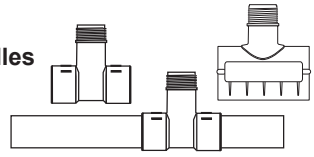
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

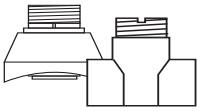
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

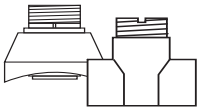
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



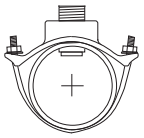
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

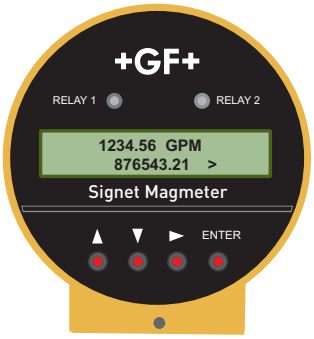
Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

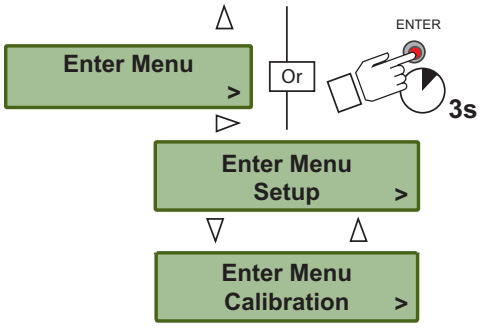
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

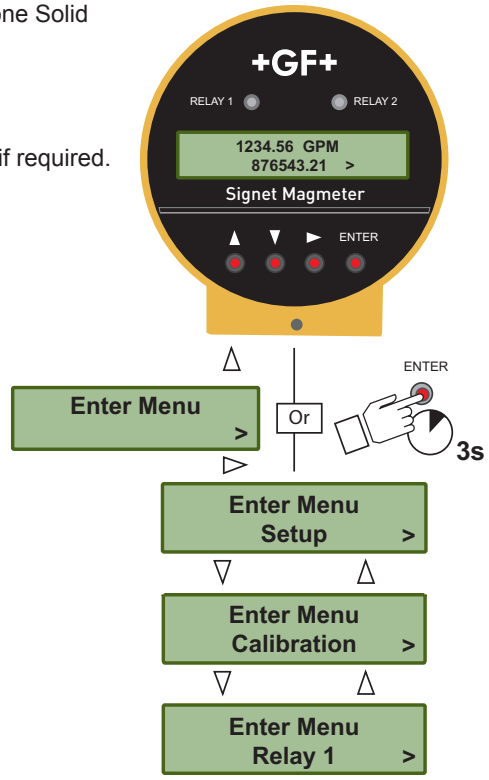
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

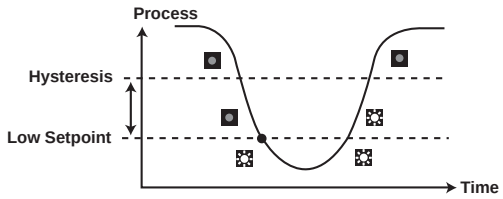
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

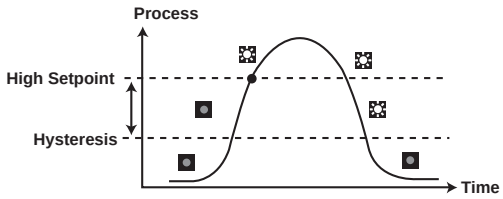
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

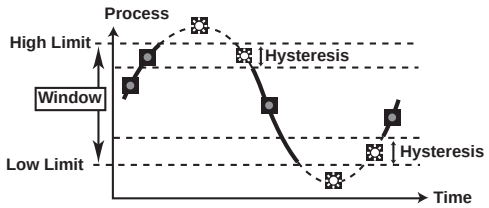
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

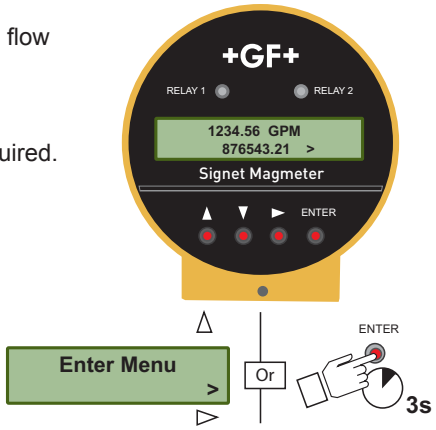


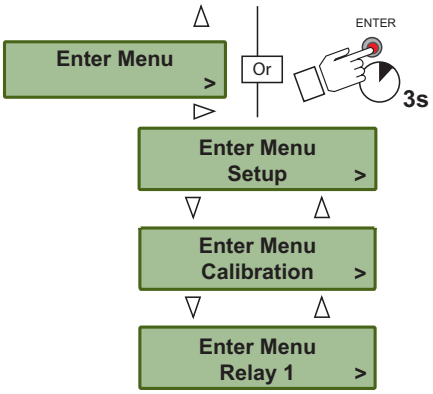
Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated





NOTE: The Security Code must be entered before modifying the relay menu.



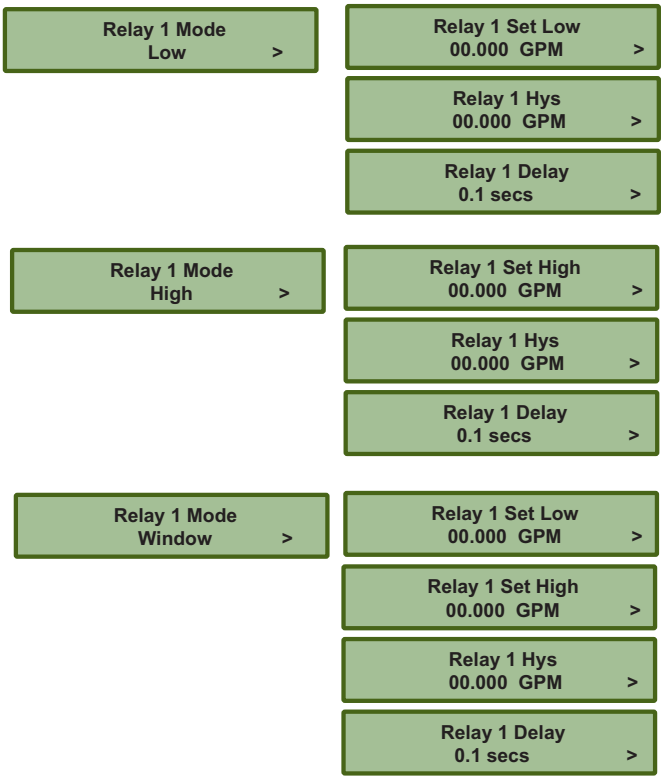
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

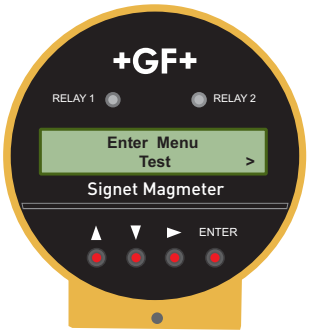
Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

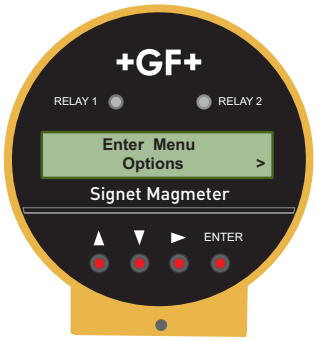
Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S³L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The **(S³L) Digital** output mode switches the 2551 to the Signet serial data output called (S³L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

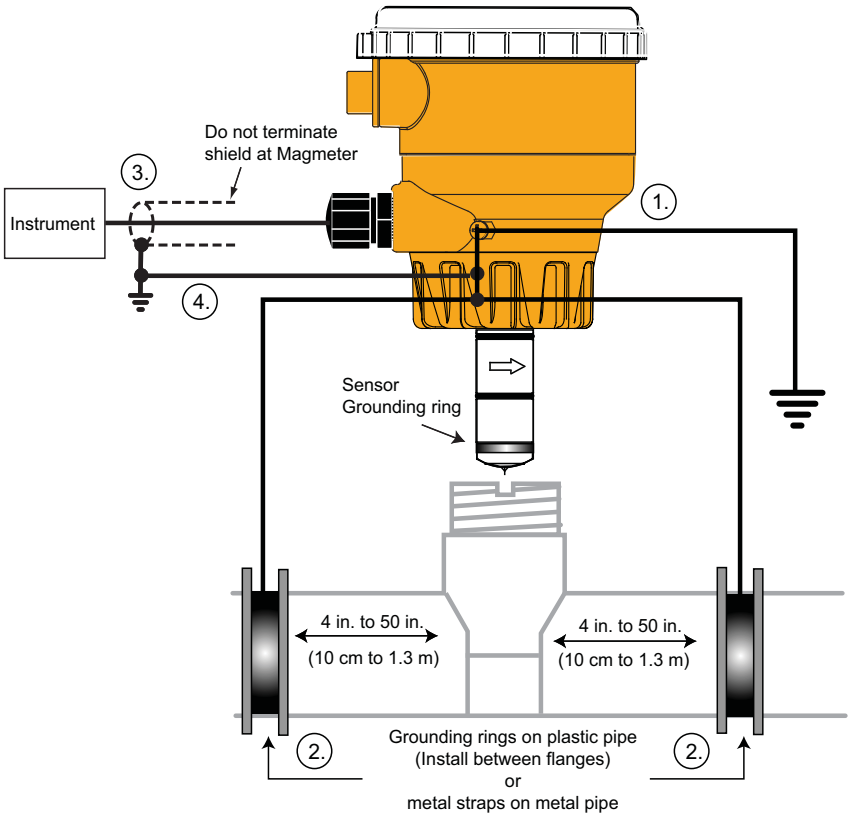
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

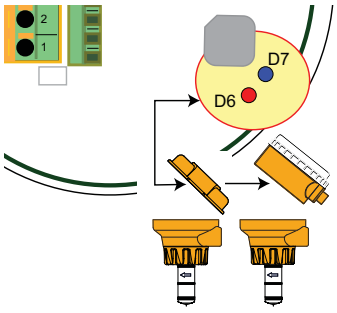
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

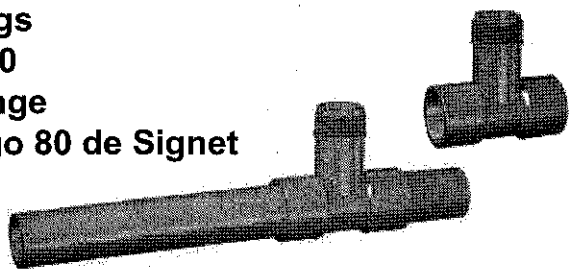
+GF+

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For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
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3-2551.090-1 Rev. M 04/15 English

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Signet Schedule 80 PVC and CPVC Installation Fittings
Raccords d'installation Signet PVC et CPVC norme 80
Signet Schedule 80 PVC- und CPVC-Installationsfittinge
Accesorios de instalación de PVC y CPVC de catálogo 80 de Signet



MXPV8.090 Rev. D 04/15 (English, French, German, Spanish)

English



SAFETY INSTRUCTIONS

1. Confirm chemical compatibility before use.
2. Do not exceed maximum temperature or pressure specifications of fittings or sensors.
3. Do not use this product for any purpose other than for which it was designed.
4. Use schedule 80 pipe.
5. Use with liquids only.
6. Improper pipe fitting installation may result in pressure failure, personal injury, and/or property damage.
7. Always match fitting and piping materials.
8. Always use piping cement designed for your specific fitting and piping material.

Français



CONSIGNES DE SÉCURITÉ

1. Vérifier la compatibilité chimique avant l'utilisation.
2. Ne pas dépasser les spécifications maximales de température et de pression pour les raccords ou les capteurs.
3. Ne pas utiliser ce produit à d'autres fins que celle pour laquelle il a été conçu.
4. Utiliser un tuyau norme 80.
5. Utiliser uniquement avec des liquides.
6. Un raccord mal installé peut entraîner des chutes de pression et des dommages corporels ou matériels.
7. Utilisez toujours un raccord de même matériau que le tuyau sur lequel il doit être posé.
8. Utilisez toujours du mastic conçu spécialement pour le matériau de votre tuyau et de votre raccord.



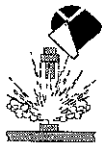
Deutsch



SICHERHEITSVORSCHRIFTEN

1. Vor dem Einsatz die Chemikalienverträglichkeit bestätigen.
2. Die angegebenen maximalen Temperatur- oder Druckwerte von Fittingen oder Sensoren nicht überschreiten.
3. Das Produkt ausschließlich für den beabsichtigten Zweck verwenden.
4. Schedule 80 Rohr verwenden.
5. Nur mit Flüssigkeiten verwenden.
6. Unsachgemäße Installation des Fittings kann zu Druck-, Personen- oder Sachschäden führen.
7. Fitting-und Rohrleitungsmaterial muß stets aufeinander abgestimmt sein.
8. Stets einen für das spezielle Material von Fitting und Rohrleitungen geeigneten Klebstoff verwenden.

Español



INSTRUCCIONES DE SEGURIDAD

1. Confirme la compatibilidad química antes de utilizar este producto.
2. No exceda las especificaciones de temperatura o presión máximas de los accesorios o sensores.
3. No use este producto para ningún fin que no sea para el que se ha diseñado.
4. Use tuberías de catálogo 80.
5. Use con liquidos solemente.
6. La instalación indebida del conector de tubería puede producir fallas de presión, lesión personal y/o daños a la propiedad.
7. Siempre haga coincidir los materiales del conector y de la tubería.
8. Siempre use el cemento de tubería diseñado para su conector y material de tubería especifi cos.

Compatibility

These schedule 80 fittings are designed to be used with the Signet flow and pH sensors listed below.

Compatibilité

Ces raccords norme 80 sont conçus pour être utilisés avec les capteurs de pH et d'écoulement Signet répertoriés ci-dessous.

Kompatibilität

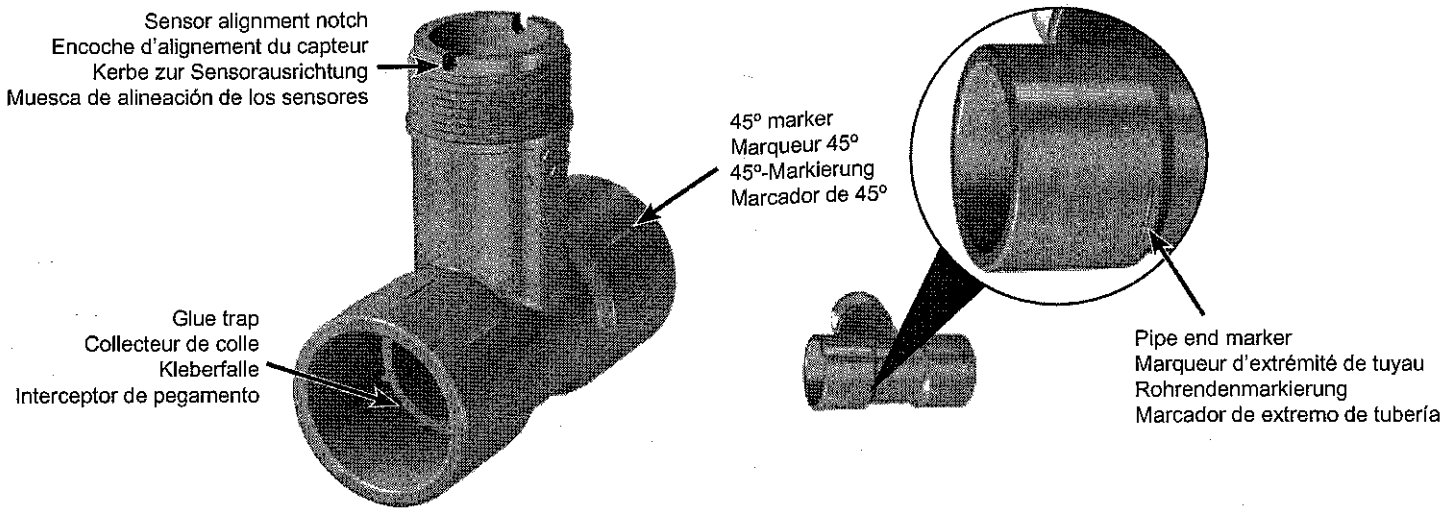
Diese Schedule 80 Fittinge sind zur Verwendung mit den nachstehend aufgeführten Durchfluss- und pH-Sensoren von Signet konzipiert.

Compatibilidad

Estos accesorios de catálogo 80 están diseñados para ser usados con los sensores de caudal y pH de Signet indicados abajo.

Flow Sensors Capteurs d'écoulement Durchflusssensoren Sensores de caudal	pH/ORP Electrodes Électrodes indicatrices de pH/ORP pH/ORP-Elektroden Electrodos de pH/ORP (pH/potencial redox)
P51530-X0	
3-8510-X0	3-2724, 3-2725, 3-2726, 3-2734, 3-2735, 3-2736
3-8512-X0	
3-2536-X0	
3-2537-XC-X0	
3-2551-X0-XX	

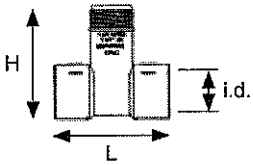
Identification | Identification | Identifizierung | Identificación



Fitting only | Raccord uniquement | Nur Fitting | Accesorio solamente



Material
Matériau
Material
Material

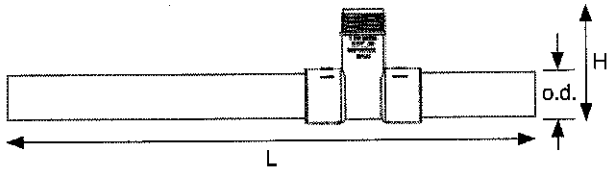


SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	i.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005F	159 001 614	MCPV8T005F	159 001 632	1/2"	3.75	3.50	0.85
MPV8T007F	159 001 615	MCPV8T007F	159 001 633	3/4"	3.75	3.70	1.06
MPV8T010F	159 001 616	MCPV8T010F	159 001 634	1"	4.30	4.00	1.33
MPV8T012F	159 001 617	MCPV8T012F	159 001 635	1-1/4"	4.40	4.30	1.67
MPV8T015F	159 001 618	MCPV8T015F	159 001 636	1-1/2"	5.00	4.60	1.91
MPV8T020F	159 001 619	MCPV8T020F	159 001 637	2"	5.50	5.00	2.40

Fitting with pipe | Raccord avec tuyau | Fitting mit Rohr | Accesorio con tubería



Material
Matériau
Material
Material



SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	o.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005	159 001 623	MCPV8T005	159 001 641	1/2"	14	3.50	0.84
MPV8T007	159 001 624	MCPV8T007	159 001 642	3/4"	14	3.70	1.05
MPV8T010	159 001 625	MCPV8T010	159 001 643	1"	17	4.00	1.32
MPV8T012	159 001 626	MCPV8T012	159 001 644	1-1/4"	20	4.30	1.66
MPV8T015	159 001 627	MCPV8T015	159 001 645	1-1/2"	24	4.60	1.90
MPV8T020	159 001 628	MCPV8T020	159 001 646	2"	26.5	5.02	2.38

K-Factors

A **K-Factor** is the number of pulses (**P**) a sensor will generate for each engineering unit of fluid that passes the sensor. K-factors for water are listed below in U.S. gallons and liters. For example, in a 1 inch SCH 80 PVC pipe, the 515 paddlewheel generates 172.07 pulses per gallon of water passing the rotor.

K-Factors are for schedule 80 pipe.

Facteurs K

Un **Facteur K** est le nombre d'impulsions (**P**) qu'un capteur produit pour chaque unité d'ingénierie de fluide qui y passe. Les facteurs K pour l'eau sont indiqués ci-dessous en gallons U.S. et en litres. Par exemple, dans un tuyau en PVC de 25,4 mm (1 pouce), la roue à palettes 515 produit 172.07 impulsions par gallon (3,78 litres) d'eau qui passe dans le rotor.

Les facteurs K sont pour les tuyaux de norme 80.

K-Faktoren

Der **K-Faktor** repräsentiert die Anzahl der Impulse (**P**), die vom Sensor für jede physikalische Einheit durchfließender Flüssigkeit erzeugt wird. K-Faktoren für Wasser sind nachstehend in US-Gallonen und Liter aufgeführt. Beispielsweise erzeugt das 515 Schaufelrad in einem 1-Zoll-PVC-Rohr 172.07 Impulse pro Gallone Wasser, das durch den Rotor fließt.

K-Faktoren sind für Schedule 80 Rohre.

Factores K

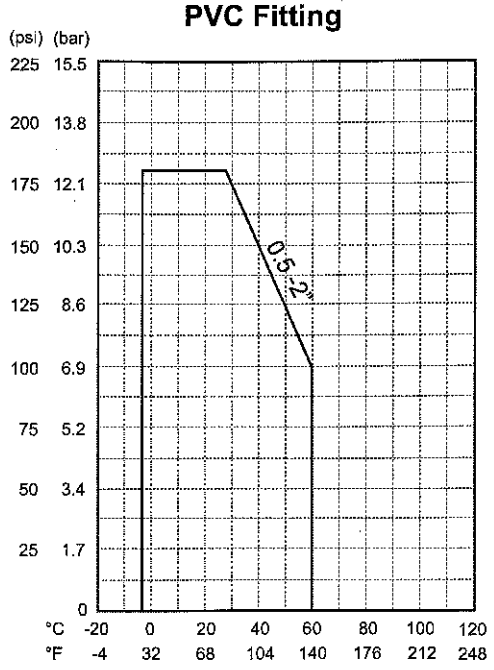
El **Factor K** es el número de impulsos (**P**) que genera un sensor por cada unidad de líquido que pasa por el sensor. En las tablas de abajo se muestran los factores K para agua (en unidades de galones norteamericanos [EE. UU.] y litros). Por ejemplo, en una tubería de PVC de 1 pulg., la 515 rueda de paletas genera 172.07 impulsos por galón de agua que pasa por el rotor.

Los factores K son para tuberías del catálogo 80.

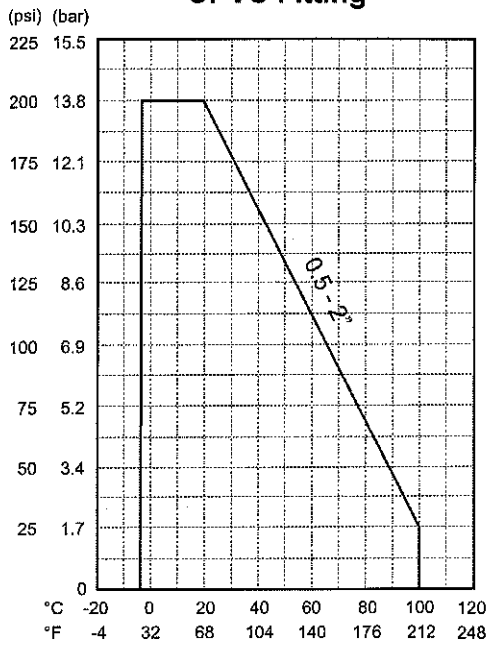
PIPE SIZE TAILLE DE TUYAU ROHRGRÖSSE TAMAÑO DE LA TUBERÍA	SCH. 80 FITTING RACCORD DE NORME 80 SCHEDULE 80 FITTING ACCESORIO DE CATÁLOGO 80	515/8510		2536/2537/8512		2551	
		P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL
1/2"	MPV8T005F MCPV8T005F MPV8T005 MCPV8T005	137.42	520.12	271.37	1027.1	601.58	2277.0
3/4"	MPV8T007F MCPV8T007F MPV8T007 MCPV8T007	78.61	297.52	154.08	583.19	371.90	1407.6
1"	MPV8T010F MCPV8T010F MPV8T010 MCPV8T010	45.46	172.07	88.65	335.53	227.52	861.17
1-1/4"	MPV8T012F MCPV8T012F MPV8T012 MCPV8T012	24.19	91.54	47.24	178.79	122.83	464.91
1-1/2"	MPV8T015F MCPV8T015F MPV8T015 MCPV8T015	16.44	62.22	32.08	121.42	87.56	331.43
2"	MPV8T020F MCPV8T020F MPV8T020 MCPV8T020	9.60	36.32	18.87	71.44	50.96	192.89

Specifications | Spécifications | Spezifikationen | Especificaciones

PVC Fitting



CPVC Fitting





The pressure ratings are for the fitting only.
NEVER EXCEED the pressure rating of the installed sensor.

Follow plastic piping cement manufacturer's recommended preparation and gluing instructions. Avoid excess cement in fitting joints to prevent any port obstruction.

Rigid PVC and CPVC Material Compounds Specification:
ASTM D 1784

Dimensional and Compound Plastic Pipe Fittings Specifications:
ASTM D 2467
ASTM F 439

Standard Test Methods Specification:
ASTM F 1970

Approvals:
NSF (fitting only)

Les niveaux de pression ne concernent que le raccord.
NE JAMAIS DÉPASSER le niveau de pression du capteur installé.

Suivez les instructions de préparation et d'application du mastic données par le fournisseur de celui-ci. Evitez d'appliquer le mastic en trop grande quantité pour ne risquer aucune obstruction.

Matériau PVC et CPVC rigide Spécifications des composés :
ASTM D 1784

Dimensions et composé Raccords pour tuyau en plastique Spécifications :
ASTM D 2467
ASTM F 439

Méthodes standard de test Spécifications :
ASTM F 1970

Homologations :
NSF (Raccord uniquement)

Die Drucknennwerte beziehen sich nur auf die Fittinge.
Den Drucknennwert des installierten Sensors NIEMALS ÜBERSCHREITEN.

Anweisungen des Klebstoff-Herstellers befolgen. Nicht zuviel Klebstoff an den Verbindungsstellen auftragen, um Verstopfungen der Öffnungen zu vermeiden.

Verbundstoffspezifikation für unbiegsames PVC- und CPVC-Material:
ASTM D 1784

Abmessungs- und Verbundstoffspezifikationen für Rohrfittinge aus Kunststoff:
ASTM D 2467
ASTM F 439

Spezifikation für Standardtestmethoden:
ASTM F 1970

Zulassungen:
NSF (Nur Fitting)

Las presiones nominales son para el accesorio solamente.
NO EXCEDA NUNCA la presión nominal del sensor instalado.

Siga las instrucciones recomendadas por el fabricante para la preparación y el engomado del cemento para tuberías plásticas. Evite el exceso de cemento en las juntas de los conectores para prevenir obstrucciones en los orificios.

PVC y CPVC rígidos Especificación de los compuestos:
ASTM D 1784

Dimensiones y composición Accesorios de tuberías de plástico Especificaciones:
ASTM D 2467
ASTM F 439

Métodos de prueba estándar Especificación:
ASTM F 1970

Certificados de aprobación:
NSF (Accesorio solamente)

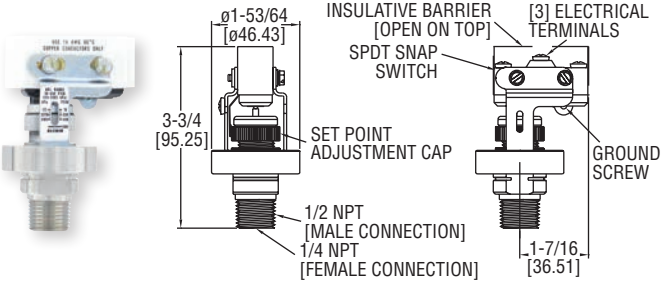
+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
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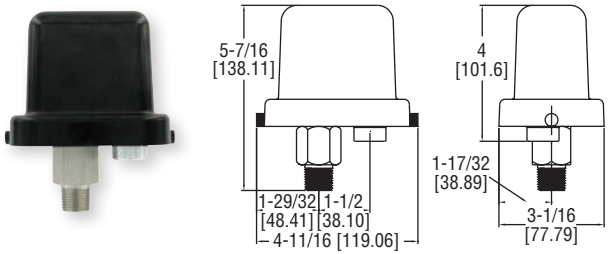
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LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS

- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS

- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
~~A1F-O-SS-1-1~~	~~2 to 15 (0.14 to 1.03)~~	~~2 (0.14)~~	~~3 (0.21)~~
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
~~A1F-O-SS-1-3~~	~~8 to 225 (0.55 to 15.5)~~	~~8 (0.55)~~	~~25 (1.7)~~
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

Note: Optional enclosure factory installed. To order, change O to PC.
Example: A1F-PC-SS-1-1

Series A1F Compact OEM Pressure Switch

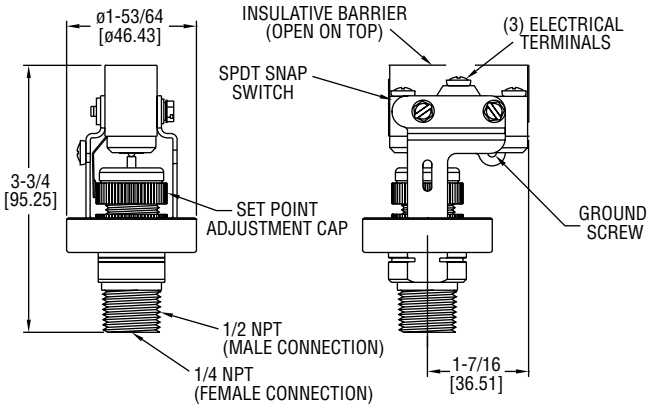
Specifications - Installation and Operating Instructions

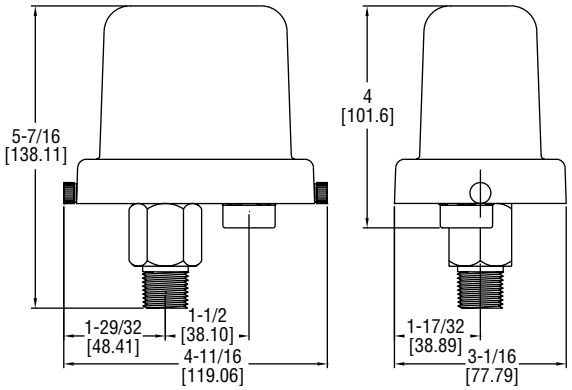


A1F



A1F with A-447





The **SERIES A1F** Compact OEM Pressure Switch is ideal for panel mounting wherever a high-quality, economical open-case or weatherproof control is required.

INSTALLATION

1. Location: Select a location where the temperature limits of -40 to 180°F (-40 to 82°C) will not be exceeded. Locate the switch as close as possible to the pressure source. Long lengths of piping will not affect accuracy of the actuation point but will slightly add to response time.

2. Mounting and Processing Connection: Avoid mounting surfaces with excess vibration which could cause false actuation when pressure is near setpoint. The switch should be mounted within 20° of vertical for proper operation. Mount the switch by connecting it to the process piping using either 1/4″ NPT female or 1/2″ male connection. Pipe joint compound or TFE thread tape should be used to prevent leakage.

3. Electrical Connections: The SPDT snap switch includes normally open, normally closed and common connections. The common and normally open contacts will close and the common and normally closed contacts will open when pressure increases to the setpoint. The actions will reverse when pressure decreases below the setpoint minus the deadband. A green grounding screw is provided on the switch bracket. All wiring should be in accordance with local codes.

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure Chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 500 psig (34 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional A-447 enclosure meets NEMA 4X standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed, See deadband chart.
Weight: 10.5 oz (297 g).

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SETPOINT ADJUSTMENT

1. Determine the setpoint pressure. The approximate actuation point can be set by turning the adjustment cap up or down, aligning the top of the O-ring, located above the cap, with the appropriate scale graduation.
2. Connect tubing or piping from the pressure port on bottom of switch to one leg of a tee. Connect the second leg to a pressure test gage of known accuracy and in an appropriate range. The third leg should be connected to a controllable source of pressure.
3. Connect a volt/ohm meter or other circuit tester to the snap action terminals to indicate when switching occurs.
4. Slowly apply pressure to the system and note the pressure at which switching occurs.
5. Operate the switch through several cycles to confirm proper actuation point.
6. Remove test apparatus and attach switch to pressure source and control circuit wiring. Place switch in service.

Example of how to order:

A1F - O - SS - 1 - 4
1 2 3 4 5

1. Diaphragm Designation:
   F - Fluorocarbon
2. Enclosure Designation:
   O - Open Construction No Enclosure
3. Housing Material Designation:
   SS - 316SS
4. Switch Designation:
   1 - SPDT Snap Action Switch
5. Operating Pressure Range Designation:
   1 - 2 to 15 psig
   2 - 4 to 75 psig
   3 - 8 to 225 psig
   4 - 16 to 450 psig

DEADBAND CHART-PSIG (BAR)		
Range	Deadband at Minimum Range	Deadband at Maximum Range
2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

MAINTENANCE

Upon final installation of the Series A1F Compact OEM Pressure Switch, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series A1F is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

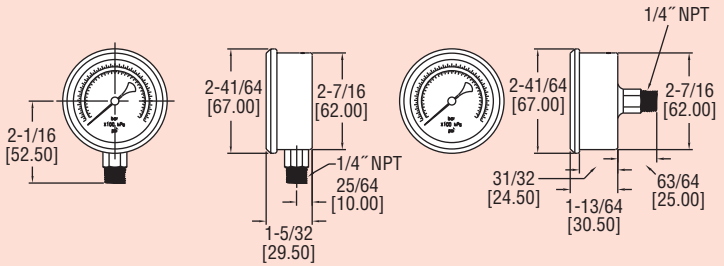
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

FIT-107

Georg Fischer Signet LLC
Signet 2551 Magmeter

+GF+

Test Certificate

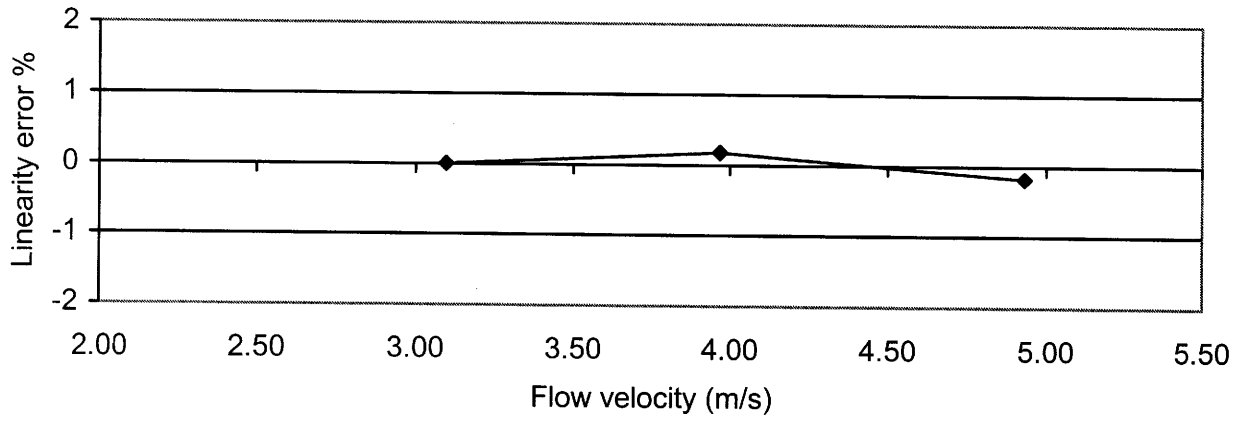
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61604250408
Calibration date: April 25, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.16 (3.10)	137245.74	0.00
13.02 (3.97)	176330.36	0.18
16.18 (4.93)	219349.65	-0.18



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

Georg Fischer Signet LLC certifies that the reference used in the calibration of this product is traceable to NIST (National Institute of Standards and Technology). Improper handling may adversely affect the accuracy.

Georg Fischer Signet LLC products are manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management.

Georg Fischer Signet LLC
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El Monte, CA 91731-2882
www.gfsignet.com

FIT-107

English

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

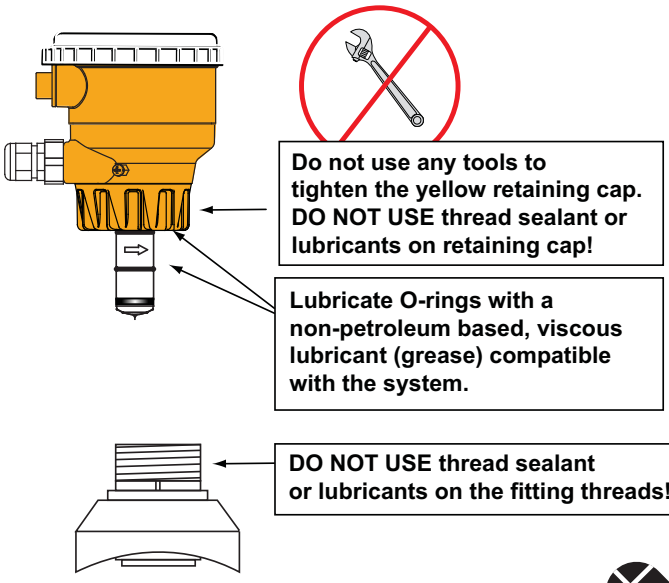
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

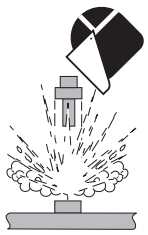
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

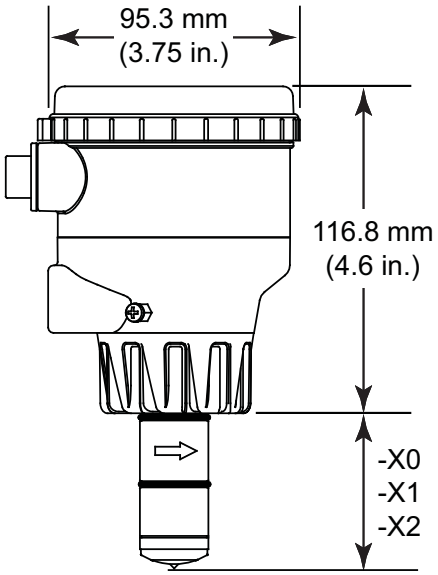


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary.....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance....300 Ω
Loop Accuracy.....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

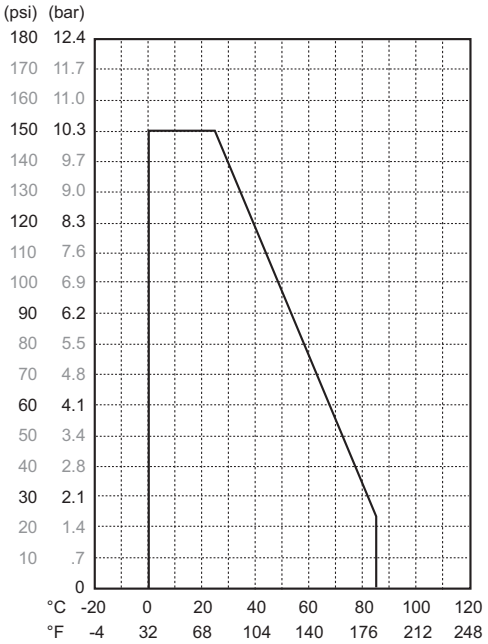
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



Standards and Approvals

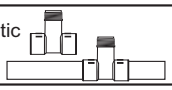
- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant
- China RoHS (visit gfsignet.com for details)
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

Pipe Fittings

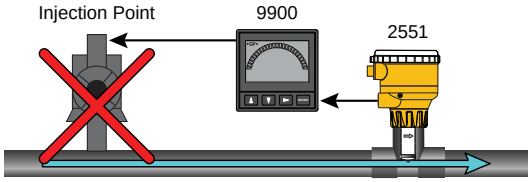
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

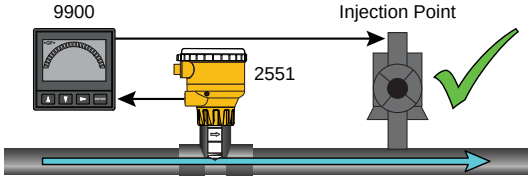
Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

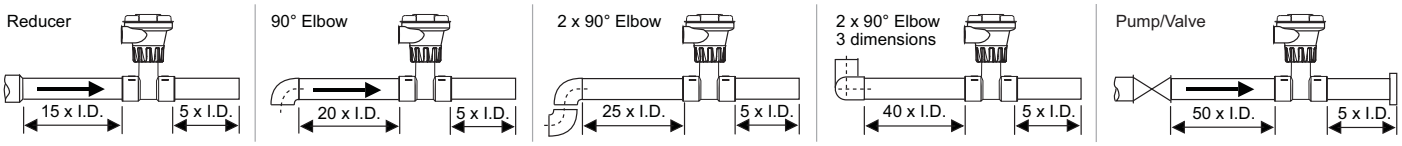
Selecting a Location

- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

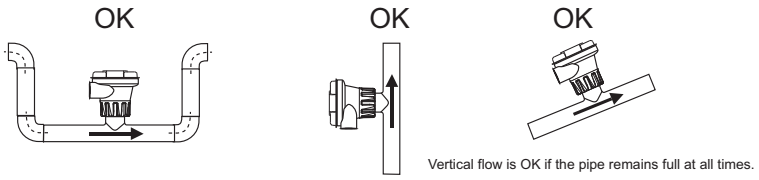




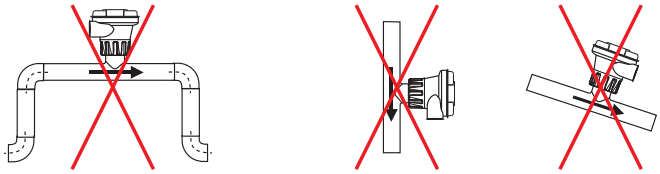
Select a location with sufficient distance of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.

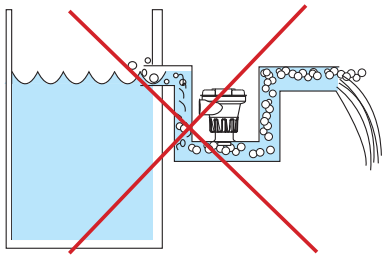


These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

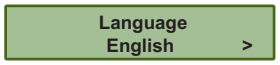
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



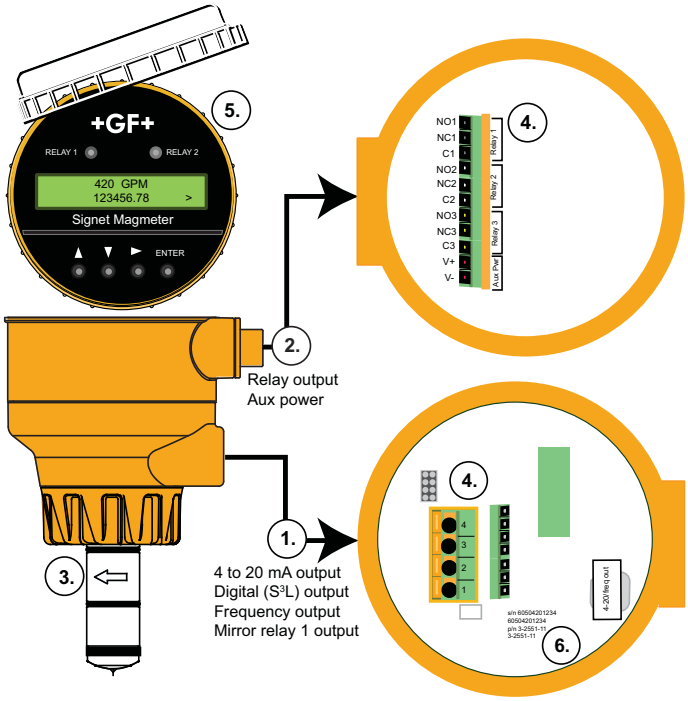
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

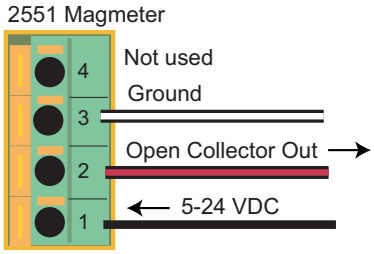


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

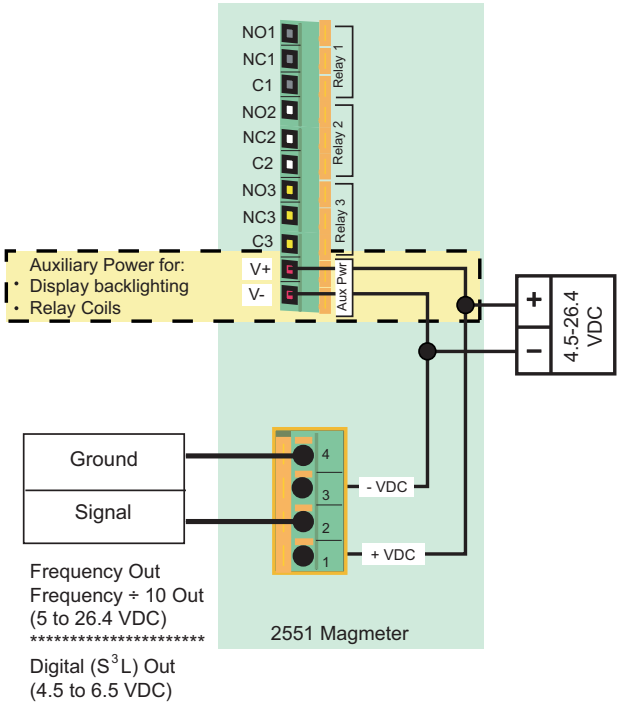
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

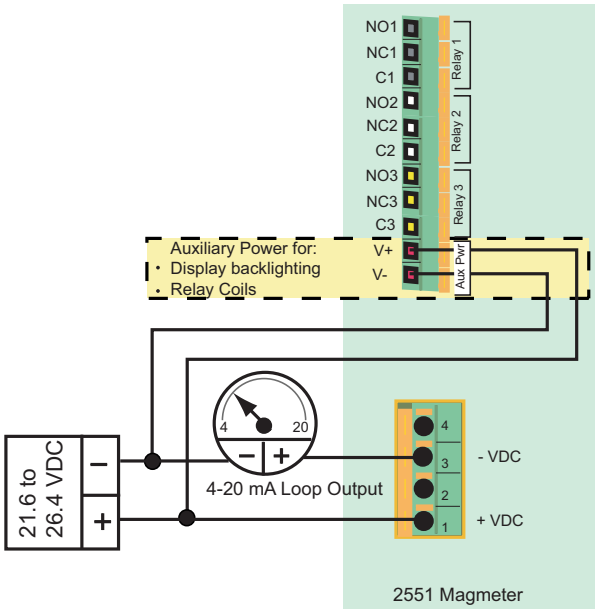
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

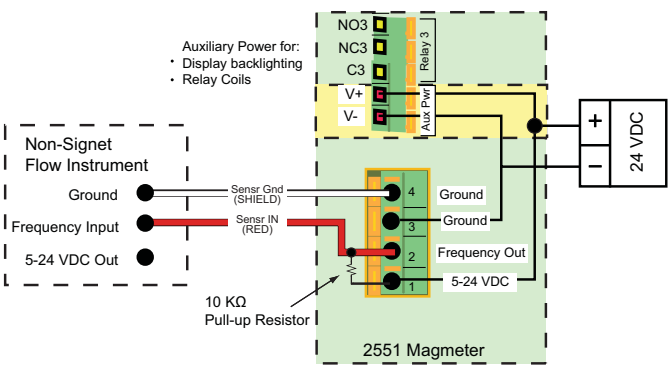
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

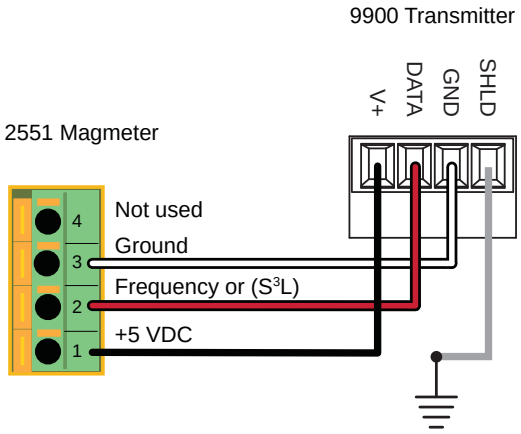


Wiring to Signet Flow Instruments

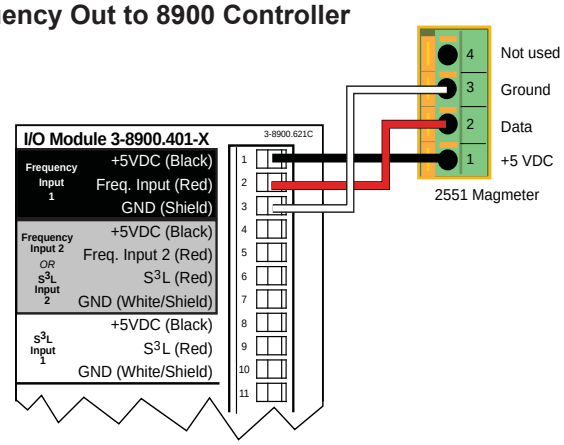
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S³L) output.

Frequency and Digital (S³L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

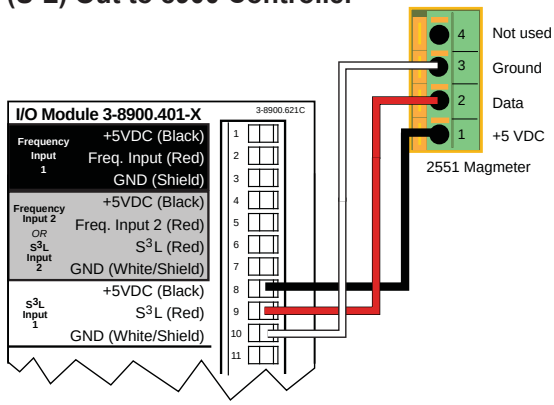
2551 Frequency or Digital (S³L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S³L) Out to 8900 Controller



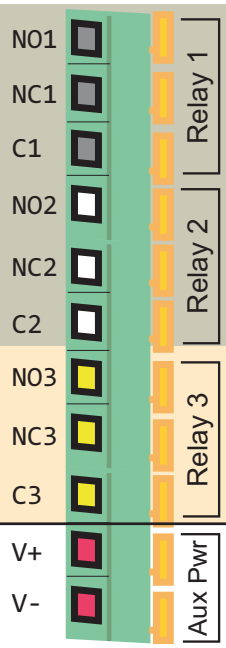
Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)



Mechanical Relays:
5A @ 250 VAC
5A @ 30 VDC

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Solid State Relay 3:
50 mA max @ 30 VDC
50 mA max @ 42 VAC

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.

Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

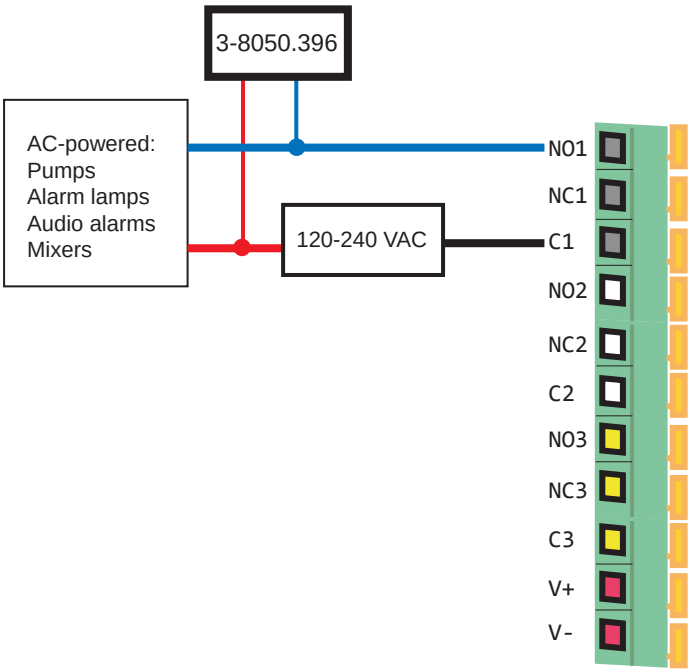
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.

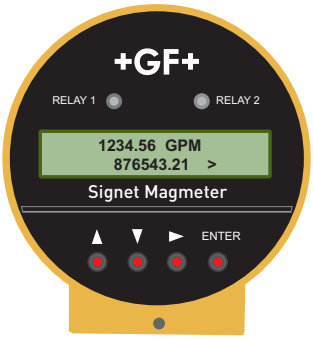


Navigating the Menus

Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

- All menu instructions in this manual assume that the instrument is showing this display.

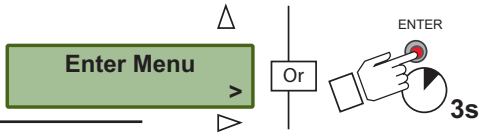


2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

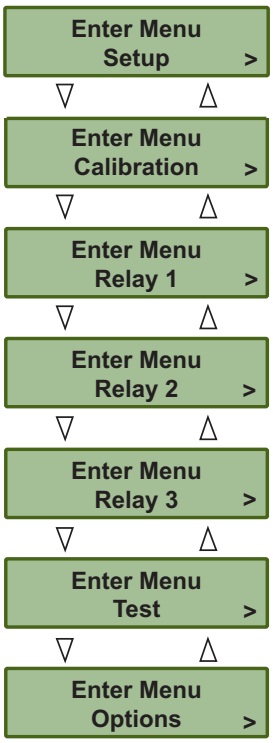
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.

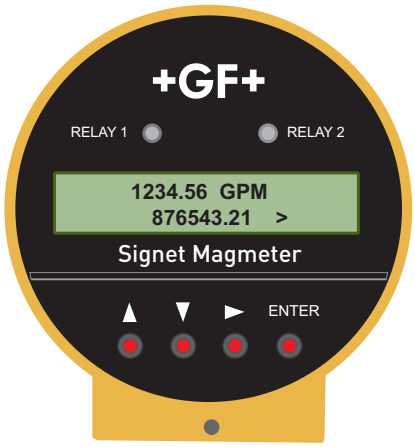


Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



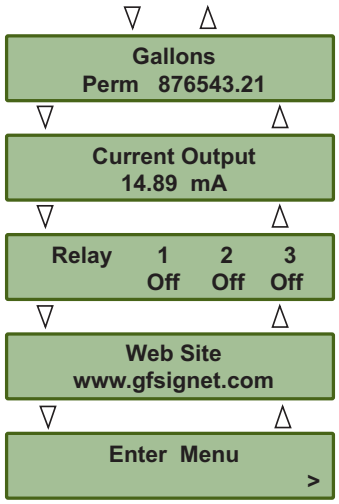
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

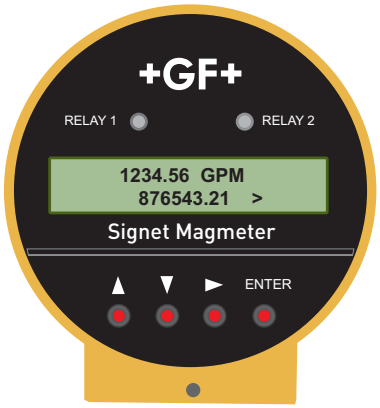
Relay States shown for units with a relay board.

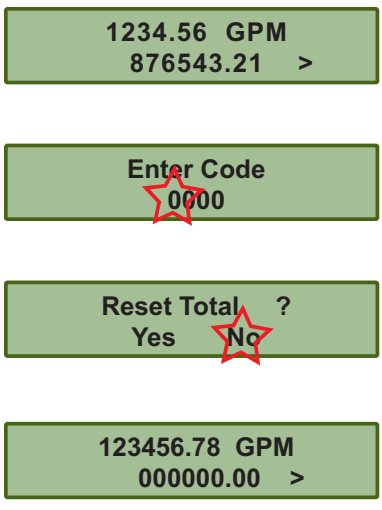
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..



Enter Code
0000

Use the keypad to navigate through each setting.

△ ▽ ▷ ENTER

The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.

K-Factor
060.000 >

Pipe Size: Select the pipe size that is nearest to the nominal pipe size.

Pipe Size
2" DN50 >

Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot)
- μ (micro)
- _ (blank)
- - (dash)
- / (slash)
- 3 (for cubic units)

The last character selects the timebase for the flow rate measurement. Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)

Flow Units
GPM >

Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

Set 4 mA
-100 GPM >

Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

Set 20 mA
100.00 GPM >

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.

Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)

Total Factor
1000.0 >

Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.

Totalizer Units
Gallons >

Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.

Low Flow Cutoff
0.5 GPM >

Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.

Averaging
25 secs >

Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.

Sensitivity
100% >

Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

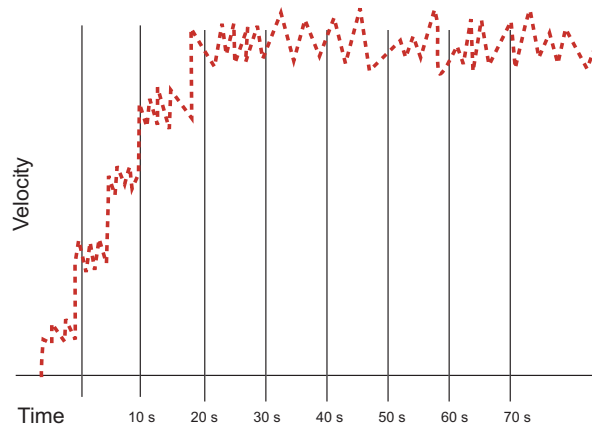
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

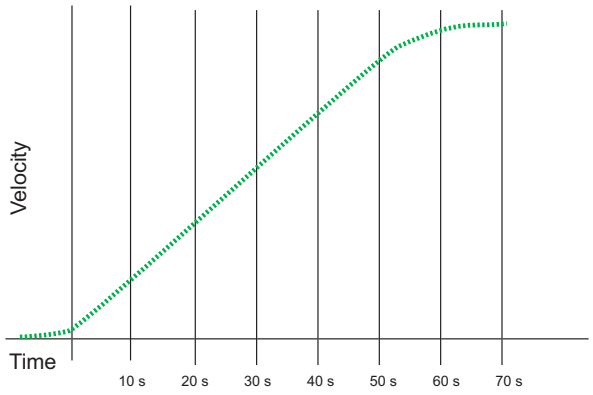
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



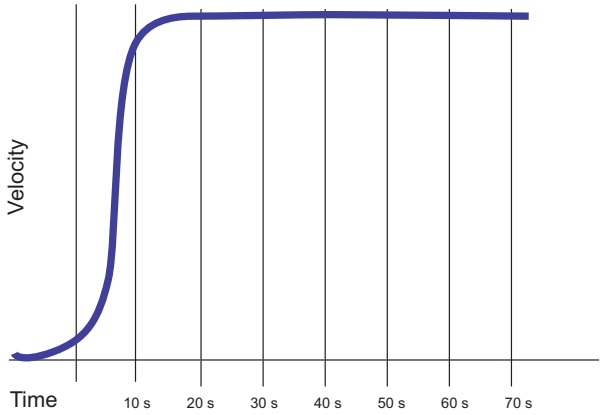
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



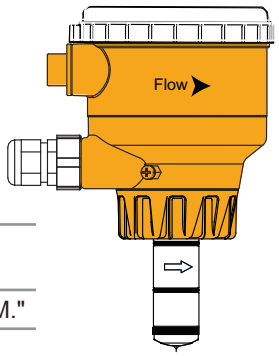
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

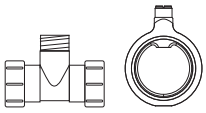
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

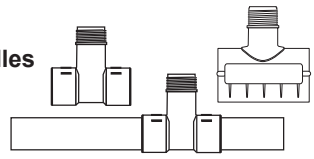
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

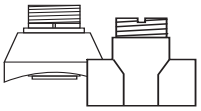
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

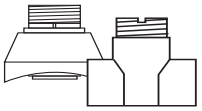
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



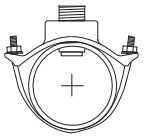
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

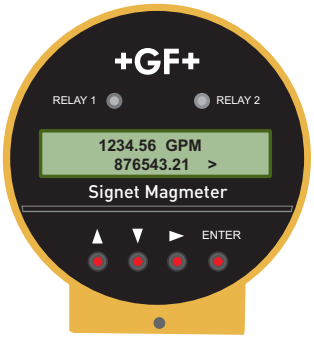
Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

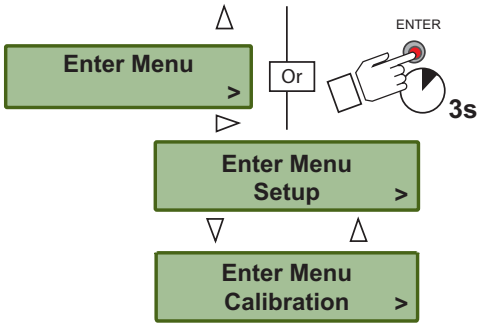
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

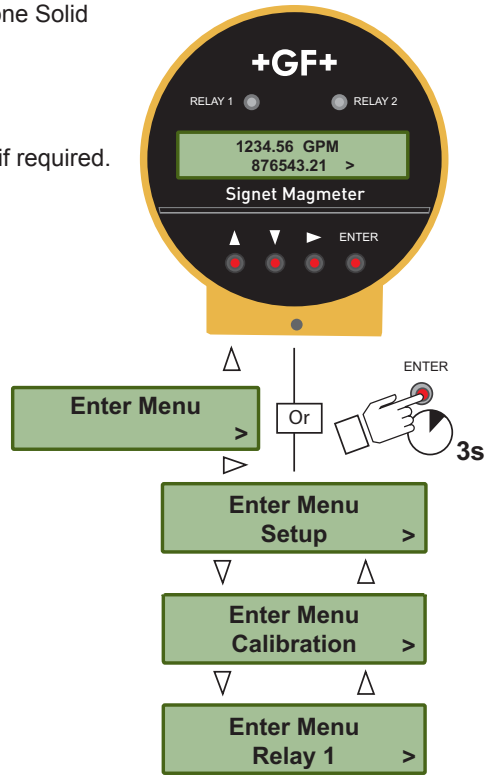
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

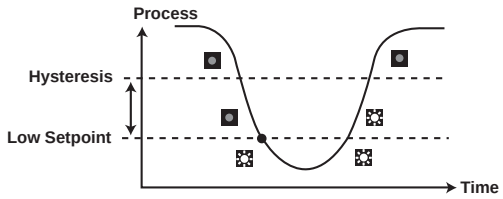
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

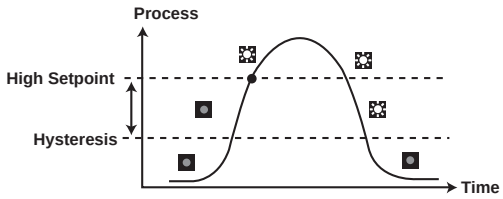
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

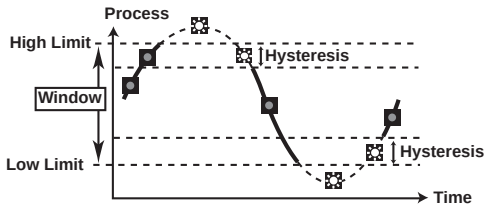
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

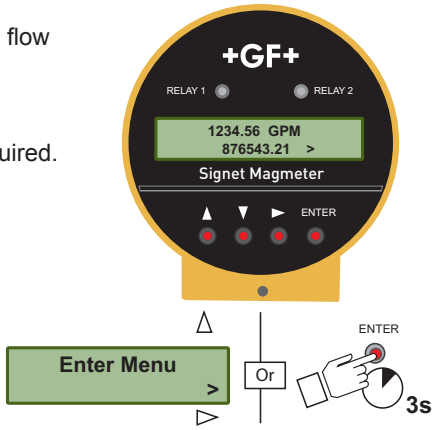


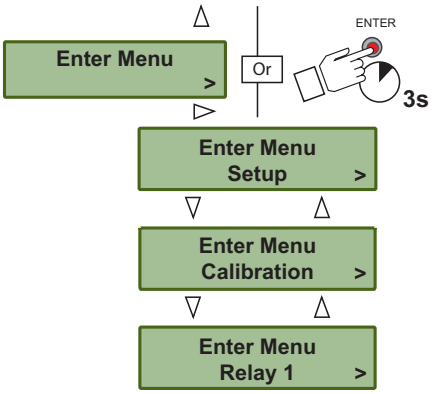
Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated





NOTE: The Security Code must be entered before modifying the relay menu.



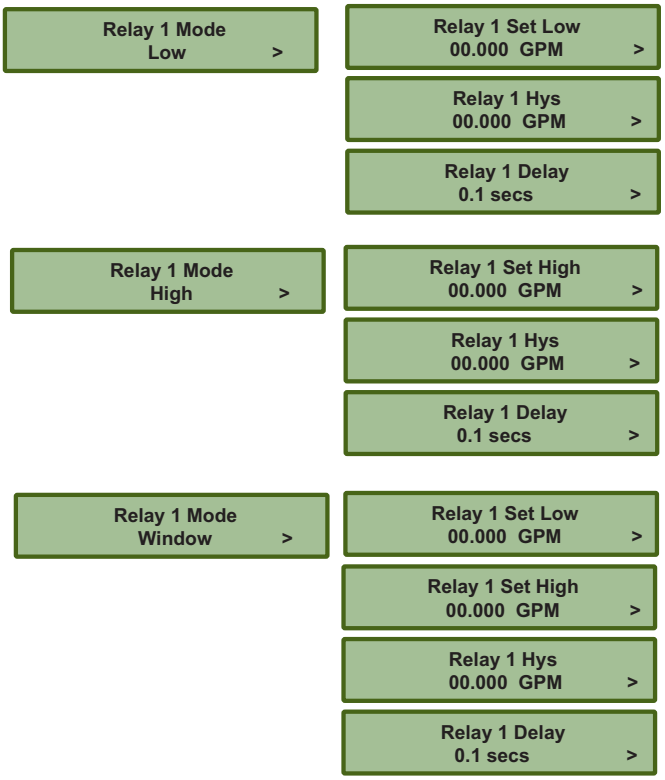
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

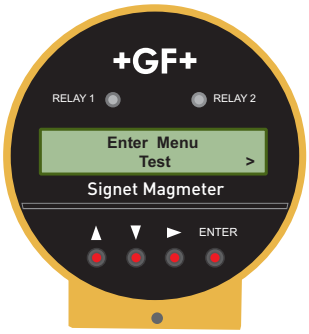
Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

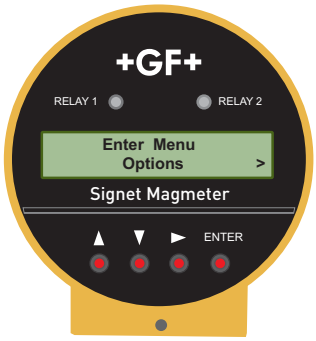
Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S³L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The **(S³L) Digital** output mode switches the 2551 to the Signet serial data output called (S³L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

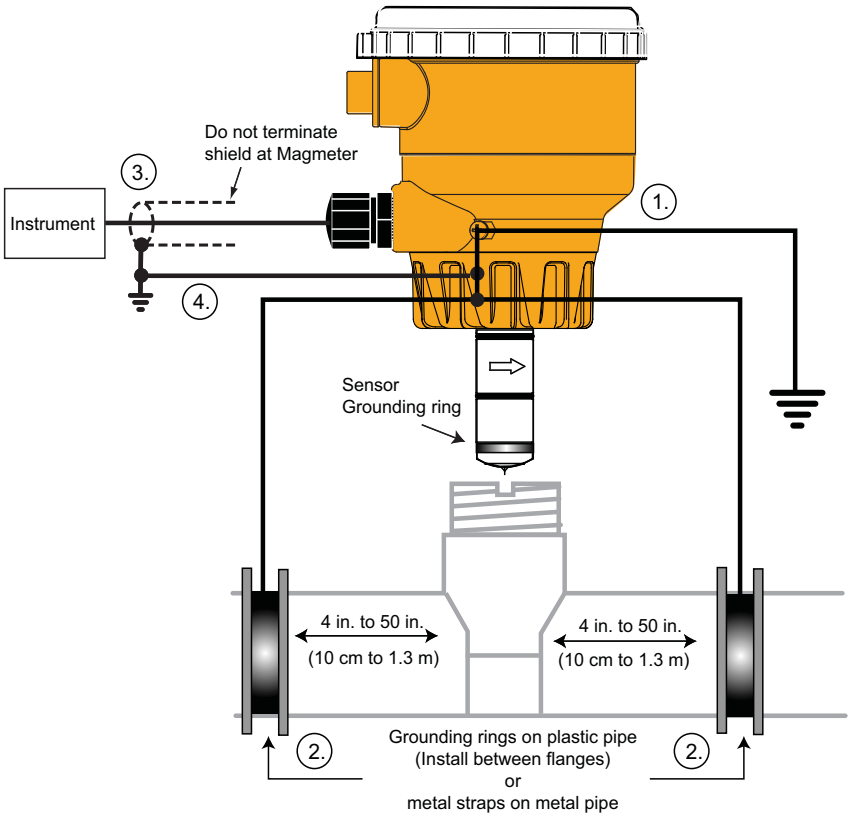
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

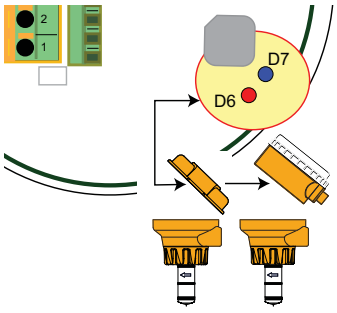
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

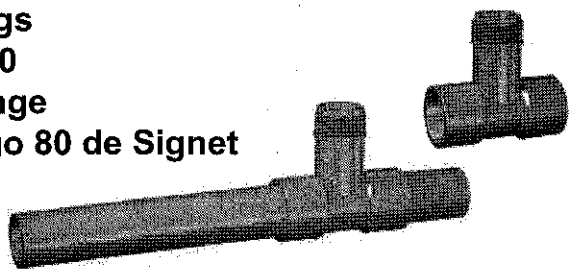
+GF+

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For the most up-to-date information, please refer to our website at www.gfsignet.com

3-2551.090-1 Rev. M 04/15 English

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Signet Schedule 80 PVC and CPVC Installation Fittings
Raccords d'installation Signet PVC et CPVC norme 80
Signet Schedule 80 PVC- und CPVC-Installationsfittinge
Accesorios de instalación de PVC y CPVC de catálogo 80 de Signet



MXPV8.090 Rev. D 04/15 (English, French, German, Spanish)

English



SAFETY INSTRUCTIONS

1. Confirm chemical compatibility before use.
2. Do not exceed maximum temperature or pressure specifications of fittings or sensors.
3. Do not use this product for any purpose other than for which it was designed.
4. Use schedule 80 pipe.
5. Use with liquids only.
6. Improper pipe fitting installation may result in pressure failure, personal injury, and/or property damage.
7. Always match fitting and piping materials.
8. Always use piping cement designed for your specific fitting and piping material.

Français



CONSIGNES DE SÉCURITÉ

1. Vérifier la compatibilité chimique avant l'utilisation.
2. Ne pas dépasser les spécifications maximales de température et de pression pour les raccords ou les capteurs.
3. Ne pas utiliser ce produit à d'autres fins que celle pour laquelle il a été conçu.
4. Utiliser un tuyau norme 80.
5. Utiliser uniquement avec des liquides.
6. Un raccord mal installé peut entraîner des chutes de pression et des dommages corporels ou matériels.
7. Utilisez toujours un raccord de même matériau que le tuyau sur lequel il doit être posé.
8. Utilisez toujours du mastic conçu spécialement pour le matériau de votre tuyau et de votre raccord.



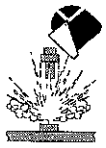
Deutsch



SICHERHEITSVORSCHRIFTEN

1. Vor dem Einsatz die Chemikalienverträglichkeit bestätigen.
2. Die angegebenen maximalen Temperatur- oder Druckwerte von Fittingen oder Sensoren nicht überschreiten.
3. Das Produkt ausschließlich für den beabsichtigten Zweck verwenden.
4. Schedule 80 Rohr verwenden.
5. Nur mit Flüssigkeiten verwenden.
6. Unsachgemäße Installation des Fittings kann zu Druck-, Personen- oder Sachschäden führen.
7. Fitting-und Rohrleitungsmaterial muß stets aufeinander abgestimmt sein.
8. Stets einen für das spezielle Material von Fitting und Rohrleitungen geeigneten Klebstoff verwenden.

Español



INSTRUCCIONES DE SEGURIDAD

1. Confirme la compatibilidad química antes de utilizar este producto.
2. No exceda las especificaciones de temperatura o presión máximas de los accesorios o sensores.
3. No use este producto para ningún fin que no sea para el que se ha diseñado.
4. Use tuberías de catálogo 80.
5. Use con liquidos solemente.
6. La instalación indebida del conector de tubería puede producir fallas de presión, lesión personal y/o daños a la propiedad.
7. Siempre haga coincidir los materiales del conector y de la tubería.
8. Siempre use el cemento de tubería diseñado para su conector y material de tubería especifi cos.

Compatibility

These schedule 80 fittings are designed to be used with the Signet flow and pH sensors listed below.

Compatibilité

Ces raccords norme 80 sont conçus pour être utilisés avec les capteurs de pH et d'écoulement Signet répertoriés ci-dessous.

Kompatibilität

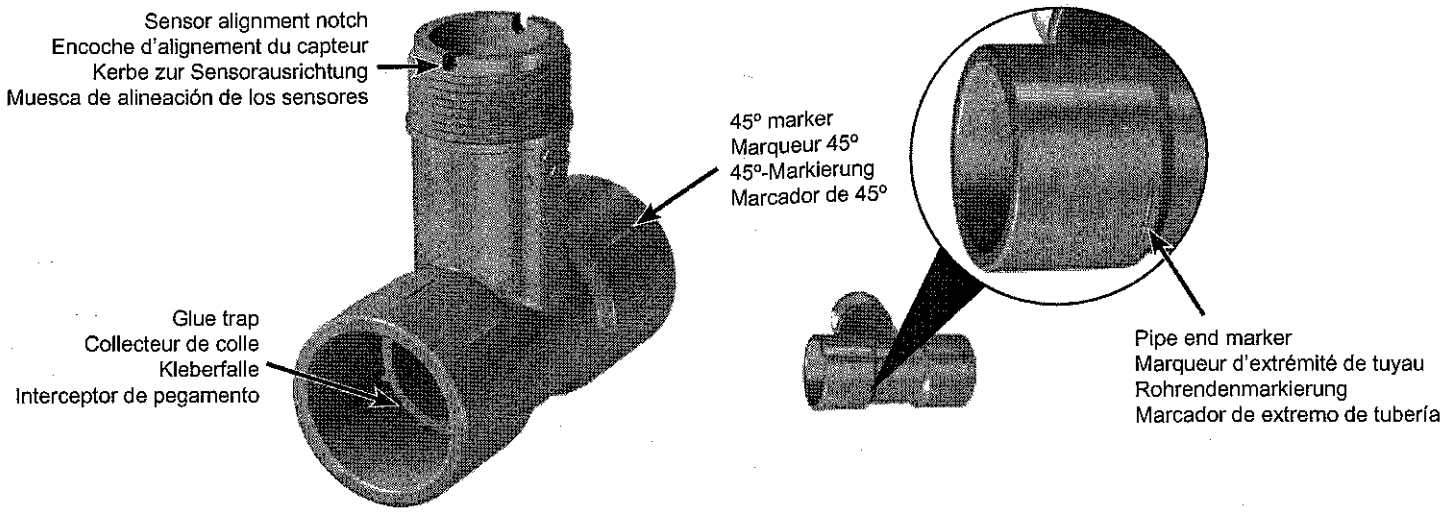
Diese Schedule 80 Fittinge sind zur Verwendung mit den nachstehend aufgeführten Durchfluss- und pH-Sensoren von Signet konzipiert.

Compatibilidad

Estos accesorios de catálogo 80 están diseñados para ser usados con los sensores de caudal y pH de Signet indicados abajo.

Flow Sensors Capteurs d'écoulement Durchflusssensoren Sensores de caudal	pH/ORP Electrodes Électrodes indicatrices de pH/ORP pH/ORP-Elektroden Electrodos de pH/ORP (pH/potencial redox)
P51530-X0	
3-8510-X0	3-2724, 3-2725, 3-2726, 3-2734, 3-2735, 3-2736
3-8512-X0	
3-2536-X0	
3-2537-XC-X0	
3-2551-X0-XX	

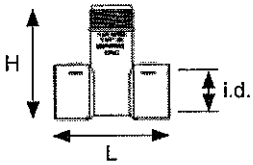
Identification | Identification | Identifizierung | Identificación



Fitting only | Raccord uniquement | Nur Fitting | Accesorio solamente



Material
Matériau
Material
Material

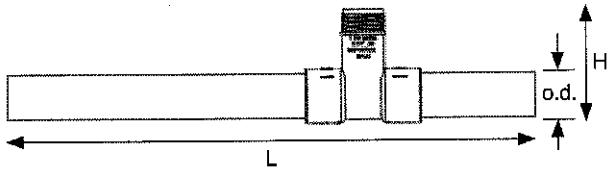


SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	i.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005F	159 001 614	MCPV8T005F	159 001 632	1/2"	3.75	3.50	0.85
MPV8T007F	159 001 615	MCPV8T007F	159 001 633	3/4"	3.75	3.70	1.06
MPV8T010F	159 001 616	MCPV8T010F	159 001 634	1"	4.30	4.00	1.33
MPV8T012F	159 001 617	MCPV8T012F	159 001 635	1-1/4"	4.40	4.30	1.67
MPV8T015F	159 001 618	MCPV8T015F	159 001 636	1-1/2"	5.00	4.60	1.91
MPV8T020F	159 001 619	MCPV8T020F	159 001 637	2"	5.50	5.00	2.40

Fitting with pipe | Raccord avec tuyau | Fitting mit Rohr | Accesorio con tubería



Material
Matériau
Material
Material



SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	o.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005	159 001 623	MCPV8T005	159 001 641	1/2"	14	3.50	0.84
MPV8T007	159 001 624	MCPV8T007	159 001 642	3/4"	14	3.70	1.05
MPV8T010	159 001 625	MCPV8T010	159 001 643	1"	17	4.00	1.32
MPV8T012	159 001 626	MCPV8T012	159 001 644	1-1/4"	20	4.30	1.66
MPV8T015	159 001 627	MCPV8T015	159 001 645	1-1/2"	24	4.60	1.90
MPV8T020	159 001 628	MCPV8T020	159 001 646	2"	26.5	5.02	2.38

K-Factors

A **K-Factor** is the number of pulses (**P**) a sensor will generate for each engineering unit of fluid that passes the sensor. K-factors for water are listed below in U.S. gallons and liters. For example, in a 1 inch SCH 80 PVC pipe, the 515 paddlewheel generates 172.07 pulses per gallon of water passing the rotor.

K-Factors are for schedule 80 pipe.

Facteurs K

Un **Facteur K** est le nombre d'impulsions (**P**) qu'un capteur produit pour chaque unité d'ingénierie de fluide qui y passe. Les facteurs K pour l'eau sont indiqués ci-dessous en gallons U.S. et en litres. Par exemple, dans un tuyau en PVC de 25,4 mm (1 pouce), la roue à palettes 515 produit 172.07 impulsions par gallon (3,78 litres) d'eau qui passe dans le rotor.

Les facteurs K sont pour les tuyaux de norme 80.

K-Faktoren

Der **K-Faktor** repräsentiert die Anzahl der Impulse (**P**), die vom Sensor für jede physikalische Einheit durchfließender Flüssigkeit erzeugt wird. K-Faktoren für Wasser sind nachstehend in US-Gallonen und Liter aufgeführt. Beispielsweise erzeugt das 515 Schaufelrad in einem 1-Zoll-PVC-Rohr 172.07 Impulse pro Gallone Wasser, das durch den Rotor fließt.

K-Faktoren sind für Schedule 80 Rohre.

Factores K

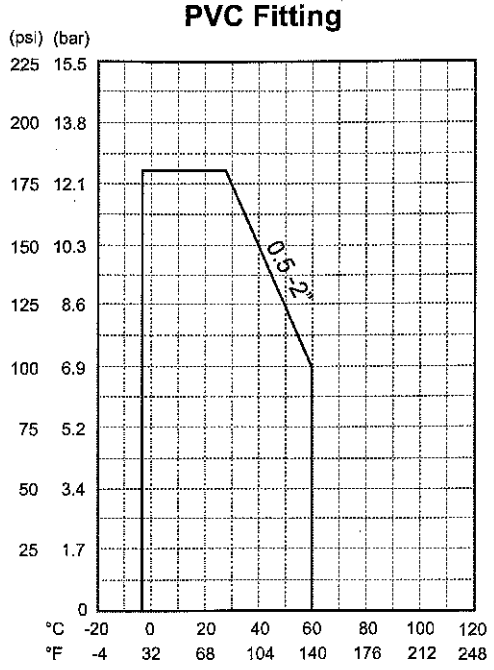
El **Factor K** es el número de impulsos (**P**) que genera un sensor por cada unidad de líquido que pasa por el sensor. En las tablas de abajo se muestran los factores K para agua (en unidades de galones norteamericanos [EE. UU.] y litros). Por ejemplo, en una tubería de PVC de 1 pulg., la 515 rueda de paletas genera 172.07 impulsos por galón de agua que pasa por el rotor.

Los factores K son para tuberías del catálogo 80.

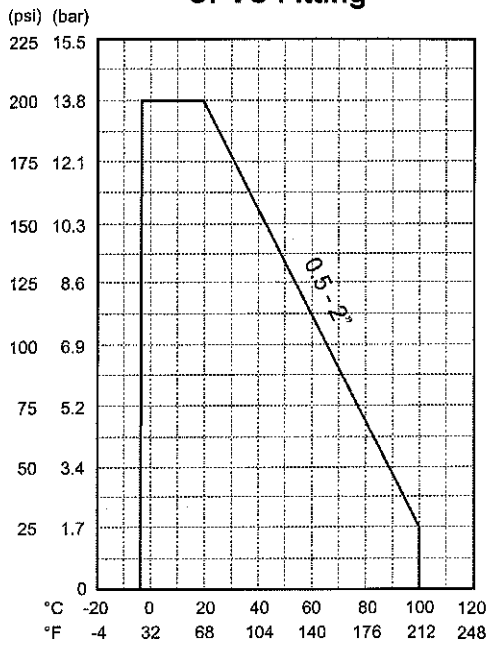
PIPE SIZE TAILLE DE TUYAU ROHRGRÖSSE TAMAÑO DE LA TUBERÍA	SCH. 80 FITTING RACCORD DE NORME 80 SCHEDULE 80 FITTING ACCESORIO DE CATÁLOGO 80	515/8510		2536/2537/8512		2551	
		P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL
1/2"	MPV8T005F MCPV8T005F MPV8T005 MCPV8T005	137.42	520.12	271.37	1027.1	601.58	2277.0
3/4"	MPV8T007F MCPV8T007F MPV8T007 MCPV8T007	78.61	297.52	154.08	583.19	371.90	1407.6
1"	MPV8T010F MCPV8T010F MPV8T010 MCPV8T010	45.46	172.07	88.65	335.53	227.52	861.17
1-1/4"	MPV8T012F MCPV8T012F MPV8T012 MCPV8T012	24.19	91.54	47.24	178.79	122.83	464.91
1-1/2"	MPV8T015F MCPV8T015F MPV8T015 MCPV8T015	16.44	62.22	32.08	121.42	87.56	331.43
2"	MPV8T020F MCPV8T020F MPV8T020 MCPV8T020	9.60	36.32	18.87	71.44	50.96	192.89

Specifications | Spécifications | Spezifikationen | Especificaciones

PVC Fitting



CPVC Fitting





The pressure ratings are for the fitting only.
NEVER EXCEED the pressure rating of the installed sensor.

Follow plastic piping cement manufacturer's recommended preparation and gluing instructions. Avoid excess cement in fitting joints to prevent any port obstruction.

Rigid PVC and CPVC Material Compounds Specification:
ASTM D 1784

Dimensional and Compound Plastic Pipe Fittings Specifications:
ASTM D 2467
ASTM F 439

Standard Test Methods Specification:
ASTM F 1970

Approvals:
NSF (fitting only)

Les niveaux de pression ne concernent que le raccord.
NE JAMAIS DÉPASSER le niveau de pression du capteur installé.

Suivez les instructions de préparation et d'application du mastic données par le fournisseur de celui-ci. Evitez d'appliquer le mastic en trop grande quantité pour ne risquer aucune obstruction.

Matériau PVC et CPVC rigide Spécifications des composés :
ASTM D 1784

Dimensions et composé Raccords pour tuyau en plastique Spécifications :
ASTM D 2467
ASTM F 439

Méthodes standard de test Spécifications :
ASTM F 1970

Homologations :
NSF (Raccord uniquement)

Die Drucknennwerte beziehen sich nur auf die Fittinge.
Den Drucknennwert des installierten Sensors NIEMALS ÜBERSCHREITEN.

Anweisungen des Klebstoff-Herstellers befolgen. Nicht zuviel Klebstoff an den Verbindungsstellen auftragen, um Verstopfungen der Öffnungen zu vermeiden.

Verbundstoffspezifikation für unbiegsames PVC- und CPVC-Material:
ASTM D 1784

Abmessungs- und Verbundstoffspezifikationen für Rohrfittinge aus Kunststoff:
ASTM D 2467
ASTM F 439

Spezifikation für Standardtestmethoden:
ASTM F 1970

Zulassungen:
NSF (Nur Fitting)

Las presiones nominales son para el accesorio solamente.
NO EXCEDA NUNCA la presión nominal del sensor instalado.

Siga las instrucciones recomendadas por el fabricante para la preparación y el engomado del cemento para tuberías plásticas. Evite el exceso de cemento en las juntas de los conectores para prevenir obstrucciones en los orificios.

PVC y CPVC rígidos Especificación de los compuestos:
ASTM D 1784

Dimensiones y composición Accesorios de tuberías de plástico Especificaciones:
ASTM D 2467
ASTM F 439

Métodos de prueba estándar Especificación:
ASTM F 1970

Certificados de aprobación:
NSF (Accesorio solamente)

+GF+

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For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

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EchoSpan® LU80/81/83/84 Ultrasonic Level Transmitter

Application



The general purpose ultrasonic level transmitter provides continuous level measurement up to 32.8' (10m) with a 4-20 mA signal output, and is configured via its integral push button display module. This non-contact liquid level sensor is ideally suited for corrosive, ultrapure, sticky or dirty liquids, and is broadly selected for bulk storage, day tank, lift station and process tank level applications.

Features

- Offered in 4 measurement ranges from 9.8' (3m) to 32.8' (10m)
- Configuration is simple via integral push button display module
- LCD display indicates level in inches, centimeters and percentages
- Narrow 2" or 3" beam width for applications with limited measurement space
- Fail-safe intelligence and diagnostic feedback for simple troubleshooting
- PVDF transducer and NEMA 4X polycarbonate enclosure for corrosive liquids
- Automatic temperature compensation for accurate measurement

Success



North American thermoelectric power plants use 225M gallons of water per day in their steam turbines and cooling towers. Most US plants are located in the Coastal and upper Mid West states with easy access to abundant ocean or lake resources. These facilities have lots of sumps that collect and pump transfer water into treatment for reuse or release to the environment. But sumps capture much more than water including grease, oil, chemical and trash, that coats everything in the pit. Here, an EchoSpan ultrasonic level transmitter is installed over the sump man-way. The patented digital signal processing technology features an industry leading 3" beam width that enables installation in close proximity to the ladder and side wall.

Compatible Products

DataLoop™
Level Indicator



LI25

DataView™
Level Controller



LI55

Commander™
Multi-Tank Level Controller



LI90

DataPoint™
Level Controller



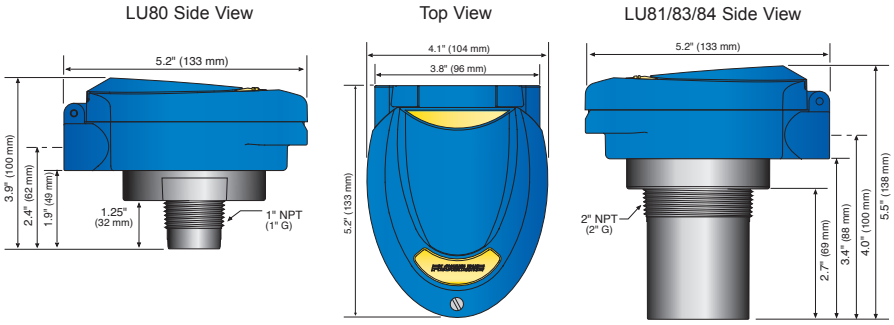
LC52

EchoSpan® LU80/81/83/84 Ultrasonic Level Transmitter

Specifications

Range:	LU80: 4” to 9.8’ (10cm to 3m) LU81: 8” to 18.0’ (20cm to 5.5m) LU83: 8” to 26.2’ (20cm to 8m) LU84: 12” to 32.8’ (30cm to 10m)
Accuracy:	± 0.2% of range
Resolution:	LU80: 0.019” (0.5mm) LU81/83: 0.039” (1mm) LU84: 0.078” (2mm)
Dead band:	LU80: 4” (10cm) LU81/83: 8” (20cm) LU84: 12” (30cm)
Beam width:	LU80: 2” (5cm) LU81/83/84: 3” (7.6cm)
Configuration:	Push button
Memory:	Non-volatile
Display type:	LCD, 6-digit
Display units:	Inch, cm and percent
Supply voltage:	12-28 VDC
Loop resist.:	500 Ohms @ 24 VDC
Signal output:	4-20 mA, two-wire
Signal invert:	4-20 mA, 20-4 mA
Signal fail-safe:	4mA, 20mA, 21mA, 22mA or hold last
Process temp.:	F: -7° to 140° C: -20° to 60°
Temp. comp.:	Automatic
Ambient temp.:	F: -40° to 160° C: -40° to 71°
Pressure:	MWP = 30 psi (2 bar)
Enclosure rating:	NEMA 4X (IP65)
Encl. material:	Polycarbonate
Encl. hardware:	Brass & stainless
Enclosure vent:	Water tight membrane
Conduit entrance:	Dual, 1/2” NPT
Trans. material:	PVDF
Process mount:	LU80: 1” NPT (1” G) LU81/83/84: 2” NPT (2” G)
Mount gasket:	Viton®
Classification:	General purpose
Compliance:	CE, RoHS

Dimensions



Fittings

For optimum performance, install the level sensor using the below recommended or direct equivalent fittings.



P/N	Description
LM52-1400	2” NPT x 1” NPT (Sch. 40)
LM52-2400	3” NPT x 2” NPT (Sch. 40)
LM52-2800	3” NPT x 2” NPT (Sch. 80)
LM52-3800	4” NPT x 2” NPT (Sch. 80)



LM52-1410	2” Socket x 1” NPT (Sch. 40)
LM52-2410	3” Socket x 2” NPT (Sch. 40)
LM52-3410	4” Socket x 2” NPT (Sch. 40)
LM52-2810	3” Socket x 2” NPT (Sch. 80)
LM52-3810	4” Socket x 2” NPT (Sch. 80)



LM52-2890	2” NPT Bulkhead Fitting, PVC



LM50-1001-1	1” NPT Bracket, Polypropylene
LM50-1001	2” NPT Bracket, Polypropylene

Ordering

LU8[ ]-51[ ]1

Sensor range

0	*3m (9.8’)*
1	*5.5m (18.0')*
3	*8m (26.2')*
4	*10m (32.8')*

Process mount (1)

0	*NPT (US)*
6	*G (Metric)*

Notes

1) Install the level sensor using Flowline installation fittings or equivalents.

EchoSpan

LU80-5101, LU8-5161,LU81-5101, LU81-5161, LU83-5101, LU83-5161, LU84-5101 & LU84-5161 Series

Revision A.1



Flowline Inc.
10500 Humbolt Street
Los Alamitos, CA 90720
Tel: (562) 598-3015
Fax: (562) 431-8507
www.flowline.com

Preface
This manual explains how to use the EchoSpan, LU81, LU83 and LU84 series transmitter.

Warranty, Service & Repair
To register your product with the manufacturer, go to the Flowline website for on-line registration. The website address is as follows:

www.flowline.com

On-line Warranty Registration can be found on the Flowline home page.

If for some reason your product must be returned for factory service, go to the Flowline website to receive a Material Return Authorization number (MRA), providing the following information:

1. Full Part Number, Full Serial Number
2. Name and telephone number of someone who can answer technical questions related to the product and its application.
3. Return Shipping Address
4. Brief Description of the Symptom
5. Brief Description of the Application

On-line Material Return Authorization can be found under Support in the Navigation Bar along the side of the home page. Click on *Return Authorization* to begin the MRA request. Once you have received a MRA number, ship the product prepaid in its original packing to:

Flowline Factory Service
MRA_____
10500 Humbolt Street
Los Alamitos, CA 90720

To avoid delays in processing your repair, write the MRA on the shipping label. Please include the information about the malfunction with your product. This information enables our service technicians to process your repair order as quickly as possible.

Warranty

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service in accordance with instructions furnished by Flowline for a period, which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products. Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products or components, which Flowline's examination determines to its satisfaction to be defective in material or workmanship within the warranty period. Flowline must be notified pursuant to the instructions below of any claim under this warranty within thirty (30) days of any claimed lack of conformity of the product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original warranty period.

Returns

Products cannot be returned to Flowline without Flowline's prior authorization. To return a product that is thought to be defective, go to www.flowline.com, and submit a customer return (MRA) request form and follow the instructions therein. All warranty and non-warranty product returns to Flowline must be shipped prepaid and insured. Flowline will not be responsible for any products lost or damaged in shipment.

Limitations

This warranty does not apply to products which: 1) are beyond the warranty period or are products for which the original purchaser does not follow the warranty procedures outlined above; 2) have been subjected to electrical, mechanical or chemical damage due to improper, accidental or negligent use; 3) have been modified or altered; 4) anyone other than service personnel authorized by Flowline have attempted to repair; 5) have been involved in accidents or natural disasters; or 6) are damaged during return shipment to Flowline. Flowline reserves the right to unilaterally waive this warranty and dispose of any product returned to Flowline where: 1) there is evidence of a potentially hazardous material present with the product; or 2) the product has remained unclaimed at Flowline for more than 30 days after Flowline has dutifully requested disposition. This warranty contains the sole express warranty made by Flowline in connection with its products. ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED. The remedies of repair or replacement as stated above are the exclusive remedies for the breach of this warranty. IN NO EVENT SHALL FLOWLINE BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND INCLUDING PERSONAL OR REAL PROPERTY OR FOR INJURY TO ANY PERSON. THIS WARRANTY CONSTITUTES THE FINAL, COMPLETE AND EXCLUSIVE STATEMENT OF WARRANTY TERMS AND NO PERSON IS AUTHORIZED TO MAKE ANY OTHER WARRANTIES OR REPRESENTATIONS ON BEHALF OF FLOWLINE. This warranty will be interpreted pursuant to the laws of the State of California. If any portion of this warranty is held to be invalid or unenforceable for any reason, such finding will not invalidate any other provision of this warranty.

Introduction:

The EchoSpan is a general-purpose ultrasonic level transmitter that provides a loop powered 4-20 mA output. The 4-20 mA output can be used to provide the proportional level of liquid in any tank or vessel. The signal can be connected to any device that accepts a loop powered 4-20 mA signal, such as a PLC, SCADA, DCS, display, controller, etc.

New Features

- Simple configuration with push button configuration
- Adjustable Loop Fail-Safe, Hold Last, Empty, Full, 21 mA, 22 mA
- Easy to reverse mA output, 4-20 mA to 20-4 mA
- Increased output filtering

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About this Manual:

PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on the EchoSpan series Ultrasonic Level Switch from FLOWLINE. Please refer to the part number located on the switch label to verify the exact model configuration, which you have purchased.

User's Responsibility for Safety:

FLOWLINE manufactures a broad range of level sensing technologies. While each of these sensors is designed to operate in a wide variety of applications, it is the user's responsibility to select a sensor model that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

Proper Installation and Handling:

Only professional staff should install and/or repair this product. Install the switch with the included Viton gasket and never over tighten the switch within the fitting. Always check for leaks prior to system start-up.

Wiring and Electrical:

A supply voltage of 12 to 28 VDC is used to power the EchoSpan. Electrical wiring of the transmitter should be performed in accordance with all applicable national, state, and local codes.

Material Compatibility:

The enclosure is made of Polycarbonate (PC). The transducer is made of Polyvinylidene Fluoride (PVDF). Make sure that the model, which you have selected, is chemically compatible with the application media.

Enclosure:

While the switch housing is liquid-resistant the EchoSpan is not designed to be operational when immersed. It should be mounted in such a way that the enclosure and transducer do not come into contact with the application media under normal operational conditions.

The enclosure has a flip cover with dual 1/2" NPT female conduit ports and an internal terminal strip for wiring. To open the enclosure, you will need a small insertion tool such as a screwdriver. Loosen the locking screw located at the top front of the enclosure. Rotate the hinged cover up for 135° access to the faceplate and terminal strips. Before closing the enclosure, make sure that the enclosure gasket is properly seated, and that any conduit fittings, cable connectors or plugs are installed correctly and sealed.

Handling Static-Sensitive Circuits/Devices:

When handling the transmitter, the technician should follow these guidelines to reduce any possible electrostatic charge build-up on the technician's body and the electronic part.

1. Always touch a known good ground source before handling the part. This should be repeated while handling the part and more frequently after sitting down from a standing position, sliding across the seat or walking a distance.
2. Avoid touching electrical terminals of the part unless making connections.
3. DO NOT open the unit cover until it is time to calibrate.

Make a Fail-Safe System:
Design a fail-safe system that accommodates the possibility of switch and/or power failure.
FLOWLINE recommends the use of redundant backup systems and alarms in addition to the primary system.

Flammable, Explosive or Hazardous Applications:

EchoSpan should not be used within classified hazardous environments.

Warning:

Always use the Viton gasket when installing the EchoSpan, and make sure that all electrical wiring of the switch is in accordance with applicable codes.

Components:

EchoSpan is offered in three different models. Depending on the model purchased, you may or may not have been shipped all the components shown below. You do however, need an EchoSpan and Viton® gasket to configure, install and operate EchoSpan.

- EchoSpan
  - LU80-5101 – 9.8’ (3 m) range, Type 4X encl., 1” NPT
  - LU80-5161 – 9.8’ (3 m) range, Type 4X encl., 1” G
  - LU81-5101 – 18.0’ (5.5 m) range, Type 4X encl., 2” NPT
  - LU81-5161 – 18.0’ (5.5 m) range, Type 4X encl., 2” G
  - LU83-5101 – 26.2’ (8 m) range, Type 4X encl., 2” NPT
  - LU83-5161 – 26.2’ (8 m) range, Type 4X encl., 2” G
  - LU84-5101 – 32.8’ (10 m) range, Type 4X encl., 2” NPT
  - LU84-5161 – 32.8’ (10 m) range, Type 4X encl., 2” G
- Viton Gasket
  - Part #220128 – for LU80 series only
  - Part #220129 – for LU81, LU83 and LU84 series
- Quick Start Guide

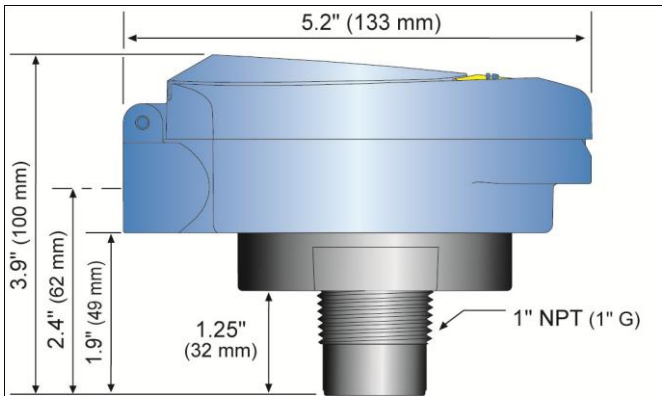
Specifications:

Range:	LU80: 4" to 9.8' (10 cm to 3m) LU81: 8" to 18.0' (20 cm to 5.5m) LU83: 8" to 26.4' (20 cm to 8m) LU84: 12" to 32.8' (30 cm to 10m)
Accuracy:	± 0.2% of range
Resolution:	LU80: 0.019" (0.5mm) LU81/83: 0.039" (1mm) LU84: 0.078" (2 mm)
Dead band:	LU80: 4" (10cm) LU81\83: 8" (20 cm) LU84: 12" (30 cm)
Beam width:	LU80: 2" (5cm) LU81/83/84" 3" (7.6 cm) dia.
Configuration:	Push button
Memory:	Non-volatile
Display type:	LCD, 6-digit
Display units:	Inch, cm, Feet, m or percent

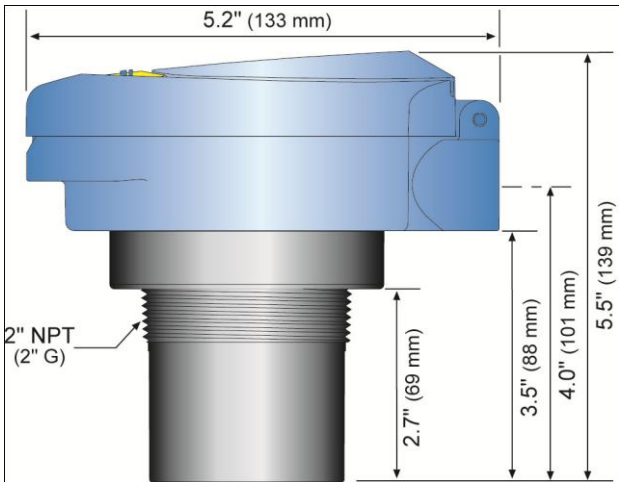
Supply voltage:	12-28 VDC
Loop resistance:	500 Ohms @ 24 VDC
Signal output:	4-20 mA, two-wire
Signal invert:	4-20 mA / 20-4 mA
Signal fail-safe:	4mA, 20 mA, 21 mA, 22 mA, hold last
Process temp.:	F: -4° to 140° C: -20° to 60°
Temp. comp.:	Automatic
Ambient temp.:	F: -31° to 140° C: -35° to 60°
Pressure:	MWP = 30 PSI
Enclosure rating:	NEMA 4X (IP65)
Encl. material:	PC/ABS FR
Encl. hardware:	Brass and stainless
Enclosure vent:	Water tight membrane
Conduit entrance:	Dual, 1/2" NPT
Trans. material:	PVDF
Process mount:	LU80: 1" NPT/1" G LU81/83/84: 2" NPT/2" G
Mount. gasket:	Viton®
Classification:	General purpose
Compliance:	CE, RoHS

Dimensions:

Side View / LU80 Series



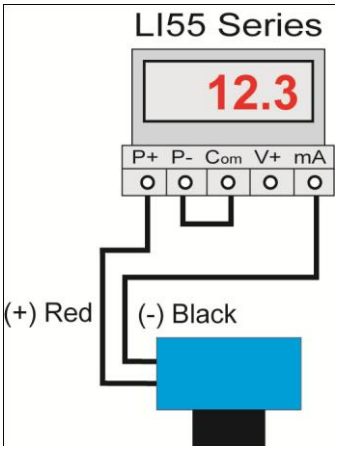
Side View / LU81, LU83 and LU84 Series



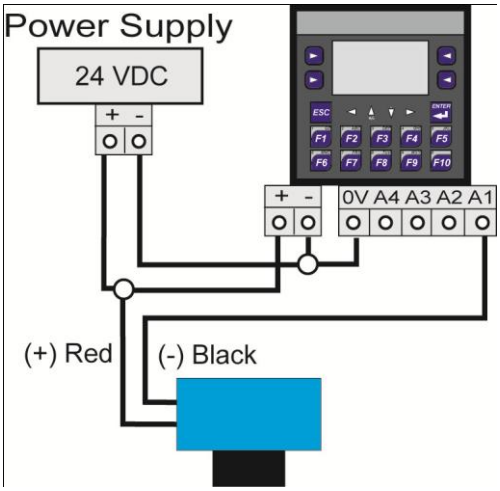
Wiring to Display, Controllers & PLC's

Below is a quick review of wiring the EchoSpan to common display, controllers and PLC's.

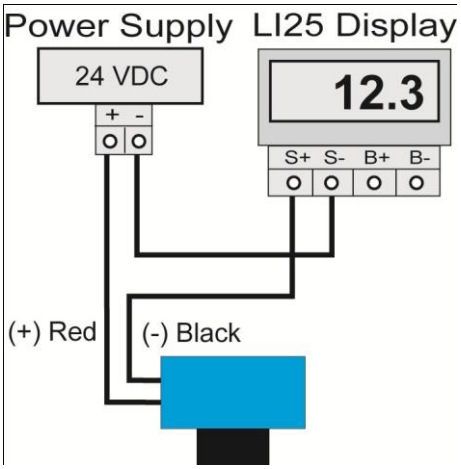
DataView LI55 Series
Level Controller



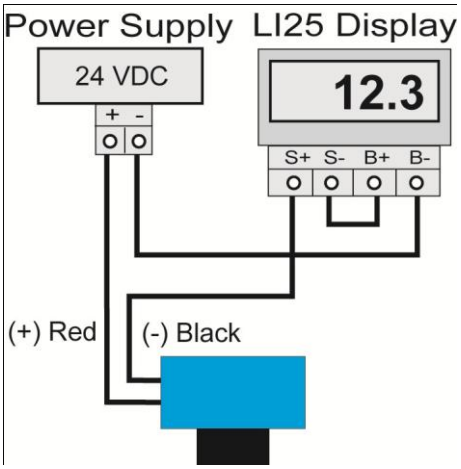
Commander LI90 Series
Multi-Tank Level Controller



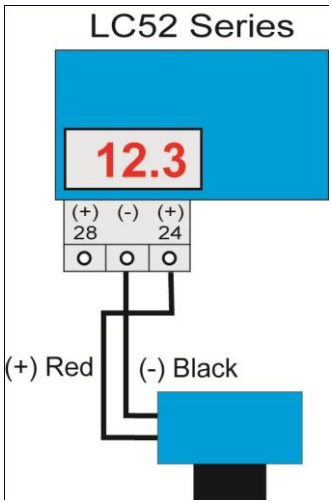
DataLoop LI25 Series
Level Indicator
without the backlight



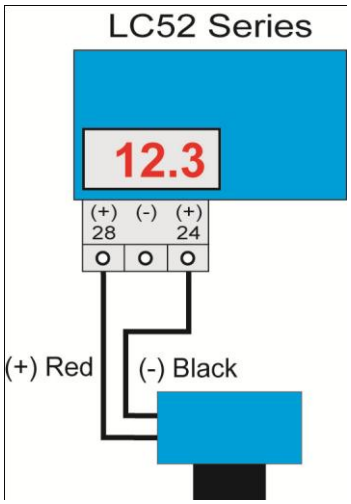
DataLoopLI25 Series
Level Indicator
with the backlight



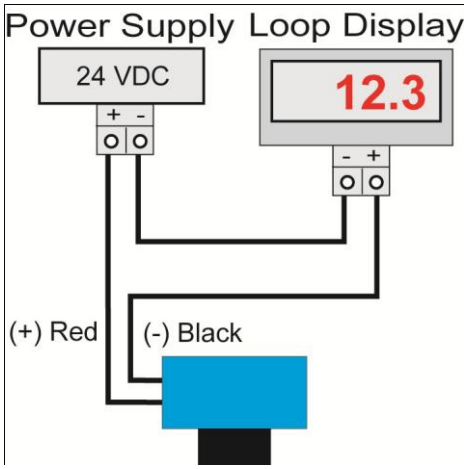
DataPoint LC52 Series
Level Controller
JWA mode (Factory Setting)



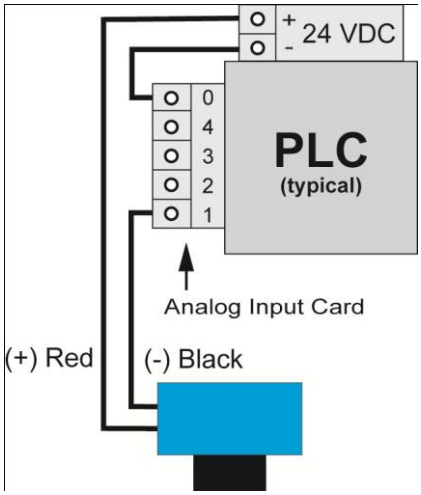
DataPoint LC52 Series
Level Controller
JWB mode



Generic Loop
Powered Display



Generic PLC



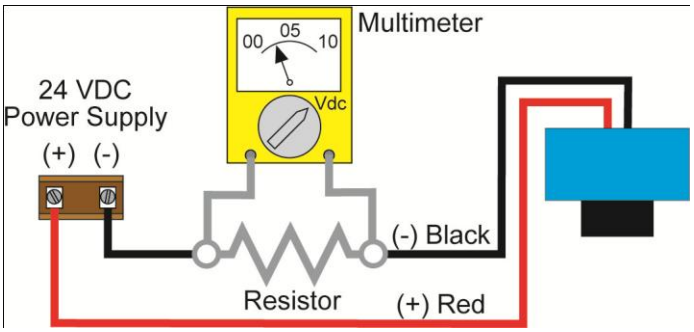
General notes for electrical connections, usage and safety:

- Where personal safety or significant property damage can occur due to a spill, the installation must have a redundant backup safety system installed.
- Wiring should always be completed by a licensed electrician.
- Supply voltage should never exceed 28 VDC.
- The sensor materials must be Chemically compatible with the liquids to be measured.
- Design a fail-safe system for possible sensor and/or power failure.
- Never use the sensor in environments classified as **Hazardous**.

Voltage Output

EchoSpan can be used as a 0 to 5 or 0 to 10 VDC output device. A resistor will need to be added to the circuit to enable a voltage output (refer to the wiring diagram below).

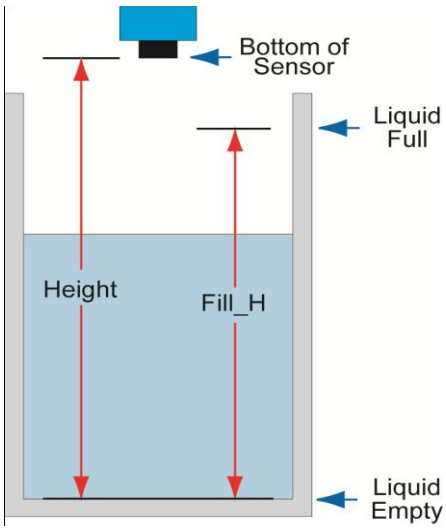
- 0-5 VDC output
  - Add a 250 Ohm resistor
  - Actual output will be 0.8 to 5 VDC
- 0-10 VDC output
  - Add a 500 Ohm resistor
  - Actual output will be 2 to 10 VDC



Getting Started:

EchoSpan can be configured before installation. The switch features non-volatile memory, so the set points configured before installation will not be lost when the switch is powered down. To start, all you need is the following information:

- Basic Tank Information:
  - ***HEIGHT*** – Distance from the transducer face to the bottom of the tank.
  - ***FILL-H*** – Maximum fill height of the liquid from the bottom of the tank.
  - These values will all be in the same distance value (inches, centimeters, feet or meters) and will all be measured from the bottom of the tank.
- Power:
  - Provide 12 to 28 VDC input power to the EchoSpan.



Feature Guide:

FEATURE	ACCESS BY
Easy to use **MENU**	Press and hold *SELECT* key until **MENU** is displayed approximately 5 seconds. The **MENU** items will rotate through display, press *SELECT* to change an item.
Many **UNITS** of measurement.	In the **MENU** mode, press *SELECT* when **UNITS** is display, then select ***INCHES***, ***CM*** (centimeter), ***FEET***, ***METERS*** or ***PERCENT***.
No cumbersome measure required. Set point distances are relative to the tank bottom.	In **MENU** mode, select the **TANK** item and set the ***HEIGHT*** of the tank from the transducer face to the bottom of the tank. Set the Fill Height (***FILL-H***) to the maximum fill height of the liquid from the bottom of the tank. Now all of the set points are from the bottom of the tank up.
Optional Target Calibration	Use this feature if the tank is at the empty or full setting. This will accept the current level as either empty (***TG CAL EMPTY***) of full (***TG CAL FULL***).
Fail-Safety	Use the **SAFE** function to preset the output to either Empty (***4 mA***), Full (***20 mA***, ***21 mA*** or ***22 mA***) or ***Hold*** Last Value in case the transmitter looses its signal (**LOST**).

Getting around:

EchoSpan is configured by the use of three push buttons (UP, DOWN and SELECT) and a LCD display. As a lockout feature, the buttons are inactive until the SELECT button is held down for 5 seconds, and then the display will begin to scroll through the top level of the configuration menu.

Steps for Basic Configuration:

1. Select and Set the units of operation in the **UNITS** menu.
2. Configure the Sensor ***Height*** and ***Fill-H*** under the **TANK** menu.
3. Set the **SAFE** vaule.

Top Level

- The Configuration menu will continue to scroll through the items below until the **SELECT** button is pressed.
- **UNITS – TANK – SAFE – TG CAL – VALUES - HELP – RUN**.
- To return to the Operational mode of EchoSpan, press *SELECT* while RUN appears in the display.
- **UNITS** – Allows end user to select the units for configuration and operation. Select between Inches, Centimeters, Feet, Meters or Percent. Press *EXIT* to return to the Top Level menu.
- **TANK** – Allows the end user to configure the operational range for the switch.
    - ***HEIGHT*** – Distance from the transducer face to the bottom of the tank.
    - ***FILL-H*** – Maximum fill height of the liquid from the bottom of the tank.
    - ***REV MA*** – Allows the transmitter to reverse the current output such that 4 mA is at FULL and 20 mA is at EMPTY.
    - Press *Exit* to return to the Top level Menu.

- ***Note:*** *if UNITS is set to Percent, then TANK will not appear. To view TANK, set UNITS to any of the following: Inches, Centimeters, Feet or Meters.*

- **SAFE** – The fail-safe for the EchoSpan can be preset to the customer's requirement.
  - ***22 mA*** – Overfill fail-safe setting.
  - ***21 mA*** – Overfill fail-safe setting.
  - ***20 mA*** – Full fail-safe setting.
  - ***4 mA*** – Empty fail-safe setting.
  - ***HOLD*** – Keeps the output at its last current reading when fail-safe condition occurs.
- **TG CAL** – Target Calibration (allows for the sensor to accept the current level as either EMPTY or FULL.
- **VALUES** – Provides setup information, the ability to reset the EchoSpan and a simulation mode to test the relay function.
  - **SETUP** – Will display the setting for all functions of EchoSpan.
  - **DIAG** – This is a production test feature used by the factory to confirm operation. ***This mode should only be used when supervised by a Flowline representative.***
  - **RESET** – Will reset the EchoSpan back to its original factory setting.
- **HELP** – Provides information for contacting Flowline no-line.
- **RUN** – Returns the unit to normal measurement and control mode.

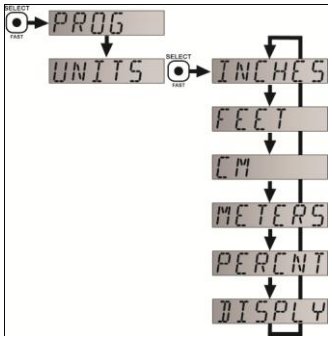
How to enter the MENU:

1. Press and hold *SELECT* key (approximately 5 seconds) until **MENU** is displayed.
2. The menu items will rotate through display.
3. Press *SELECT* to change an item.



How to configure UNITS:

1. In the **MENU** mode, press select when **UNITS** is display.
2. Press *SELECT* to choose between ***INCHES***, ***CM*** (centimeter), ***FEET***, ***METERS*** or ***PERCENT***.
3. Select *EXIT* to return to the Top Level Menu.



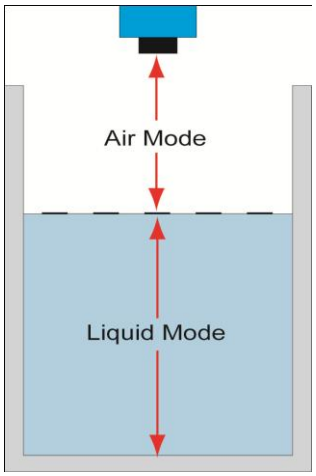
Note: Reading the level of liquid in Percent:

- Flowline recommends that when selecting ***PERCENT***, configure the ***HEIGHT*** and ***FILL-H*** settings before selecting ***PERCENT*** in order to span the EchoSpan for your application requirements.
- When in ***PERCENT***, the operational span will be based upon the last **TANK** settings, typically the factory settings for ***HEIGHT*** and ***FILL-H***.

EchoSpan	*HEIGHT*	*FILL-H*
LU80 Series	118.1” (300 cm)	114.1” (290 cm)
LU81 Series	216.5” (550 cm)	208.5” (530 cm)
LU83 Series	314.9” (800 cm)	307.1” (780 cm)
LU84 Series	393.7” (1000 cm)	381.9” (970 cm)

- When ***PERCENT*** is selected, the **TANK** settings (***HEIGHT*** and ***FILL-H***) will be disabled.

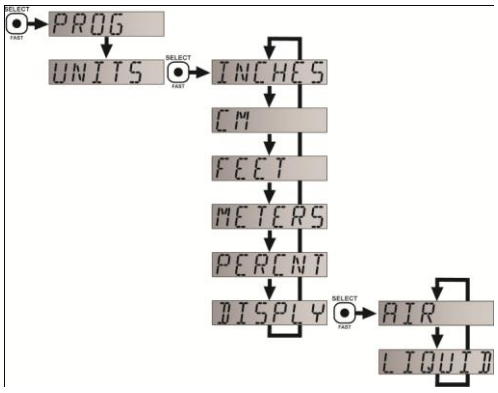
DISPLAY - AIR Mode vs. LIQUID Mode:



The display can be made to display either the height of liquid in the tank (***LIQUID*** mode) or the amount of air in the tank (***AIR*** mode).

***AIR* mode** – Will display the distance from the bottom of the sensor to the surface of the liquid.

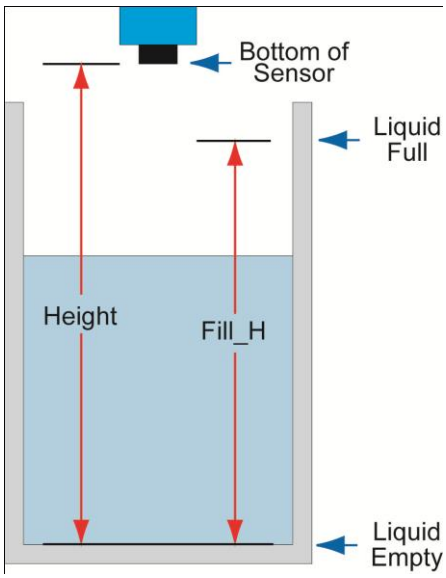
***LIQUID* mode** – Will display the height of liquid measured from the bottom of the tank.



How to change the display mode:

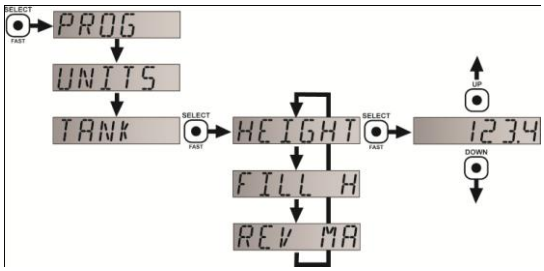
1. In the **MENU** mode, press select when **UNITS** is display.
2. Press *SELECT* when ***DISPLAY*** appears.
3. Press *SELECT* to choose between ***AIR*** or ***LIQUID***.
4. When ***EXIT*** appears, press *SELECT* return to Top Level Menu.

How to configure the Operational range of EchoSpan:

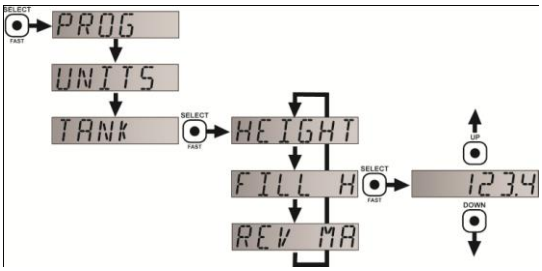


No cumbersome measurement is required via Target Calibration to establish set points. Set point distances are relative to the tank bottom.

1. In **MENU** mode, select the **TANK** item.
2. When ***HEIGHT*** appears, press *SELECT*.
3. Using the *UP* and *DOWN* buttons, set the ***HEIGHT*** of the tank from the transducer face to the bottom of the tank.
4. To enter the value, press and hold *SELECT* (Approximately 2 seconds) until ***SAVED*** is displayed.
5. When ***FILL-H*** appears, press *SELECT*.
6. Using the *UP* and *DOWN* buttons, set the Fill Height (***FILL-H***) to the maximum fill height of the liquid from the bottom of the tank.
7. Press and hold *SELECT* (2 seconds) to enter the value.
8. When ***EXIT*** appears, press *SELECT* return to Top Leve Menu.



Sensor Height

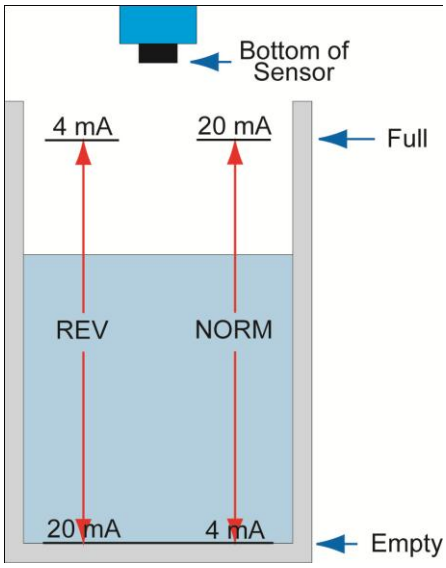


Fill-Height

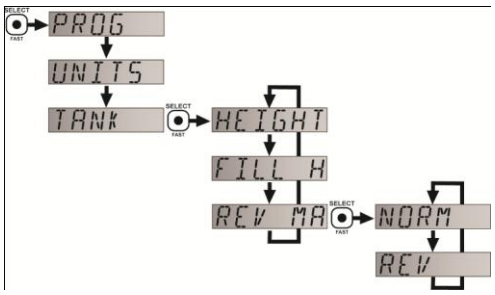
Note:

- Flowline recommends that when selecting PERCENT, configure the Height and Fill-H settings before selecting PERCENT in order to span the EchoSpan for your application requirements.
- When PERCENT is selected, the TANK settings (Height and Fill-H) will be disabled.

How to set a Reverse the Current Output:



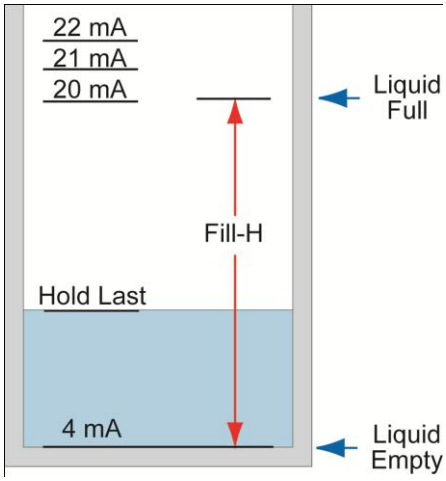
The default for EchoSpan is to have 4 mA at Empty and 20 mA at Full. This is the normal (***NORM***) setting. The output can be reversed (***REV***) with 20 mA at Empty and 4 mA at Full.



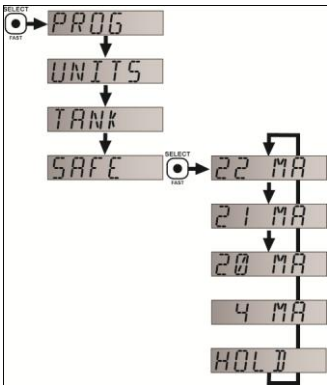
1. In **MENU** mode, select the **TANK** item.
2. When ***REV MA*** appears, press *SELECT*.
3. When ***REV*** appears, press *SELECT*.
4. When ***EXIT*** appears, press *SELECT* return to Top Level Menu.

EchoSpan is now in the Reverse mode. To switch back to the Normal mode, follow the instructions above and select ***NORM*** under step 3.

How to set the SAFE setting:

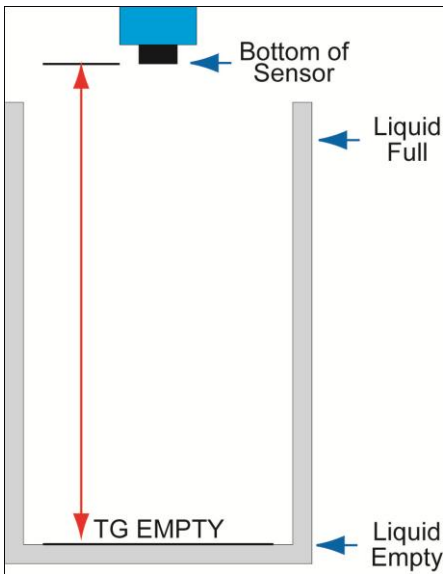


The default for Fail-Safety (LOST) can be preset. The choices are ***4 mA***, ***20 mA***, ***21 mA***, ***22 mA*** and ***HOLD***.

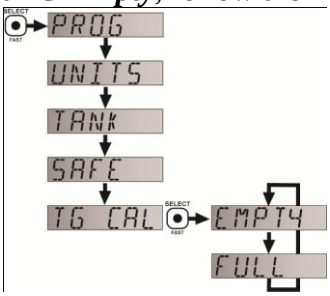


1. In **MENU** mode, select the **SAFE** item.
2. When the required setting appears, press *SELECT*.
3. When ***EXIT*** appears, press *SELECT* return to Top Level Menu.

How to set using Target Calibration (Empty):

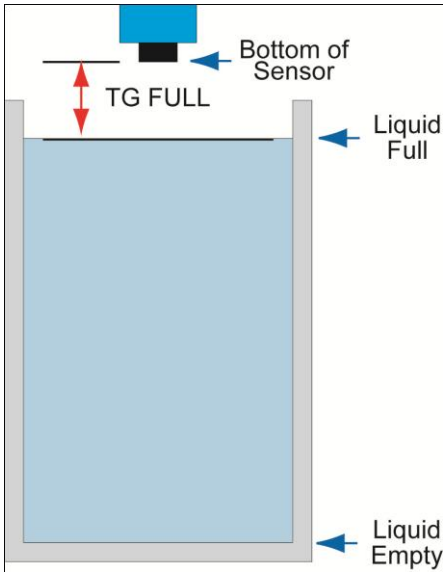


Instead of measuring for Empty tank, the Empty distance can be set automatically. This method requires that the tank be Empty or at the level that is considered Empty in the application. To set ***TG Empty***, follow the instructions below.

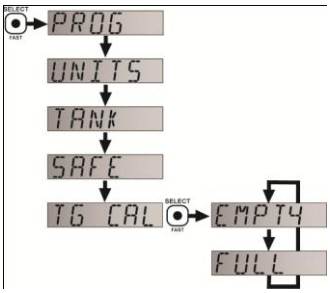


1. Before beginning, make sure the level is tank is at the Empty level.
2. In **MENU** mode, select the **TG CAL** item.
3. When ***EMPTY*** appears, press *SELECT*. This sets the current distance as the new Empty setting.
4. When ***EXIT*** appears, press *SELECT* return to Top Level Menu.

How to set using Target Calibration (Full):



Instead of measuring for Full tank, the Full distance can be set automatically. This method requires that the tank be Full or at the level that is considered Full in the application. To set ***TG Full***, follow the instructions below.



1. Before beginning, make sure the level is tank is at the Full level.
2. In **MENU** mode, select the **TG CAL** item.
3. When ***FULL*** appears, press *SELECT*. This sets the current distance as the new Full setting.
4. When ***EXIT*** appears, press *SELECT* return to Top Level Menu.

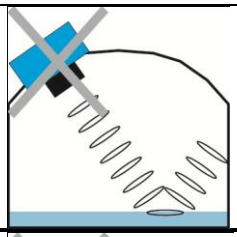
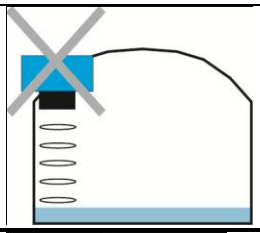
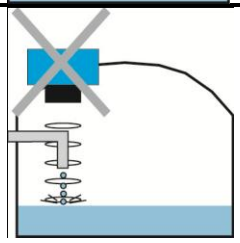
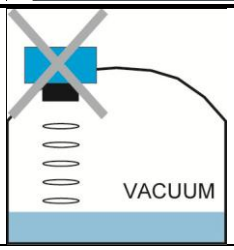
*Note: When setting either the **TG EMPTY** or **TG FULL**, make sure the reflective surface is perpendicular to the EchoSpan and not at an angle. Be careful if the tank has a sloped or cone bottom and the bottom of the tank is exposed to air.*

Installation

The EchoSpan should always be mounted perpendicular to the liquid surface and installed using the provided Viton mounting gasket. Make sure that the fitting and transmitter threads are not damaged or worn. Always *hand-tighten* the transmitter within the fitting. Perform an installed leak test under normal process conditions prior to system start up. ***Note:*** *The preferred mounting fitting for the LU80 series is the LM52-1400 (2" thread x 1" thread) reducer bushing.*

Mounting Guide

1. Do not mount at an angle
2. Liquid should never enter the dead band
3. Side Wall:
    a. For LU80 Series - mount at least 2" from the side wall
    b. For LU81, LU83 & LU84 Series - mount at least 3" from the side wall
4. Do not mount where obstacles will intrude on sensor's beam width
    a. See Specifications on page 8
5. Do not mount in a vacuum
6. Avoid mounting in the center of a dome top tank.
7. In cone bottom tank, position the sensor over the deepest part of the tank.

Do not install at angle relative to the liquid.		*Do not install within 3" of tank sidewall.*	
Do not install with objects in the beam.		*Do not install in applications with vacuum.*	

Installation in existing fittings

If the existing fitting is larger than the threads of the EchoSpan, select a reducer bushing such as the LM52-1400 (2" thread x 1" thread) or LM52-2400 (3" thread x 2" thread).

Metal Tanks (LU80 series)

Flowline ultrasonic transmitters have been optimized for use in non-metallic fittings.

1. For best performance, avoid the use of metallic fittings.
    a. Use a plastic 2" x 1" reducer bushing, such as the LM52-1400 or a plastic 1" flange, such as the LM52-1850 for metallic tanks.
2. While installations directly into a 1" metal fitting are not recommended, acceptable results may be obtained if the 1" fitting is a half coupling in form and the outer diameter of the coupling is tightly wrapped in vinyl tape to dampen vibrations.

Fitting Selection:

Check the part number to determine the required fitting mount size and thread type. EchoSpan is commonly installed in tank adapters, flanges, brackets or standpipes. Note: Always include the gasket when installing the EchoSpan.

1. **Tank Adapter:** Select a tank adapter fitting, such as the LM52-1890 for the LU80 series or the LM52-2890 for the LU81, LU83 & LU84 series.
    a. *For best results, select a 2" tank adapter and add a reducer bushing such as the LM52-1400, thread x thread, reducer bushing.*
    b. Avoid tank adapter (thread x thread) styles and/or pipe stops forward of the installed transducer.

2" Tank Adapter Socket x Thread



Tank Adapter w/ 2"x1" Reducer Bushing

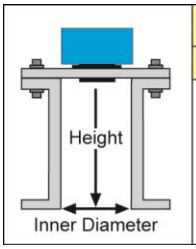


Tank Adapter Thread x Thread



Do not use thread x thread

2. **Riser:** Installations with tall, narrow risers can impede the acoustic signal.
    a. **LU81, LU83 & LU84 Series:** 2" (5 cm) diameter risers should be no taller than 5" (12.7 cm). Larger diameter risers should be no taller than 12" (30.5 cm).
    b. **LU80 Series:**



Riser Specifications	
Inner Diameter	Maximum Height
2" (5 cm)	3" (7.6 cm)
4" (10 cm)	8" (20 cm)
6" (15 cm)	12" (30 cm)

Note: *Do not exceed the dimensions listed above*

3. **Flange (LU80 series):** If installing on a flange, select a flange with a thread that is above the plane of the flange, such as the LM52-1850.
    a. *The LU81, LU81 & LU83 series works well with Flange installations.*
    b. Avoid the use of blind flanges with tapped threads or flanges where the threads are even with the plane of the flange, such as the Banjo 1" Poly ANSI Flange (series AF100).
    c. Use a flange with a 2” thread and add a 2” to 1” reducer bushing to complete the installation.

2” Flange w/ thread out of plane



2” Flange w/ thread in plane

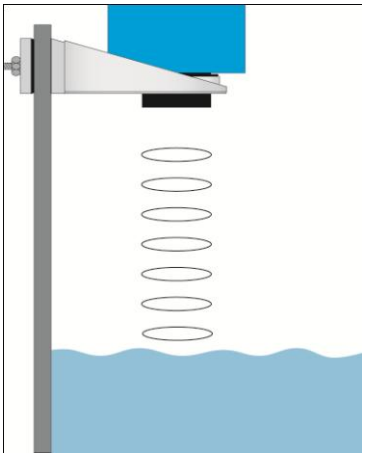


Do not use thread in plane

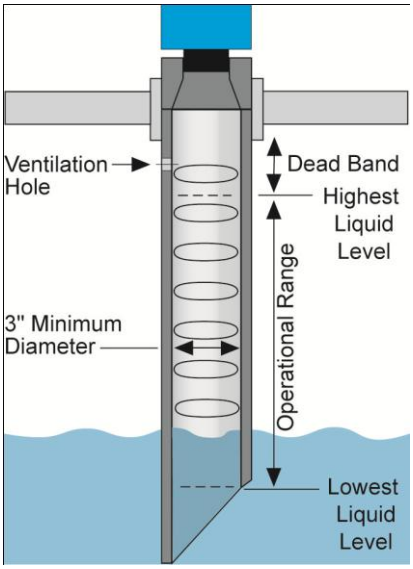
2” Flange w/ Reducer Bushing



4. **Side Mount Bracket:** For installations in open tanks and sumps, use the LM50 series side mount bracket.
    a. For the LU80 series, order the LM50-1001-1, which includes a 2”x 1” Reducer Bushing.
    b. For the LU81, LU83 & LU84, series, order the LM50-1001 side mount bracket.



5. **Stand Pipe:** A standpipe maybe used to dampen turbulence or when foam is present in the application.
    a. Pipe can be made of any material.
    b. Select a minimum 3” ID pipe for the stand pipe.
        i. A 2” pipe is usable with the LU80 series, but is the minimum.
        ii. Pipes larger than 3” can also be used.
    c. Use a coupling and reducer bushing to attach the EchoSpan to the pipe.
        i. With the LU80 series, be sure to use a plastic reducing bushing such as LM52-1400 2” T x 1” T fitting or the LM52-1410 2” S x 1” T fitting.
    d. The pipe length should run the measurement span and the bottom of the pipe should remain submerged at all times to prevent foam from entering the pipe.
    e. Cut a 45°notch at the bottom of the pipe and drill a 1/4”pressure equalization hole in the dead band.
    f. The pumps should not drive liquid past the open end of the stand pipe which causes the liquid in the pipe to oscillate.



Appendix:

Setup:

You can view how the EchoSpan is configured.

1. From the main **MENU** level, press *SETUP* when **VALUES** appears.
2. When ***SETUP*** appears, press the *SELECT* key.
3. Setup will display the following information:
    a. ***Units***, ***Display***, ***Rev mA***, ***Safe***, **Height**, ***Fill-H***
4. When completed, press *SELECT* when ***EXIT*** appears to return to the main program level.

Diagnostics (DIAG) Parameters:

This mode runs diagnostic tests that confirm operation of EchoSpan. ***This mode should only be used when supervised by a Flowline representative.***

Reset:

EchoSpan enables the end user to reset the entire configuration back to the original factory settings. Follow the instructions below to reset EchoSpan:

1. From the main **MENU** level, press *SELECT* when ***VALUES*** appears.
2. When ***RESET*** appears, press the *SELECT* key.
3. When ***YES*** appears, press *SELECT* key to reset EchoSpan.
    a. To cancel the reset, press *SELECT* when ***NO*** appears.
4. When completed, press *SELECT* when **EXIT** appears to return to the main program level.

Factory Settings:

EchoSpan	*HEIGHT*	*FILL-H*
LU80 Series	118.1” (300 cm)	114.1” (290 cm)
LU81 Series	216.5” (550 cm)	208.5” (530 cm)
LU83 Series	314.9” (800 cm)	307.1” (780 cm)
LU84 Series	393.7” (1000 cm)	381.9” (970 cm)

Troubleshooting:

PROBLEM	SOLUTION
TANK does not appear on the main menu:	Units function is set for ***PERCENT*** on EchoSpan: When Units is set for ***PERCENT***, the **TANK** function is disabled. To re-enable **TANK**, change units to ***INCHES***, ***CM***, ***FEET*** or ***METERS***.
Display shows ***FULL***:	Level of liquid is above the ***FILL-H*** setting: Check the ***FILL-H*** setting, making sure the ***FILL-H*** setting is high enough so the level of liquid is below the ***FILL-H*** setting. The ***Fill-H*** setting is the distance from the bottom of the tank to the Full level of liquid.
Display shows ***EMPTY***:	Level of liquid is beyond the ***HEIGHT*** setting: Check the ***HEIGHT*** setting, making sure the ***HEIGHT*** setting is low enough so the level of liquid is above the ***HEIGHT*** setting.
Display shows ***WARMUP***:	Typically occurs when power is being applied to transmitter. Indicates a weak power supply, bad wire connections or the sensor is out of the operational range.
Display shows ***LOST***:	Sensor is in a Fail-Safe state. The return sound pulses are not reaching the transducer. First, cycle power off and on, waiting 5 seconds between the off and on states. If problem persists, check the installation fitting against the Installation instructions in the manual.
Display is opposite of the measured value:	Check the ***DISPLAY*** setting. ***AIR*** mode indicates the distance from the liquid to the sensor. ***LIQUID*** mode indicates the height of liquid in the tank. Change the ***DISPLAY*** mode from ***AIR*** to ***LIQUID*** or vice versa to correct.
Transmitter indicates a current of 0 mA:	Check the wiring for an open circuit. An open circuit is the most common issue with a 0 mA signal.
Transmitter jumps to a current reading between 19 and 20 mA:	Check the installation of the transmitter. Bad installation fittings will cause false signals near the top of the tank, which typically translates to a signal between 19 and 20 mA. Also look for interference just below the transmitter. If the transmitter is installed in a metal fitting, switch to a plastic fitting.
Transmitter indicates a current over 23 mA:	Immediately check the wiring for a short circuit. The EchoSpan is current limited to 22 mA. Anything above 23 mA indicates a short circuit.

MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

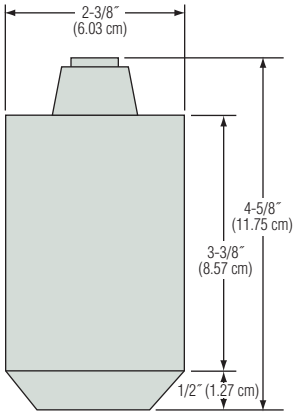


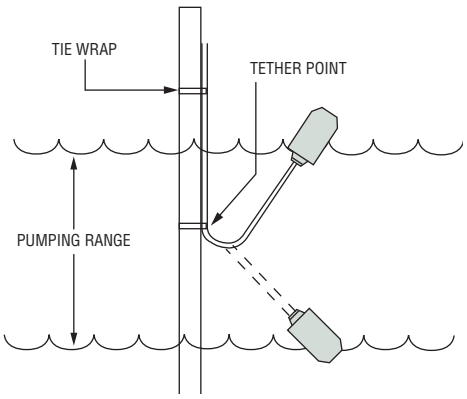
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

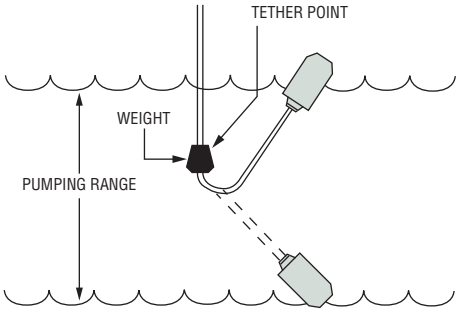
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Form 237
Sheet P/N 7801165
Rev. D

Warrick®
Series M Mechanical Tilt Float Switch
Installation and Operation Bulletin

Specifications

Cord	16 gauge, 2 or 3 conductor SJOW, Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC, 1/2hp
Contact Design	SPST, Normally Open or Normally Closed, Common with N.O. & N.C. (Form C)
Temperature Rating	32°F (0°C) to 194°F (90°C) Dry and 140°F (60°C) Water Resistant
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Certified

Installation

Tether Tie-Wrap (Fig 1)
Attach cord, using a tie-wrap, to a stationary structure. This is known as the tether point, it will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Tether-Weight (Fig 2)
Place tension-brand over the cord before installation. Place the weight at the desired position and secure with the tension-band. This position will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Determine tether point using charts below as a reference

Notes:
1. To Prevent Motor Burnout - In a pumpdown application make sure the turn-off level is at least 2 inches above the intake of the submersible pump.

2. Securing Tether Points - Make sure levels are correct and that floats are free from any obstructions before securing tether points.

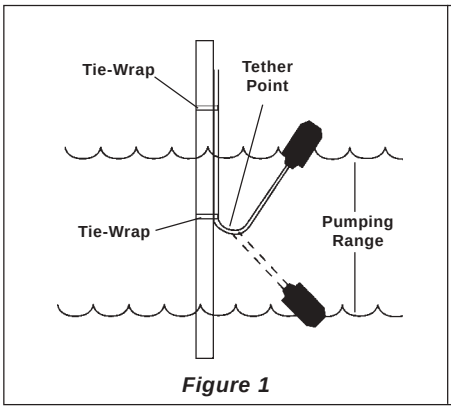


Figure 1

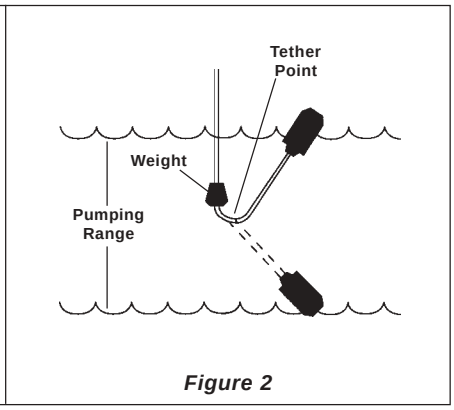
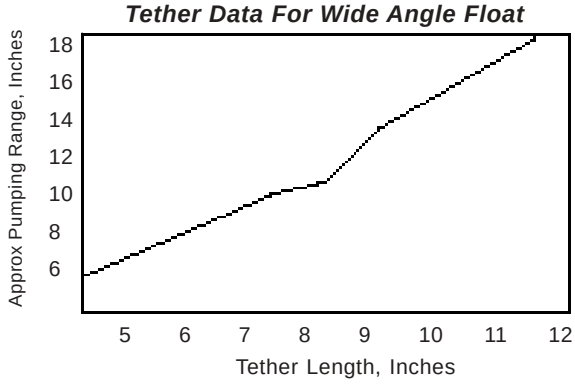
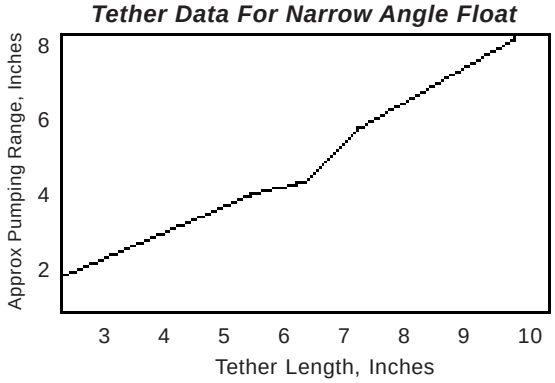


Figure 2

Tether Data For Wide Angle Float

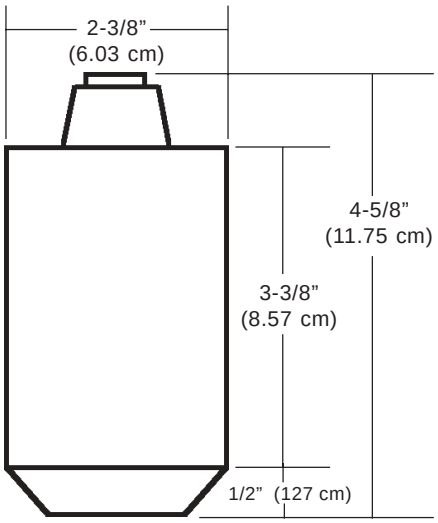


Tether Data For Narrow Angle Float

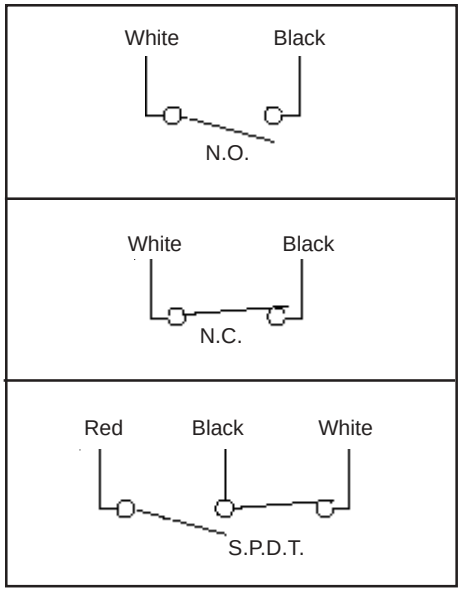


Notes:
1. Narrow angle pumping range is approximately 2 In. to 8 In.
2. Wide angle pumping range is approximately 5 In. to 18 In.

Dimensions



Contact Configurations



Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applica tions according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563

Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580

Series SGZ 2.5″ Stainless Steel Industrial Pressure Gage

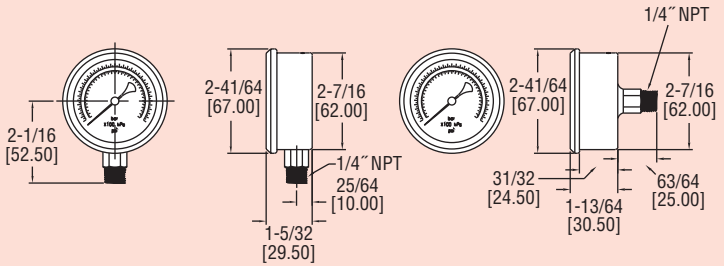
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

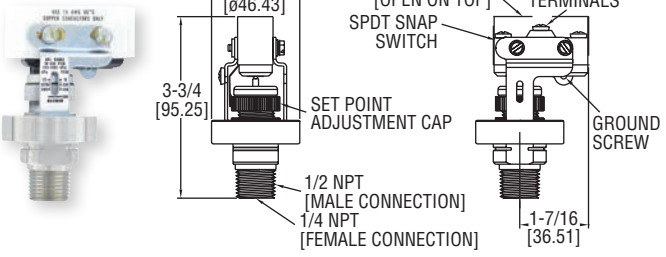
OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

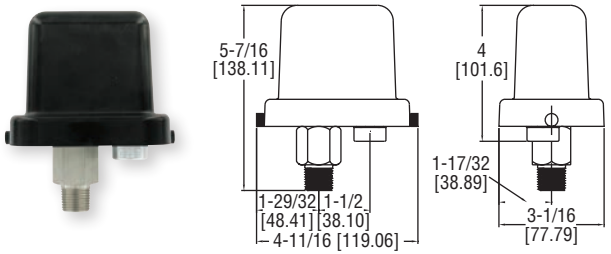
ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS

- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS

- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
A1F-O-SS-1-1	2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
A1F-O-SS-1-3	8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)
Note: Optional enclosure factory installed. To order, change O to PC.			
Example: A1F-PC-SS-1-1			

Series A1F Compact OEM Pressure Switch

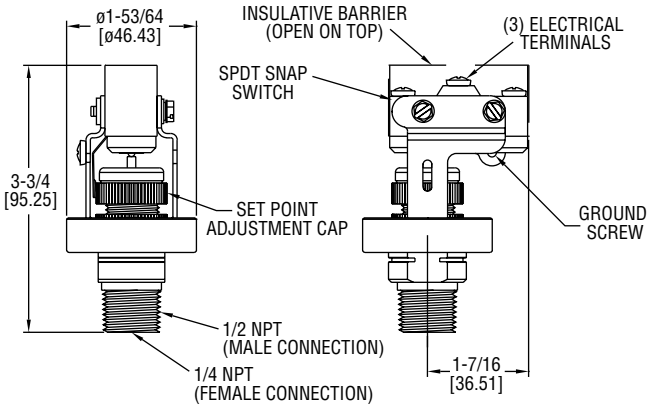
Specifications - Installation and Operating Instructions

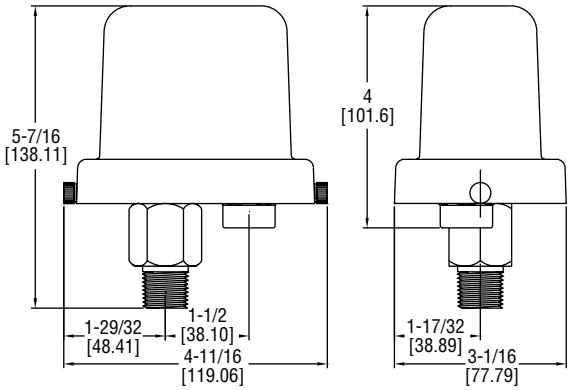


A1F



A1F with A-447





The **SERIES A1F** Compact OEM Pressure Switch is ideal for panel mounting wherever a high-quality, economical open-case or weatherproof control is required.

INSTALLATION

1. Location: Select a location where the temperature limits of -40 to 180°F (-40 to 82°C) will not be exceeded. Locate the switch as close as possible to the pressure source. Long lengths of piping will not affect accuracy of the actuation point but will slightly add to response time.

2. Mounting and Processing Connection: Avoid mounting surfaces with excess vibration which could cause false actuation when pressure is near setpoint. The switch should be mounted within 20° of vertical for proper operation. Mount the switch by connecting it to the process piping using either 1/4″ NPT female or 1/2″ male connection. Pipe joint compound or TFE thread tape should be used to prevent leakage.

3. Electrical Connections: The SPDT snap switch includes normally open, normally closed and common connections. The common and normally open contacts will close and the common and normally closed contacts will open when pressure increases to the setpoint. The actions will reverse when pressure decreases below the setpoint minus the deadband. A green grounding screw is provided on the switch bracket. All wiring should be in accordance with local codes.

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure Chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 500 psig (34 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional A-447 enclosure meets NEMA 4X standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed, See deadband chart.
Weight: 10.5 oz (297 g).

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P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyermail.com

SETPOINT ADJUSTMENT

1. Determine the setpoint pressure. The approximate actuation point can be set by turning the adjustment cap up or down, aligning the top of the O-ring, located above the cap, with the appropriate scale graduation.
2. Connect tubing or piping from the pressure port on bottom of switch to one leg of a tee. Connect the second leg to a pressure test gage of known accuracy and in an appropriate range. The third leg should be connected to a controllable source of pressure.
3. Connect a volt/ohm meter or other circuit tester to the snap action terminals to indicate when switching occurs.
4. Slowly apply pressure to the system and note the pressure at which switching occurs.
5. Operate the switch through several cycles to confirm proper actuation point.
6. Remove test apparatus and attach switch to pressure source and control circuit wiring. Place switch in service.

Example of how to order:

A1F - O - SS - 1 - 4
1 2 3 4 5

1. Diaphragm Designation:
   F - Fluorocarbon
2. Enclosure Designation:
   O - Open Construction No Enclosure
3. Housing Material Designation:
   SS - 316SS
4. Switch Designation:
   1 - SPDT Snap Action Switch
5. Operating Pressure Range Designation:
   1 - 2 to 15 psig
   2 - 4 to 75 psig
   3 - 8 to 225 psig
   4 - 16 to 450 psig

DEADBAND CHART-PSIG (BAR)		
Range	Deadband at Minimum Range	Deadband at Maximum Range
2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

MAINTENANCE

Upon final installation of the Series A1F Compact OEM Pressure Switch, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series A1F is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

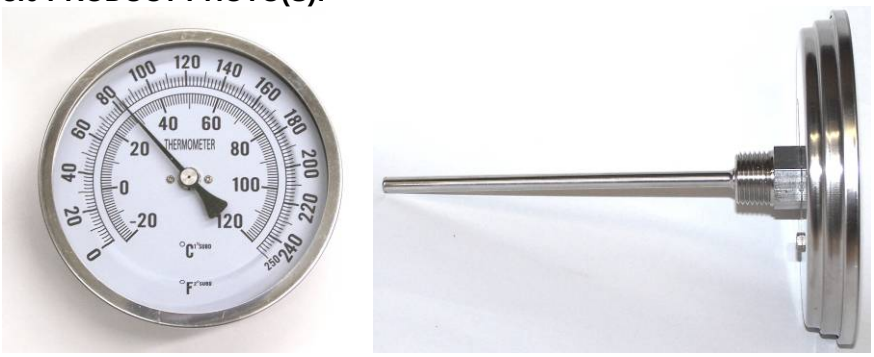
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GRAINGER® FOR THE ONES WHO GET IT DONE GRAINGER INTERNATIONAL, INC. GLOBAL SOURCING DIVISION	-- GGS TECHNICAL SPECIFICATION --			
	SPECIFICATION NUMBER: 1NFY4_TSRev1.doc	AUTHOR: Hoskinson	TITLE: ENG	REL. DATE: 5/25/07
	GGS MODEL NUMBER(s): 1NFY4	DESCRIPTION: Industrial thermometer	REVISION #: 1	REV. DATE: 8/10/07

1.0 BRAND:	No brand
2.0 PRODUCT DESCRIPTION:	Bimetal Industrial Thermometer

3.0 PRODUCT PHOTO(S):



4.0 PRODUCT REQUIREMENTS:

4.1 Features & Performance	Requirement
Temperature scale(s)	°F: 0 to 250 °C: -20 to 120
Connection location/type	Back; 1/2 inch NPT
Dial size (inches)	3
Stem length (inches)	2 1/2
Stem diameter (inches)	1/4 In
Rotated degrees	N/A
Angled degrees	N/A
Full scale accuracy	≤40°F: ±1.5% 41 to 200°F: ±1% ≥201°F: ±1.5%
Calibration	External Adjustment

4.2 Materials & Construction	Requirement
Case	Stainless Steel Hermetically Sealed to Prevent Icing/Fogging Inside
Stem	Stainless Steel
Coil dampening	Silicone for Superior Time Response and Vibration Dampening
Dial face	Glass

4.3 Finish / Color	Requirement
All Surface Finishes	a) Surface finishes must be uniform and continuous. The surface finish must not exhibit any visual defects such as blisters, rust, corrosion, scratches, peeling, bubbles, and/or cracking. b) All exposed surfaces must be free of burrs and sharp edges. c) All applied finishes must adhere to the surface and show no signs of delamination or peeling.
Finish	Stainless Steel

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This specification is based on the manufacturers design and is to be used as a Quality Control document.

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Pressure Gauge, Liquid Filled Gauge Type, 0 to 15 psi, 0 to 100 kPa Range, 2-1/2" Dial Size

- Item# **4FLC1**
- Mfr. Model# **4FLC1**
- Catalog Page# **725**
- Catalog Group# **D1345**
- UNSPSC# **41112403**

PRODUCT DETAILS

Standard Gauges with ABS Housing
• Accuracy: ±3-2-3% Acrylic lens Connection/internal material: brass/bronze Ambient operating temp.: -40° to 150°F
Use with air and noncorrosive fluids such as water and oil in pumps, filters, compressors, and regulators. Glycerin-filled gauges have reduced pulsation and pointer vibration.

TECHNICAL SPECS

- Item**Pressure Gauge**
- Gauge Type**Liquid Filled**
- Dial Size**2-1/2"**
- Range**0 to 15 psi, 0 to 100 kPa**
- Connection Size**1/4" NPT**
- Connection Location**Lower**
- Smallest Graduation**0.5 psi**
- Accuracy**+/-3-2-3%**
- Case Material**ABS Plastic**
- Case Color**Black**
- Socket Material**Brass**
- Tube Material**Bronze**
- Filled With**Glycerin**
- Lens Material**Acrylic**
- Ring Material**Crimped Stainless Steel**
- Operating Temp. Range-**40 Degrees to 150 Degrees F**

FPI SENSORS INTERNATIONAL

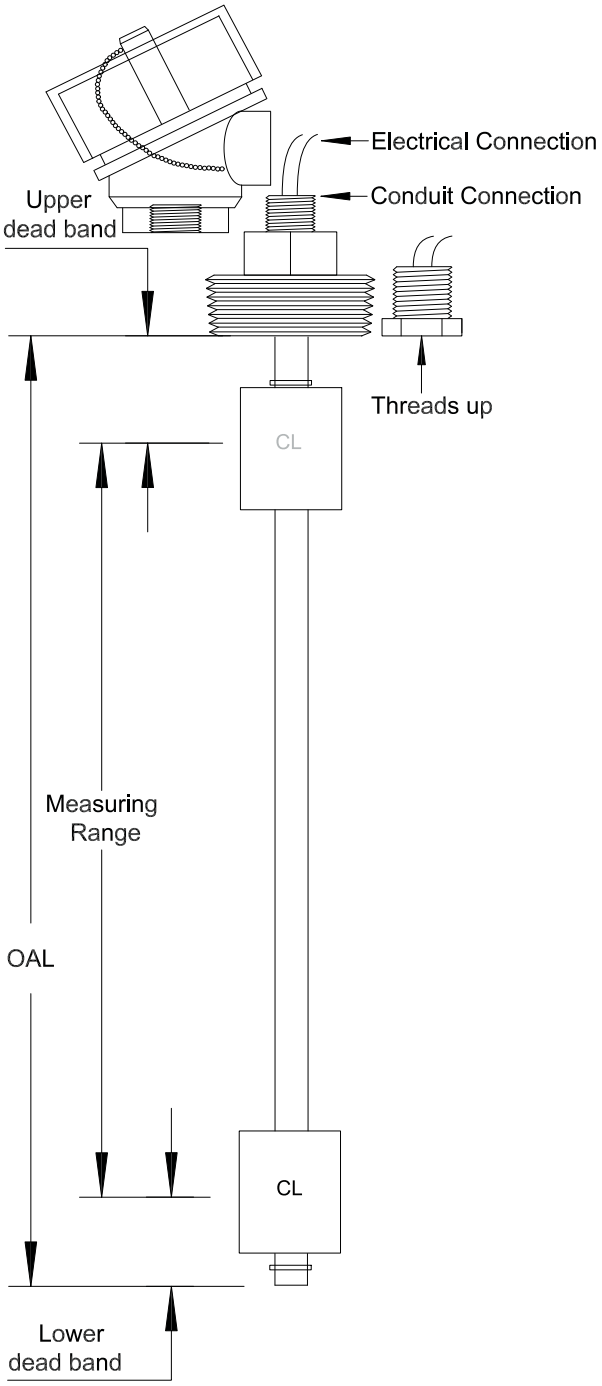
A HIGHER LEVEL OF SATISFACTION

Continuous Level (4-20ma) Configurator – Build to Order

We excel in LOW COST » HIGH QUALITY » 72 HOUR MFG TIME

WE SHIP IN 72 HOURS — FPI SENSORS INTERNATIONAL — CUSTOM ORDERS

MANY OTHER VARIATIONS AND OPTIONS ARE AVAILABLE



HOUSING:
❑ Nema 4X & Explosion Proof ☑ Watertight ❑ NA

ELECTRICAL CONNECTION:
❑ Wire ☑ Cable ❑ Connector (specify) _____

WIRING: Red Wire = Signal
Black Wire = Negative voltage
(Loop powered 10-30 VDC)

CONDUIT CONNECTION:
☑ ½" NPT ❑ Other _____ ❑ NA

FITTING AND STEM MATERIAL:
❑ SS ❑ Brass

FITTING SIZE (NPT):
❑ ¼" ❑ ½" ❑ ¾" ❑ 1" ❑ 1¼" ❑ 1½" ☑ 2"
❑ Flange _____ ❑ Other _____

THREAD ORIENTATION:
☑ Threads down *(threads from outside of the tank)*
❑ Threads up *(threads from inside of the tank)*

LEAD LENGTH: _____"

FLOAT MATERIAL:
☑ SS ❑ Buna

MEASURING RANGE: _____"
(4" – 96", 1-inch increments only)

UPPER DEAD BAND: _____" (1" minimum)

LOWER DEAD BAND: _____" (1" minimum)

OPERATIONAL INDEPENDENT ALARM SWITCH(S):

ALARM:	OPERATION:	SPECIFIC GRAVITY:
#1 _____"	❑ N.O. ❑ N.C.	☑ .60sg ❑ .93sg
#2 _____"	❑ N.O. ❑ N.C.	☑ .60sg ❑ .93sg

If alarm point is outside of the measuring range, dead band dimensions will be affected. If alarm point is inside the measuring range, contact factory for details.

OPTIONS:
☑ Centering Disk
❑ Thermocouple _____
❑ Temp Switch ❑ N.O. or ❑ N.C.
❑ Field Adjustable Length
❑ Thermistor _____
_____ °F set point

RESOLUTION: ¼" increments

ACCURACY: +/-2% of measuring range

MAXIMUM OPERATING PRESSURE: 200 PSI

OPERATING TEMPERATURE RANGE: -20°F – 250°F

1.800.852.9984

www.FPIsensors.com

info@FPIsensors.com

Fax 651.681.1888

FPI SENSORS INTERNATIONAL

4-20 mA CONTINUOUS LEVEL USER GUIDE

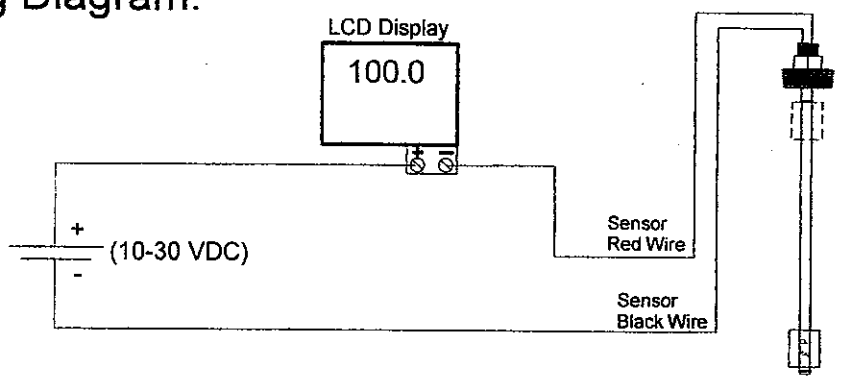
INSTALLATION:

When initially installing, mount the sensor into the tank with the matching fitting. When threading metal threads into a metal coupling, pipe sealant or Teflon® tape is recommended. After the sensor is mounted in tank, add the conduit. Use only appropriate conduit hubs that are specified to maintain the desired UL/CSA rating.

Associated apparatus must be installed in accordance with its manufacturers control drawing and Article 504 of the National Electrical Code (ANSI/NFPA 70) for installation in the United States, or Section 18 of the Canadian Electrical code for installations in Canada.

Associated apparatus must not be used in combination unless permitted by the associate's apparatus certification.

CL Wiring Diagram:



The sensor should be wired by qualified, licensed technicians only. There are two wires exiting the housing of the sensor. The red wire connects to signal (or + VDC), the black wire connects to - VDC. The power supply should be fused with a 25mA/24VDC fast blow fuse.

OPERATION:

The 4-20 mA sensor operates on a loop power or a separate power supply of 10-30 VDC. The sensor will provide a linear ouput between 4-20mA across the measuring range. When the float is at the bottom of the measuring range (furthest away from the fitting) the signal output will be 4 mA. As the float moves closer to the fitting, the mA output will increase until it reaches the top of the measuring range, providing a 20 mA signal. The mA signal will change every 1/4" of float movement. The mA value will change with every 1/4" of float movement. The value of mA change per 1/4" of float movement equals 4 divided by total measuring range inches.

CALIBRATION AND MAINTENANCE:

There is no calibration necessary. For reliable operation, the float and stem need to remain clean so the float has unrestricted movement as it travels up and down the stem. When cleaning, only use solutions that are compatabile with the sensor material. It is also necessary that the leads exiting the sensor are kept dry and protected.

TROUBLESHOOTING:

Verify that the wiring is correct and proper power is being applied to the sensor. If the system is still not working, isolate the sensor from the system, apply 24VDC and monitor the senors output with a mA meter. Wire the independent meter and power supply as shown above. Move the float up and down the stem to verify the sensor's signal is correct. If the sensor is still not operating, contact FPI Sensors for assistance.

FPI Sensors 1-800-852-9984 info@FPIsensors.com

MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

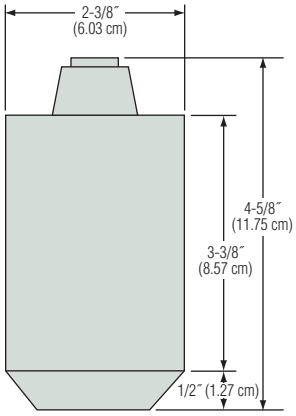


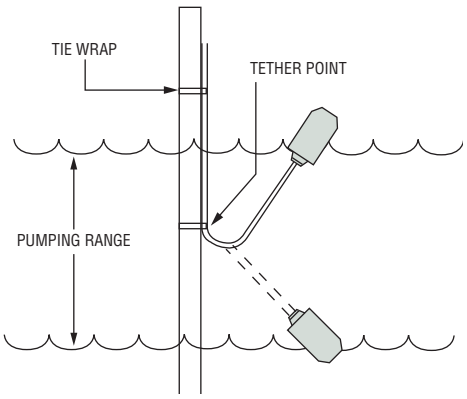
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

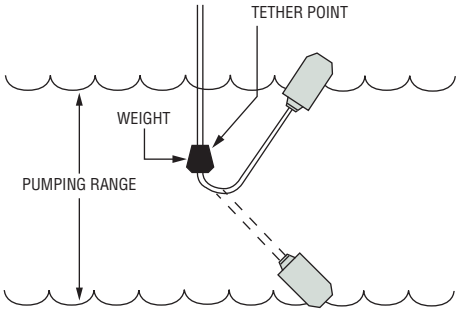
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Form 237
Sheet P/N 7801165
Rev. D

Warrick®
Series M Mechanical Tilt Float Switch
Installation and Operation Bulletin

Specifications

Cord	16 gauge, 2 or 3 conductor SJOW, Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC, 1/2hp
Contact Design	SPST, Normally Open or Normally Closed, Common with N.O. & N.C. (Form C)
Temperature Rating	32°F (0°C) to 194°F (90°C) Dry and 140°F (60°C) Water Resistant
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Certified

Installation

Tether Tie-Wrap (Fig 1)
Attach cord, using a tie-wrap, to a stationary structure. This is known as the tether point, it will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Tether-Weight (Fig 2)
Place tension-brand over the cord before installation. Place the weight at the desired position and secure with the tension-band. This position will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Determine tether point using charts below as a reference

Notes:
1. To Prevent Motor Burnout - In a pumpdown application make sure the turn-off level is at least 2 inches above the intake of the submersible pump.

2. Securing Tether Points - Make sure levels are correct and that floats are free from any obstructions before securing tether points.

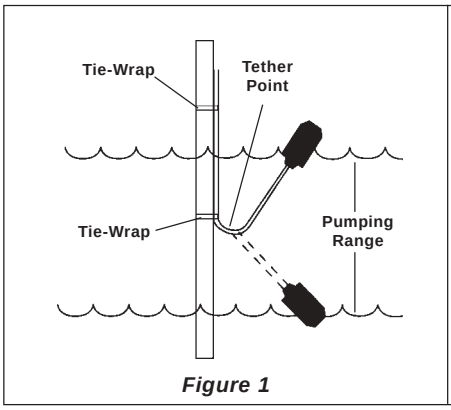


Figure 1

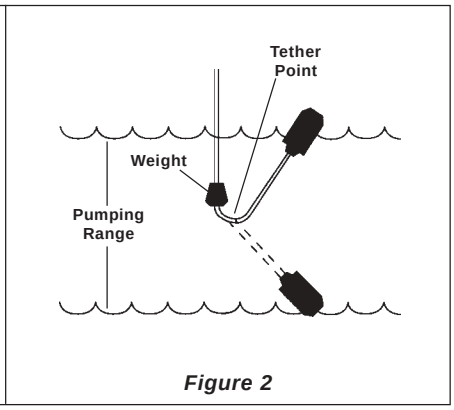
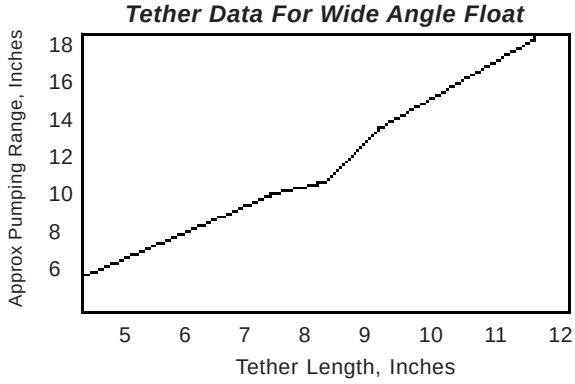
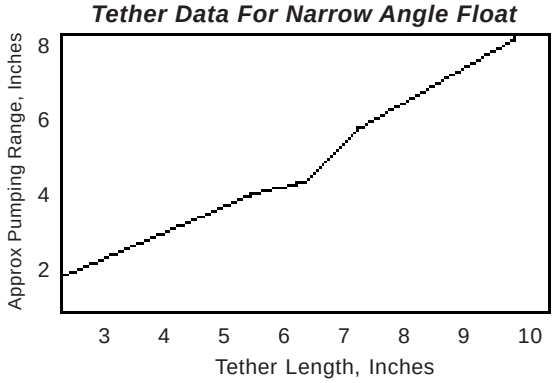


Figure 2

Tether Data For Wide Angle Float

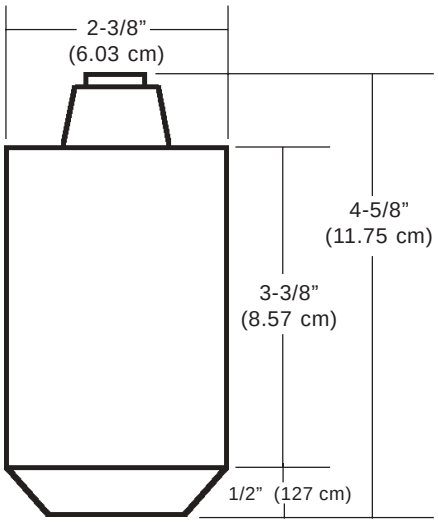


Tether Data For Narrow Angle Float

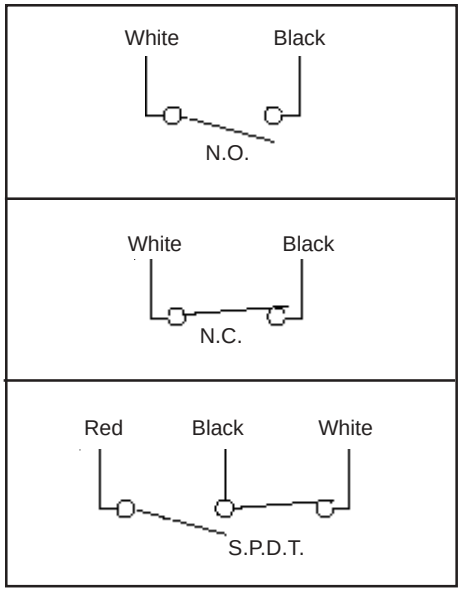


Notes:
1. Narrow angle pumping range is approximately 2 In. to 8 In.
2. Wide angle pumping range is approximately 5 In. to 18 In.

Dimensions



Contact Configurations



Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applica tions according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563

Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580

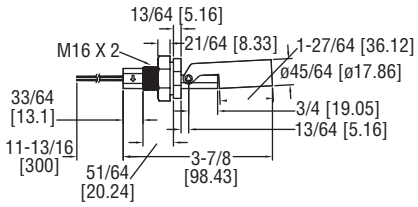
LEVEL SWITCHES - HORIZONTAL/SPECIALTY

Low Cost, Hermetically Sealed Contacts

HORIZONTAL

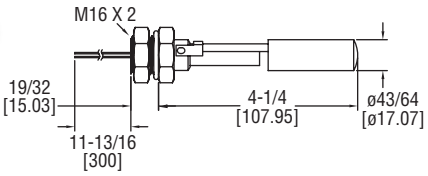


F6-HPS-11



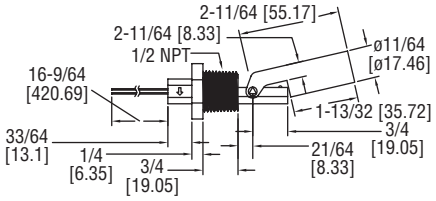


F6-MHS



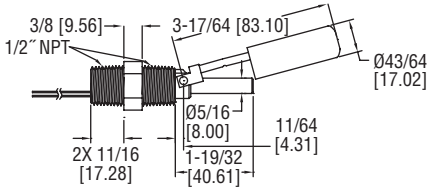


F6-HPS-21



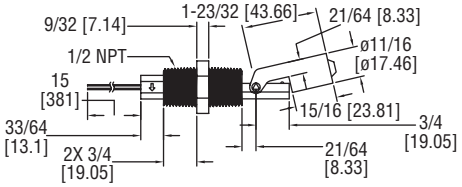


F6-MHS2



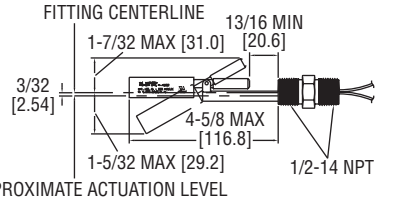


F6-HPS-31

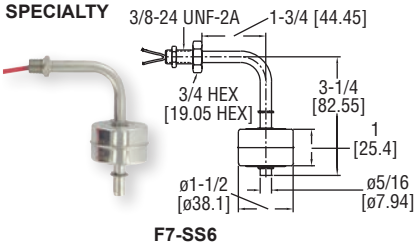




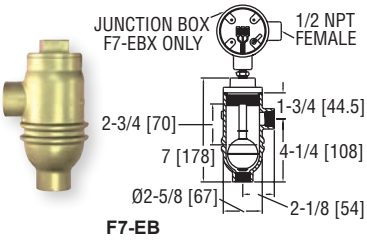
F6-HSS



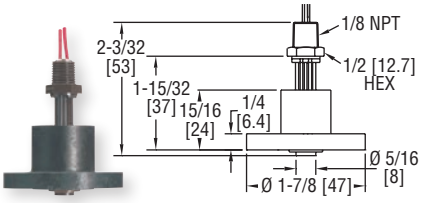
SPECIALTY



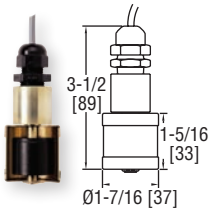
F7-SS6



F7-EB



F7-LL



F7-WBB

The **SERIES F6 & F7** Horizontal and Specialty Float Switches are designed to mount through the walls of tanks or other vessels and unique applications to provide point level indication.

FEATURES/BENEFITS

- Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float arm and can be easily adapted to open or close a circuit on rising or falling levels

APPLICATIONS

- Water level monitoring
- Oil level control
- Chemical level indication
- Sumps
- Stand pipes
- Tank level control

MODEL CHART

Model	Applications	Material Float/Stem	Temperature Limits	Pressure Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg	Weight oz (g)
F6-HPS-11	Water, oils, chemicals	Polypropylene/ polypropylene	176°F (80°C)	116 psig (8 bar)	0.60	20 VA: 0.08 A @ 240 VAC	20 AWG, 11.8″ (30 cm)	M16 x 2	1.23 (38)
F6-HPS-21	Water, oils, chemicals	Polypropylene/ polypropylene	176°F (80°C)	116 psig (8 bar)	0.60	20 VA: 0.08 A @ 240 VAC	20 AWG, 11.8″ (30 cm)	1/2″ NPT	1.23 (38)
F6-HPS-31	Water, oils, chemicals	Polypropylene/ polypropylene	176°F (80°C)	116 psig (8 bar)	0.60	20 VA: 0.08 A @ 240 VAC	20 AWG, 11.8″ (30 cm)	1/2″ NPT	1.41 (40)
F6-MHS	Corrosives	304 SS/304 SS	257°F (125°C)	218 psig (15 bar)	0.85	20 VA: 0.08 A @ 240 VAC	22 AWG, 11.8″ (30 cm)	M16 x 2	3.35 (95)
F6-MHS2	Water, oils, chemicals	304 SS/304 SS	257°F (125°C)	363 psig (25 bar)	0.85	70 VA: 0.7 A @ 250 VAC	22 AWG, 11.8″ (30 cm)	1/2″ NPT	4.8 (136)
F7-HSS†	High temp/pressure, corrosive, expl.	316 SS/316 SS	392°F (200°C)	300 psig (20.7 bar)	0.60	30 VA: 0.14 A @ 220 VAC	22 AWG, 24″ (61 cm)	1/2″ NPT (int/ext)	3 (94)

Model	Style/Applications	Material Float/Stem	Temperature Limits	Pressure Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg	Weight oz (g)
F7-SS6	Bent stem/liquids with metal particles	316 SS/316 SS	300°F (149°C)	100 psig (7 bar)	0.70	20 VA: 0.08 A @ 220 VAC N.O. operation	22 AWG, 24″ (61 cm)	3/8″-24″ UNF-2A	2 (58)
F7-SS6B	Bent stem/liquids with metal particles	316 SS/316 SS	300°F (149°C)	100 psig (7 bar)	0.70	20 VA: 0.08 A @ 220 VAC N.C. operation	22 AWG, 24″ (61 cm)	3/8″-24″ UNF-2A	2 (58)
F7-EB‡**	Non-intrusive bottle type/ Outside tank mounting	Brass/316 SS (Brass housing)	300°F (149°C)	500 psig (34 bar)	0.75	20 VA: 0.08 A @ 240 VAC	18 AWG, 24″ (61 cm)	3/4″ NPT female	5 lb 5 oz (2.4 kg)
F7-LL	Vertical/detect levels as low as 5/8″	Polysulfone/ Buna-N	180°F (82°C)	50 psig (3 bar)	–	20 VA: 0.08 A @ 240 VAC	22 AWG, 72″ (182 cm)	1/8″ NPT male	2 (58)
F7-WBB	25′ cable, slosh shield/ Sumps, stand pipes	Brass/Buna-N	180°F (82°C)	150 psig (10 bar)	0.45	20 VA: 0.08 A @ 240 VAC	22 AWG, 25′ (7.6 m)	–	10.8 (310)

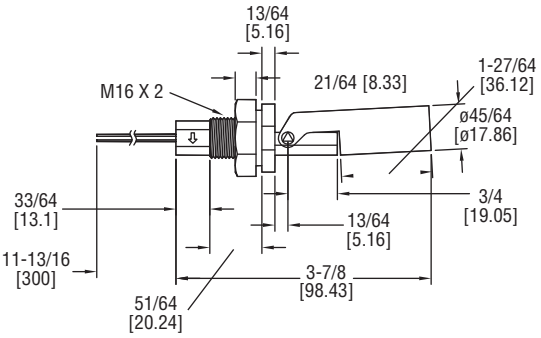
† F7-HSS is rated explosion-proof for Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III.
‡ Explosion proof model available with DPDT switch. **Example:** F7-EBX
** Model available with normally closed switch. **Example:** F7-EBNC

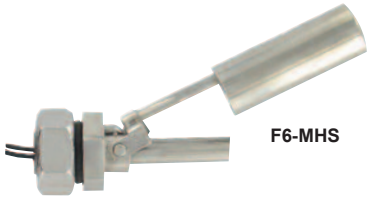
Series F6 Horizontal and Vertical Mount Level Switches

Specifications - Installation and Operating Instructions

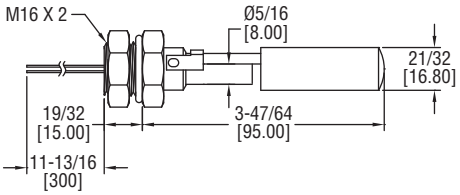


F6-HPS-11



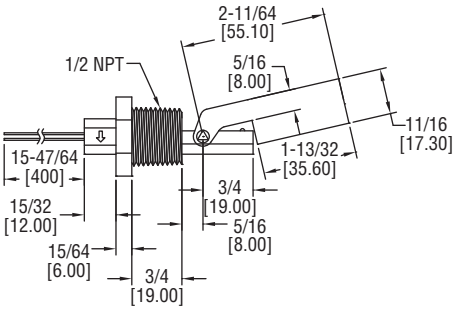


F6-MHS



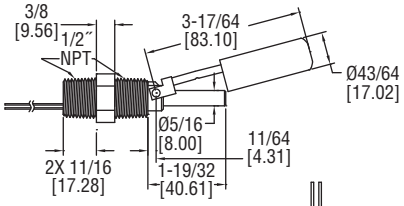


F6-HPS-21



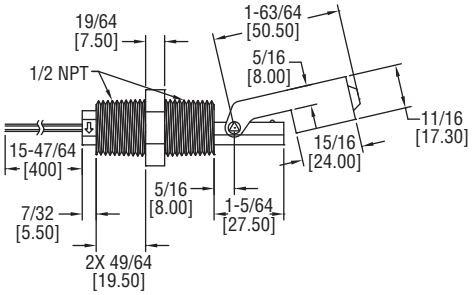


F6-MHS2



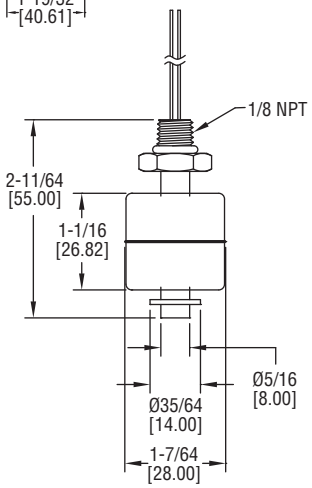


F6-HPS-31





F6-SS



Series F6 Level Switches provide a simple, inexpensive control of the liquid level within a tank. Switch ratings are suitable for many solid-state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels.

SPECIFICATIONS

Service: Compatible liquids.
Wetted Materials: See model table.
Temperature Limit: F6-SS, F6-MHS & F6-MHS2: -4 to 257°F (-20 to 125°C); F6-HPS-11, 21, 31: 14 to 176°F (-10 to 80°C).
Pressure Limit: F6-SS & F6-MHS: 218 psi (15 bar); F6-HPS-11, 21, 31: 116 psi (8 bar); FS-MHS2: 363 psi (25 bar).
Enclosure Rating: General purpose.
Switch Type: SPST Hermetically sealed reed switch, reversible for N.O. or N.C.
Electrical Rating: 20VA: 0.17A @ 120VAC, 0.08A @ 240 VAC.
Electrical Connections: 22 AWG, 11.811″ (300mm) long.
Process Connection: F6-SS: 1/8″ NPT; F6-HPS-21, 31, F6-MHS2: 1/2″ NPT; F6-MHS, F6-HPS-11: M16*2.
Mounting Orientation: F6-SS: Vertical ±20°; F6-MHS/HPS/MHS2: Horizontal with index arrow pointing up or down.
Weight: F6-HPS-11, 21: 1.23 oz (38 g); F6-MHS-31: 1.41 oz (40 g); F6-MHS: 3.35 oz (95 g); F6-SS: 1.59 oz (45 g); F6-MHS2: 4.8 oz (136 g).
Specific Gravity: F6-SS: 0.65, F6-MHS, MHS2: 0.85, F6-HPS-11, 21, 31: 0.6.

W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC.
P.O. BOX 358 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Phone: 219/879-8000
Fax: 219/872-9057
www.dwyer-inst.com
e-mail: info@dwyermail.com

Switch Action (Normally Open, Normally Closed)

Vertical Models

Vertical mount models are shipped with normally open switch contacts that close as the float rises toward the mounting threads. To reverse the switch action, remove the float, rotate it end-for-end, and then replace it back on the stem. The floats will be marked for Normal Open and Normal Closed orientation.

Horizontal Models

Contacts in the horizontal models F6-HPS-11 (internally mounted), F6-HPS-21 (externally mounted), and F6-HPS-31 (internally or externally mounted) have indicating arrows on the wrench flat end of the switch to confirm float alignment. When the indicating arrow points up and the float is below the stem the switch is normally open and when the indicating arrow points down and the float is above the stem the switch is normally closed. The models F6-MHS and F6-MHS2 do not have an indication arrow to show normally open or closed orientation. The models F6-MHS and F6-MHS2 are normally open when the switch is oriented so that the float is directly below the stem and normally closed when the switch is oriented so that the float is directly above the stem.

Installation

Choose a location away from fill pipes, drains, or other areas where turbulence or wave motion might occur. Turbulence will cause false actuations and shorten contact life. Excess contaminants in fluid may inhibit float operation and an occasional wipe-down may be necessary. Care should be taken that switches are always operated within electrical ratings.

Mounting

Install the vertical mount model in an appropriate 1/8" NPT fitting. The vertical model mounts internally. It should be aligned within ±20° of vertical, or select optional fittings for external mounting. Models F6-HPS-11, F6-MHS and F6-MHS2 must be mounted internally, which means the switch must be secured to the wall of the tank or vessel from the inside. Install horizontal models F6-HPS-11 and F6-MHS in a M16 suitable size hole and secure them with the nut provided. Models F6-HPS-21 and F6-MHS2 require a horizontal 1/2″ NPT fitting and can be fitted to the tank or vessel from the outside. Models F6-HPS-31 and F6-MHS2 require a horizontal 1/2″ NPT fitting and can be mounted from the inside or outside (internally or externally) of the tank or vessel.

MAINTENANCE

Upon final installation of the Series F6 Level Switches, no routine maintenance is required. A periodic check of system calibration is recommended. The Series F6 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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P.O. BOX 358 • MICHIGAN CITY, INDIANA 46360 U.S.A.

Phone: 219/879-8000
Fax: 219/872-9057

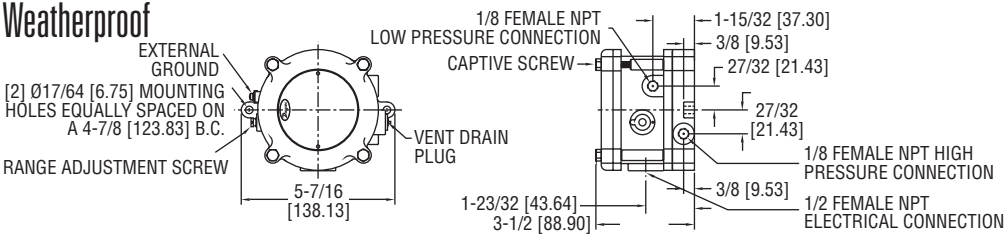
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Dwyer

EXPLOSION-PROOF DIFFERENTIAL PRESSURE SWITCH

Compact, Low Cost, Explosion-proof and Weatherproof





SERIES 1950 Explosion-proof Differential Pressure Switch combines the best features of the popular Dwyer® Series 1900 Pressure Switch with an integral explosion-proof and weatherproof housing, making it an exceptional value for either application. It is CE, UL and CSA listed, FM approved for use in Class I, Div 1, Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres NEMA 7 & 9. Rain tight NEMA 3 (IP54), weatherproof features include a drain plug and O-ring seal in cover. Electrical connections are easily made by removing front cover. For convenience the set point adjustment screw is located on the outside of the housing. Twelve models offer set points from .03 to 20 in w.c. (0.0075 to 5 kPa) and from .5 to 60 psi (0.035 to 3.5 bar). The unit is very light and compact - about half the weight and bulk of other explosion-proof or weatherproof switches with separate enclosures.
CAUTION: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

FEATURES/BENEFITS

- Explosion-proof and weatherproof housing provides device protection for outdoor use or harsh environment operation
- External set point screw provides easy access that simplifies making adjustments without opening or disassembling enclosure
- Easily accessible electrical connection simplifies the installation

APPLICATIONS

• HVAC applications • Process applications • All-weather applications

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits: Continuous: 1950's - 45 in w.c. (0.11 bar); 1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar). Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: NEMA 3 (IP54), NEMA 7 & 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, CSA, FM, UL.

MODEL CHART

Model	Range, psid	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model*	Range*	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model	Range, in w.c.	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point
1950P-2-2F	0.5 to 2	0.3	0.3	**1950P-50-2F**	15 to 50	1.0	1.5	**1950-1-2F**	.4 to 1.6	.15	.20
1950P-8-2F	1.5 to 8	1.0	1.0	**1950-02-2S**	.03 to .10	.025	.05	**1950-5-2F**	1.4 to 5.5	.30	.40
1950P-15-2F	3 to 15	0.9	0.9	**1950-00-2F**	.07 to .15	.04	.05	**1950-10-2F**	3 to 11	.40	.50
1950P-25-2F	4 to 25	0.7	0.7	**1950-0-2F**	.15 to .50	.10	.15	**1950-20-2F**	4 to 20	.40	.60

*P=PSID range models. Other ranges in w.c.

Caution: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

Series 1950 Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION
For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

Note: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

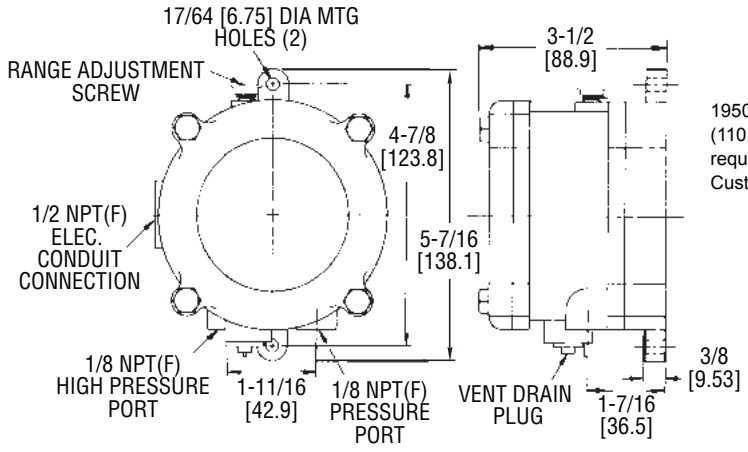
Series 1950 Switches
Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02-2S	0.03 to 0.10	0.025	0.05
1950-00-2F	0.07 to 0.15	0.04	0.05
1950-0-2F	0.15 to 0.5	0.10	0.15
1950-1-2F	0.4 to 1.6	0.15	0.20
1950-5-2F	1.4 to 5.5	0.3	0.4
1950-10-2F	3.0 to 11.0	0.4	0.5
1950-20-2F	4.0 to 20.0	0.4	0.6
	Operating	Approximate Dead Band	
Model Number	Range: PSI	Min. Set Point	Max. Set Point
1950P-2-2F	0.5 to 2.0	0.3 psi	0.3 psi
1950P-8-2F	1.5 to 8.0	1.0 psi	1.0 psi
1950P-15-2F	3.0 to 15.0	0.9 psi	0.9 psi
1950P-25-2F	4.0 to 25.0	0.7 psi	0.7 psi
1950P-50-2F	15.0 to 50	1.0 psi	1.5 psi

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits:
Continuous: 1950's - 45″ w.c. (0.11 bar);
1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar).
Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: IP54, NEMA 3, 7 and 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, UL, CSA, FM.

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 **www.dwyer-inst.com**
Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**



1950-02: 7-3/4″ (196.9) dia. x 4-11/32″ (110.3) depth. For complete dimensions request drawing 28-700175-00 from our Customer Service Department

1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Specifications on reverse. Switch may be installed outdoors or in areas where the hazard of explosion exists. See reverse for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4″ O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8″ female NPT pressure ports as noted below:

A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.

B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.

C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked “COM” (common), “NO” (norm open), “NC” (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the set point pressure and counterclockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a “T” assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch. The Series 1950 Explosion-Proof Differential Pressure Switch is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

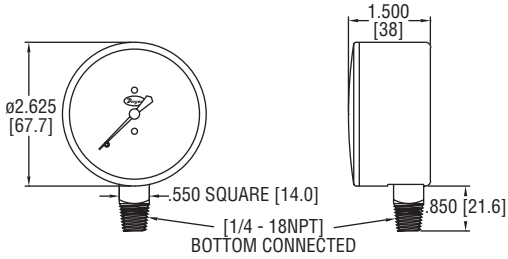
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DWYER INSTRUMENTS, INC.
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Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**

2.5″ LOW PRESSURE GAGE

1.5% Full-Scale Accuracy in a 2.5″ Gage





Our **SERIES LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

FEATURES/BENEFITS
- Low pressure gage provides a selection to meet specific applications
- Specified with high ambient and process temperature ratings mean more robust uses and longer service-life
- High accuracy gage for applications requiring more precise measurement is a concern

APPLICATIONS
- Air flow indication
- Liquid level
- Draft measurement

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% FS.
Pressure Limit: 100% of range scale.
Temperature Limits: Process: -40 to 160°F (-40 to 70°C); Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

OPTION	
Use order code:	**Description**
NISTCAL-PG1	NIST traceable calibration certificate

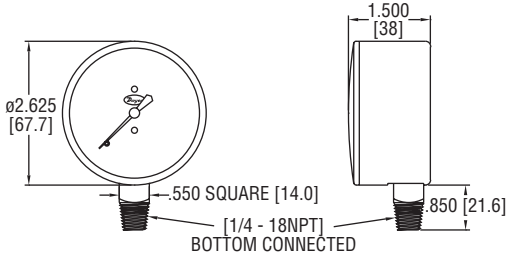
MODEL CHART

Model	Range	Model	Range
LPG4-D7122N	-10 to 0 in w.c. (-2.5 to 0 kPa)	**LPG4-D8322N**	0 to 40 in w.c. (0 to 10 kPa)
LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	**LPG4-D8422N**	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	**LPG4-D8522N**	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	**LPG4-D8622N**	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	**LPG4-D8722N**	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	**LPG4-D8922N**	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	**LPG4-D9022N**	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	**LPG4-D9122N**	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	**LPG4-D9222N**	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	**LPG4-D9322N**	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	**LPG4-D9422N**	-30 to 0 to 50 in w.c. (-7.5 to 0 to 12.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	**LPG4-D9522N**	-40 to 0 to 60 in w.c. (-10 to 0 to 15.0 kPa)

2.5″ LOW PRESSURE GAGE

1.5% Full-Scale Accuracy in a 2.5″ Gage





Our **SERIES LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

FEATURES/BENEFITS
- Low pressure gage provides a selection to meet specific applications
- Specified with high ambient and process temperature ratings mean more robust uses and longer service-life
- High accuracy gage for applications requiring more precise measurement is a concern

APPLICATIONS
- Air flow indication
- Liquid level
- Draft measurement

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% FS.
Pressure Limit: 100% of range scale.
Temperature Limits: Process: -40 to 160°F (-40 to 70°C); Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

OPTION	
Use order code:	**Description**
NISTCAL-PG1	NIST traceable calibration certificate

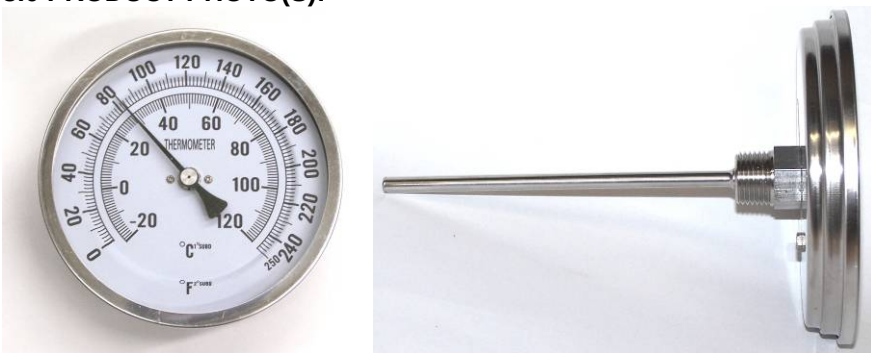
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LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	**LPG4-D8422N**	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	**LPG4-D8522N**	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	**LPG4-D8622N**	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	**LPG4-D8722N**	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	**LPG4-D8922N**	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	**LPG4-D9022N**	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	**LPG4-D9122N**	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	**LPG4-D9222N**	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	**LPG4-D9322N**	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	**LPG4-D9422N**	-30 to 0 to 50 in w.c. (-7.5 to 0 to 12.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	**LPG4-D9522N**	-40 to 0 to 60 in w.c. (-10 to 0 to 15.0 kPa)

GRAINGER® FOR THE ONES WHO GET IT DONE GRAINGER INTERNATIONAL, INC. GLOBAL SOURCING DIVISION	-- GGS TECHNICAL SPECIFICATION --			
	SPECIFICATION NUMBER: 1NFY4_TSRev1.doc	AUTHOR: Hoskinson	TITLE: ENG	REL. DATE: 5/25/07
	GGS MODEL NUMBER(s): 1NFY4	DESCRIPTION: Industrial thermometer	REVISION #: 1	REV. DATE: 8/10/07

1.0 BRAND:	No brand
2.0 PRODUCT DESCRIPTION:	Bimetal Industrial Thermometer

3.0 PRODUCT PHOTO(S):



4.0 PRODUCT REQUIREMENTS:

4.1 Features & Performance	Requirement
Temperature scale(s)	°F: 0 to 250 °C: -20 to 120
Connection location/type	Back; 1/2 inch NPT
Dial size (inches)	3
Stem length (inches)	2 1/2
Stem diameter (inches)	1/4 In
Rotated degrees	N/A
Angled degrees	N/A
Full scale accuracy	≤40°F: ±1.5% 41 to 200°F: ±1% ≥201°F: ±1.5%
Calibration	External Adjustment

4.2 Materials & Construction	Requirement
Case	Stainless Steel Hermetically Sealed to Prevent Icing/Fogging Inside
Stem	Stainless Steel
Coil dampening	Silicone for Superior Time Response and Vibration Dampening
Dial face	Glass

4.3 Finish / Color	Requirement
All Surface Finishes	a) Surface finishes must be uniform and continuous. The surface finish must not exhibit any visual defects such as blisters, rust, corrosion, scratches, peeling, bubbles, and/or cracking. b) All exposed surfaces must be free of burrs and sharp edges. c) All applied finishes must adhere to the surface and show no signs of delamination or peeling.
Finish	Stainless Steel

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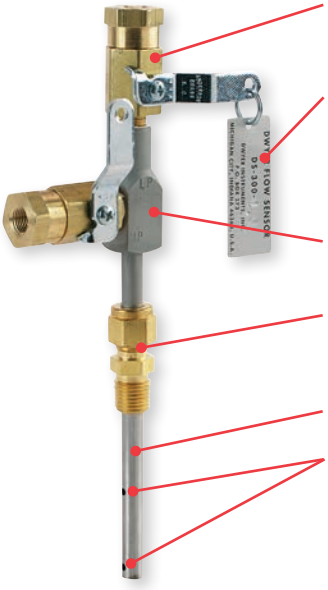
This specification is based on the manufacturers design and is to be used as a Quality Control document.

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Dwyer

IN-LINE FLOW SENSORS

Use with the Dwyer® Differential Pressure Gages or Transmitters



Valves — Standard, brass with TFE seat and Buna-N O-ring

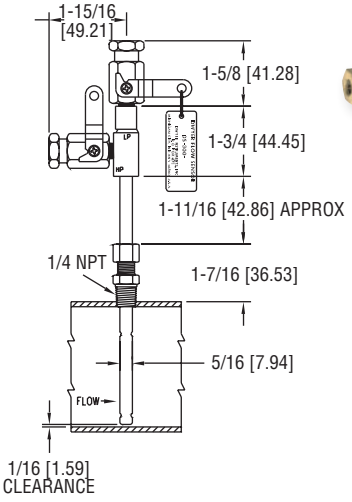
Nameplate — Stainless steel permanently attached with split ring. Includes complete size and model information.

Head — Machined stainless steel.

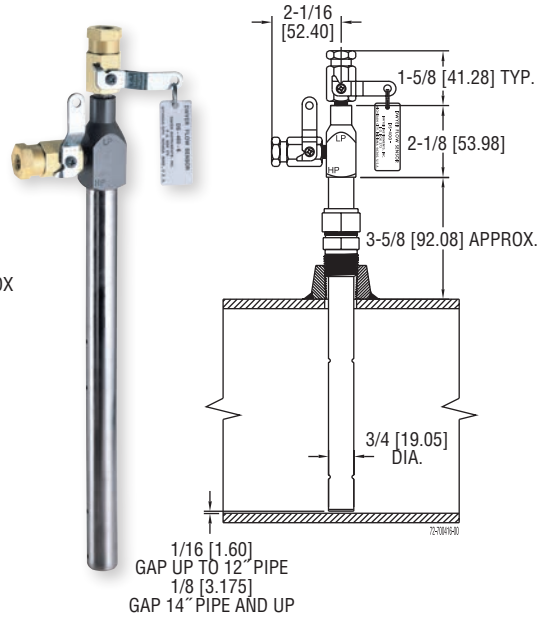
Packing gland — Brass compression fitting.

Sensor tube — 304 SS.

Sensing ports — Multiple upstream and downstream ports sized and positioned to provide effective accurate pressure averaging, even at lower velocities.



Series DS-300



Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches

Series DS-400

The **SERIES DS** In-Line Flow Sensors are two Series of averaging Pitot tubes for compatible gases and liquids that provide accurate and convenient flow rate sensing, for schedule 40 pipe, when purchased with suitable differential pressure gage with appropriate range.

The Series DS-300 Averaging Flow Sensors are designed to be inserted in the pipeline through a compression fitting and available for pipe sizes from 1 to 10″ (2.5 to 25.4 cm). Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® Gage Kit.

The Series DS-400 Averaging Flow Sensors are designed for insertion lengths up to 24″ (61 cm) and include a pair of 1/8″ NPT x 1/4″ SAE 45° flared adapters which are compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. The supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a threaded branch connection (not included).

FEATURES/BENEFITS

- Multiple sensing point measurement and built-in averaging capability eliminates the need for “traversing” the flowing stream with single point velocity pressure measurement saving time
- Extremely reliable, proven technology, Pitot tubes, have been used in flow measurement for years
- All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing with 1/8″ female NPT valve assembly process connections.
- Furnished with instrument shut-off valves on both pressure connections with 1/8″ female NPT connections rated at 200 psig (13.7 bar) and 200°F (93.3°C)
- Where valves are not required, they can be omitted at reduced cost
- The Series DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water
- Economical flow indication when used with appropriate differential pressure gage
- Rugged construction yields, non-clogging, stable design

APPLICATIONS

- Remediation
- Natural, flare, flue, stack gas
- Boiler feedwater
- Cooling water
- Superheated, saturated, or geothermal steam
- Combustion or compressed air
- Oil flow monitoring

IN-LINE FLOW SENSORS

Use with the Dwyer® Differential Pressure Gages or Transmitters

HOW TO ORDER

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2″ pipe would be a Model No. DS-300-2″.

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

MODEL CHART

Model	Description	Model	Description
DS-300-1″	1″ pipe size	**DS-400-6″**	6″ pipe size
DS-300-1-1/4″	1-1/4″ pipe size	**DS-400-8″**	8″ pipe size
DS-300-1-1/2″	1-1/2″ pipe size	**DS-400-10″**	10″ pipe size
DS-300-2″	2″ pipe size	**DS-400-12″**	12″ pipe size
DS-300-2-1/2″	2-1/2″ pipe size	**DS-400-14″**	14″ pipe size
DS-300-3″	3″ pipe size	**DS-400-16″**	16″ pipe size
DS-300-4″	4″ pipe size	**DS-400-18″**	18″ pipe size
DS-300-6″	6″ pipe size	**DS-400-20″**	20″ pipe size
DS-300-8	8″ pipe size	**DS-400-24″**	24″ pipe size
DS-300-10″	10″ pipe size		

OPTION

To order add suffix:	Description
-LV	DS-300 or DS-400 Less Valves

RANGE CHART

Gage Range (in w.c.)	Media @ 70°F	Full Range Flows by Pipe Size (Approximate)									
		1″	1-1/4″	1-1/2″	2″	2-1/2″	3″	4″	6″	8″	10″
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
2	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
2	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
5	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
5	Air @ 100 PSIG (SCFM)	83.0	142.0	190.0	340.0	610	820	1600	3300	5700	10000
10	Water (GPM)	11.0	19.0	25.5	45.5	67	110	195	450	800	1260
10	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
10	Air @ 100 PSIG (SCFM)	120.0	205.0	275.0	470.0	740	1100	2000	4600	8100	15000
25	Water (GPM)	18.0	32.0	40.5	72.0	108	173	310	720	1250	2000
25	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
25	Air @ 100 PSIG (SCFM)	185.0	325.0	430.0	760.0	1200	1800	3300	7200	13000	22000
50	Water (GPM)	25.0	44.0	57.5	100.0	152	247	435	1000	1800	
50	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
50	Air @ 100 PSIG (SCFM)	260.0	460.0	620.0	1050.0	1700	2600	4600	10000	18500	
100	Water (GPM)	36.5	62.0	82.0	142.0	220	350	620	1500		
100	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
100	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

ACCESSORIES

Model	Description
A-160	Threaded branch connection, 3/8″ NPT, forged steel, 3000 psi
A-161	Brass bushing, 1/4″ x 3/8″
A-471	Portable Kit. For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings.❶
631B	Capsuhelic® Wet/Wet Differential Pressure Transmitter. Low pressure transmitter for use with DS-300/400 flow sensors. Use Series 631B Capsuhelic® Wet/Wet Differential Pressure Transmitter.❷



Capsuhelic® Gage Shown Installed In A-471 Portable Kit



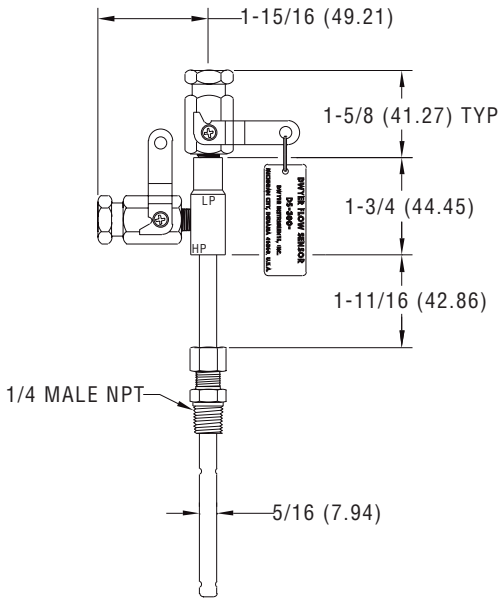
Series 631B

❶See page 15 (Series 4000)
❷See page 60 (Series 631B)

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations





Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

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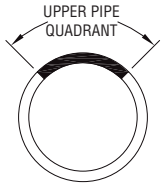
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

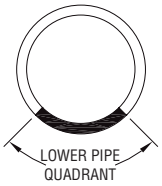
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4˝ x 3/8˝) will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16˝ to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

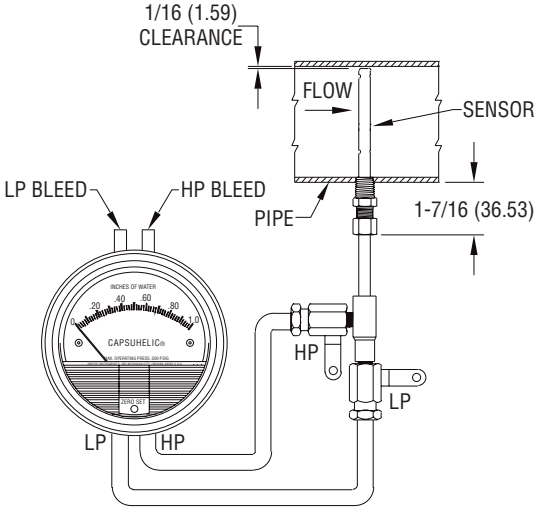
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

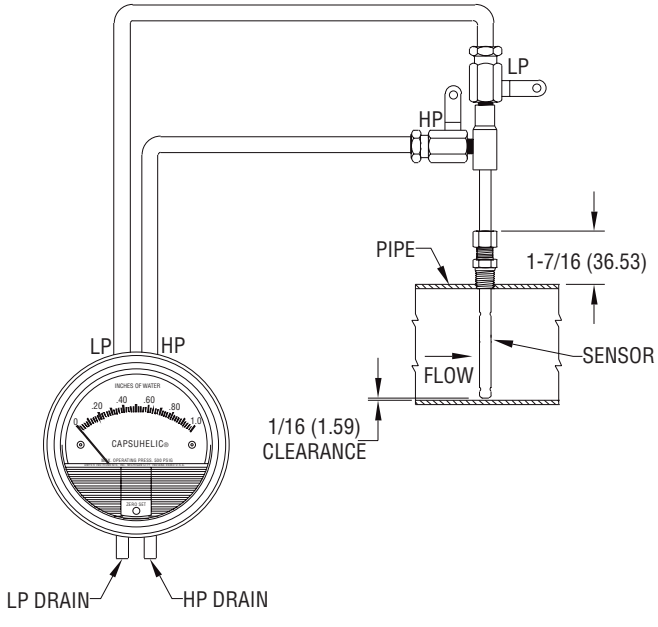
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

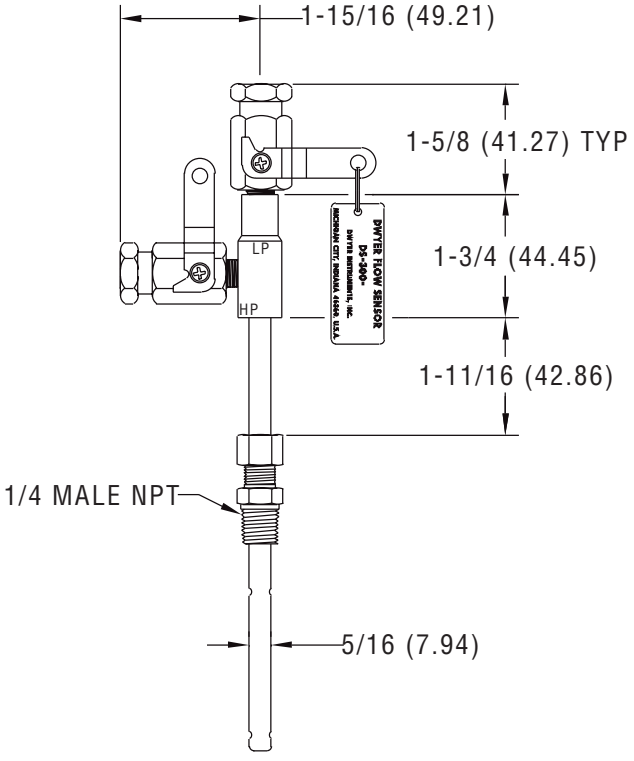
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 “Flow of Fluids Through Valves, Fittings and Pipe.” It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient “K”	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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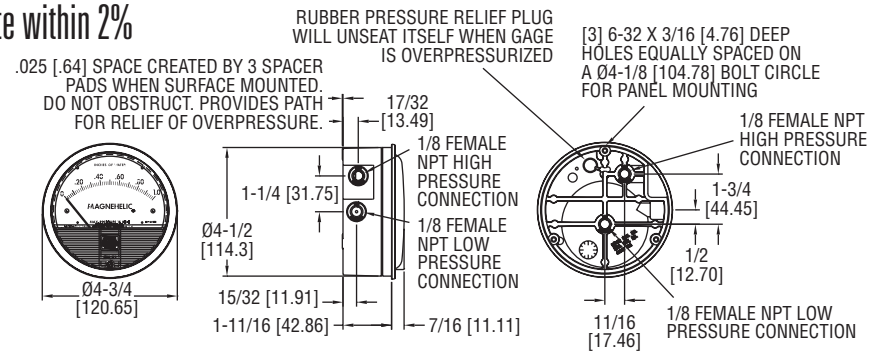
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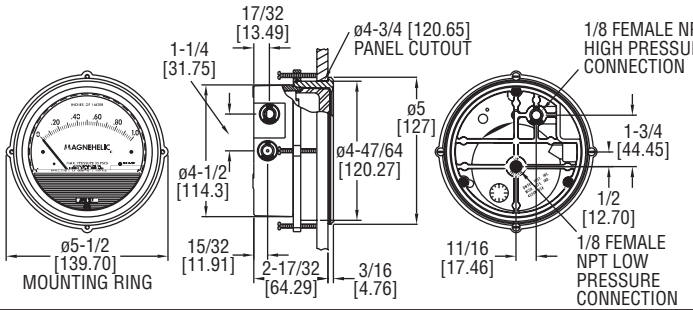
Dwyer

MAGNEHELIC® DIFFERENTIAL PRESSURE GAGES

Indicate Positive, Negative or Differential, Accurate within 2%







Scan here to watch product video

Select the **SERIES 2000** Magnehelic® Gage for high accuracy--guaranteed within 2% of full scale--and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures--either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures.

FEATURES/BENEFITS

- Easy to read gage through undistorted plastic face permits viewing from far away
- Patented design provides quick response to pressure changes means no delay in assessing critical situations
- Durable and rugged housing and high-quality components combine to provide long-service life and minimized down-time

APPLICATIONS

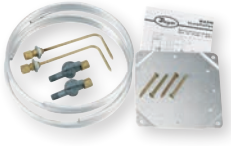
- Filter monitoring
- Air velocity with Dwyer pitot tube
- Blower vacuum monitoring
- Fan pressure indication
- Duct, room or building pressures
- Clean room positive pressure indication

SPECIFICATIONS	
Service: Air and non-combustible, compatible gases (natural gas option available). Note: May be used with hydrogen. Order a Buna-N diaphragm. Pressures must be less than 35 psi. **Wetted Materials:** Consult factory. **Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test. **Accuracy:** ±2% of FS (±3% on -0, -100PA, -125PA, -10MM and ±4% on -00, -60PA, -6MM ranges), throughout range at 70°F (21.1°C). **Pressure Limits:** -20 in Hg to 15 psig† (-0.677 to 1.034 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar). **Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.❶ **Temperature Limits:** 20 to 140°F* (-6.67 to 60°C). -20°F (-28°C) with low temperature option.	**Size:** 4″ (101.6 mm) diameter dial face. **Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations. **Process Connections:** 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back. **Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g). **Standard Accessories:** Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter, and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for three adapters in MP & HP gage accessories.) **Agency Approvals:** Meets the technical requirements of EU Directive 2011/65/EU (RoHS II). Note: -SP models not RoHS approved.
Note: For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.	
*Low temperature models available as special options.	

ACCESSORIES	
Model	**Description**
A-432	Portable kit; combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ ID rubber tubing, standhang bracket and terminal tube with holder
A-605	Air filter gage accessory kit; adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing, two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves
A-605B	Air filter gage accessory kit; air filter kit with two plastic open/close valves, two 4″ steel static tips, plastic tubing and mounting flange
A-605C	Air filter gage accessory kit; air filter kit with two plastic open/close valves, two plastic static tips, plastic tubing and mounting flange



A-432



A-605

❶Over Protection Note: See page 5 (Series 2000)

MAGNEHELIC® DIFFERENTIAL PRESSURE GAGES

Indicate Positive, Negative or Differential, Accurate within 2%

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

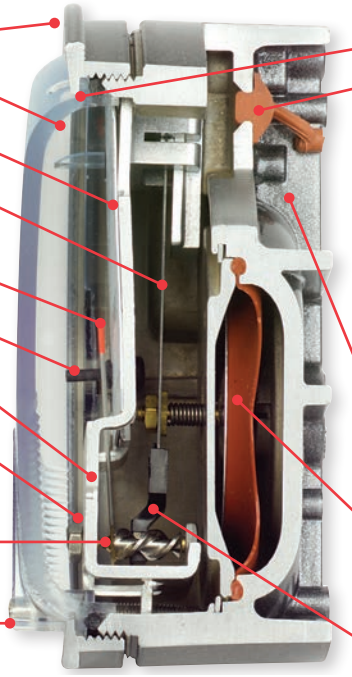
Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

OVERPRESSURE PROTECTION
Blowout plug is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.
The blowout plug is not used on models above 180″ of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings of any component.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

MODEL CHART

Model	Range, Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180*	0-180
2250*	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range, PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

Model	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

Model	Range, MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10

Model	Range, Pa
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-1000
Zero Center Ranges	
Model	**Range, Pa**
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

Model	Range, in w.c./ Velocity F.P.M.
2000-00AV†••	0-.25/ 300-2000
2000-0AV†•	0-.50/ 500-2800
2001AV	0-1.0/ 500-4000
2002AV	0-2.0/ 1000-5600
2005AV	0-5.0/ 2000-8800
2010AV	0-10/ 2000-12500

Dual Scale English/Metric Models

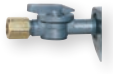
Model	Range, in w.c.	Range, Pa or kPa
2000-00D†••	0-.25	0-62 Pa
2000-0D†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

†These ranges calibrated for vertical scale position • Accuracy ±3% •• Accuracy ±4% *MP option standard **HP option standard

VELOCITY AND VOLUMETRIC FLOW UNITS
Scales are available on the Magnehelic® that read in velocity units (FPM, m/s) or volumetric flow units (SCFM, m^3/s, m^3/h). Stocked velocity units with dual range scales in inches w.c. and feet per minute are shown above. For other ranges contact the factory.
When ordering volumetric flow scales please specify the maximum flow rate and its corresponding pressure.
Example: 0.5 in w.c. = 16,000 CFM.

ACCESSORIES

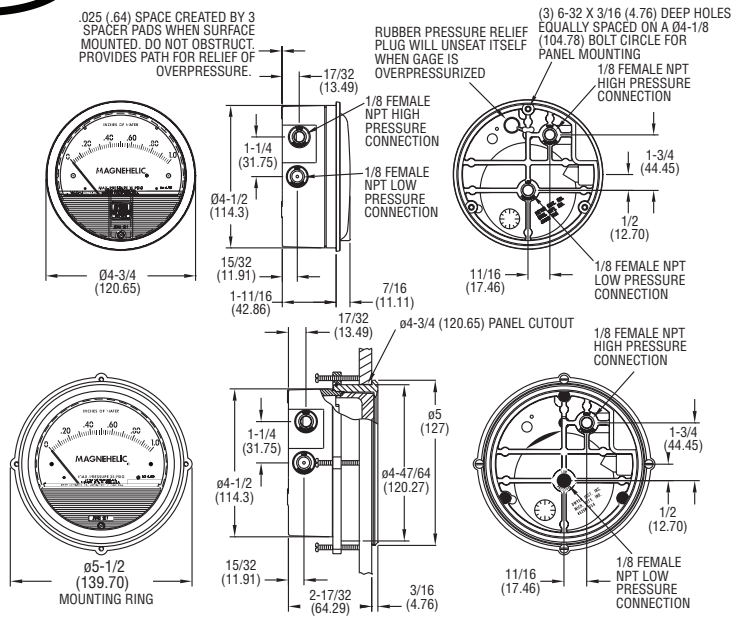
Model	Description
A-321	Safety relief valve
A-448	3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-135	Rubber gasket for panel mounting
A-401	Plastic carry case
A-310A	3-way vent valves. In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.



A-310A

Bulletin A-27

Magnehelic® Differential Pressure Gage



**The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.*

STANDARD GAGE ACCESSORIES: Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapters and three flush mounting adapters with screws.

MP AND HP GAGE ACCESSORIES: Mounting ring and snap ring retainer substituted for 3 adaptors, 1/4" compression fittings replace 1/8" pipe thread to rubber tubing adaptors.

OVERPRESSURE PROTECTION: Standard Magnehelic® Differential Pressure Gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (excludes MP and HP models). To provide a free path for pressure relief, there are four spacer pads which maintain .023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. (MP model has polycarbonate cover).
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on -00, - 00N, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20″ Hg to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
Temperature Limits: 20 to 140°F (-6.67 to 60°C). *Low temperature models available as special option.
Size: 4″ (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Agency Approvals: RoHS.

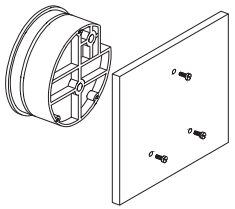
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.

Note: May be used with hydrogen when ordering Buna-N diaphragm. Pressure must be less than 35 psi.

INSTALLATION

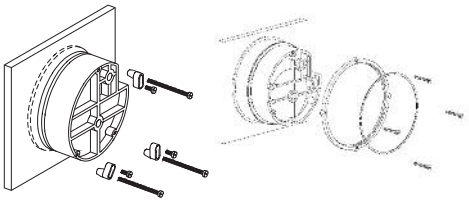
Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.
All standard Magnehelic® Differential Pressure Gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range models of 0.5" w.c. plus 0.25" w.c. and metric equivalents must be used in the vertical position only.

SURFACE MOUNTING



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

FLUSH MOUNTING



Provide a 4-9/16" dia. (116 mm) opening in panel. Provide a 4-3/4" dia. (120 mm) opening for MP and HP models. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place.

PIPE MOUNTING

To mount gage on 1-1/4" - 2" pipe, order optional A-610 pipe mounting kit.

TO ZERO GAGE AFTER INSTALLATION

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

OPERATION

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.
Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.
Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.
When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with flexible rubber or vinyl tubing.
B. For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended.

MAINTENANCE

No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves should be used in permanent installations. The Series 2000 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

WARNING

Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended.

TROUBLE SHOOTING TIPS

Gage won't indicate or is sluggish.

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.

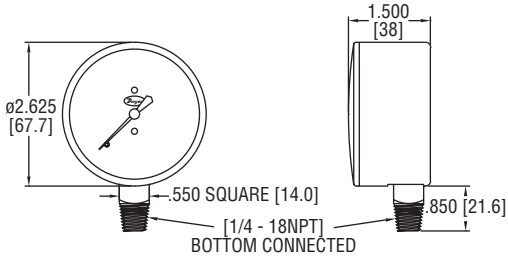
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2.5″ LOW PRESSURE GAGE

1.5% Full-Scale Accuracy in a 2.5″ Gage





Our **SERIES LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

FEATURES/BENEFITS
- Low pressure gage provides a selection to meet specific applications
- Specified with high ambient and process temperature ratings mean more robust uses and longer service-life
- High accuracy gage for applications requiring more precise measurement is a concern

APPLICATIONS
- Air flow indication
- Liquid level
- Draft measurement

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% FS.
Pressure Limit: 100% of range scale.
Temperature Limits: Process: -40 to 160°F (-40 to 70°C); Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

OPTION	
Use order code:	**Description**
NISTCAL-PG1	NIST traceable calibration certificate

MODEL CHART

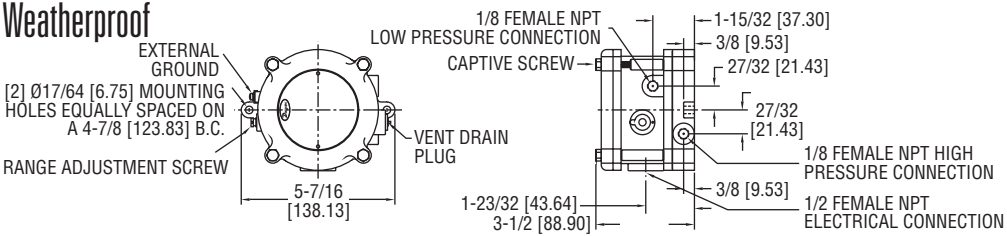
Model	Range	Model	Range
LPG4-D7122N	-10 to 0 in w.c. (-2.5 to 0 kPa)	**LPG4-D8322N**	0 to 40 in w.c. (0 to 10 kPa)
LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	**LPG4-D8422N**	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	**LPG4-D8522N**	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	**LPG4-D8622N**	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	**LPG4-D8722N**	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	**LPG4-D8922N**	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	**LPG4-D9022N**	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	**LPG4-D9122N**	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	**LPG4-D9222N**	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	**LPG4-D9322N**	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	**LPG4-D9422N**	-30 to 0 to 50 in w.c. (-7.5 to 0 to 12.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	**LPG4-D9522N**	-40 to 0 to 60 in w.c. (-10 to 0 to 15.0 kPa)

Dwyer

EXPLOSION-PROOF DIFFERENTIAL PRESSURE SWITCH

Compact, Low Cost, Explosion-proof and Weatherproof





SERIES 1950 Explosion-proof Differential Pressure Switch combines the best features of the popular Dwyer® Series 1900 Pressure Switch with an integral explosion-proof and weatherproof housing, making it an exceptional value for either application. It is CE, UL and CSA listed, FM approved for use in Class I, Div 1, Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres NEMA 7 & 9. Rain tight NEMA 3 (IP54), weatherproof features include a drain plug and O-ring seal in cover. Electrical connections are easily made by removing front cover. For convenience the set point adjustment screw is located on the outside of the housing. Twelve models offer set points from .03 to 20 in w.c. (0.0075 to 5 kPa) and from .5 to 60 psi (0.035 to 3.5 bar). The unit is very light and compact - about half the weight and bulk of other explosion-proof or weatherproof switches with separate enclosures.
CAUTION: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

FEATURES/BENEFITS

- Explosion-proof and weatherproof housing provides device protection for outdoor use or harsh environment operation
- External set point screw provides easy access that simplifies making adjustments without opening or disassembling enclosure
- Easily accessible electrical connection simplifies the installation

APPLICATIONS

• HVAC applications • Process applications • All-weather applications

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits: Continuous: 1950's - 45 in w.c. (0.11 bar); 1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar). Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: NEMA 3 (IP54), NEMA 7 & 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, CSA, FM, UL.

MODEL CHART

Model	Range, psid	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model*	Range*	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model	Range, in w.c.	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point
1950P-2-2F	0.5 to 2	0.3	0.3	**1950P-50-2F**	15 to 50	1.0	1.5	**1950-1-2F**	.4 to 1.6	.15	.20
~~**1950P-8-2F**~~	~~4.5 to 8~~	~~1.0~~	~~1.0~~	**1950-02-2S**	.03 to .10	.025	.05	**1950-5-2F**	1.4 to 5.5	.30	.40
1950P-15-2F	3 to 15	0.9	0.9	**1950-00-2F**	.07 to .15	.04	.05	**1950-10-2F**	3 to 11	.40	.50
1950P-25-2F	4 to 25	0.7	0.7	**1950-0-2F**	.15 to .50	.10	.15	**1950-20-2F**	4 to 20	.40	.60

*P=PSID range models. Other ranges in w.c.

Caution: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

Series 1950 Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION
For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

Note: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

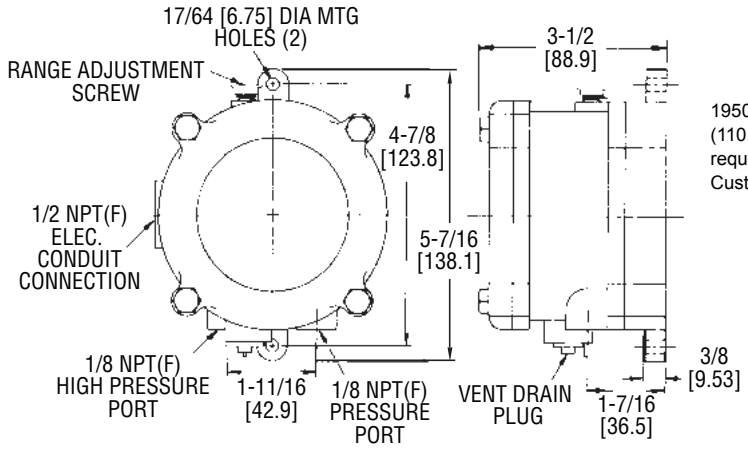
Series 1950 Switches
Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02-2S	0.03 to 0.10	0.025	0.05
1950-00-2F	0.07 to 0.15	0.04	0.05
1950-0-2F	0.15 to 0.5	0.10	0.15
1950-1-2F	0.4 to 1.6	0.15	0.20
1950-5-2F	1.4 to 5.5	0.3	0.4
1950-10-2F	3.0 to 11.0	0.4	0.5
1950-20-2F	4.0 to 20.0	0.4	0.6
	Operating	Approximate Dead Band	
Model Number	Range: PSI	Min. Set Point	Max. Set Point
1950P-2-2F	0.5 to 2.0	0.3 psi	0.3 psi
1950P-8-2F	1.5 to 8.0	1.0 psi	1.0 psi
1950P-15-2F	3.0 to 15.0	0.9 psi	0.9 psi
1950P-25-2F	4.0 to 25.0	0.7 psi	0.7 psi
1950P-50-2F	15.0 to 50	1.0 psi	1.5 psi

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits:
Continuous: 1950's - 45″ w.c. (0.11 bar);
1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar).
Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: IP54, NEMA 3, 7 and 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, UL, CSA, FM.

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

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Phone: 219/879-8000 **www.dwyer-inst.com**
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1950-02: 7-3/4″ (196.9) dia. x 4-11/32″ (110.3) depth. For complete dimensions request drawing 28-700175-00 from our Customer Service Department

1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Specifications on reverse. Switch may be installed outdoors or in areas where the hazard of explosion exists. See reverse for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4″ O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8″ female NPT pressure ports as noted below:

A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.

B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.

C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked “COM” (common), “NO” (norm open), “NC” (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the set point pressure and counterclockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a “T” assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch. The Series 1950 Explosion-Proof Differential Pressure Switch is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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Series SGZ 2.5″ Stainless Steel Industrial Pressure Gage

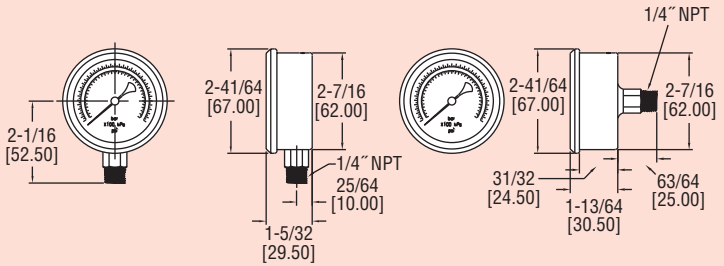
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

Series SGZ 2.5″ Stainless Steel Industrial Pressure Gage

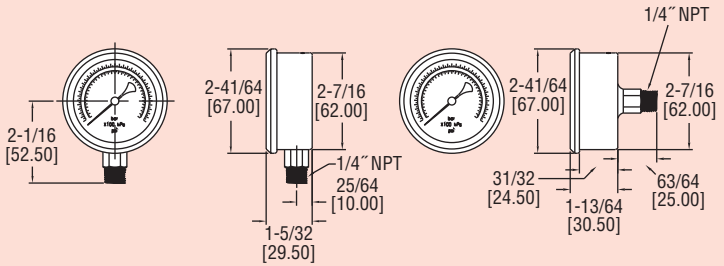
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



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Model	Range	Model	Range
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SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

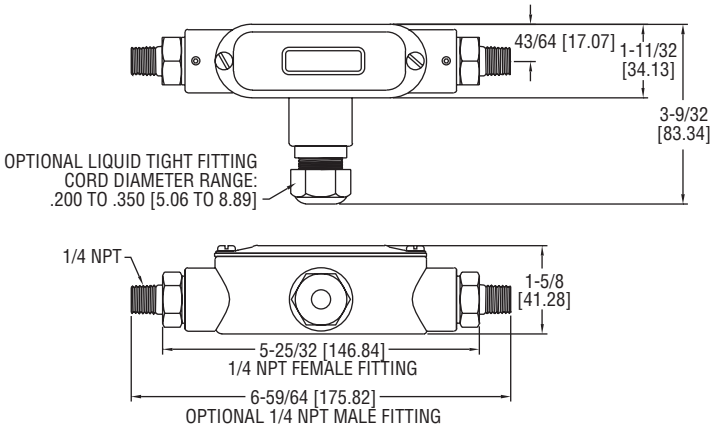
ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

Dwyer

WET/WET DIFFERENTIAL PRESSURE TRANSMITTER

0.5% Accuracy, NEMA 4X (IP66) Enclosure





The **SERIES 629** Differential Pressure Transmitter monitors differential pressure of air and compatible gases and liquids with 0.5% accuracy. The design employs dual pressure sensors converting pressure changes into a standard 4 to 20 mA output signal for two wire circuits. Small internal volume and minimum moving parts result in exceptional response and reliability. Terminal block, zero and span adjustments are easily accessed under the top cover. The Series 629 Differential Pressure Transmitter is designed to meet NEMA 4X (IP66) construction.

FEATURES/BENEFITS

- Versatile, high-accuracy device for liquid or gas supports designs requiring more precise measurements in support of application
- Minimum components provide excellent response and reliability
- Span and zero controls reduce installation and service time
- Terminal block reduces wiring difficulties saving installation time
- Optional LED indicator provides local status to identify operational conditions.
- Optional 3-way valve manifold supports higher line pressures or simplifying removal of transmitter without interrupting process

APPLICATIONS

- Flow elements
- Heat exchangers
- Filters
- Coils
- Chiller
- Pumps

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Without valve: 316, 316L SS. Additional wetted parts with 3-way valve option: Buna-N, silicone grease, PTFE, brass 360, copper, reinforced acetal copolymer.
Accuracy: ±0.5% FS (includes linearity, hysteresis & repeatability).
Temperature Limits: 0 to 200°F (-18 to 93°C).
Compensated Temperature Limits: 0 to 175°F (-18 to 79°C).
Pressure Limits: See chart.
Thermal Effect: 0.02%/°F (0.036%/°C) includes zero & span.
Power Requirements: 13 to 30 VDC (2-wire).
Output Signal: 4 to 20 mA. Optional 0 to 5, 0 to 10 VDC.
Response Time: 50 ms.
Loop Resistance: 0 to 1300 Ω maximum for current output. For voltage outputs, minimum load resistance: 2000 Ω.
Electrical Connections: Terminal block; 1/2″ female NPT conduit.
Process Connections: 1/4″ female NPT.
Enclosure Rating: Designed to meet NEMA 4X (IP66).
Mounting Orientation: Not position sensitive.
Weight: 10.1 oz (286 g).
Agency Approvals: CE.

MODEL CHART - Standard

Model	Range	Pressure Limits	
		Working* Pressure	Over Pressure
629-02-CH-P2-E5-S1	10 psid	20 psi	100 psi
629-03-CH-P2-E5-S1	25 psid	50 psi	250 psi
629-04-CH-P2-E5-S1	50 psid	100 psi	250 psi
629-05-CH-P2-E5-S1	100 psid	200 psi	500 psi

*Pressures exceeding the working pressure limit may cause a calibration shift of up to ±3% of full scale.

MODEL CHART - 3-Way Valve Manifold Assembly

Model	Range	Pressure Limits	
		Working* Pressure	Over Pressure
629-02-CH-P2-E5-S1-3V	10 psid	20 psi	100 psi
629-03-CH-P2-E5-S1-3V	25 psid	50 psi	100 psi
629-04-CH-P2-E5-S1-3V	50 psid	100 psi	100 psi
629-05-CH-P2-E5-S1-3V	100 psid	100 psi	100 psi

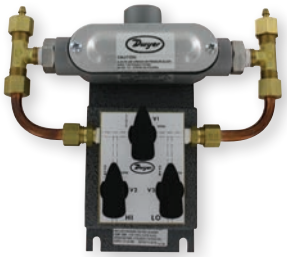
*Pressures exceeding the working pressure limit may cause a calibration shift of up to ±3% of full scale.

OPTIONS

To order add suffix:	Description
-LED	4.5 digit LED display
-NIST	NIST traceable calibration certificate

ACCESSORIES

Model	Description
A-131A	3-way brass manifold valve
641-LED	Field-upgradeable LED
A-155	Cable gland with 1/2″ NPT male
BBV-1B	Mini SS 3-valve block manifold
A-228	12″ SS flex hose



3-way valve assembly with integral bleed screws

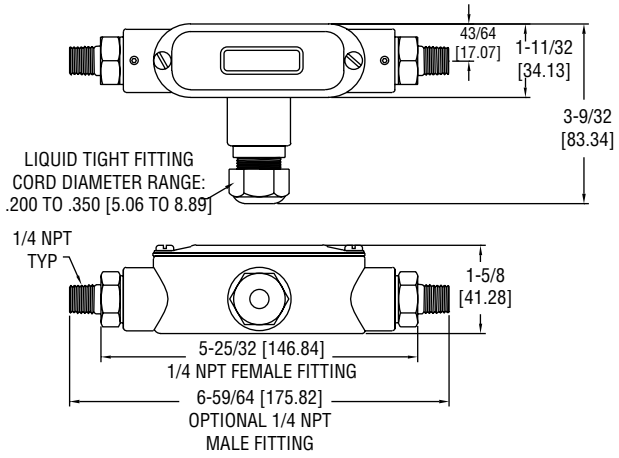


629 shown with optional red LED and cable gland

Series 629 Differential Pressure Transmitter

Specifications - Installation and Operating Instructions





The **SERIES 629** Differential Pressure Transmitter monitors differential pressure of air and compatible gases and liquids with 0.5% accuracy. The design employs dual pressure sensors converting pressure changes into a standard 4-20 mA output signal for two wire circuits. Small internal volume and minimum moving parts result in exceptional response and reliability. Terminal block, zero and span adjustments are easily accessed under the top cover. The Series 629 Differential Pressure Transmitter is designed to meet NEMA-4X (IP66) construction.

PRESSURE LIMITS		
	Max. Static on Either Port	
Range (psid)	Working* Pressure (psi)	Over Pressure (psi)
5	10	50
10	20	100
25	50	250
30	60	250
50	100	250
100	200	500
150	300	750
200	400	1000
300	600	1200
500	1000	2000
*Pressures exceeding the working pressure limit may cause a calibration shift of up to ±3% of full scale.		

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Types 316, 316L SS.
Accuracy: ±0.5% F.S. (includes linearity, hysteresis & repeatability).
Temperature Limits: 0 to 200°F (-18 to 93°C).
Compensated Temperature Limits: 0 to 175°F (-18 to 79°C).
Pressure Limits: See chart.
Thermal Effect: 0.02%/°F (0.036%/°C) includes zero & span.
Power Requirements: 13-30 VDC.
Output Signal: 4 to 20 mA. Optional 0-5, 1-5, 0-10, 1-6 or 2-10 VDC.
Zero & Span: Potentiometers inside conduit enclosure.
Response Time: 50 msec.
Loop Resistance: 0-1300 ohms maximum for current output. For voltage outputs, minimum load resistance: 2000 ohms.
Current Consumption: Transmitter: 40 mA max; Transmitter with optional display: 140 mA max.
Electrical Connections: Terminal block.
Process Connections: 1/4″ female NPT.
Display: Optional 4-1/2 digit 1/2″ (12.7 mm) height LED.
Enclosure Rating: Designed to meet NEMA 4X (IP66) for non-LED models.
Mounting Orientation: Not position sensitive.
Weight: 10.1 oz (286 g).

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INSTALLATION

1. Location: Select a location where the temperature of the unit will be between 0°F and 175°F. Distance from the receiver is limited only by total loop resistance (see electrical connections).The tubing feeding pressure to the instrument can be practically any length required, but long lengths will increase the response time slightly. Mount the instrument in a location that will not be subject to excessive temperature, shock or vibration.

2. Position: A vertical position is recommended (pressure connections pointing horizontally) since that is how all standard models were originally spanned and zeroed at the factory. They can be used at other angles, but may require final spanning and zeroing. Due to potential condensation build up that may travel down conduit or cable and into the housing, it is recommended to install with the electrical conduit or cable gland pointing downward.

3. Pressure Connection: Dual 1/4″ female NPT pressure connections are provided. Use pipe thread sealant tape or other suitable pipe joint compound when making connection to the pressure source. Avoid excess sealant which could block the pressure passage. When monitoring liquid pressures, air trapped in the lines can cause incorrect readings. Bleed fittings or similar mechanisms should be used to bleed off any trapped air.

Optional 3-Way Valve

For applications where higher line pressures may be encountered at installation or when it is necessary to remove the transmitter for maintenance without interrupting the process, the optional three way valve is recommended (See Fig. A).

Begin with valve V1 open and valves V2 and V3 closed (See Fig. B). Slowly open valves V2 and V3. Once the pressure has stabilized and is equal on the high and low side of the transmitter, valve V1 can be closed and normal operation can proceed.

To ensure proper pressures will be detected by the 629 use the bleed fitting provided with this package to free media of bubbles. Before applying pressure to the process connections, turn V1 to the open position and back off the bleed screw. Next apply pressure. After the flowing liquid is free of bubbles, retighten the bleed screw.

Before removing the transmitter from operation, open valve V1 then close valves V2 and V3.

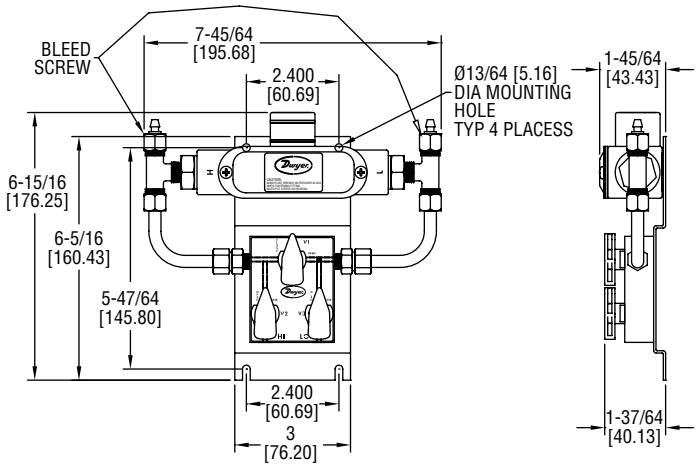


Fig. A

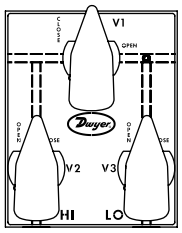


Fig. B

ELECTRICAL CONNECTIONS

Shielded cable is recommended for control loop wiring.

Current Output

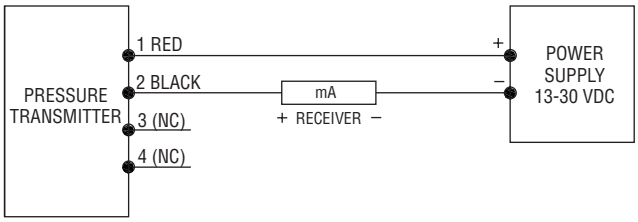
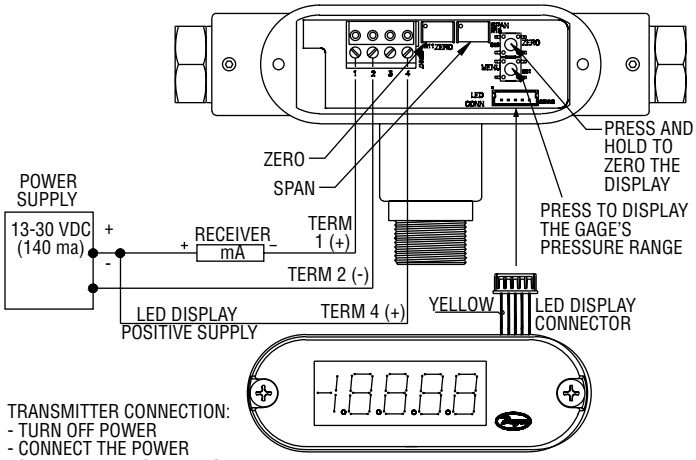


Fig. C: Current output connection

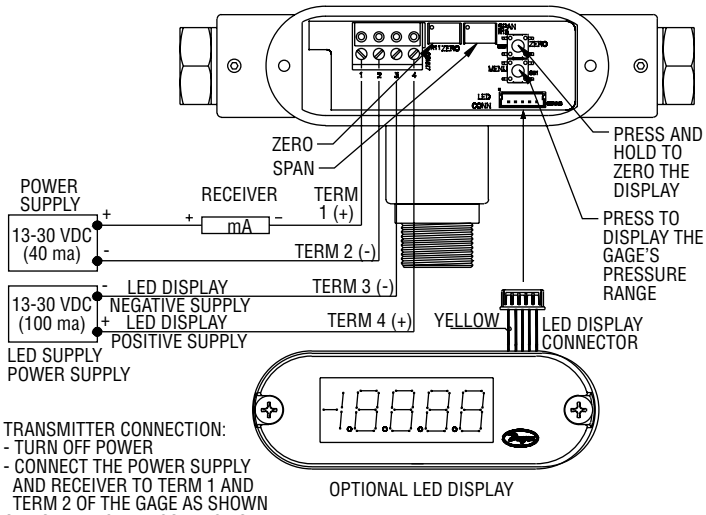
Electrical connections to the Series 629 pressure transmitters are made to the terminal block located inside the housing. Remove the screws and lift off the cover. Wire as shown in Fig. C, D or E. Use Fig. C for current output connection. Use Fig. D for current output with optional LED display. Use Fig. E for current output with optional LED display using two power supplies. If ordering pre-wired cable, black wire is negative (-) and red wire is positive (+).



TRANSMITTER CONNECTION:
- TURN OFF POWER
- CONNECT THE POWER SUPPLY AND RECEIVER TO TERM 1 AND TERM 2 OF THE GAGE AS SHOWN
- CONNECT POWER SUPPLY (+) TO TERMINAL 4 (REQUIRED FOR THE OPTIONAL DISPLAY ONLY)
- INSTALL THE DISPLAY'S CONNECTOR
- TURN ON POWER

BE SURE TO TURN OFF POWER WHEN CONNECTING OR REMOVING THE DISPLAY'S CONNECTOR. FAILURE TO DO SO CAN RESULT IN THE GAGE DAMAGE.

Fig. D: Current output with optional LED display



TRANSMITTER CONNECTION:
- TURN OFF POWER
- CONNECT THE POWER SUPPLY AND RECEIVER TO TERM 1 AND TERM 2 OF THE GAGE AS SHOWN

OPTIONAL DISPLAY CONNECTION:
- CONNECT LED POWER SUPPLY (-) TO TERMINAL 3
- CONNECT LED POWER SUPPLY (+) TO TERMINAL 4
- INSTALL THE DISPLAY'S CONNECTOR
- TURN ON POWER

BE SURE TO TURN OFF POWER WHEN CONNECTING OR REMOVING THE DISPLAY'S CONNECTOR. FAILURE TO DO SO CAN RESULT IN THE GAGE DAMAGE.

Fig. E: Current output with optional LED display using two power supplies

Wire Length - The maximum length of wire connecting transmitter and receiver is a function of wire size and receiver resistance. Wiring should not contribute to more than 10% of receiver resistance to total loop resistance. For extremely long runs (over 1000 ft.), choose receivers with higher resistance to minimize size and cost of connecting leads. When the wiring length is under 100 feet, lead wire as small as 22 AWG can be used.

Current (4-20 mA) Output Operation - An external power supply delivering 13-30 VDC with minimum current capability of 40 mA DC (per transmitter)is required to power the control loop. See Fig. C for connection of the power supply, transmitter, and receiver. The range of the appropriate receiver load resistance (RL) for the DC power supply voltage available is expressed by the formula:

$$R_L \text{ Max} = \frac{Vps - 13}{20 \text{ mA DC}}$$

VOLTAGE (0-5, 1-5, 0-10, 1-6 or 2-10 Volt) OUTPUT OPERATION

For voltage outputs, wire as shown in Fig. F or Fig. G. Use Fig. F for voltage output connection. Use Fig. G for voltage output with optional LED display. Terminal 1 is positive (+), terminal 2 is negative (-), terminal 3 is +Vout, terminal 4 is LED positive supply. If ordering optional pre-wired cable, black wire is negative (-), red wire is positive (+) and white wire is +Vout.

Voltage Output

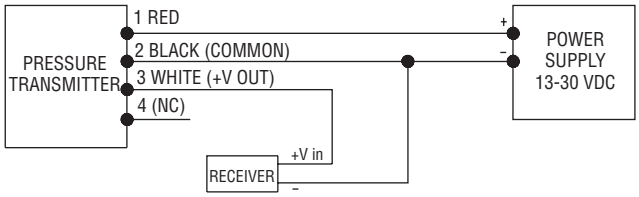
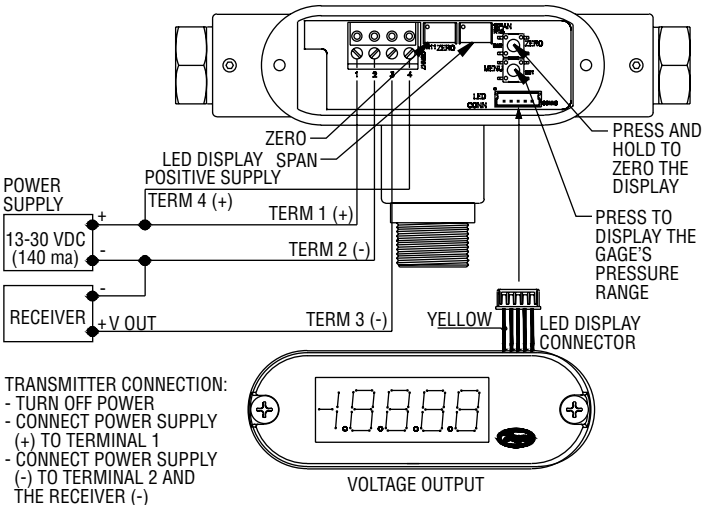


Fig. F: Voltage output connection



TRANSMITTER CONNECTION:
- TURN OFF POWER
- CONNECT POWER SUPPLY (+) TO TERMINAL 1
- CONNECT POWER SUPPLY (-) TO TERMINAL 2 AND THE RECEIVER (-)
- CONNECT THE RECEIVER (+) TO TERMINAL 3
- CONNECT LED POWER SUPPLY (+) TO TERMINAL 4
- INSTALL THE DISPLAY'S CONNECTOR
- TURN ON POWER

OPTIONAL LED DISPLAY
BE SURE TO TURN OFF POWER WHEN CONNECTING OR REMOVING THE DISPLAY'S CONNECTOR. FAILURE TO DO SO CAN RESULT IN THE GAGE DAMAGE.

Fig. G: Voltage output with optional LED display

MULTIPLE RECEIVER INSTALLATION

An advantage of the standard 4-20 mA DC output signal provided by the Series 629 Differential Transmitter is that any number or receivers can be connected in series in the current loop. Thus, an A-701 digital readout, an analog panel meter, a chart recorder, process controlling equipment, or any combination of these devices can be operated simultaneously. It is necessary only that each be equipped with a standard 4-20 mA input and proper polarity of the input connections be observed when inserting the device into the current loop. If any of the receiving devices displays a negative or downscale reading this indicates that the signal input leads are reversed.

MAINTENANCE

Upon final installation of the Series 629 Differential Pressure Transmitter and the companion receiver, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series 629 Differential Pressure Transmitter is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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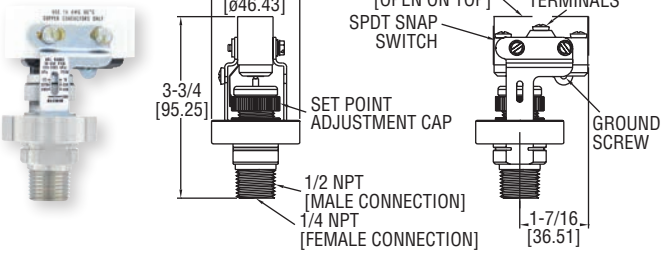
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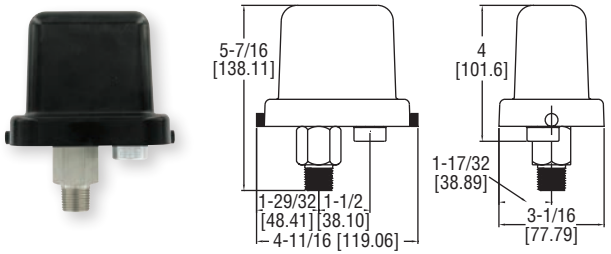
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LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS

- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS

- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
A1F-O-SS-1-1	2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
A1F-O-SS-1-3	8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

Note: Optional enclosure factory installed. To order, change O to PC.
Example: A1F-PC-SS-1-1

Series A1F Compact OEM Pressure Switch

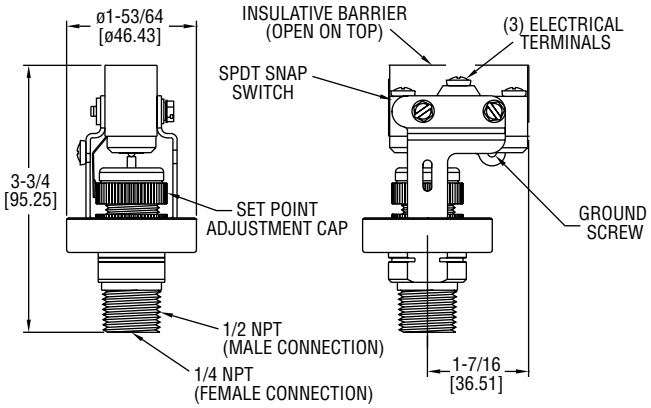
Specifications - Installation and Operating Instructions

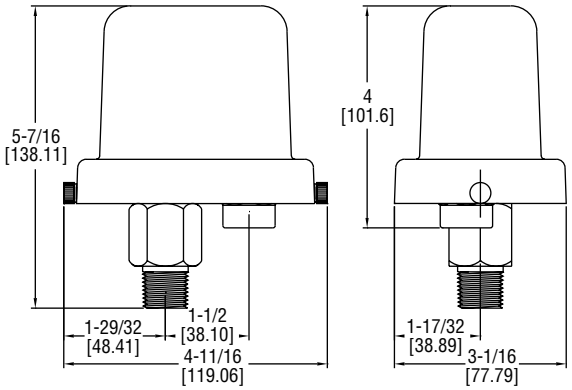


A1F



A1F with A-447





The **SERIES A1F** Compact OEM Pressure Switch is ideal for panel mounting wherever a high-quality, economical open-case or weatherproof control is required.

INSTALLATION

1. Location: Select a location where the temperature limits of -40 to 180°F (-40 to 82°C) will not be exceeded. Locate the switch as close as possible to the pressure source. Long lengths of piping will not affect accuracy of the actuation point but will slightly add to response time.

2. Mounting and Processing Connection: Avoid mounting surfaces with excess vibration which could cause false actuation when pressure is near setpoint. The switch should be mounted within 20° of vertical for proper operation. Mount the switch by connecting it to the process piping using either 1/4″ NPT female or 1/2″ male connection. Pipe joint compound or TFE thread tape should be used to prevent leakage.

3. Electrical Connections: The SPDT snap switch includes normally open, normally closed and common connections. The common and normally open contacts will close and the common and normally closed contacts will open when pressure increases to the setpoint. The actions will reverse when pressure decreases below the setpoint minus the deadband. A green grounding screw is provided on the switch bracket. All wiring should be in accordance with local codes.

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure Chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 500 psig (34 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional A-447 enclosure meets NEMA 4X standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed, See deadband chart.
Weight: 10.5 oz (297 g).

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SETPOINT ADJUSTMENT

1. Determine the setpoint pressure. The approximate actuation point can be set by turning the adjustment cap up or down, aligning the top of the O-ring, located above the cap, with the appropriate scale graduation.
2. Connect tubing or piping from the pressure port on bottom of switch to one leg of a tee. Connect the second leg to a pressure test gage of known accuracy and in an appropriate range. The third leg should be connected to a controllable source of pressure.
3. Connect a volt/ohm meter or other circuit tester to the snap action terminals to indicate when switching occurs.
4. Slowly apply pressure to the system and note the pressure at which switching occurs.
5. Operate the switch through several cycles to confirm proper actuation point.
6. Remove test apparatus and attach switch to pressure source and control circuit wiring. Place switch in service.

Example of how to order:

A1F - O - SS - 1 - 4
1 2 3 4 5

1. Diaphragm Designation:
   F - Fluorocarbon
2. Enclosure Designation:
   O - Open Construction No Enclosure
3. Housing Material Designation:
   SS - 316SS
4. Switch Designation:
   1 - SPDT Snap Action Switch
5. Operating Pressure Range Designation:
   1 - 2 to 15 psig
   2 - 4 to 75 psig
   3 - 8 to 225 psig
   4 - 16 to 450 psig

DEADBAND CHART-PSIG (BAR)		
Range	Deadband at Minimum Range	Deadband at Maximum Range
2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

MAINTENANCE

Upon final installation of the Series A1F Compact OEM Pressure Switch, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series A1F is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

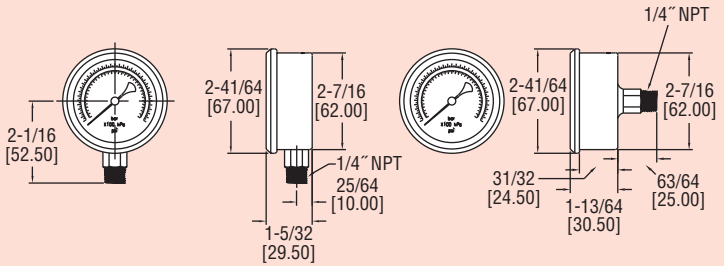
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model.
For back connect, change ending from 22N to 42N

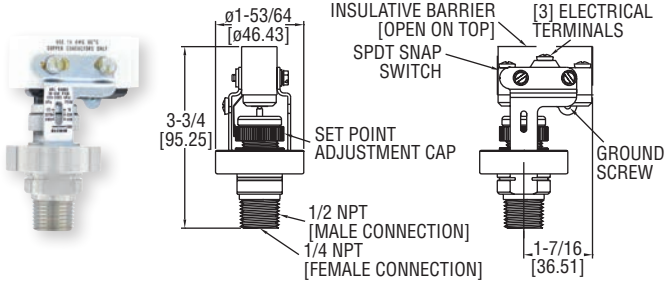
OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

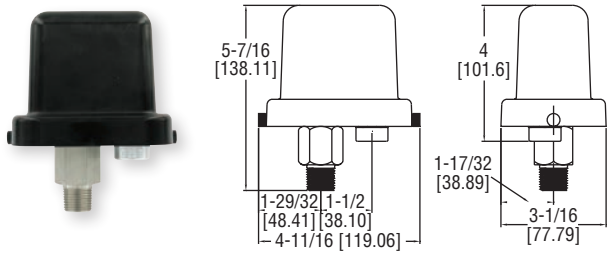
ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS

- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS

- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
~~A1F-O-SS-1-1~~	~~2 to 15 (0.14 to 1.03)~~	~~2 (0.14)~~	~~3 (0.21)~~
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
~~A1F-O-SS-1-3~~	~~8 to 225 (0.55 to 15.5)~~	~~8 (0.55)~~	~~25 (1.7)~~
~~A1F-O-SS-1-4~~	~~16 to 450 (1.1 to 31.0)~~	~~15 (1.0)~~	~~50 (3.5)~~

Note: Optional enclosure factory installed. To order, change O to PC.
Example: A1F-PC-SS-1-1

Series A1F Compact OEM Pressure Switch

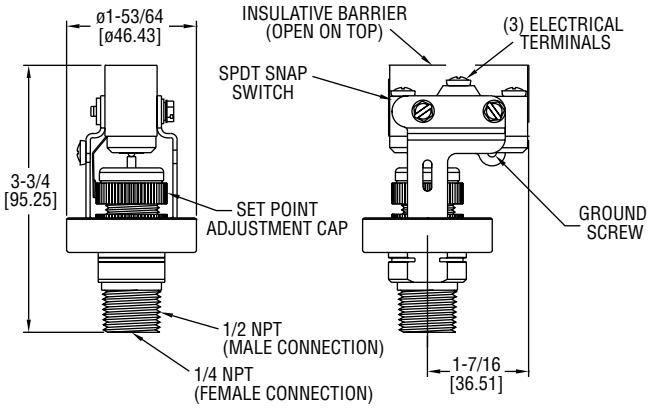
Specifications - Installation and Operating Instructions

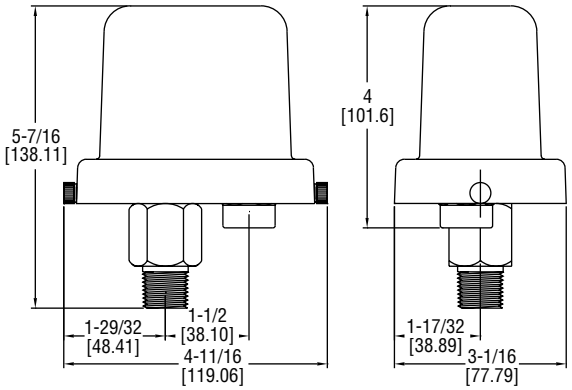


A1F



A1F with A-447





The **SERIES A1F** Compact OEM Pressure Switch is ideal for panel mounting wherever a high-quality, economical open-case or weatherproof control is required.

INSTALLATION

1. Location: Select a location where the temperature limits of -40 to 180°F (-40 to 82°C) will not be exceeded. Locate the switch as close as possible to the pressure source. Long lengths of piping will not affect accuracy of the actuation point but will slightly add to response time.

2. Mounting and Processing Connection: Avoid mounting surfaces with excess vibration which could cause false actuation when pressure is near setpoint. The switch should be mounted within 20° of vertical for proper operation. Mount the switch by connecting it to the process piping using either 1/4″ NPT female or 1/2″ male connection. Pipe joint compound or TFE thread tape should be used to prevent leakage.

3. Electrical Connections: The SPDT snap switch includes normally open, normally closed and common connections. The common and normally open contacts will close and the common and normally closed contacts will open when pressure increases to the setpoint. The actions will reverse when pressure decreases below the setpoint minus the deadband. A green grounding screw is provided on the switch bracket. All wiring should be in accordance with local codes.

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure Chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 500 psig (34 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional A-447 enclosure meets NEMA 4X standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed, See deadband chart.
Weight: 10.5 oz (297 g).

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SETPOINT ADJUSTMENT

1. Determine the setpoint pressure. The approximate actuation point can be set by turning the adjustment cap up or down, aligning the top of the O-ring, located above the cap, with the appropriate scale graduation.
2. Connect tubing or piping from the pressure port on bottom of switch to one leg of a tee. Connect the second leg to a pressure test gage of known accuracy and in an appropriate range. The third leg should be connected to a controllable source of pressure.
3. Connect a volt/ohm meter or other circuit tester to the snap action terminals to indicate when switching occurs.
4. Slowly apply pressure to the system and note the pressure at which switching occurs.
5. Operate the switch through several cycles to confirm proper actuation point.
6. Remove test apparatus and attach switch to pressure source and control circuit wiring. Place switch in service.

Example of how to order:

A1F - O - SS - 1 - 4
1 2 3 4 5

1. Diaphragm Designation:
   F - Fluorocarbon
2. Enclosure Designation:
   O - Open Construction No Enclosure
3. Housing Material Designation:
   SS - 316SS
4. Switch Designation:
   1 - SPDT Snap Action Switch
5. Operating Pressure Range Designation:
   1 - 2 to 15 psig
   2 - 4 to 75 psig
   3 - 8 to 225 psig
   4 - 16 to 450 psig

DEADBAND CHART-PSIG (BAR)		
Range	Deadband at Minimum Range	Deadband at Maximum Range
2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

MAINTENANCE

Upon final installation of the Series A1F Compact OEM Pressure Switch, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series A1F is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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FIT-601

Georg Fischer Signet LLC
Signet 2551 Magmeter

+GF+

Test Certificate

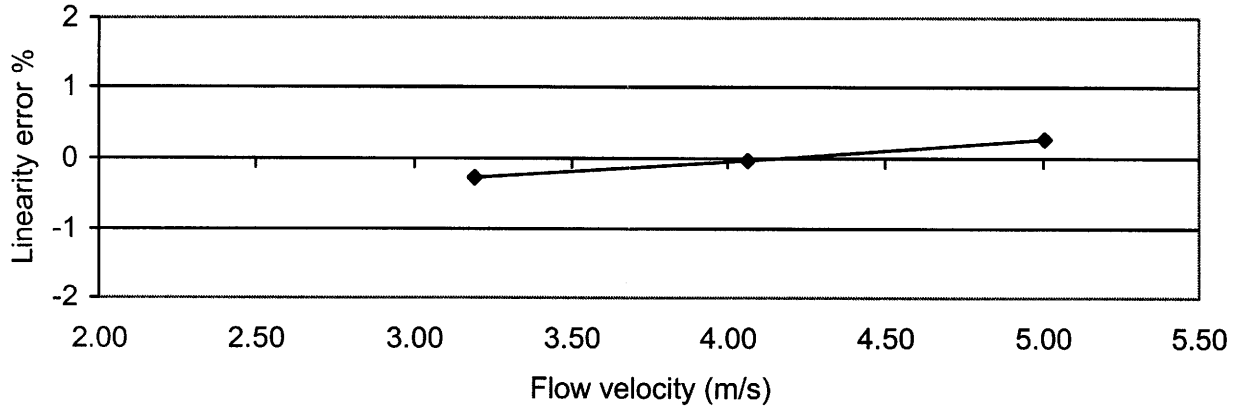
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603090477
Calibration date: March 14, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.47 (3.19)	129654.08	-0.27
13.33 (4.06)	165260.59	-0.03
16.42 (5.00)	203737.00	0.27



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

Georg Fischer Signet LLC certifies that the reference used in the calibration of this product is traceable to NIST (National Institute of Standards and Technology). Improper handling may adversely affect the accuracy.

Georg Fischer Signet LLC products are manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management.

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El Monte, CA 91731-2882
www.gfsignet.com

FIT-602

Georg Fischer Signet LLC
Signet 2551 Magmeter

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Test Certificate

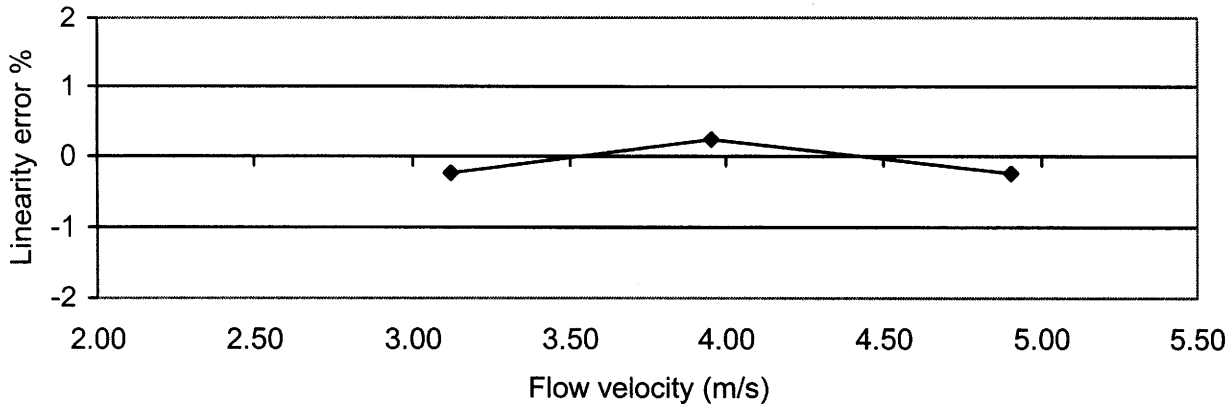
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140339
Calibration date: March 15, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.24 (3.12)	128664.64	-0.23
12.97 (3.95)	162887.05	0.24
16.08 (4.90)	201929.66	-0.24



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

Georg Fischer Signet LLC certifies that the reference used in the calibration of this product is traceable to NIST (National Institute of Standards and Technology). Improper handling may adversely affect the accuracy.

Georg Fischer Signet LLC products are manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management.

Georg Fischer Signet LLC
3401 Aero Jet Avenue
El Monte, CA 91731-2882
www.gfsignet.com

English

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

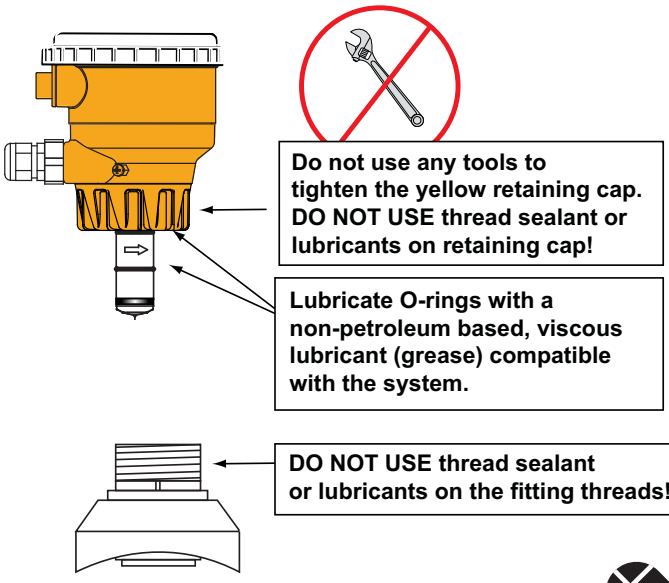
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

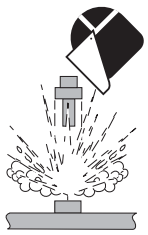
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

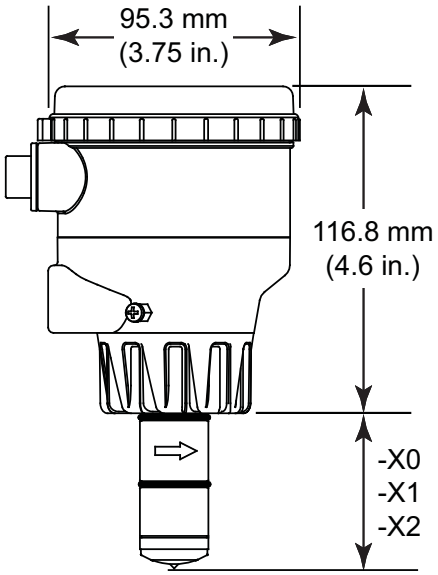


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max. 400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary .....9 to 24 VDC, 0.4A max (only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance ....300 Ω
Loop Accuracy .....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S^3L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

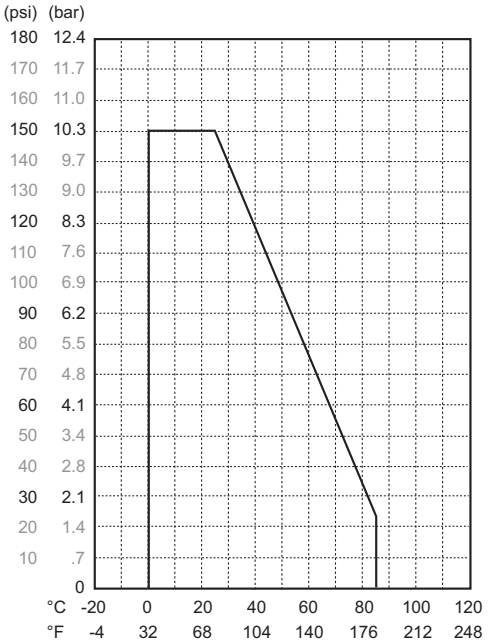
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max., 5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



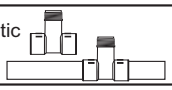
Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant
- China RoHS (visit gfsignet.com for details)
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

Pipe Fittings

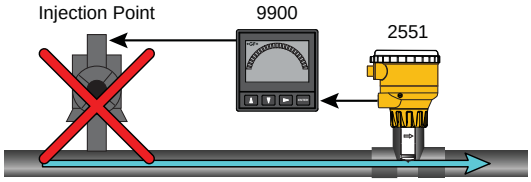
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

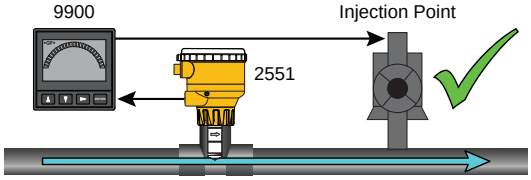
Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

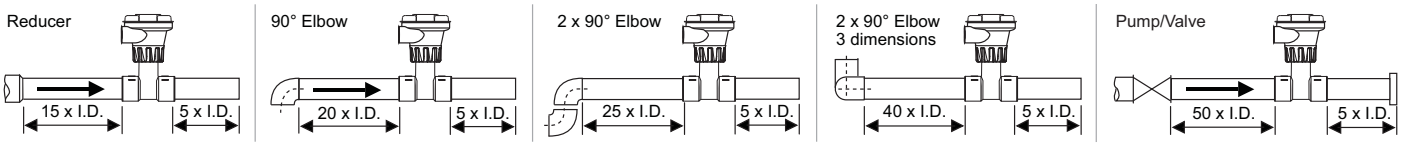
Selecting a Location

- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

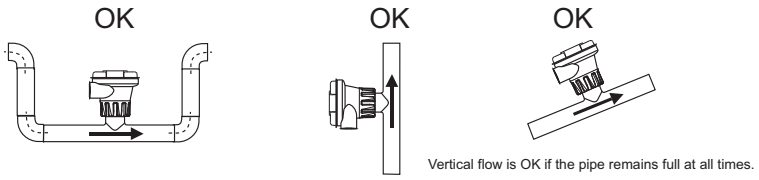




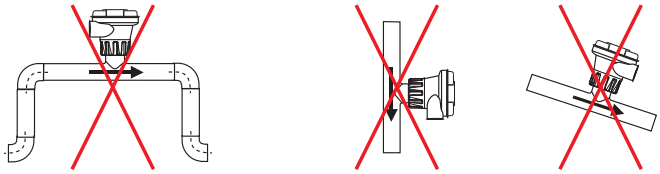
Select a location with sufficient distance of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.

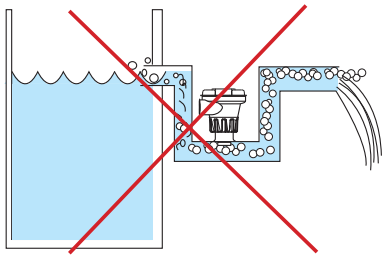


These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

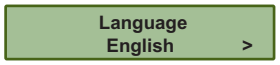
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



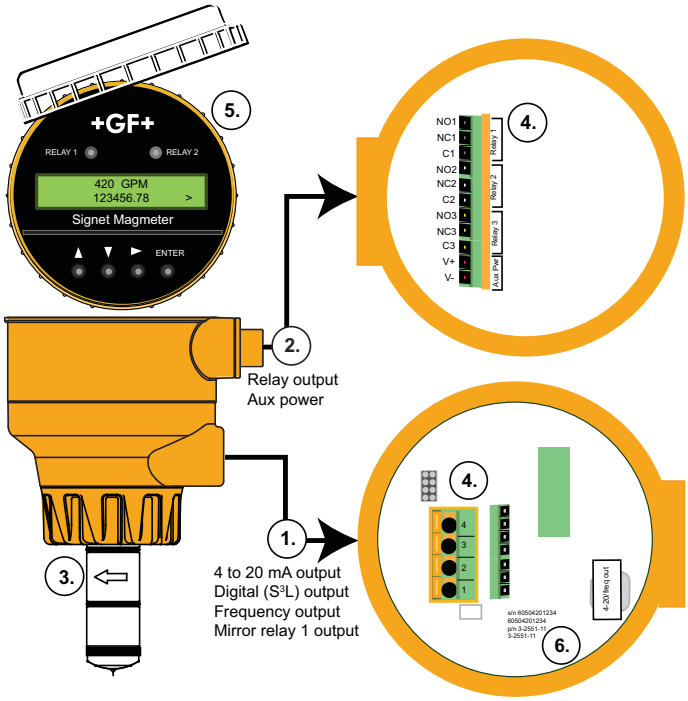
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

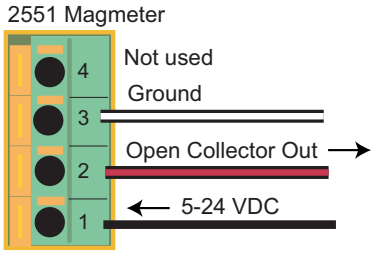


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

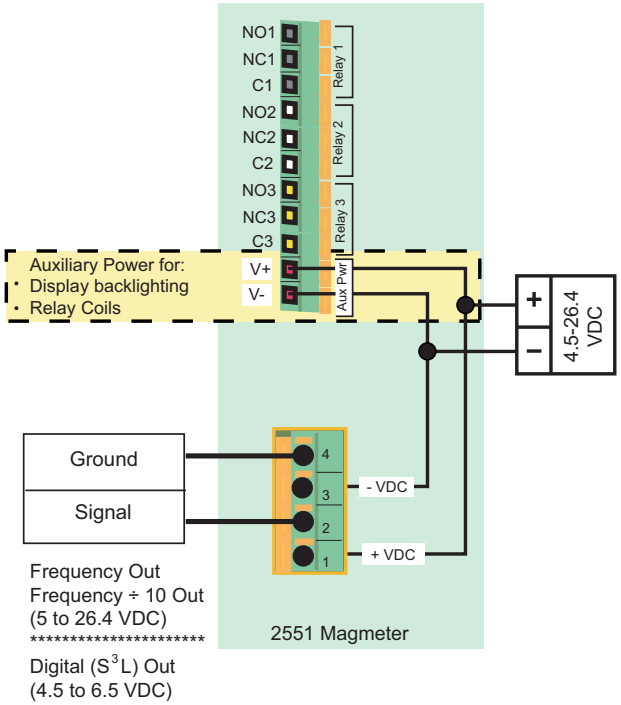
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

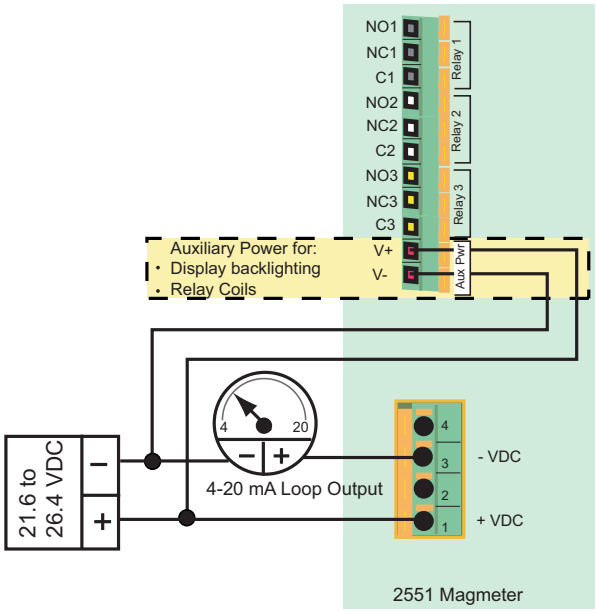
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

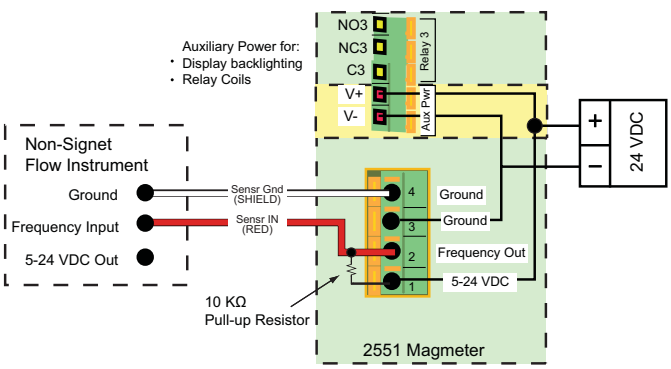
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

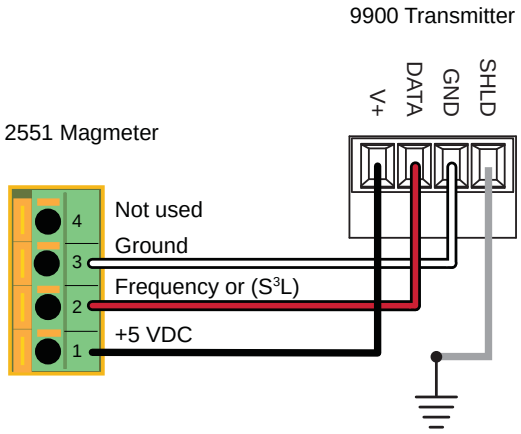


Wiring to Signet Flow Instruments

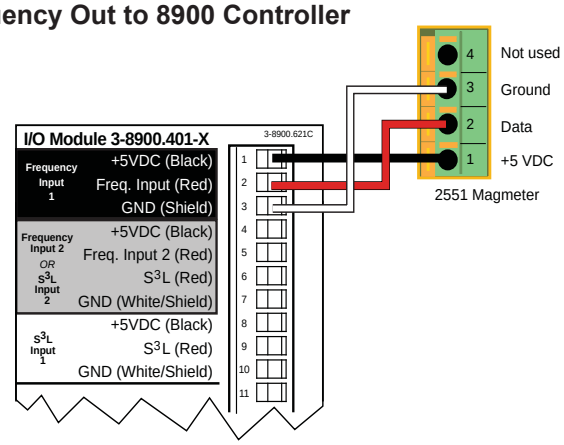
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S³L) output.

Frequency and Digital (S³L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

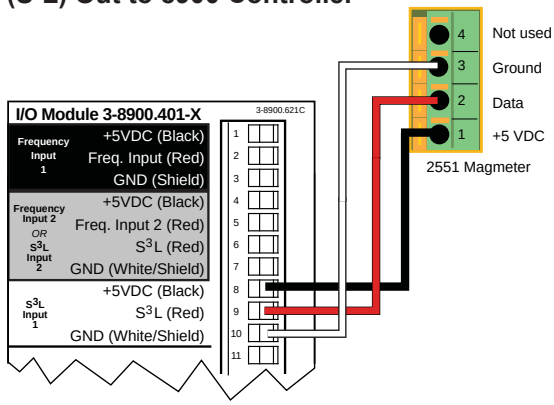
2551 Frequency or Digital (S³L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S³L) Out to 8900 Controller



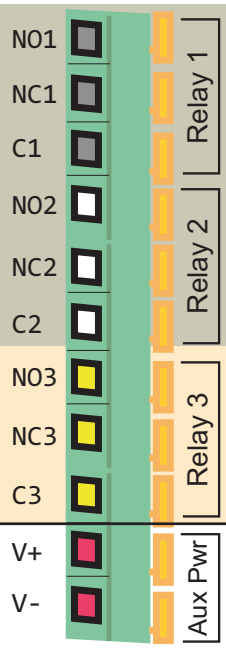
Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)



Mechanical Relays:
5A @ 250 VAC
5A @ 30 VDC

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Solid State Relay 3:
50 mA max @ 30 VDC
50 mA max @ 42 VAC

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.

Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

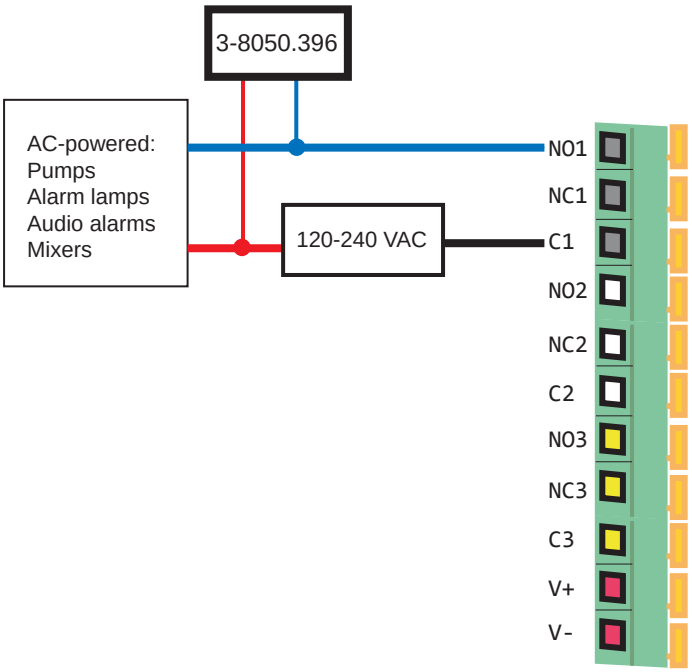
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.

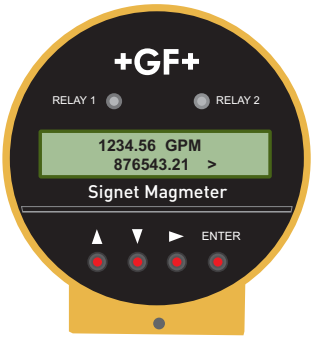


Navigating the Menus

Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

- All menu instructions in this manual assume that the instrument is showing this display.

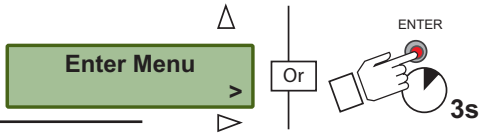


2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

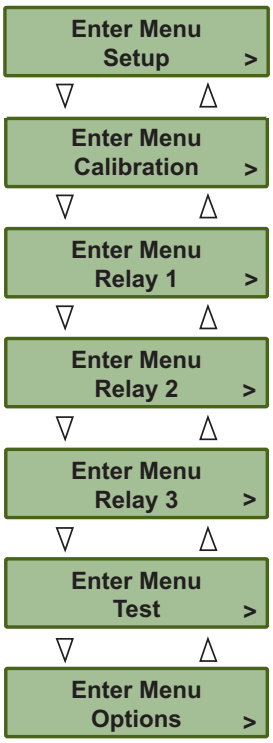
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.

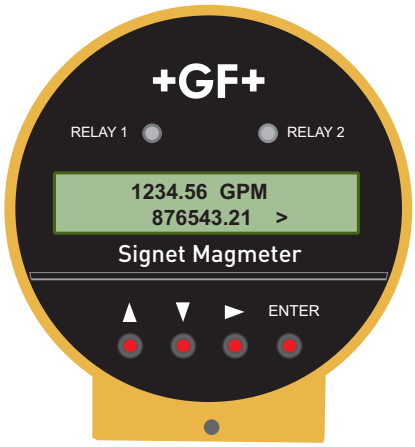


Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



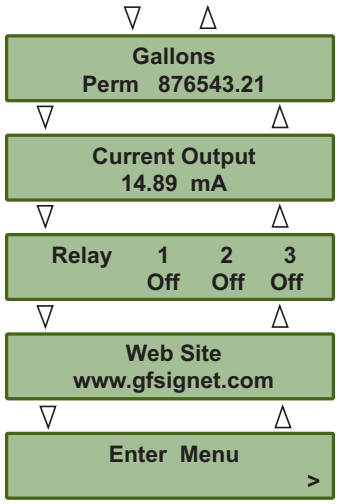
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

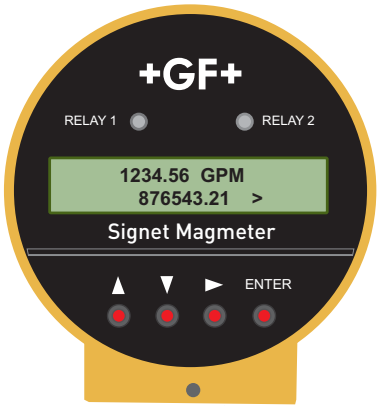
Relay States shown for units with a relay board.

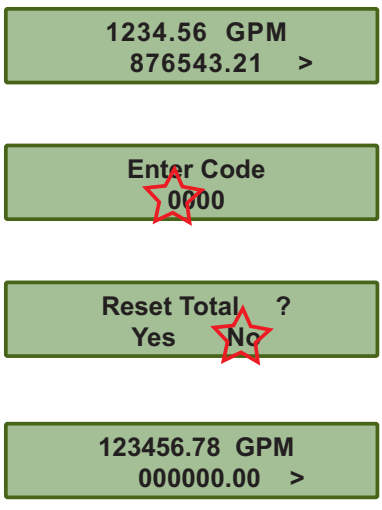
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..



Enter Code
0000

Use the keypad to navigate through each setting.

△ ▽ ▷ ENTER

The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.

K-Factor
060.000 >

Pipe Size: Select the pipe size that is nearest to the nominal pipe size.

Pipe Size
2" DN50 >

Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot)
- μ (micro)
- _ (blank)
- - (dash)
- / (slash)
- 3 (for cubic units)

The last character selects the timebase for the flow rate measurement. Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)

Flow Units
GPM >

Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

Set 4 mA
-100 GPM >

Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

Set 20 mA
100.00 GPM >

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.

Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)

Total Factor
1000.0 >

Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.

Totalizer Units
Gallons >

Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.

Low Flow Cutoff
0.5 GPM >

Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.

Averaging
25 secs >

Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.

Sensitivity
100% >

Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

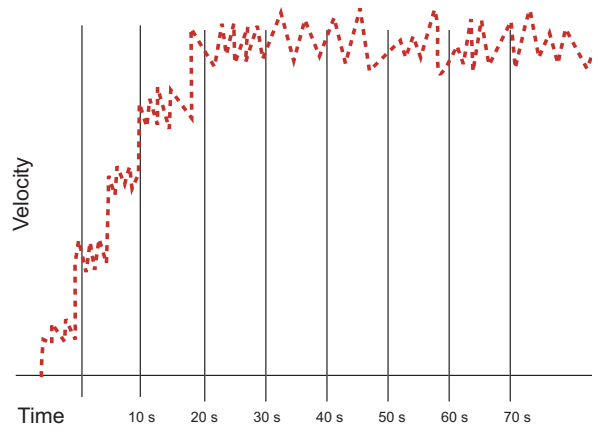
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

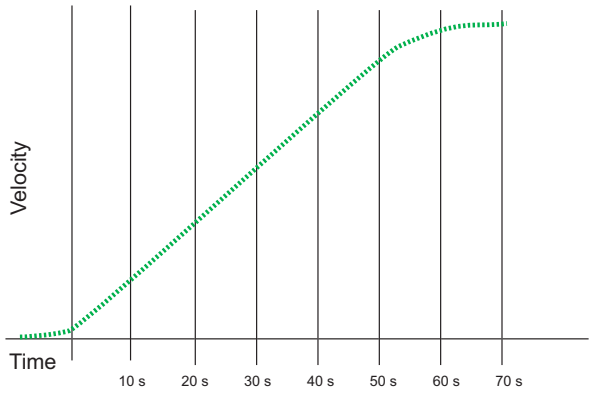
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



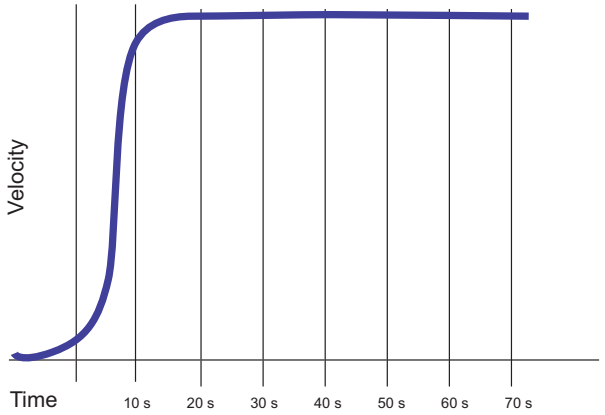
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



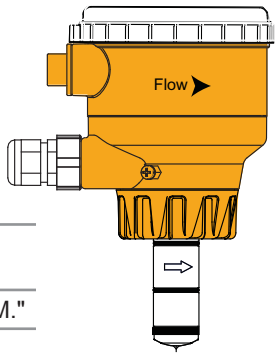
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

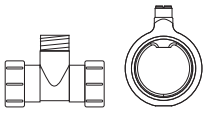
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

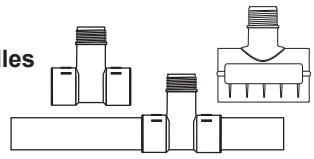
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

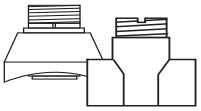
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

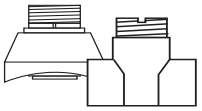
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



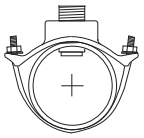
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

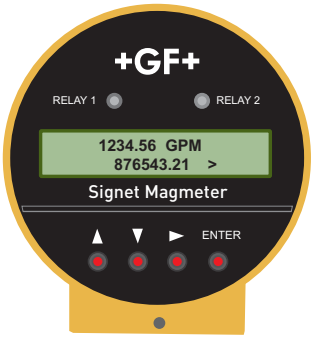
Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

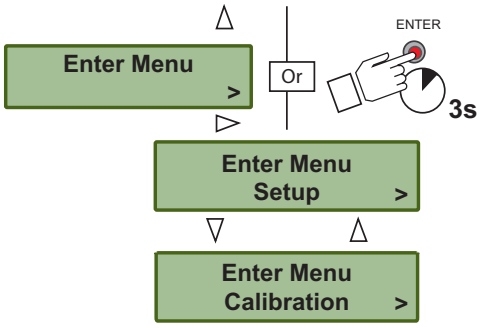
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

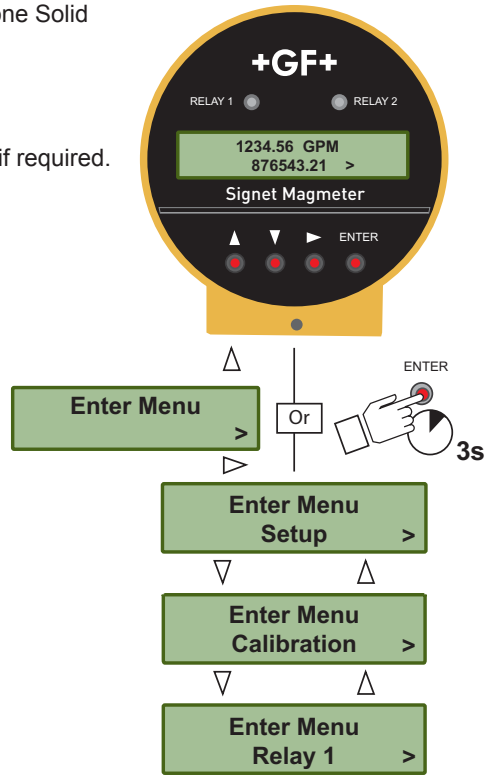
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

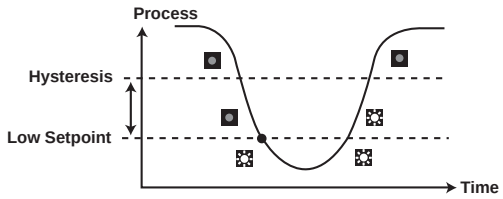
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

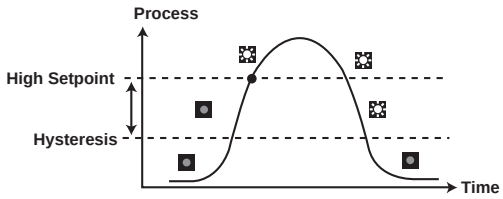
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

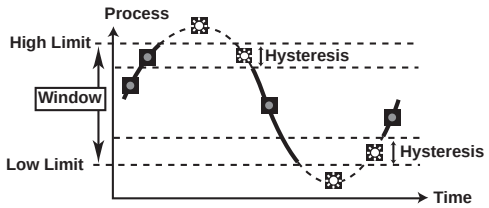
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

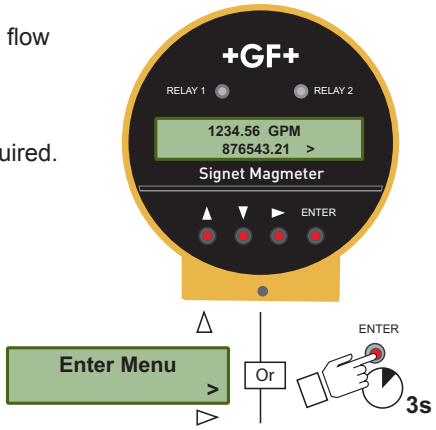


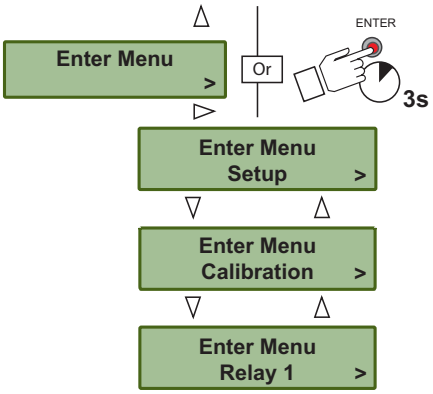
Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated





NOTE: The Security Code must be entered before modifying the relay menu.



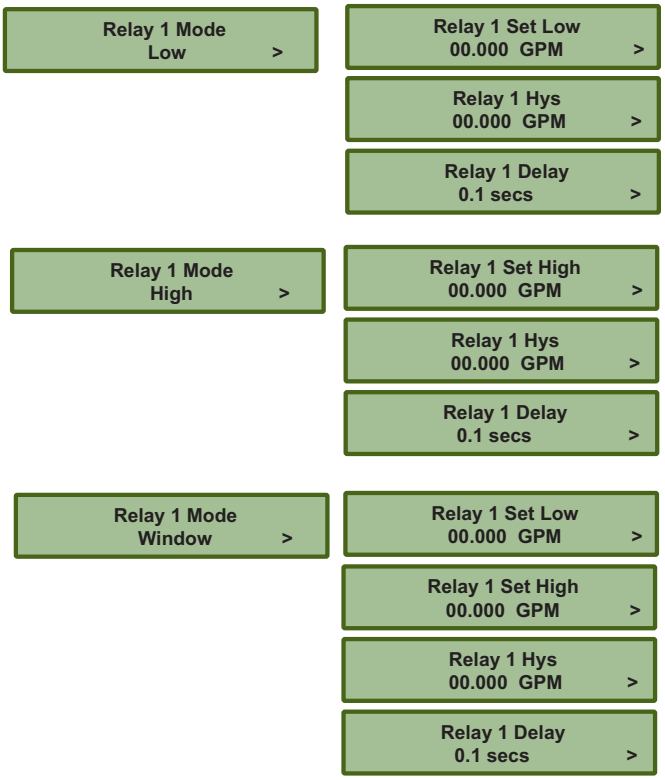
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

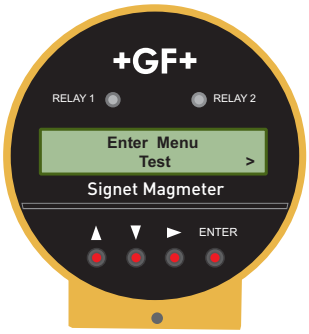
Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

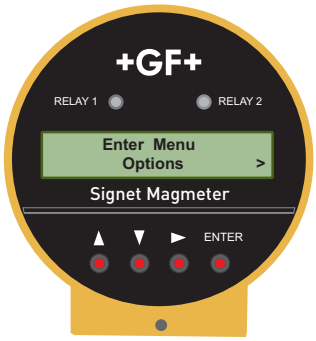
Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S³L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The **(S³L) Digital** output mode switches the 2551 to the Signet serial data output called (S³L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

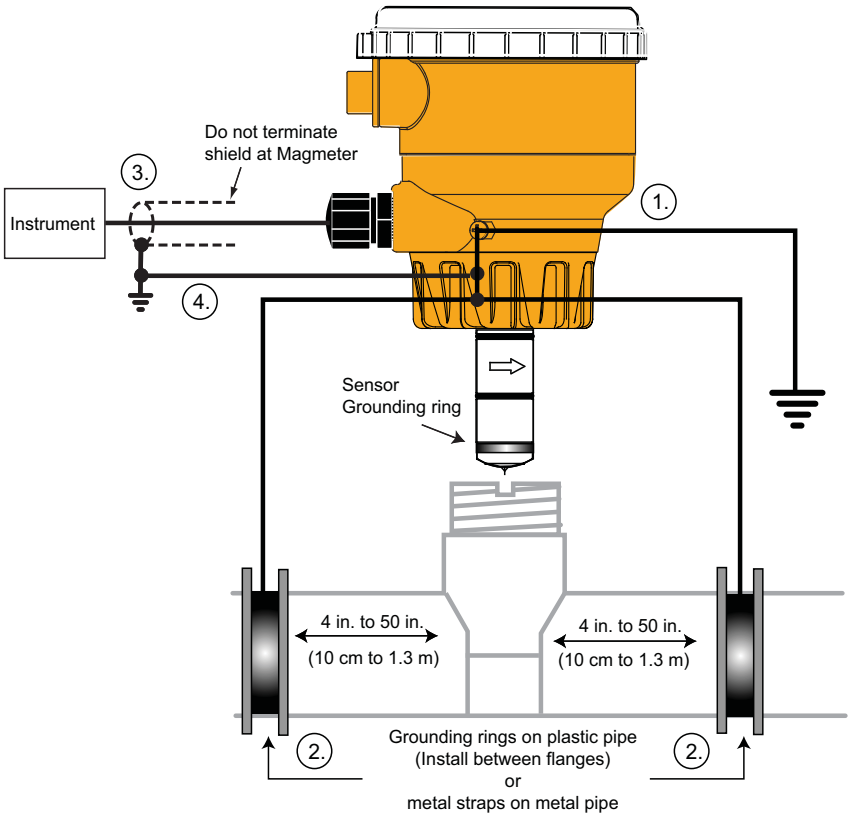
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

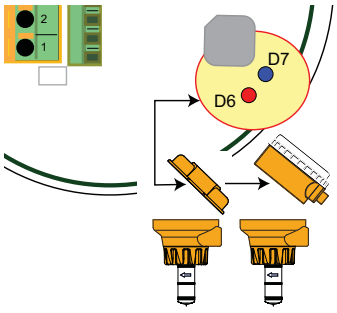
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

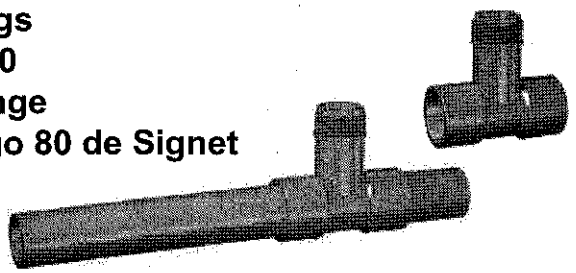
1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

+GF+

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For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

3-2551.090-1 Rev. M 04/15 English
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Signet Schedule 80 PVC and CPVC Installation Fittings
Raccords d'installation Signet PVC et CPVC norme 80
Signet Schedule 80 PVC- und CPVC-Installationsfittinge
Accesorios de instalación de PVC y CPVC de catálogo 80 de Signet



MXPV8.090 Rev. D 04/15 (English, French, German, Spanish)

English



SAFETY INSTRUCTIONS

1. Confirm chemical compatibility before use.
2. Do not exceed maximum temperature or pressure specifications of fittings or sensors.
3. Do not use this product for any purpose other than for which it was designed.
4. Use schedule 80 pipe.
5. Use with liquids only.
6. Improper pipe fitting installation may result in pressure failure, personal injury, and/or property damage.
7. Always match fitting and piping materials.
8. Always use piping cement designed for your specific fitting and piping material.

Français



CONSIGNES DE SÉCURITÉ

1. Vérifier la compatibilité chimique avant l'utilisation.
2. Ne pas dépasser les spécifications maximales de température et de pression pour les raccords ou les capteurs.
3. Ne pas utiliser ce produit à d'autres fins que celle pour laquelle il a été conçu.
4. Utiliser un tuyau norme 80.
5. Utiliser uniquement avec des liquides.
6. Un raccord mal installé peut entraîner des chutes de pression et des dommages corporels ou matériels.
7. Utilisez toujours un raccord de même matériau que le tuyau sur lequel il doit être posé.
8. Utilisez toujours du mastic conçu spécialement pour le matériau de votre tuyau et de votre raccord.



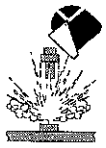
Deutsch



SICHERHEITSVORSCHRIFTEN

1. Vor dem Einsatz die Chemikalienverträglichkeit bestätigen.
2. Die angegebenen maximalen Temperatur- oder Druckwerte von Fittingen oder Sensoren nicht überschreiten.
3. Das Produkt ausschließlich für den beabsichtigten Zweck verwenden.
4. Schedule 80 Rohr verwenden.
5. Nur mit Flüssigkeiten verwenden.
6. Unsachgemäße Installation des Fittings kann zu Druck-, Personen- oder Sachschäden führen.
7. Fitting-und Rohrleitungsmaterial muß stets aufeinander abgestimmt sein.
8. Stets einen für das spezielle Material von Fitting und Rohrleitungen geeigneten Klebstoff verwenden.

Español



INSTRUCCIONES DE SEGURIDAD

1. Confirme la compatibilidad química antes de utilizar este producto.
2. No exceda las especificaciones de temperatura o presión máximas de los accesorios o sensores.
3. No use este producto para ningún fin que no sea para el que se ha diseñado.
4. Use tuberías de catálogo 80.
5. Use con liquidos solemente.
6. La instalación indebida del conector de tubería puede producir fallas de presión, lesión personal y/o daños a la propiedad.
7. Siempre haga coincidir los materiales del conector y de la tubería.
8. Siempre use el cemento de tubería diseñado para su conector y material de tubería especifi cos.

Compatibility

These schedule 80 fittings are designed to be used with the Signet flow and pH sensors listed below.

Compatibilité

Ces raccords norme 80 sont conçus pour être utilisés avec les capteurs de pH et d'écoulement Signet répertoriés ci-dessous.

Kompatibilität

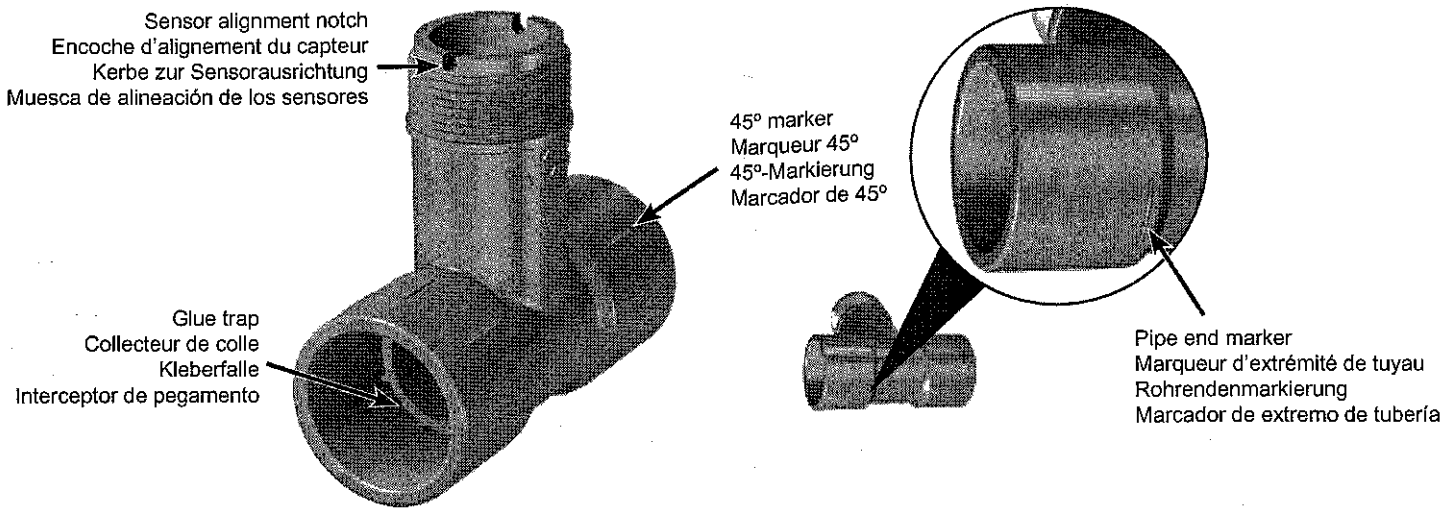
Diese Schedule 80 Fittinge sind zur Verwendung mit den nachstehend aufgeführten Durchfluss- und pH-Sensoren von Signet konzipiert.

Compatibilidad

Estos accesorios de catálogo 80 están diseñados para ser usados con los sensores de caudal y pH de Signet indicados abajo.

Flow Sensors Capteurs d'écoulement Durchflusssensoren Sensores de caudal	pH/ORP Electrodes Électrodes indicatrices de pH/ORP pH/ORP-Elektroden Electrodos de pH/ORP (pH/potencial redox)
P51530-X0	
3-8510-X0	3-2724, 3-2725, 3-2726, 3-2734, 3-2735, 3-2736
3-8512-X0	
3-2536-X0	
3-2537-XC-X0	
3-2551-X0-XX	

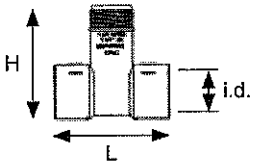
Identification | Identification | Identifizierung | Identificación



Fitting only | Raccord uniquement | Nur Fitting | Accesorio solamente



Material
Matériau
Material
Material

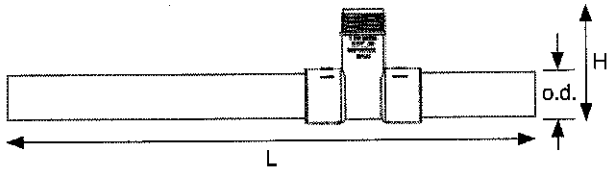


SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	i.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005F	159 001 614	MCPV8T005F	159 001 632	1/2"	3.75	3.50	0.85
MPV8T007F	159 001 615	MCPV8T007F	159 001 633	3/4"	3.75	3.70	1.06
MPV8T010F	159 001 616	MCPV8T010F	159 001 634	1"	4.30	4.00	1.33
MPV8T012F	159 001 617	MCPV8T012F	159 001 635	1-1/4"	4.40	4.30	1.67
MPV8T015F	159 001 618	MCPV8T015F	159 001 636	1-1/2"	5.00	4.60	1.91
MPV8T020F	159 001 619	MCPV8T020F	159 001 637	2"	5.50	5.00	2.40

Fitting with pipe | Raccord avec tuyau | Fitting mit Rohr | Accesorio con tubería



Material
Matériau
Material
Material



SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	o.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005	159 001 623	MCPV8T005	159 001 641	1/2"	14	3.50	0.84
MPV8T007	159 001 624	MCPV8T007	159 001 642	3/4"	14	3.70	1.05
MPV8T010	159 001 625	MCPV8T010	159 001 643	1"	17	4.00	1.32
MPV8T012	159 001 626	MCPV8T012	159 001 644	1-1/4"	20	4.30	1.66
MPV8T015	159 001 627	MCPV8T015	159 001 645	1-1/2"	24	4.60	1.90
MPV8T020	159 001 628	MCPV8T020	159 001 646	2"	26.5	5.02	2.38

K-Factors

A **K-Factor** is the number of pulses (**P**) a sensor will generate for each engineering unit of fluid that passes the sensor. K-factors for water are listed below in U.S. gallons and liters. For example, in a 1 inch SCH 80 PVC pipe, the 515 paddlewheel generates 172.07 pulses per gallon of water passing the rotor.

K-Factors are for schedule 80 pipe.

Facteurs K

Un **Facteur K** est le nombre d'impulsions (**P**) qu'un capteur produit pour chaque unité d'ingénierie de fluide qui y passe. Les facteurs K pour l'eau sont indiqués ci-dessous en gallons U.S. et en litres. Par exemple, dans un tuyau en PVC de 25,4 mm (1 pouce), la roue à palettes 515 produit 172.07 impulsions par gallon (3,78 litres) d'eau qui passe dans le rotor.

Les facteurs K sont pour les tuyaux de norme 80.

K-Faktoren

Der **K-Faktor** repräsentiert die Anzahl der Impulse (**P**), die vom Sensor für jede physikalische Einheit durchfließender Flüssigkeit erzeugt wird. K-Faktoren für Wasser sind nachstehend in US-Gallonen und Liter aufgeführt. Beispielsweise erzeugt das 515 Schaufelrad in einem 1-Zoll-PVC-Rohr 172.07 Impulse pro Gallone Wasser, das durch den Rotor fließt.

K-Faktoren sind für Schedule 80 Rohre.

Factores K

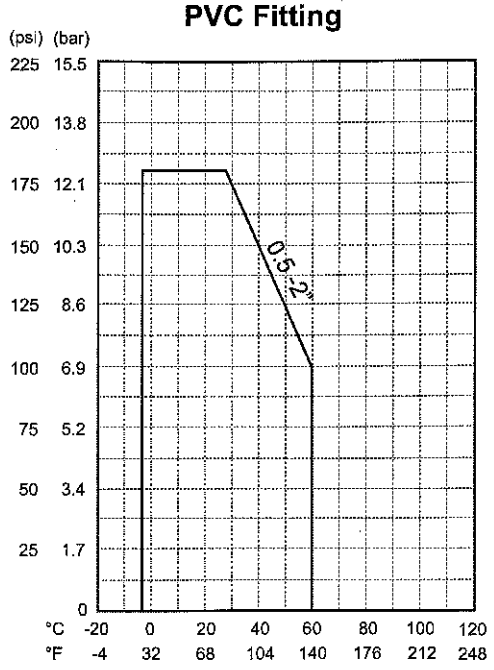
El **Factor K** es el número de impulsos (**P**) que genera un sensor por cada unidad de líquido que pasa por el sensor. En las tablas de abajo se muestran los factores K para agua (en unidades de galones norteamericanos [EE. UU.] y litros). Por ejemplo, en una tubería de PVC de 1 pulg., la 515 rueda de paletas genera 172.07 impulsos por galón de agua que pasa por el rotor.

Los factores K son para tuberías del catálogo 80.

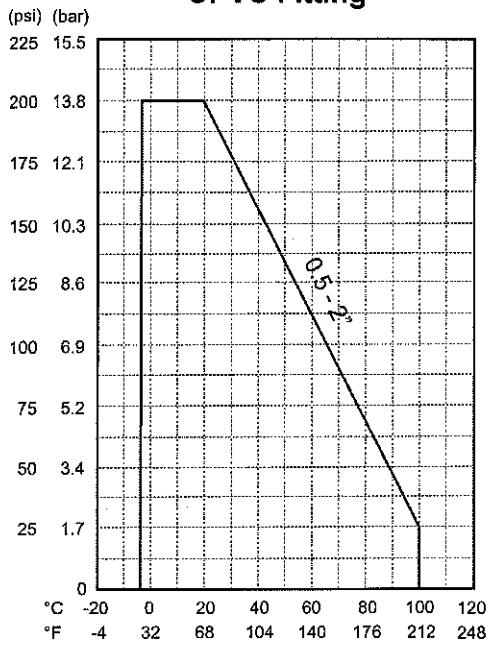
PIPE SIZE TAILLE DE TUYAU ROHRGRÖSSE TAMAÑO DE LA TUBERÍA	SCH. 80 FITTING RACCORD DE NORME 80 SCHEDULE 80 FITTING ACCESORIO DE CATÁLOGO 80	515/8510		2536/2537/8512		2551	
		P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL
1/2"	MPV8T005F MCPV8T005F MPV8T005 MCPV8T005	137.42	520.12	271.37	1027.1	601.58	2277.0
3/4"	MPV8T007F MCPV8T007F MPV8T007 MCPV8T007	78.61	297.52	154.08	583.19	371.90	1407.6
1"	MPV8T010F MCPV8T010F MPV8T010 MCPV8T010	45.46	172.07	88.65	335.53	227.52	861.17
1-1/4"	MPV8T012F MCPV8T012F MPV8T012 MCPV8T012	24.19	91.54	47.24	178.79	122.83	464.91
1-1/2"	MPV8T015F MCPV8T015F MPV8T015 MCPV8T015	16.44	62.22	32.08	121.42	87.56	331.43
2"	MPV8T020F MCPV8T020F MPV8T020 MCPV8T020	9.60	36.32	18.87	71.44	50.96	192.89

Specifications | Spécifications | Spezifikationen | Especificaciones

PVC Fitting



CPVC Fitting





The pressure ratings are for the fitting only.
NEVER EXCEED the pressure rating of the installed sensor.

Follow plastic piping cement manufacturer's recommended preparation and gluing instructions. Avoid excess cement in fitting joints to prevent any port obstruction.

Rigid PVC and CPVC Material Compounds Specification:
ASTM D 1784

Dimensional and Compound Plastic Pipe Fittings Specifications:
ASTM D 2467
ASTM F 439

Standard Test Methods Specification:
ASTM F 1970

Approvals:
NSF (fitting only)

Les niveaux de pression ne concernent que le raccord.
NE JAMAIS DÉPASSER le niveau de pression du capteur installé.

Suivez les instructions de préparation et d'application du mastic données par le fournisseur de celui-ci. Evitez d'appliquer le mastic en trop grande quantité pour ne risquer aucune obstruction.

Matériau PVC et CPVC rigide Spécifications des composés :
ASTM D 1784

Dimensions et composé Raccords pour tuyau en plastique Spécifications :
ASTM D 2467
ASTM F 439

Méthodes standard de test Spécifications :
ASTM F 1970

Homologations :
NSF (Raccord uniquement)

Die Drucknennwerte beziehen sich nur auf die Fittinge.
Den Drucknennwert des installierten Sensors NIEMALS ÜBERSCHREITEN.

Anweisungen des Klebstoff-Herstellers befolgen. Nicht zuviel Klebstoff an den Verbindungsstellen auftragen, um Verstopfungen der Öffnungen zu vermeiden.

Verbundstoffspezifikation für unbiegsames PVC- und CPVC-Material:
ASTM D 1784

Abmessungs- und Verbundstoffspezifikationen für Rohrfittinge aus Kunststoff:
ASTM D 2467
ASTM F 439

Spezifikation für Standardtestmethoden:
ASTM F 1970

Zulassungen:
NSF (Nur Fitting)

Las presiones nominales son para el accesorio solamente.
NO EXCEDA NUNCA la presión nominal del sensor instalado.

Siga las instrucciones recomendadas por el fabricante para la preparación y el engomado del cemento para tuberías plásticas. Evite el exceso de cemento en las juntas de los conectores para prevenir obstrucciones en los orificios.

PVC y CPVC rígidos Especificación de los compuestos:
ASTM D 1784

Dimensiones y composición Accesorios de tuberías de plástico Especificaciones:
ASTM D 2467
ASTM F 439

Métodos de prueba estándar Especificación:
ASTM F 1970

Certificados de aprobación:
NSF (Accesorio solamente)

+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

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MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

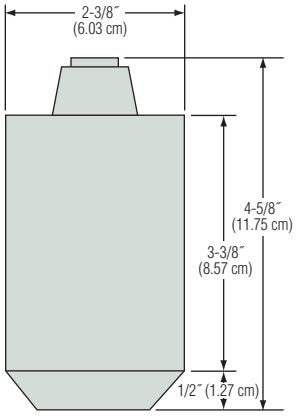


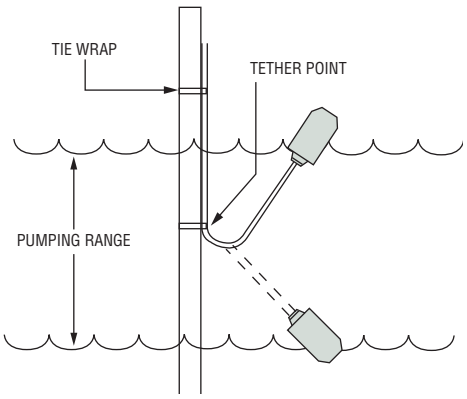
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

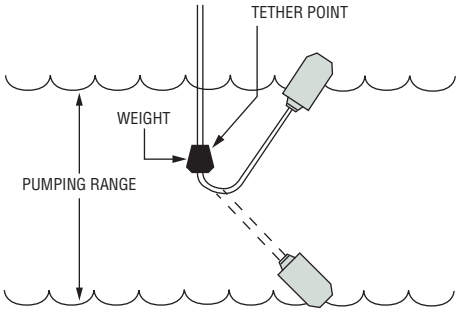
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
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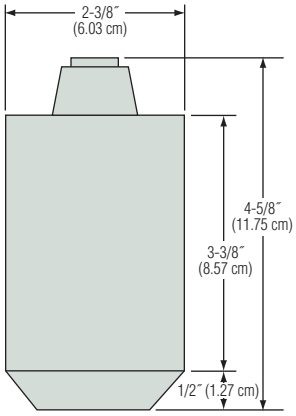


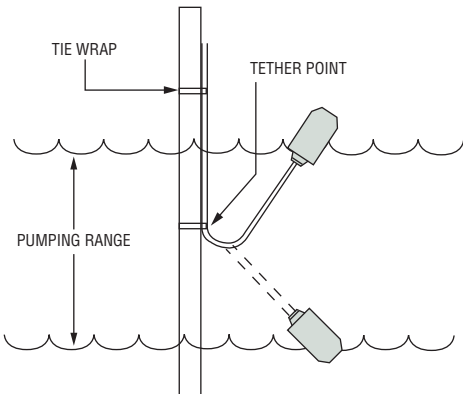
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

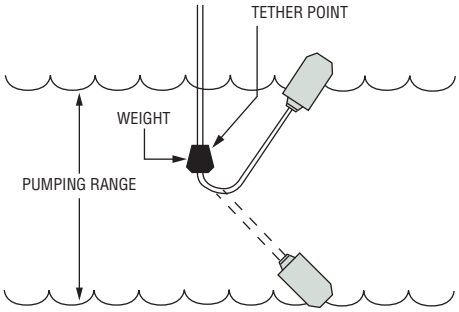
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
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40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Form 237
Sheet P/N 7801165
Rev. D

Warrick®
Series M Mechanical Tilt Float Switch
Installation and Operation Bulletin

Specifications

Cord	16 gauge, 2 or 3 conductor SJOW, Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC, 1/2hp
Contact Design	SPST, Normally Open or Normally Closed, Common with N.O. & N.C. (Form C)
Temperature Rating	32°F (0°C) to 194°F (90°C) Dry and 140°F (60°C) Water Resistant
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Certified

Installation

Tether Tie-Wrap (Fig 1)
Attach cord, using a tie-wrap, to a stationary structure. This is known as the tether point, it will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Tether-Weight (Fig 2)
Place tension-brand over the cord before installation. Place the weight at the desired position and secure with the tension-band. This position will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Determine tether point using charts below as a reference

Notes:
1. To Prevent Motor Burnout - In a pumpdown application make sure the turn-off level is at least 2 inches above the intake of the submersible pump.

2. Securing Tether Points - Make sure levels are correct and that floats are free from any obstructions before securing tether points.

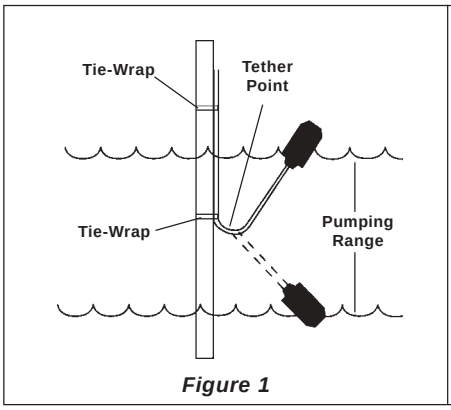


Figure 1

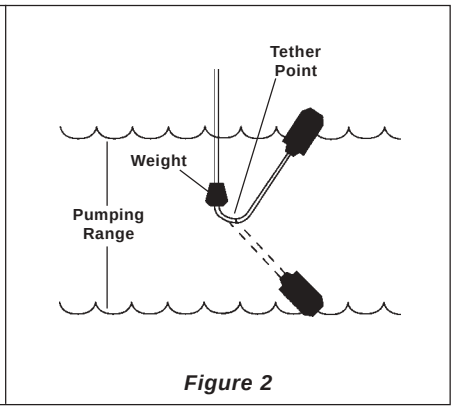
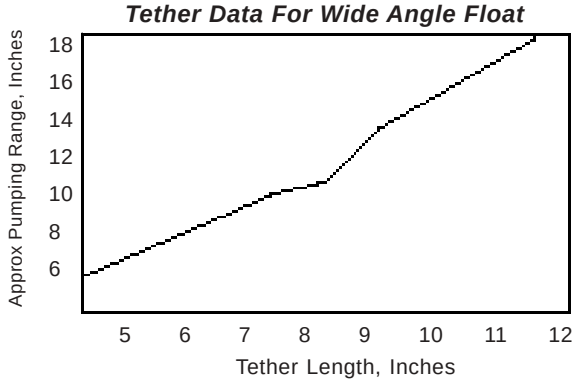
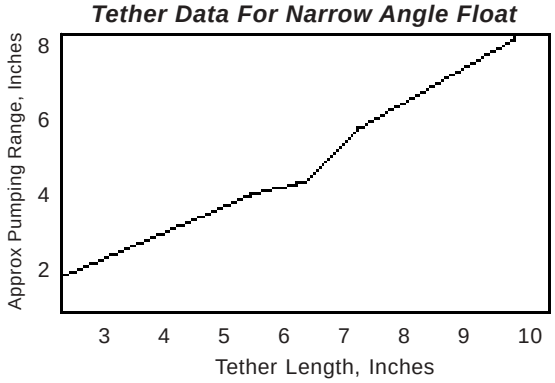


Figure 2

Tether Data For Wide Angle Float

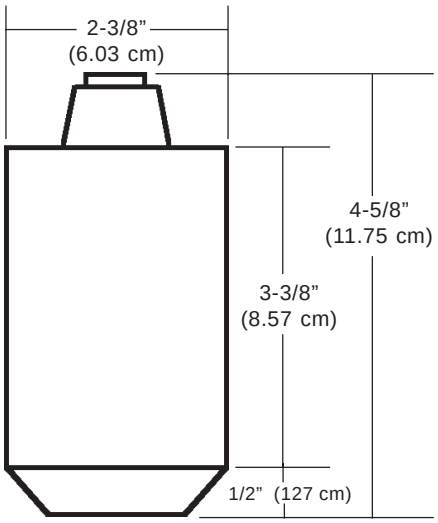


Tether Data For Narrow Angle Float

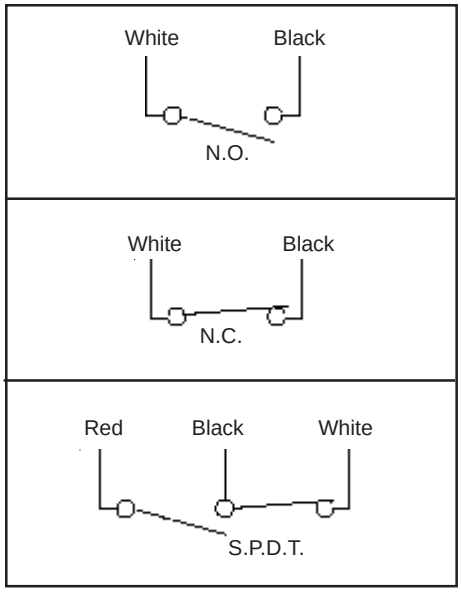


Notes:
1. Narrow angle pumping range is approximately 2 In. to 8 In.
2. Wide angle pumping range is approximately 5 In. to 18 In.

Dimensions



Contact Configurations



Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applica tions according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563

Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580

Series SGZ 2.5″ Stainless Steel Industrial Pressure Gage

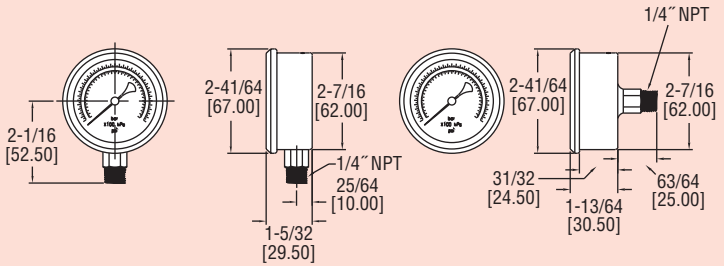
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

FIT-701

Georg Fischer Signet LLC
Signet 2551 Magmeter

+GF+

Test Certificate

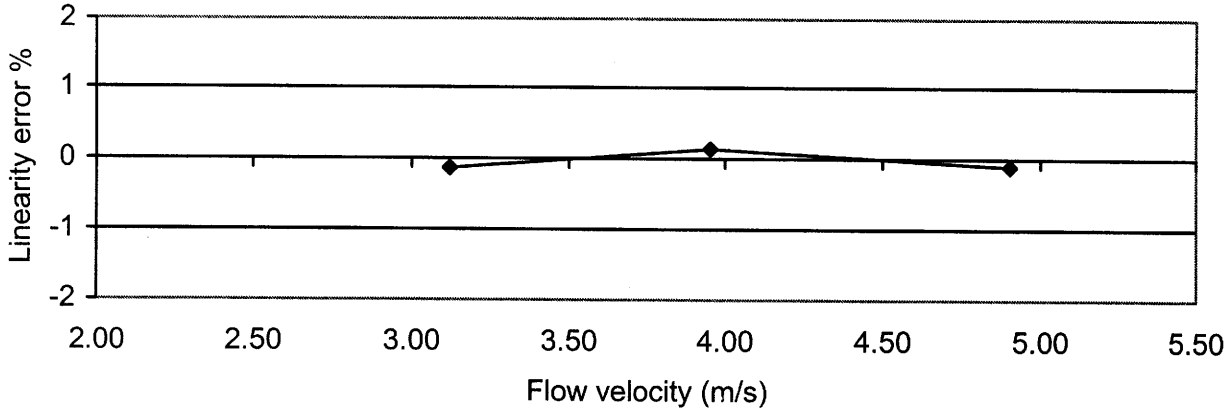
Part Information

Mfr. part #: 3-2551-P0-22
Type: PP/316L SS; mA output
Serial number: 61603140338
Calibration date: March 15, 2016

Test Data

Test media: Water
Pipe type: SYGEF PVDF d50
Pipe fitting: PVDF Tee d50, SFMT015
Output jumper: S³L (applies to 3-2551-XX-X1 only)
Pipe size jumper: Off

Flow Velocity ft/s (m/s)	Reynolds Number	Linearity (% of reading)
10.24 (3.12)	128664.64	-0.14
12.97 (3.95)	162924.52	0.14
16.08 (4.90)	201883.20	-0.11



Refer to Signet 2551 Magmeter manual (PN 3-2551.090 or 3-2551.090-1) for technical specification.

Georg Fischer Signet LLC certifies that the reference used in the calibration of this product is traceable to NIST (National Institute of Standards and Technology). Improper handling may adversely affect the accuracy.

Georg Fischer Signet LLC products are manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management.

Georg Fischer Signet LLC
3401 Aero Jet Avenue
El Monte, CA 91731-2882
www.gfsignet.com

English

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

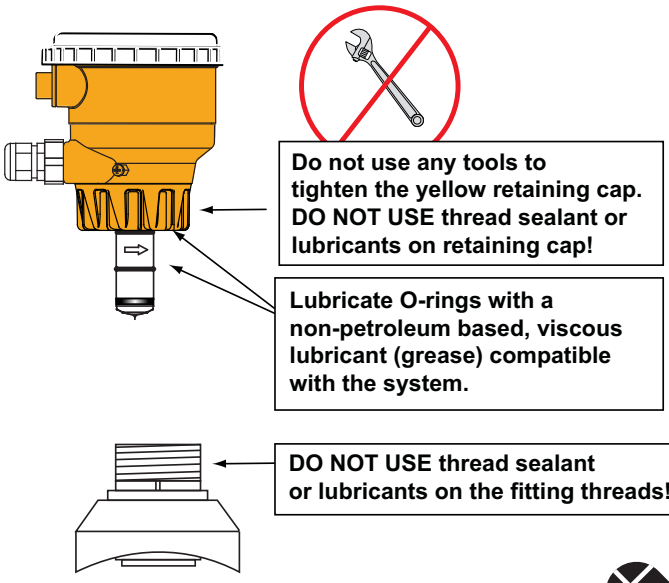
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

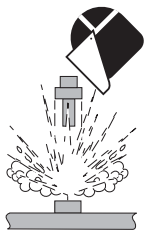
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

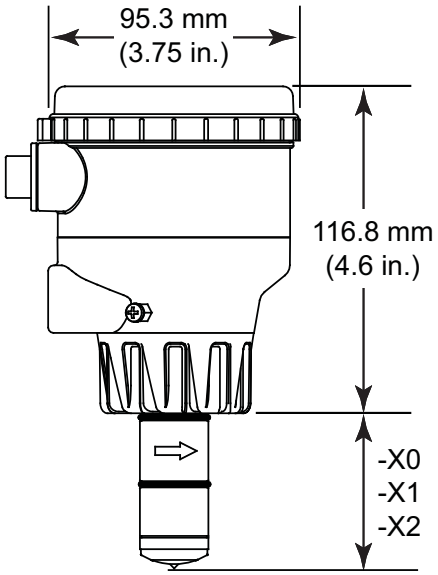


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary.....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance....300 Ω
Loop Accuracy.....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

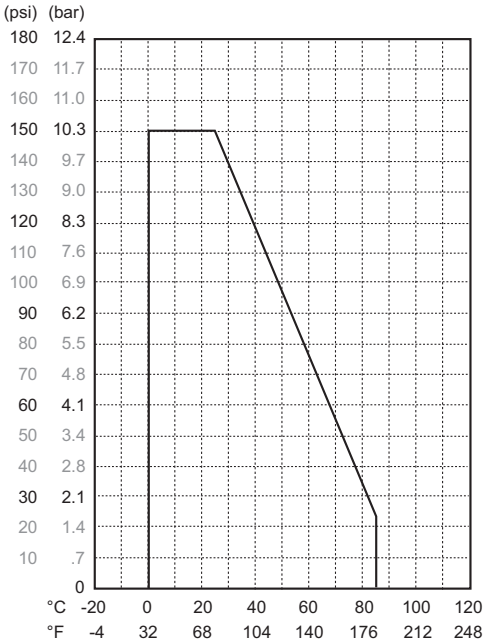
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



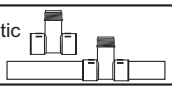
Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant
- China RoHS (visit gfsignet.com for details)
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

Pipe Fittings

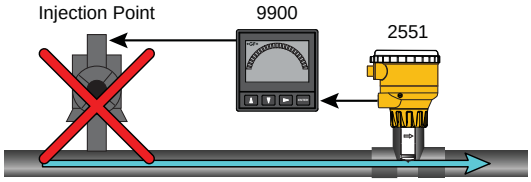
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

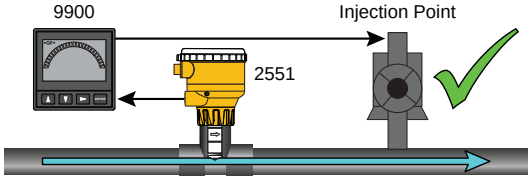
Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

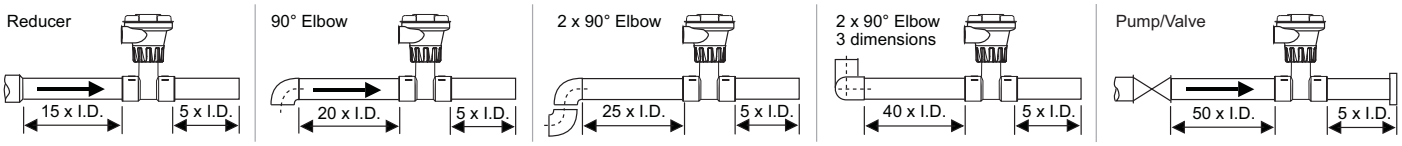
Selecting a Location

- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

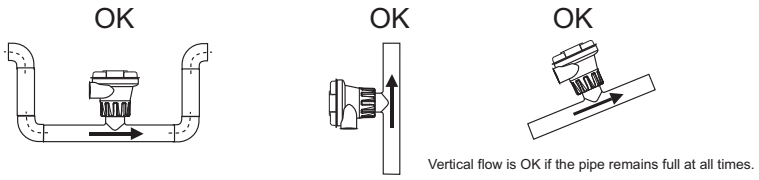




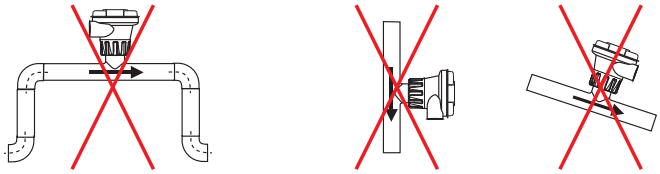
Select a location with sufficient distance of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.

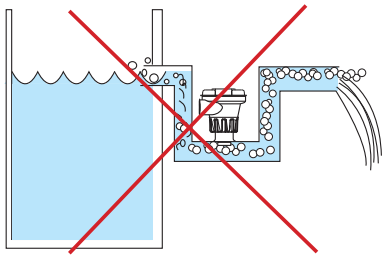


These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

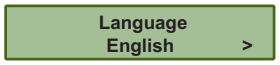
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



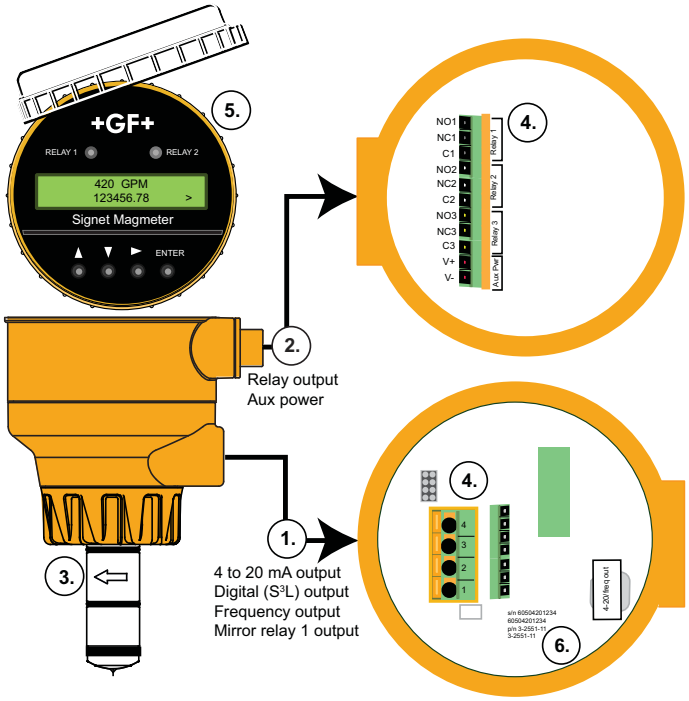
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

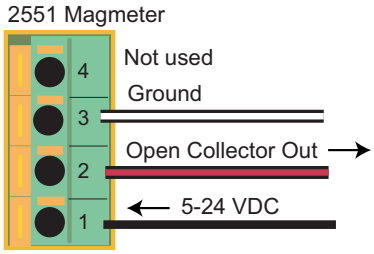


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

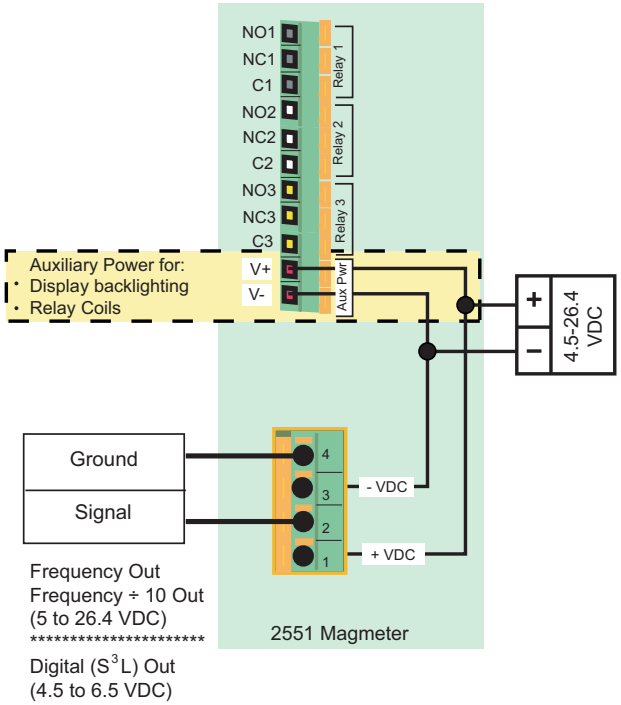
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

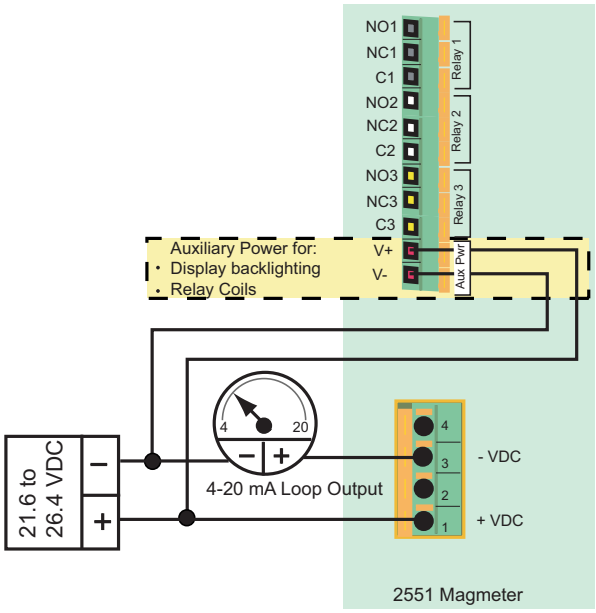
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

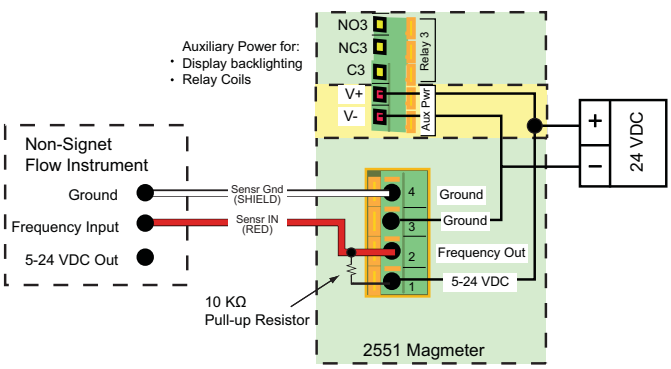
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

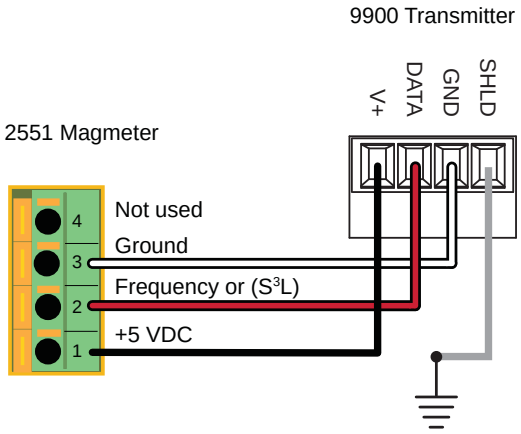


Wiring to Signet Flow Instruments

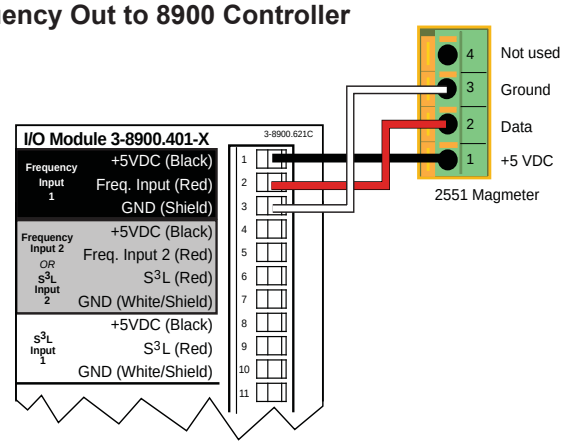
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S³L) output.

Frequency and Digital (S³L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

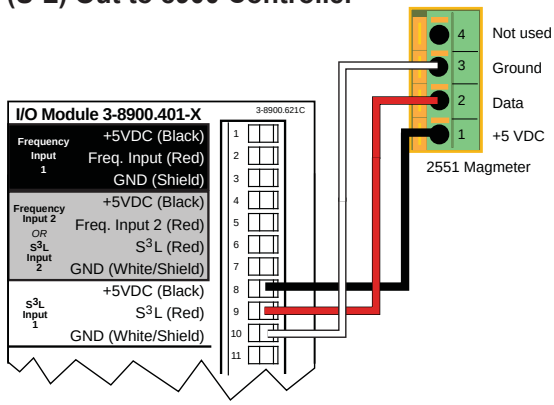
2551 Frequency or Digital (S³L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S³L) Out to 8900 Controller



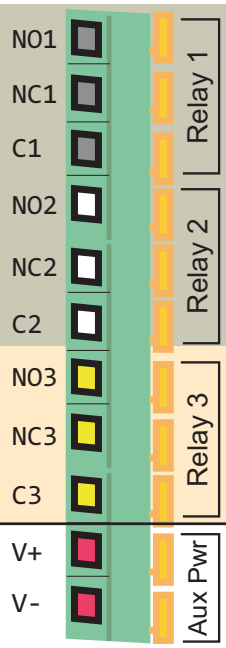
Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)



Mechanical Relays:
5A @ 250 VAC
5A @ 30 VDC

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Solid State Relay 3:
50 mA max @ 30 VDC
50 mA max @ 42 VAC

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.

Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

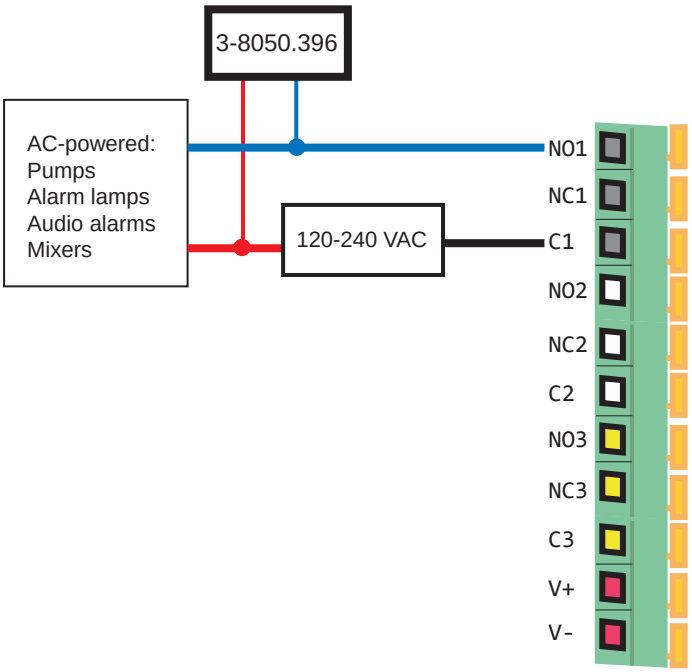
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.

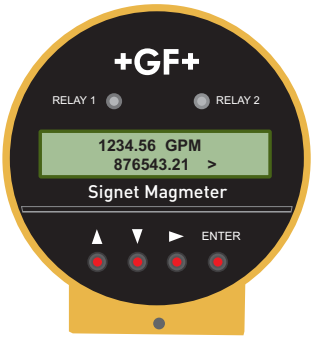


Navigating the Menus

Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

- All menu instructions in this manual assume that the instrument is showing this display.

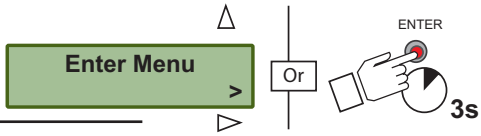


2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

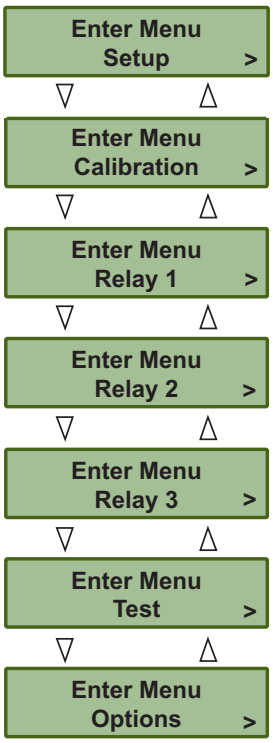
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.

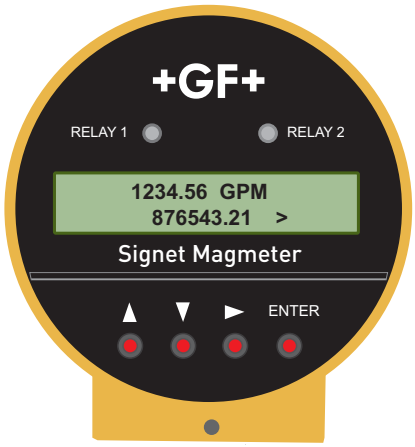


Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



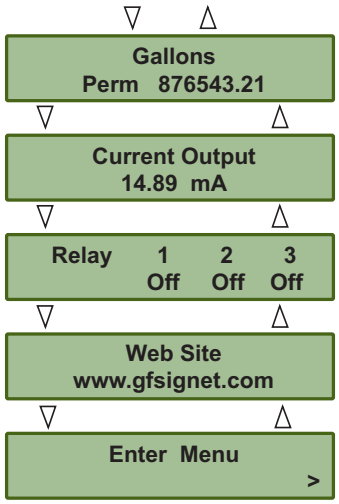
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

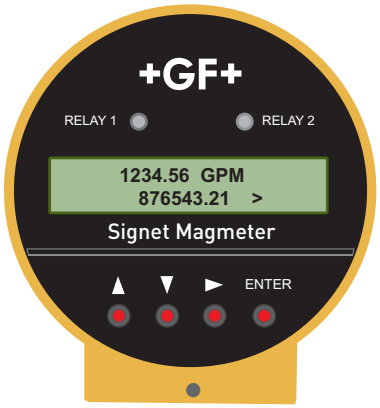
Relay States shown for units with a relay board.

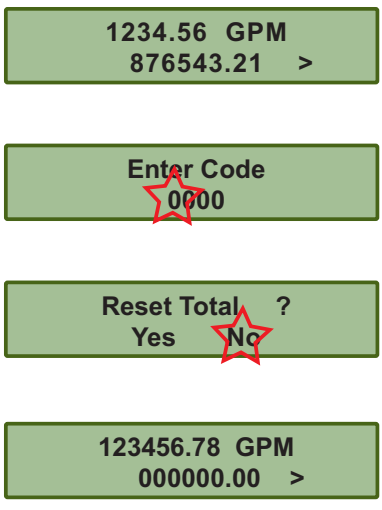
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..



Enter Code
0000

Use the keypad to navigate through each setting.

△ ▽ ▷ ENTER

The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.

K-Factor
060.000 >

Pipe Size: Select the pipe size that is nearest to the nominal pipe size.

Pipe Size
2" DN50 >

Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot)
- μ (micro)
- _ (blank)
- - (dash)
- / (slash)
- 3 (for cubic units)

The last character selects the timebase for the flow rate measurement. Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)

Flow Units
GPM >

Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

Set 4 mA
-100 GPM >

Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

Set 20 mA
100.00 GPM >

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.

Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)

Total Factor
1000.0 >

Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.

Totalizer Units
Gallons >

Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.

Low Flow Cutoff
0.5 GPM >

Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.

Averaging
25 secs >

Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.

Sensitivity
100% >

Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

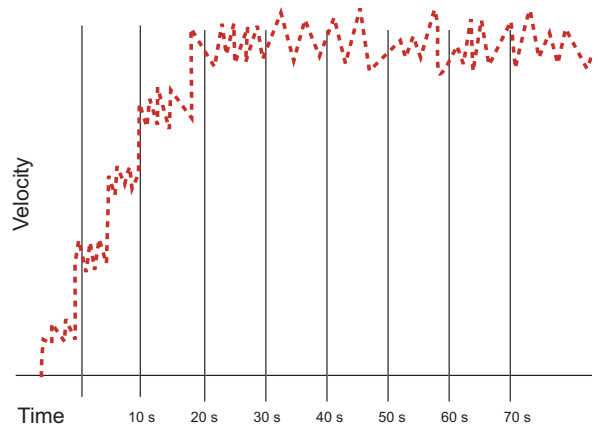
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

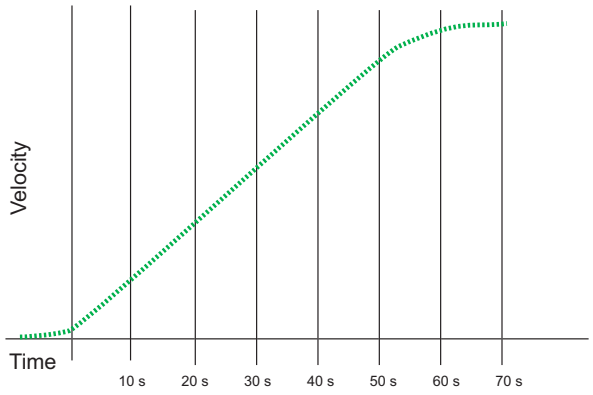
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



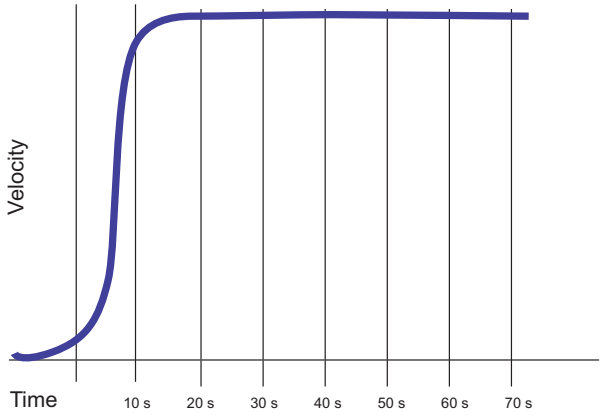
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



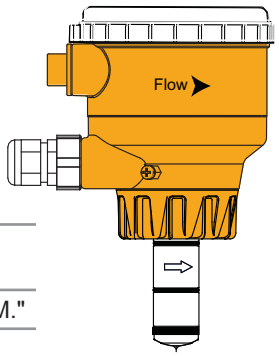
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

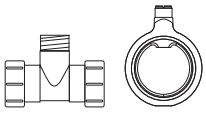
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

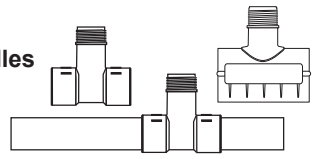
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

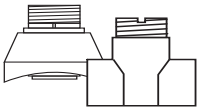
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

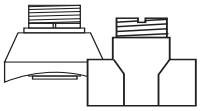
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



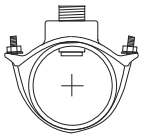
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

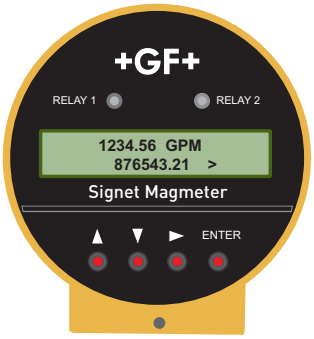
Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

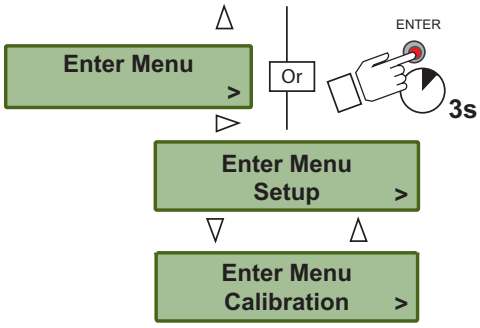
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

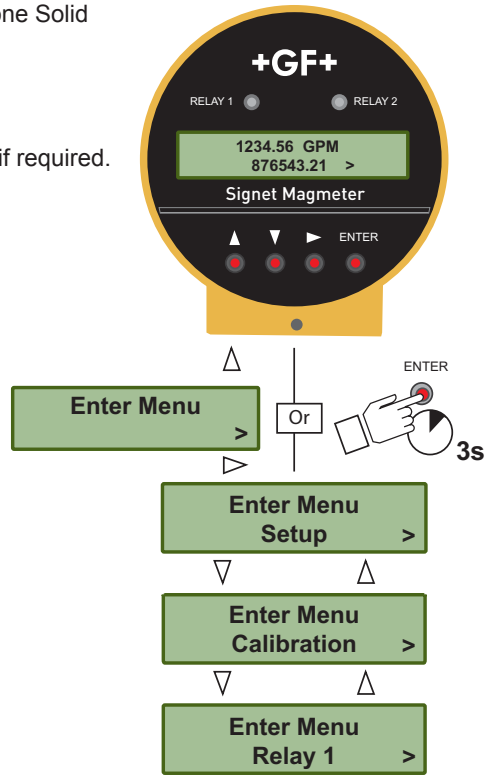
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

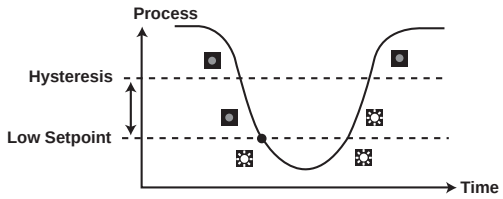
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

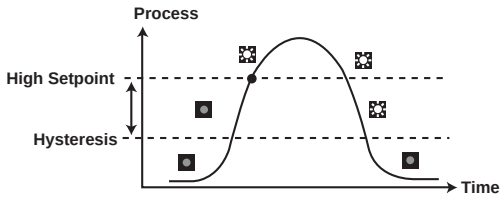
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

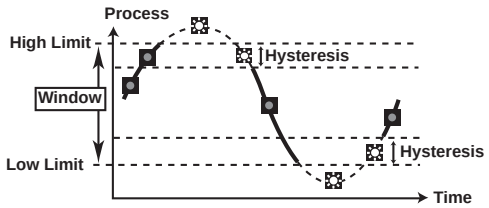
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

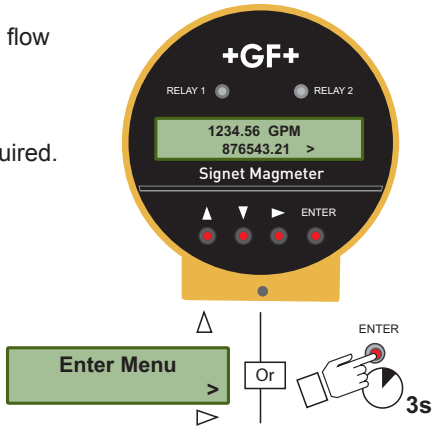


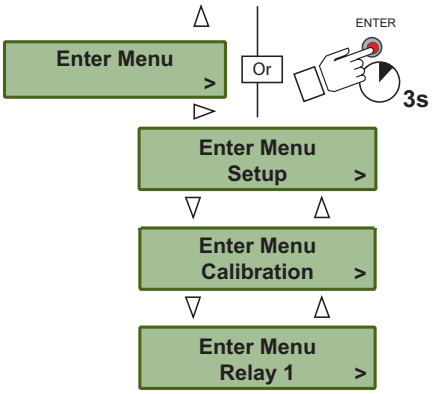
Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated





NOTE: The Security Code must be entered before modifying the relay menu.



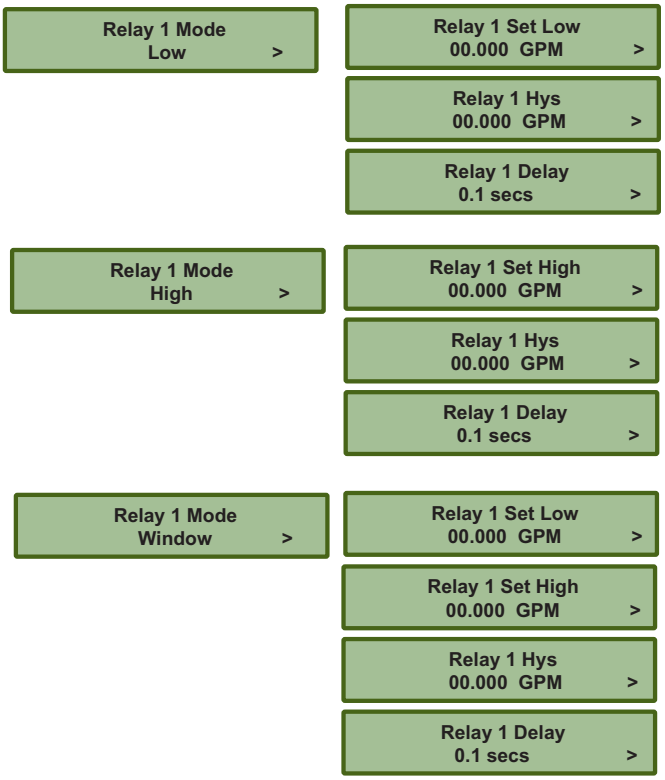
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

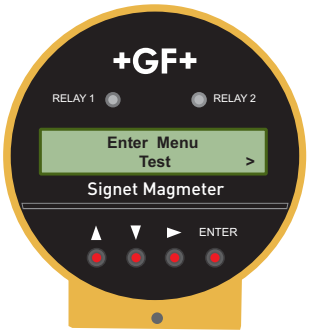
Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

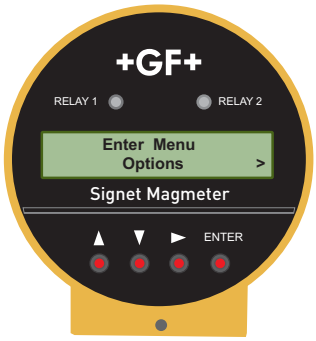
Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S³L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The **(S³L) Digital** output mode switches the 2551 to the Signet serial data output called (S³L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

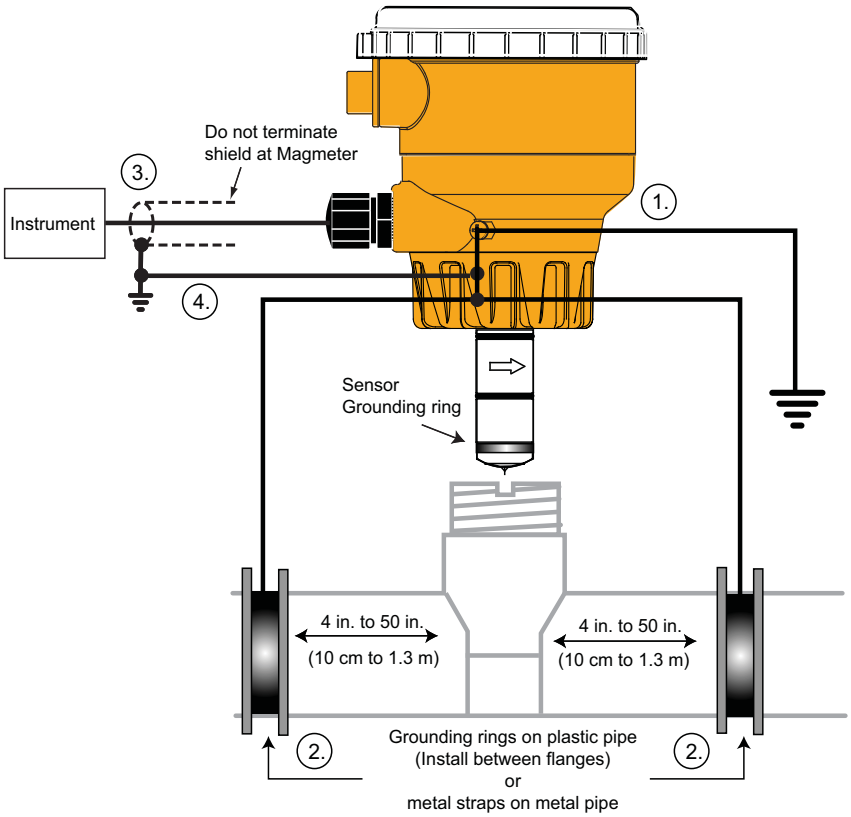
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

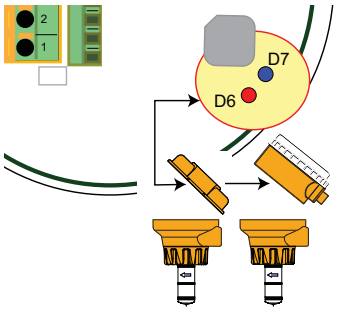
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

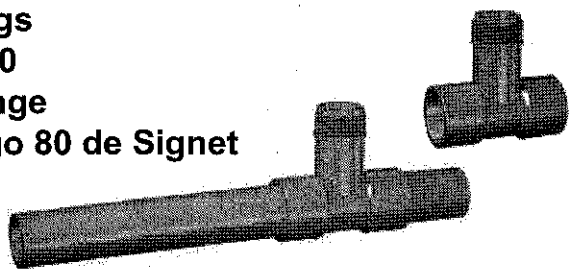
+GF+

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For the most up-to-date information, please refer to our website at www.gfsignet.com

3-2551.090-1 Rev. M 04/15 English

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Signet Schedule 80 PVC and CPVC Installation Fittings
Raccords d'installation Signet PVC et CPVC norme 80
Signet Schedule 80 PVC- und CPVC-Installationsfittinge
Accesorios de instalación de PVC y CPVC de catálogo 80 de Signet



MXPV8.090 Rev. D 04/15 (English, French, German, Spanish)

English



SAFETY INSTRUCTIONS

1. Confirm chemical compatibility before use.
2. Do not exceed maximum temperature or pressure specifications of fittings or sensors.
3. Do not use this product for any purpose other than for which it was designed.
4. Use schedule 80 pipe.
5. Use with liquids only.
6. Improper pipe fitting installation may result in pressure failure, personal injury, and/or property damage.
7. Always match fitting and piping materials.
8. Always use piping cement designed for your specific fitting and piping material.

Français



CONSIGNES DE SÉCURITÉ

1. Vérifier la compatibilité chimique avant l'utilisation.
2. Ne pas dépasser les spécifications maximales de température et de pression pour les raccords ou les capteurs.
3. Ne pas utiliser ce produit à d'autres fins que celle pour laquelle il a été conçu.
4. Utiliser un tuyau norme 80.
5. Utiliser uniquement avec des liquides.
6. Un raccord mal installé peut entraîner des chutes de pression et des dommages corporels ou matériels.
7. Utilisez toujours un raccord de même matériau que le tuyau sur lequel il doit être posé.
8. Utilisez toujours du mastic conçu spécialement pour le matériau de votre tuyau et de votre raccord.



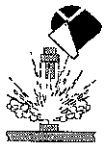
Deutsch



SICHERHEITSVORSCHRIFTEN

1. Vor dem Einsatz die Chemikalienverträglichkeit bestätigen.
2. Die angegebenen maximalen Temperatur- oder Druckwerte von Fittingen oder Sensoren nicht überschreiten.
3. Das Produkt ausschließlich für den beabsichtigten Zweck verwenden.
4. Schedule 80 Rohr verwenden.
5. Nur mit Flüssigkeiten verwenden.
6. Unsachgemäße Installation des Fittings kann zu Druck-, Personen- oder Sachschäden führen.
7. Fitting-und Rohrleitungsmaterial muß stets aufeinander abgestimmt sein.
8. Stets einen für das spezielle Material von Fitting und Rohrleitungen geeigneten Klebstoff verwenden.

Español



INSTRUCCIONES DE SEGURIDAD

1. Confirme la compatibilidad química antes de utilizar este producto.
2. No exceda las especificaciones de temperatura o presión máximas de los accesorios o sensores.
3. No use este producto para ningún fin que no sea para el que se ha diseñado.
4. Use tuberías de catálogo 80.
5. Use con liquidos solemente.
6. La instalación indebida del conector de tubería puede producir fallas de presión, lesión personal y/o daños a la propiedad.
7. Siempre haga coincidir los materiales del conector y de la tubería.
8. Siempre use el cemento de tubería diseñado para su conector y material de tubería especifi cos.

Compatibility

These schedule 80 fittings are designed to be used with the Signet flow and pH sensors listed below.

Compatibilité

Ces raccords norme 80 sont conçus pour être utilisés avec les capteurs de pH et d'écoulement Signet répertoriés ci-dessous.

Kompatibilität

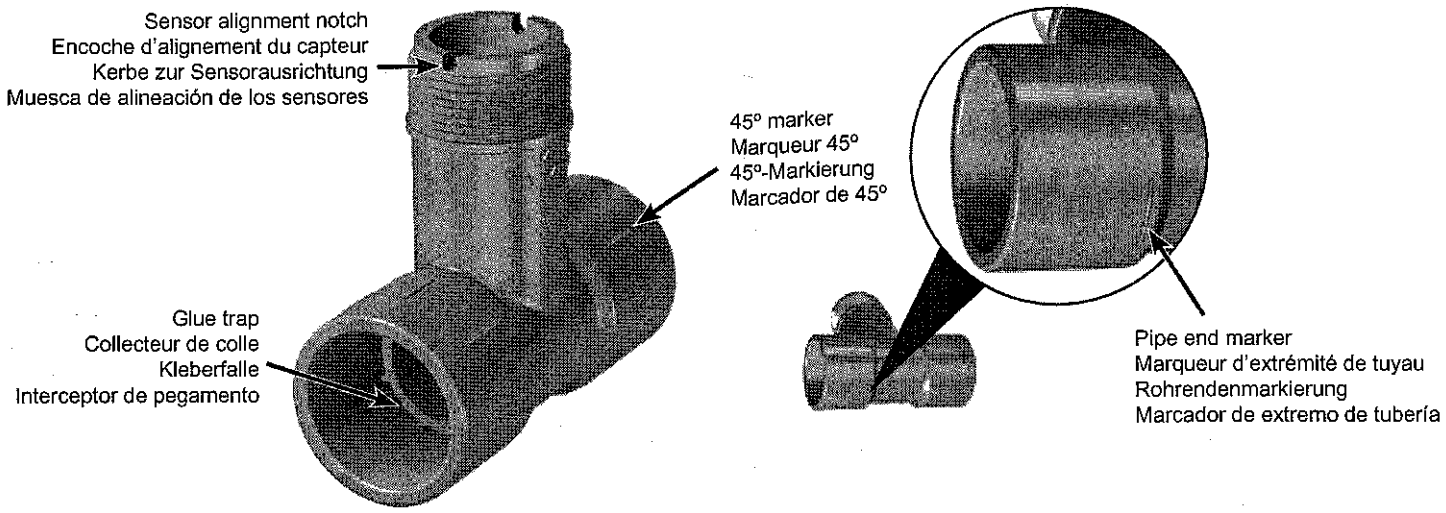
Diese Schedule 80 Fittinge sind zur Verwendung mit den nachstehend aufgeführten Durchfluss- und pH-Sensoren von Signet konzipiert.

Compatibilidad

Estos accesorios de catálogo 80 están diseñados para ser usados con los sensores de caudal y pH de Signet indicados abajo.

Flow Sensors Capteurs d'écoulement Durchflusssensoren Sensores de caudal	pH/ORP Electrodes Électrodes indicatrices de pH/ORP pH/ORP-Elektroden Electrodos de pH/ORP (pH/potencial redox)
P51530-X0	
3-8510-X0	3-2724, 3-2725, 3-2726, 3-2734, 3-2735, 3-2736
3-8512-X0	
3-2536-X0	
3-2537-XC-X0	
3-2551-X0-XX	

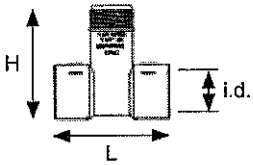
Identification | Identification | Identifizierung | Identificación



Fitting only | Raccord uniquement | Nur Fitting | Accesorio solamente



Material
Matériau
Material
Material

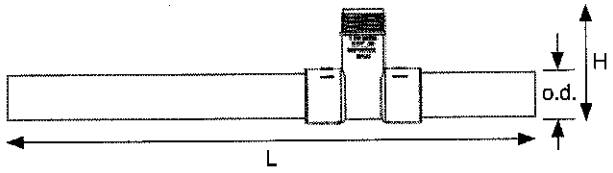


SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	i.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005F	159 001 614	MCPV8T005F	159 001 632	1/2"	3.75	3.50	0.85
MPV8T007F	159 001 615	MCPV8T007F	159 001 633	3/4"	3.75	3.70	1.06
MPV8T010F	159 001 616	MCPV8T010F	159 001 634	1"	4.30	4.00	1.33
MPV8T012F	159 001 617	MCPV8T012F	159 001 635	1-1/4"	4.40	4.30	1.67
MPV8T015F	159 001 618	MCPV8T015F	159 001 636	1-1/2"	5.00	4.60	1.91
MPV8T020F	159 001 619	MCPV8T020F	159 001 637	2"	5.50	5.00	2.40

Fitting with pipe | Raccord avec tuyau | Fitting mit Rohr | Accesorio con tubería



Material
Matériau
Material
Material



SCH 80 PVC		SCH 80 CPVC		Size (inches) Dim. (pouces) Größe (Zoll) Tamaño (pulgadas)	L (inches) (pouces) (Zoll) (pulgadas)	H (inches) (pouces) (Zoll) (pulgadas)	o.d. (inches) (pouces) (Zoll) (pulgadas)
Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código	Part No. Référence Teile-Nr. N° de pieza	Code Code Code Código				
MPV8T005	159 001 623	MCPV8T005	159 001 641	1/2"	14	3.50	0.84
MPV8T007	159 001 624	MCPV8T007	159 001 642	3/4"	14	3.70	1.05
MPV8T010	159 001 625	MCPV8T010	159 001 643	1"	17	4.00	1.32
MPV8T012	159 001 626	MCPV8T012	159 001 644	1-1/4"	20	4.30	1.66
MPV8T015	159 001 627	MCPV8T015	159 001 645	1-1/2"	24	4.60	1.90
MPV8T020	159 001 628	MCPV8T020	159 001 646	2"	26.5	5.02	2.38

K-Factors

A **K-Factor** is the number of pulses (**P**) a sensor will generate for each engineering unit of fluid that passes the sensor. K-factors for water are listed below in U.S. gallons and liters. For example, in a 1 inch SCH 80 PVC pipe, the 515 paddlewheel generates 172.07 pulses per gallon of water passing the rotor.

K-Factors are for schedule 80 pipe.

Facteurs K

Un **Facteur K** est le nombre d'impulsions (**P**) qu'un capteur produit pour chaque unité d'ingénierie de fluide qui y passe. Les facteurs K pour l'eau sont indiqués ci-dessous en gallons U.S. et en litres. Par exemple, dans un tuyau en PVC de 25,4 mm (1 pouce), la roue à palettes 515 produit 172.07 impulsions par gallon (3,78 litres) d'eau qui passe dans le rotor.

Les facteurs K sont pour les tuyaux de norme 80.

K-Faktoren

Der **K-Faktor** repräsentiert die Anzahl der Impulse (**P**), die vom Sensor für jede physikalische Einheit durchfließender Flüssigkeit erzeugt wird. K-Faktoren für Wasser sind nachstehend in US-Gallonen und Liter aufgeführt. Beispielsweise erzeugt das 515 Schaufelrad in einem 1-Zoll-PVC-Rohr 172.07 Impulse pro Gallone Wasser, das durch den Rotor fließt.

K-Faktoren sind für Schedule 80 Rohre.

Factores K

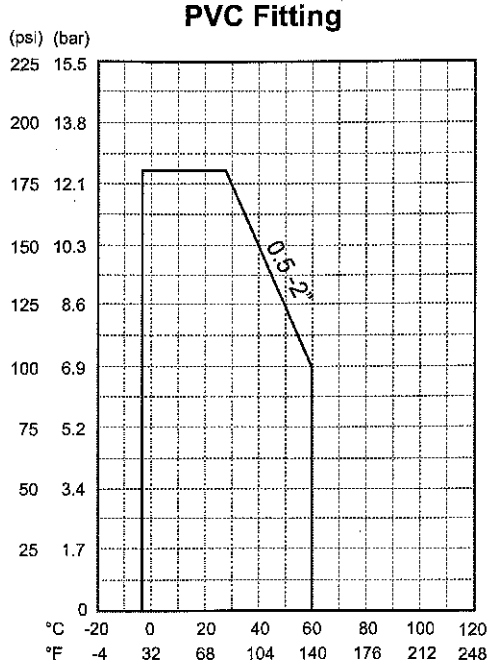
El **Factor K** es el número de impulsos (**P**) que genera un sensor por cada unidad de líquido que pasa por el sensor. En las tablas de abajo se muestran los factores K para agua (en unidades de galones norteamericanos [EE. UU.] y litros). Por ejemplo, en una tubería de PVC de 1 pulg., la 515 rueda de paletas genera 172.07 impulsos por galón de agua que pasa por el rotor.

Los factores K son para tuberías del catálogo 80.

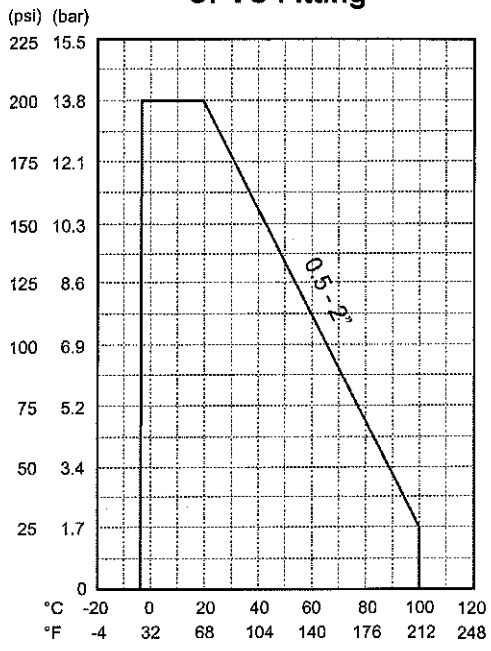
PIPE SIZE TAILLE DE TUYAU ROHRGRÖSSE TAMAÑO DE LA TUBERÍA	SCH. 80 FITTING RACCORD DE NORME 80 SCHEDULE 80 FITTING ACCESORIO DE CATÁLOGO 80	515/8510		2536/2537/8512		2551	
		P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL	P/LITERS P/LITRES P/LITROS	P/U.S. GAL
1/2"	MPV8T005F MCPV8T005F MPV8T005 MCPV8T005	137.42	520.12	271.37	1027.1	601.58	2277.0
3/4"	MPV8T007F MCPV8T007F MPV8T007 MCPV8T007	78.61	297.52	154.08	583.19	371.90	1407.6
1"	MPV8T010F MCPV8T010F MPV8T010 MCPV8T010	45.46	172.07	88.65	335.53	227.52	861.17
1-1/4"	MPV8T012F MCPV8T012F MPV8T012 MCPV8T012	24.19	91.54	47.24	178.79	122.83	464.91
1-1/2"	MPV8T015F MCPV8T015F MPV8T015 MCPV8T015	16.44	62.22	32.08	121.42	87.56	331.43
2"	MPV8T020F MCPV8T020F MPV8T020 MCPV8T020	9.60	36.32	18.87	71.44	50.96	192.89

Specifications | Spécifications | Spezifikationen | Especificaciones

PVC Fitting



CPVC Fitting





The pressure ratings are for the fitting only.
NEVER EXCEED the pressure rating of the installed sensor.

Follow plastic piping cement manufacturer's recommended preparation and gluing instructions. Avoid excess cement in fitting joints to prevent any port obstruction.

Rigid PVC and CPVC Material Compounds Specification:
ASTM D 1784

Dimensional and Compound Plastic Pipe Fittings Specifications:
ASTM D 2467
ASTM F 439

Standard Test Methods Specification:
ASTM F 1970

Approvals:
NSF (fitting only)

Les niveaux de pression ne concernent que le raccord.
NE JAMAIS DÉPASSER le niveau de pression du capteur installé.

Suivez les instructions de préparation et d'application du mastic données par le fournisseur de celui-ci. Evitez d'appliquer le mastic en trop grande quantité pour ne risquer aucune obstruction.

Matériau PVC et CPVC rigide Spécifications des composés :
ASTM D 1784

Dimensions et composé Raccords pour tuyau en plastique Spécifications :
ASTM D 2467
ASTM F 439

Méthodes standard de test Spécifications :
ASTM F 1970

Homologations :
NSF (Raccord uniquement)

Die Drucknennwerte beziehen sich nur auf die Fittinge.
Den Drucknennwert des installierten Sensors NIEMALS ÜBERSCHREITEN.

Anweisungen des Klebstoff-Herstellers befolgen. Nicht zuviel Klebstoff an den Verbindungsstellen auftragen, um Verstopfungen der Öffnungen zu vermeiden.

Verbundstoffspezifikation für unbiegsames PVC- und CPVC-Material:
ASTM D 1784

Abmessungs- und Verbundstoffspezifikationen für Rohrfittinge aus Kunststoff:
ASTM D 2467
ASTM F 439

Spezifikation für Standardtestmethoden:
ASTM F 1970

Zulassungen:
NSF (Nur Fitting)

Las presiones nominales son para el accesorio solamente.
NO EXCEDA NUNCA la presión nominal del sensor instalado.

Siga las instrucciones recomendadas por el fabricante para la preparación y el engomado del cemento para tuberías plásticas. Evite el exceso de cemento en las juntas de los conectores para prevenir obstrucciones en los orificios.

PVC y CPVC rígidos Especificación de los compuestos:
ASTM D 1784

Dimensiones y composición Accesorios de tuberías de plástico Especificaciones:
ASTM D 2467
ASTM F 439

Métodos de prueba estándar Especificación:
ASTM F 1970

Certificados de aprobación:
NSF (Accesorio solamente)

+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

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MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

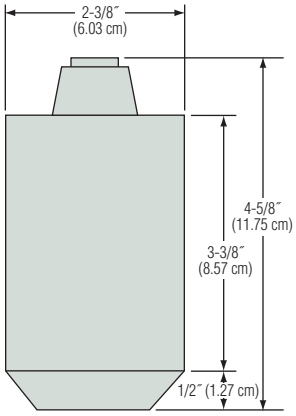


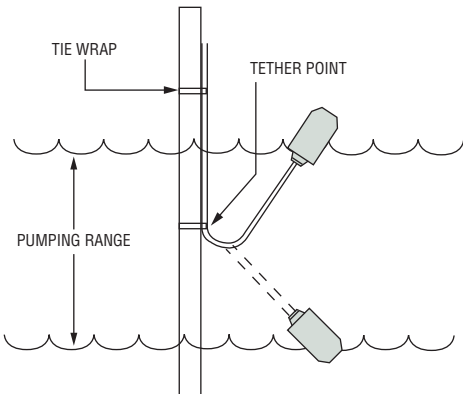
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

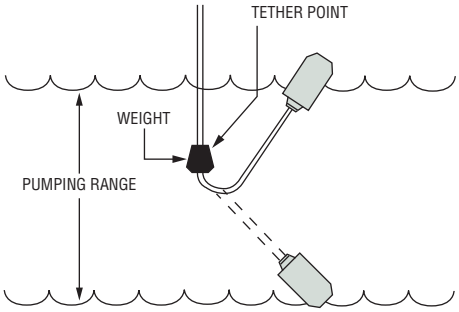
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Form 237
Sheet P/N 7801165
Rev. D

Warrick®
Series M Mechanical Tilt Float Switch
Installation and Operation Bulletin

Specifications

Cord	16 gauge, 2 or 3 conductor SJOW, Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC, 1/2hp
Contact Design	SPST, Normally Open or Normally Closed, Common with N.O. & N.C. (Form C)
Temperature Rating	32°F (0°C) to 194°F (90°C) Dry and 140°F (60°C) Water Resistant
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Certified

Installation

Tether Tie-Wrap (Fig 1)
Attach cord, using a tie-wrap, to a stationary structure. This is known as the tether point, it will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Tether-Weight (Fig 2)
Place tension-brand over the cord before installation. Place the weight at the desired position and secure with the tension-band. This position will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Determine tether point using charts below as a reference

Notes:
1. To Prevent Motor Burnout - In a pumpdown application make sure the turn-off level is at least 2 inches above the intake of the submersible pump.

2. Securing Tether Points - Make sure levels are correct and that floats are free from any obstructions before securing tether points.

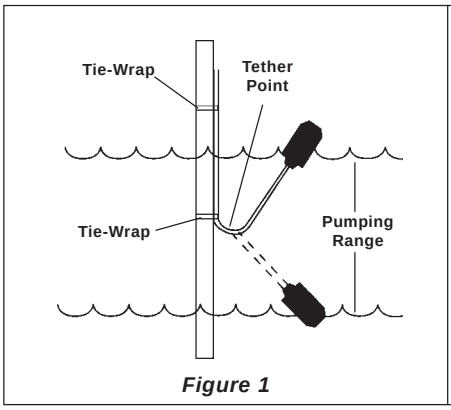


Figure 1

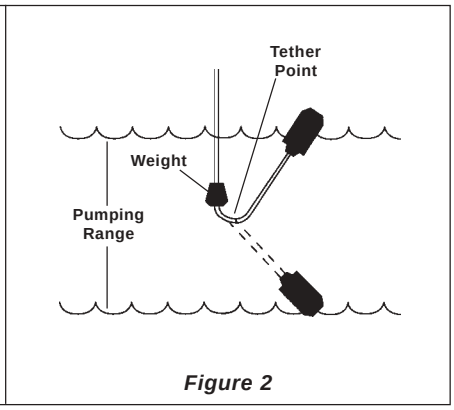
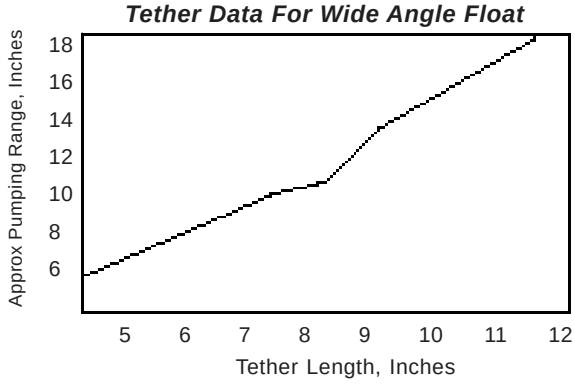
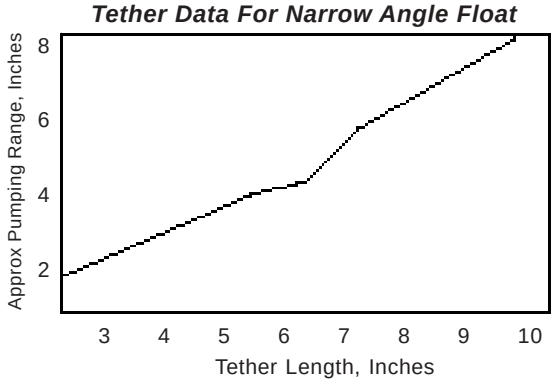


Figure 2

Tether Data For Wide Angle Float

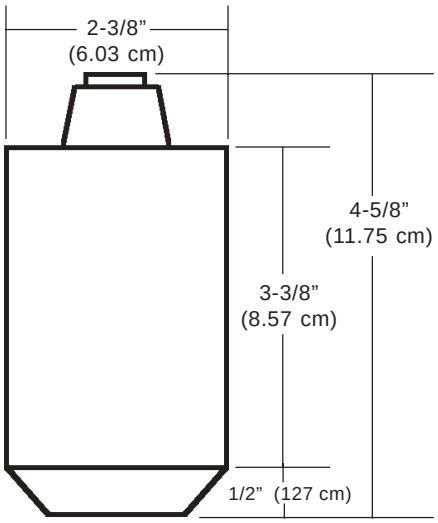


Tether Data For Narrow Angle Float

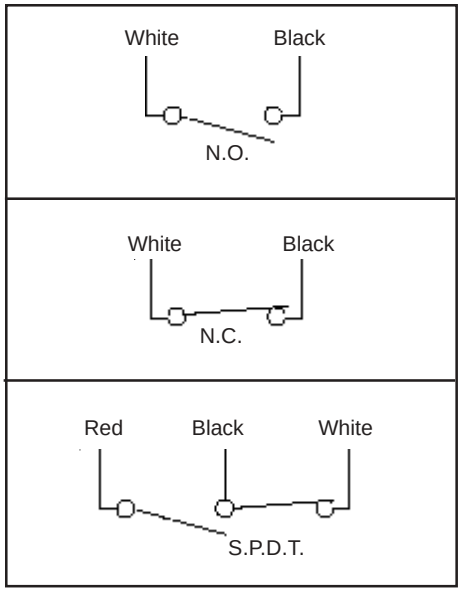


Notes:
1. Narrow angle pumping range is approximately 2 In. to 8 In.
2. Wide angle pumping range is approximately 5 In. to 18 In.

Dimensions



Contact Configurations



Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applica tions according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563

Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

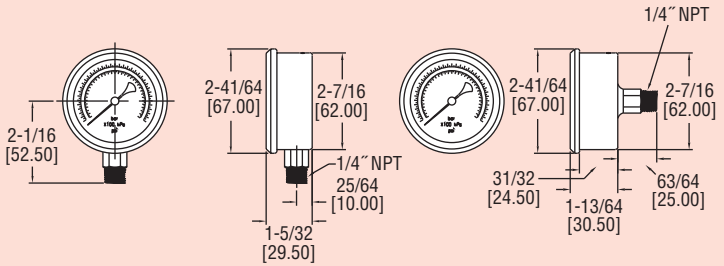
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

Series
F6 & F7

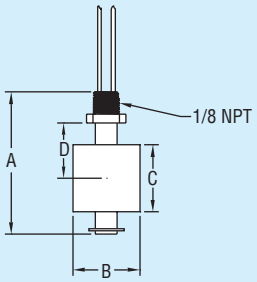
Level Switches - Vertical

Low Cost, Reliable and Compact, Hermetically Sealed Contacts

UL LISTED


F7-SB


F7-ST713



Series F6 & F7 compact level switches combine low cost and reliability with fast, simple installation. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels. Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications.

Dimensions in Inches (mm)

Model	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from Hex①
F7-SB	2.75 (70)	1.38 (35)	1.13 (29)	1.2 (31)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F6-SS	2.17 (55)	1.11 (28)	1.11 (28)	–
F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-K	2.13 (54)	1.0 (25)	1.0 (25)	0.65 (17)
F7-C11	2.06 (52)	1.0 (25)	1.0 (25)	0.56 (14)
F7-C21	2.06 (24)	1.0 (25)	1.0 (25)	0.56 (14)
F7-BB	3.19 (81)	1.88 (48)	1.81 (46)	1.19 (30)
F7-PS	3.38 (86)	1.88 (48)	1.88 (48)	1.25 (32)
F7-PVC	3.44 (87)	1.5 (38)	1.81 (46)	0.75 (19)
F7-T1	3.47 (88)	2.13 (54)	1.94 (49)	0.92 (22)
F7-ST713	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)
F7-ST714	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)

Model	Applications	Material Float/Stem	Temp. Limits	Press. Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg NPT (M)	Weight oz (g)
F7-SB	General purpose	Buna-N & Epoxy/ 316 SS	220°F (105°C)	150 psig 10 bar	0.60	25 VA: 1A @ 220 VAC	22 AWG 18″ (45 cm)	1/8″	2 (58)
F7-SS2	High temp/pressure, corrosives	316 SS (CYC)/ 316 SS	300°F (149°C)	450 psig 31 bar	0.75	25 VA: 1A @ 200 VAC	22 AWG 18″ (45 cm)	1/8″	1.2 (34)
F6-SS	Corrosives	316 SS/ 316 SS	257°F (125°C)	218 psig 15 bar	0.65	20 VA: 0.08A @ 240 VAC	20 AWG 11.8″ (30 cm)	1/8	1.59 (45)
F7-MPP**	Broad chemical compatibility	Polypropylene/ Polypropylene	180°F (82°C)	100 psig 6.89 bar	0.90	10 VA: 0.1A @ 100 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-MPP-NO**	Broad chemical compatibility	Polypropylene/ Polypropylene	176°F (80°C)	100 psig 6.89 bar	0.90	50 VA: 0.2A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-PP	Broad chemical compatibility	Polypropylene & Epoxy/Polypropylene	220°F (105°C)	100 psig 6.89 bar	0.60	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-BT	Oils & Fuels	Buna-N & Epoxy/ PBT*	220°F (105°C)	150 psig 10 bar	0.45	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.7 (20)
F7-K	Food/beverage, corrosives	PVDF/ PVDF	180°F (82°C)	100 psig 6.89 bar	1.00	50 VA: 0.25A @ 150 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C11	General purpose	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C21	Oils & water, general purpose	Buna-N/ 316 SS	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-BB	High viscosity liquids	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-PS	Water-based liquids, complies with FDA	Polysulfone/ Polysulfone†	225°F (107°C)	50 psig 3 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	4 (110)
F7-PVC	Chemical & plating	CPVC/ CPVC	180°F (82°C)	15 psig 1 bar	0.85	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-T1	Viscous, sticky or corrosive liquids	PTFE/ TFE	300°F (149°C)	30 psig 2 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)
F7-ST713	Oils, water & chemicals	316 SS/ 316 SS	300°F (149°C)	750 psig 52 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)

①Distance between hex and liquid (S.G. = 1.0) level at actuation point will vary with specific gravity changes.
*PBT - Polybutylene Terephthalate.
†Incudes 316 SS clip.
‡Spherical floats.
** F7-MPP is normally closed/F7-MPP-NO is normally open

UL Listed

OPTIONAL FITTINGS — For external mounting of vertical models
A-347, 1/8″ x 1-1/4″ NPT carbon steel adapter
A-347-SS, 1/8″ x 1-1/4″ NPT 316 SS adapter
A-348, 1/8″ x 1-1/2″ NPT carbon steel adapter

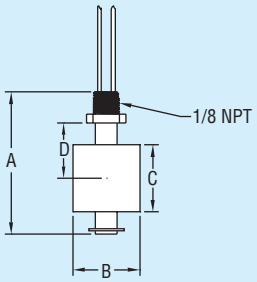
Series
F6 & F7

Level Switches - Vertical

Low Cost, Reliable and Compact, Hermetically Sealed Contacts


F7-SB


F7-ST713



Series F6 & F7 compact level switches combine low cost and reliability with fast, simple installation. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels. Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications.

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F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-K	2.13 (54)	1.0 (25)	1.0 (25)	0.65 (17)
F7-C11	2.06 (52)	1.0 (25)	1.0 (25)	0.56 (14)
F7-C21	2.06 (24)	1.0 (25)	1.0 (25)	0.56 (14)
F7-BB	3.19 (81)	1.88 (48)	1.81 (46)	1.19 (30)
F7-PS	3.38 (86)	1.88 (48)	1.88 (48)	1.25 (32)
F7-PVC	3.44 (87)	1.5 (38)	1.81 (46)	0.75 (19)
F7-T1	3.47 (88)	2.13 (54)	1.94 (49)	0.92 (22)
F7-ST713	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)
F7-ST714	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)

Model	Applications	Material Float/Stem	Temp. Limits	Press. Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg NPT (M)	Weight oz (g)
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F7-SS2	High temp/pressure, corrosives	316 SS (CYC)/ 316 SS	300°F (149°C)	450 psig 31 bar	0.75	25 VA: 1A @ 200 VAC	22 AWG 18″ (45 cm)	1/8	1.2 (34)
F6-SS	Corrosives	316 SS/ 316 SS	257°F (125°C)	218 psig 15 bar	0.65	20 VA: 0.08A @ 240 VAC	20 AWG 11.8″ (30 cm)	1/8″	1.59 (45)
F7-MPP**	Broad chemical compatibility	Polypropylene/ Polypropylene	180°F (82°C)	100 psig 6.89 bar	0.90	10 VA: 0.1A @ 100 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-MPP-NO**	Broad chemical compatibility	Polypropylene/ Polypropylene	176°F (80°C)	100 psig 6.89 bar	0.90	50 VA: 0.2A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-PP	Broad chemical compatibility	Polypropylene & Epoxy/Polypropylene	220°F (105°C)	100 psig 6.89 bar	0.60	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-BT	Oils & Fuels	Buna-N & Epoxy/ PBT*	220°F (105°C)	150 psig 10 bar	0.45	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.7 (20)
F7-K	Food/beverage, corrosives	PVDF/ PVDF	180°F (82°C)	100 psig 6.89 bar	1.00	50 VA: 0.25A @ 150 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C11	General purpose	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C21	Oils & water, general purpose	Buna-N/ 316 SS	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-BB	High viscosity liquids	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-PS	Water-based liquids, complies with FDA	Polysulfone/ Polysulfone†	225°F (107°C)	50 psig 3 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	4 (110)
F7-PVC	Chemical & plating	CPVC/ CPVC	180°F (82°C)	15 psig 1 bar	0.85	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-T1	Viscous, sticky or corrosive liquids	PTFE/ TFE	300°F (149°C)	30 psig 2 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)
F7-ST713	Oils, water & chemicals	316 SS/ 316 SS	300°F (149°C)	750 psig 52 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)

①Distance between hex and liquid (S.G. = 1.0) level at actuation point will vary with specific gravity changes.
*PBT - Polybutylene Terephthalate.
†Incudes 316 SS clip.
‡Spherical floats.
** F7-MPP is normally closed/F7-MPP-NO is normally open

UL Listed

OPTIONAL FITTINGS — For external mounting of vertical models
A-347, 1/8″ x 1-1/4″ NPT carbon steel adapter
A-347-SS, 1/8″ x 1-1/4″ NPT 316 SS adapter
A-348, 1/8″ x 1-1/2″ NPT carbon steel adapter

Series F6 & F7

Level Switches - Vertical

Low Cost, Reliable and Compact, Hermetically Sealed Contacts

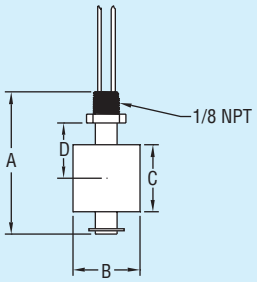
UL LISTED



F7-SB



F7-ST713



Series F6 & F7 compact level switches combine low cost and reliability with fast, simple installation. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels. Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications.

Dimensions in Inches (mm)

Model	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from Hex①
F7-SB	2.75 (70)	1.38 (35)	1.13 (29)	1.2 (31)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F6-SS	2.17 (55)	1.11 (28)	1.11 (28)	–
F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-K	2.13 (54)	1.0 (25)	1.0 (25)	0.65 (17)
F7-C11	2.06 (52)	1.0 (25)	1.0 (25)	0.56 (14)
F7-C21	2.06 (24)	1.0 (25)	1.0 (25)	0.56 (14)
F7-BB	3.19 (81)	1.88 (48)	1.81 (46)	1.19 (30)
F7-PS	3.38 (86)	1.88 (48)	1.88 (48)	1.25 (32)
F7-PVC	3.44 (87)	1.5 (38)	1.81 (46)	0.75 (19)
F7-T1	3.47 (88)	2.13 (54)	1.94 (49)	0.92 (22)
F7-ST713	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)
F7-ST714	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)

Model	Applications	Material Float/Stem	Temp. Limits	Press. Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg NPT (M)	Weight oz (g)
F7-SB	General purpose	Buna-N & Epoxy/ 316 SS	220°F (105°C)	150 psig 10 bar	0.60	25 VA: 1A @ 220 VAC	22 AWG 18″ (45 cm)	1/8″	2 (58)
F7-SS2	High temp/pressure, corrosives	316 SS (CYC)/ 316 SS	300°F (149°C)	450 psig 31 bar	0.75	25 VA: 1A @ 200 VAC	22 AWG 18″ (45 cm)	1/8	1.2 (34)
F6-SS	Corrosives	316 SS/ 316 SS	257°F (125°C)	218 psig 15 bar	0.65	20 VA: 0.08A @ 240 VAC	20 AWG 11.8″ (30 cm)	1/8″	1.59 (45)
F7-MPP**	Broad chemical compatibility	Polypropylene/ Polypropylene	180°F (82°C)	100 psig 6.89 bar	0.90	10 VA: 0.1A @ 100 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-MPP-NO**	Broad chemical compatibility	Polypropylene/ Polypropylene	176°F (80°C)	100 psig 6.89 bar	0.90	50 VA: 0.2A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-PP	Broad chemical compatibility	Polypropylene & Epoxy/Polypropylene	220°F (105°C)	100 psig 6.89 bar	0.60	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-BT	Oils & Fuels	Buna-N & Epoxy/ PBT*	220°F (105°C)	150 psig 10 bar	0.45	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.7 (20)
F7-K	Food/beverage, corrosives	PVDF/ PVDF	180°F (82°C)	100 psig 6.89 bar	1.00	50 VA: 0.25A @ 150 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C11	General purpose	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C21	Oils & water, general purpose	Buna-N/ 316 SS	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-BB	High viscosity liquids	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-PS	Water-based liquids, complies with FDA	Polysulfone/ Polysulfone†	225°F (107°C)	50 psig 3 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	4 (110)
F7-PVC	Chemical & plating	CPVC/ CPVC	180°F (82°C)	15 psig 1 bar	0.85	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-T1	Viscous, sticky or corrosive liquids	PTFE/ TFE	300°F (149°C)	30 psig 2 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)
F7-ST713	Oils, water & chemicals	316 SS/ 316 SS	300°F (149°C)	750 psig 52 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)

①Distance between hex and liquid (S.G. = 1.0) level at actuation point will vary with specific gravity changes.
*PBT - Polybutylene Terephthalate.
†Incudes 316 SS clip.
‡Spherical floats.
** F7-MPP is normally closed/F7-MPP-NO is normally open

UL Listed

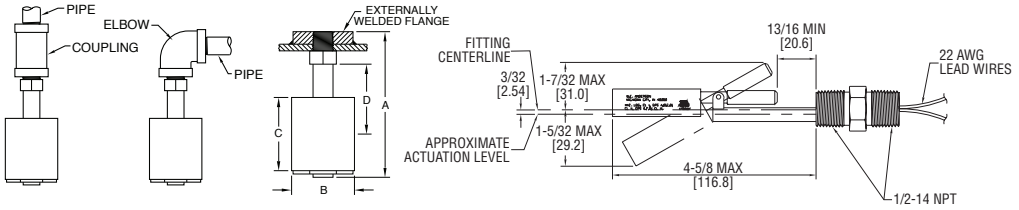
OPTIONAL FITTINGS — For external mounting of vertical models
A-347, 1/8″ x 1-1/4″ NPT carbon steel adapter
A-347-SS, 1/8″ x 1-1/4″ NPT 316 SS adapter
A-348, 1/8″ x 1-1/2″ NPT carbon steel adapter

Series F7 Liquid Level Switches

Specifications - Installation and Operating Instructions



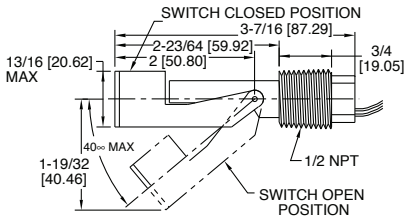
(Model F7-SB Shown)



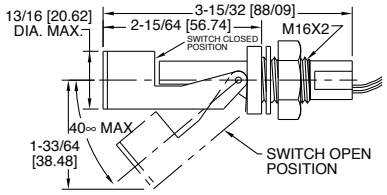
F7-HSS

Dimensions, Inches (mm)

Model	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from HEX
F7-SB	2.75 (70)	1.13 (29)	1.38 (35)	1.0 (26)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)



F7-HPS-2, EXTERNAL HORIZONTAL MOUNT



F7-HPS-2, INTERNAL HORIZONTAL MOUNT

SWITCH ACTION (Normally open/Normally closed)

Vertical Models

Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem.

Horizontal Models

Contacts in horizontal models F7-HPS-1 (internal mount) and F7-HPS-2 (external mount), are normally open when the float is down and normally closed when the float is up. Models F7-HPS-1 and -2 also have indicating arrows on the stem end to confirm float alignment. See installation notes on reverse. Horizontal model F7-HSS is in the normally open position when the indicating arrow points up, and normally closed when the arrow points down.

INSTALLATION

Choose a location away from fill pipes, drains, or other areas where turbulence or wave motion might occur. Turbulence will cause false actuations and shorten contact life. Excess contaminants in fluid may inhibit float operation and occasional wipe-down may be necessary. Care should be taken that switches are always operated within electrical ratings. Read and understand all safety precautions on back of this sheet before installing.

MOUNTING

Install vertical mount models in an appropriate 1/8″ NPT fitting. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Model F7-HPS-1 must be mounted internally, which means the switch must be secured to the wall of the tank or vessel from the inside. Install horizontal model F7-HPS-1 in a 5/8″ (16 mm) hole and secure with nut provided. Tank wall should not exceed 1/8″ (3 mm). Model F7-HPS-2 requires a horizontal 1/2″ NPT(F) fitting and can be fitted to the tank or vessel from the outside. Model F7-HSS requires a horizontal 1/2″ NPT(F) fitting and can be mounting from the inside or outside (internally or externally) of the tank or vessel.

SPECIFICATIONS

Electrical Rating (Maximum):

F7-SB, SS2: AC: 25 VA, 1A @ 200 V.
DC: 10W, 1A @ 200V.
F7-PP, BT, HSS: AC: 30 VA, 0.14A @ 200V.
DC: 0.28A @ 24 V, 0.07A @ 120V.
F7-MPP: 10 VA, 0.1A @ 120 VAC.
F7-MPP-NO: 50 VA, 0.2A @ 240 VAC.
F7-HPS: 15 VA, 1A @ 220 VAC/DC.

Mounting Connections: 1/8″ NPT(M) (all vertical mount), 1/2″ NPT(M) (F7-HPS-2, F7-HSS), M16 x 2 (F7-HPS-1).

Wire Leads: F7-SB, SS2, PP, BT: 22 AWG x 18″ (46 cm); F7-MPP, HSS: 22 AWG x 24″ (61 cm); F7-HPS: 22 AWG x 39″ (1m).

Enclosure Rating: F7-HSS: Explosion-proof, Class 1, Groups A, B, C, D; Class II, Groups E, F, G; Class III.

Weight: F7-SB, 2 oz. (58 g); F7-SS2, 1.2 oz. (34 g); F7-PP, 0.8 oz. (23 g); F7-BT, 0.7 oz. (20 g); F7-HPS-1, 1.5 oz. (43 g); F7-HPS-2, 2 oz. (57 g); F7-HSS, 3 oz. (94 g); F7-MPP, 0.8 oz. (23 g).

Model	Material Float/Stem	Max Temp.	Max Press.	Min S.G.	Approx. Deadband
Vertical Mount					
F7-SB	Buna-N & Epoxy/316SS	220°F 105°C	150 psig 10 bar	0.60	1/16″ 2 mm
F7-SS2	316SS (CYC)/316SS	300°F 149°C	450 psig 31 bar	0.75	1/16″ 2 mm
F7-PP	Polypropylene & Epoxy/Polypropylene	220°F 105°C	100 psig 6.89 bar	0.60	1/8″ 4 mm
F7-BT	Buna-N & Epoxy/PBT*	220°F 105°C	150 psig 10 bar	0.45	1/8″ 4 mm
F7-MPP	Polypropylene / Polypropylene	176° F 80° C	100 psig 6.89 bar	0.90	1/8″ 4 mm
Horizontal Mount					
F7-HPS -1, -2	Polysulfone/ Polysulfone	185°F 85°C	150 psig 10 bar	0.85	3/16″ 5 mm
F7-HSS	316SS/316SS	392°F 200°C	300 psig 20.7 bar	0.60	1/8″ 4 mm

*PBT - Polybutylene Terephthalate

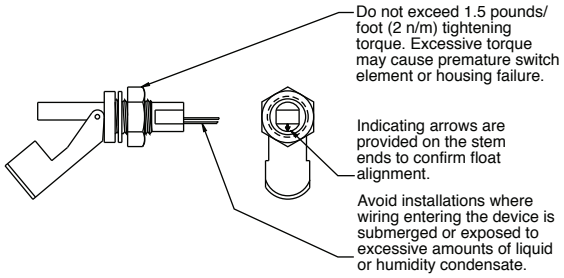
Optional Fittings (for Exterior Mounting of Vertical Models)

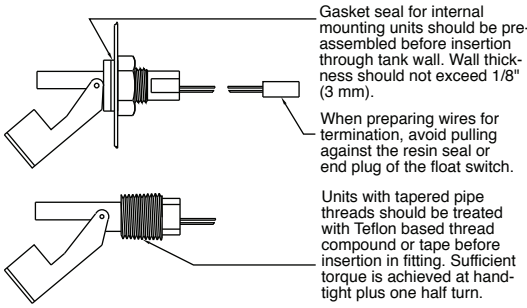
A-347, 1/8″ x 1-1/4″ NPT C.S. Adapter.
A-347-SS, 1/8″ x 1-1/4″ NPT 316SS Adapter.
A-348, 1/8″ x 1-1/2″ NPT C.S. Adapter.
A-348-SS, 1/8″ x 1-1/2″ NPT 316SS Adapter.

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Installation Notes - Do not subject reed switch controls to excessive shock or vibration or any of the following:

- Bending or placing force loads on reed switch housing.
- Over-torquing fittings on reed switch housing.
- Placing pull-out force on lead wires.





CIRCUIT INFORMATION FOR REED SWITCH PROTECTION

Read information below before installing your new reed switch control!

Exceeding the current capacity of this Reed Switch control may cause FAULTY OPERATION! Be aware of the inductive and capacitive or lamp loads you may be placing on you Reed Switch Control. The circuits below outline possible solutions to preventing overloads due to inrush or surge currents exceeding maximum or when the switch current and product of the inductive back EMF exceed the switch's power rating. Also the circuit for prevention of overload when switching filament lamps (low "cold" resistance) is outlined below. Failure to follow these measures to protect Reed Switch Contacts may cause the contacts to weld together or result in premature wear.

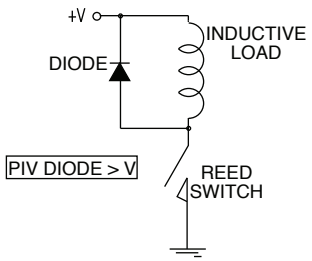
Possible Circuit Solutions Indicated by Dashed Lines

Inductive Loads

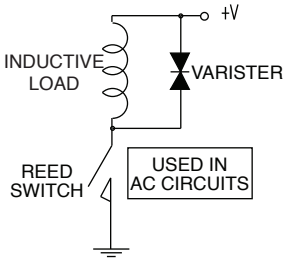
Possible causes -

An electromagnetic relay, electromagnetic solenoid, electromagnetic counter with inductive component as circuit load.

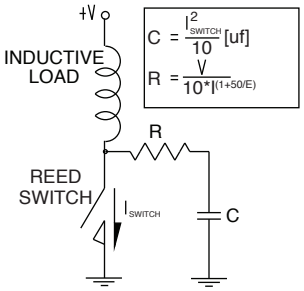
DIODE SUPPRESSION



VARISTER PROTECTION



RC SUPPRESSION

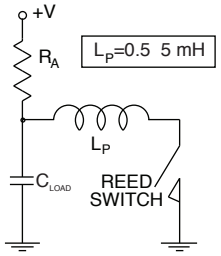


Capacitive Loads

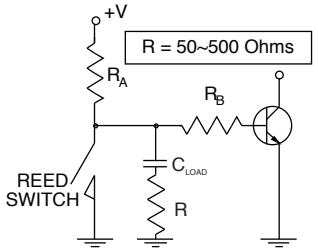
Possible causes -

A capacitor connected in series or parallel with Reed Switch control. In a closed circuit, a cable length (usually greater than 50m [162.5 ft.]) used to connect reed switch may also introduce static capacitance.

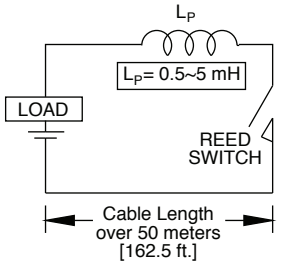
SURGE LIMITER FOR CAPACITANCE IN SERIES



RESISTOR PROTECTION FOR CAPACITIVE LOAD



INDUCTIVE PROTECTION FOR CABLE LENGTH CAPACITANCE

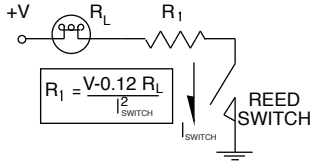


Lamp Loads

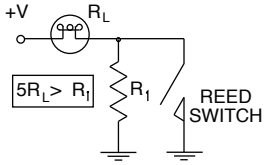
Possible causes -

A tungsten filament lamp load.

CURRENT LIMITING RESISTOR IN SERIES



CURRENT LIMITING RESISTOR IN PARALLEL



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e-mail: info@dwyermail.com

Operating Instructions | **1UHH1 thru 1UHH4, 2NNR5 thru 2NNR9, 2NNT1 thru 2NNT5, and 6EDY3 thru 6EDY7**

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Line Voltage Thermostats

Description

These Line Voltage Thermostats are designed for reliable use in heating, ventilating, and refrigeration applications. A broad temperature range between -30° and +120°F (-34° and +49°C) allows for a wide range of heating, ventilating, and refrigeration applications. Snap-acting contacts are in a dust protected enclosure. SPDT switches are enclosed and protected.

Specifications

ELECTRICAL RATINGS

AC Voltage	120 V	208 V	240 V	277 V
Models 1UHH1 thru 1UHH4, 2NNR5 thru 2NNR7, 2NNR9, 2NNT1 thru 2NNT4 & 6EDY3 thru 6EDY7:				
Inductive Full Load Amps	16.0	9.2	8.0	–
Locked Rotor Amps	96.0	55.2	48.0	–
Models 2NNR8 & 2NNT5:				
Inductive Full Load Amps	12.0	–	–	–
Locked Rotor Amps	72.0	–	–	–
Resistive Load Amps (not lamp loads):				
Models 1UHH1, 1UHH2, 2NNR6, 2NNR7, 2NNR9 & 2NNT3:				
SPST (when connected)	22.0	22.0	22.0	22.0
SPDT (when connected)	16.0	9.2	8.0	7.2
Models 1UHH3, 2NNT1 & 6EDY4:				
SPDT Rating	16.0	9.2	8.0	7.2
Models 1UHH4, 2NNR5 & 2NNT4:				
SPST Rating	22.0	22.0	22.0	22.0
Models 2NNR8 & 2NNT5*:				
SPST Rating	12.0	–	–	–

Pilot Duty . . . . . 125 VA 24/600 VAC

(*) Model numbers 2NNR8 and 2NNT5 include a 6 foot "Piggyback" cord.

NOTE: When used as a two circuit switch, the total load must not exceed 2000 VA.



Figure 1

General Safety Information

⚠ WARNING ***Disconnect all power before installing or servicing this product. If the power disconnect is out of view, lock it in the open position and tag it to prevent unexpected restarting of power. Failure to do so could result in fatal electric shock.***

1. Special attention must be given to any grounding information on this product and to other equipment associated with its installation and use. To ensure a proper ground, the grounding means must be checked by a qualified electrician.
2. Be certain that the electrical ratings of the thermostat conform to the power source and the load(s) being controlled. Loads that exceed the rating of the thermostat should be handled with a suitable rated relay or motor starter.

⚠ WARNING ***Do not depend upon the thermostat as the sole means of disconnecting power when installing or servicing the product it is controlling. Always disconnect power at the main circuit breaker as described above. Failure to do so could result in fatal electric shock.***

3. This thermostat is intended ONLY for permanent installation in accordance with the United States National Electrical Code (NEC), all applicable local codes and ordinances, and all sections of this manual. All wiring should be done by a qualified electrician, using copper wire only.

⚠ WARNING ***These thermostats are intended for general heating, ventilating, and refrigeration ONLY. They must NOT be used in potentially dangerous locations such as flammable, explosive, chemical laden areas or in wet atmospheres.***

⚠ WARNING ***These thermostats are designed for use as operating controls only. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (supervisory alarm systems) that protect against, or warn of control failure.***

ADDITIONAL SPECIFICATIONS

Model Number	Application	Switch	Temperature Range	Temperature Differential*	Sensor	Construction	Housing Rating
1UHH1	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
1UHH2	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
1UHH3	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
1UHH4	Cool Only	SPST	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
2NNR5	Refrigeration	SPST	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Steel	1
2NNR6	Heat/Cool	SPDT	0 to 120°F (-18 to 49°C)	3.5°F	Extended	Polymeric	4X
2NNR7	Heat/Cool	SPDT	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Steel	1
2NNR8	Heat Only	SPST	35 to 95°F (2 to 35°C)	3.5°F	Fixed	Steel	1
2NNR9	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT1	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT2	Cool Only	SPST	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT3	Heat/Cool	SPDT	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Stainless Steel	1
2NNT4	Refrigeration	SPST	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Stainless Steel	1
2NNT5	Heat Only	SPST	35 to 95°F (2 to 35°C)	3.5°F	Fixed	Stainless Steel	1
6EDY3	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5 to 12°F	Fixed	Polymeric	1
6EDY4	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
6EDY5	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
6EDY7	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5 to 12°F	Extended	Steel	1

(*) Temperature between stages on Models 1UHH3, 2NNT1 and 6EDY4 is fixed. The low stage makes contacts R (Red) to Y (Yellow) at the knob setting while the high stage makes contact approximately 3°F above the knob setting.

SECTION 6 - ELECTRICAL DRAWINGS & TABLE(S)

HMI SCREEN SUMMARY / INSTRUCTIONS

T-2, INTERLOCK SCHEDULE

I-1A, MASTER CONTROL PANEL LAYOUT DRAWING

I-1B, MOTOR CONTROL PANEL LAYOUT DRAWING

T-3, PANEL BILL OF MATERIAL(S)

I-2, WIRING DIAGRAMS AND TERMINAL DETAILS

E-1, LINE DIAGRAM

T-5, VFD SETTINGS TABLE(S)

NES PROJECT: 15-183, JUNE 2016
GES – BASF RENSSELAER, NY

HMI SCREEN SUMMARY & REMOTE ACCESS

ALARMS – SEE INTERLOCK TABLE 2

NORMAL OPERATION
* Equipment will operate if the panel switch is in the AUTO position and no alarm is present.
* Equipment will operate if the panel switch is in the HAND position with or without an alarm condition.
* Conditions that will stop a motor in the hand position are an overload or emergency stop.

ALARM Email Settings

1. Email from: BASF_NY@nes-inc.com

2. Email to: BASF_NY@nes-inc.com (forwards to client distrib.list, i.e.: CMinchoff@gesonline.com)

3. Subject "BASF FACILITY"

4. Body of Email - date / time / alarm, i.e. "06/05/16 05-JUN-16 CHEMICAL TANK T-1002 LOW LEVEL WARNING"

Accessing the system remotely from a web connected computer:

NES will post a program access file (15-183 EA-CON_IP=[166.139.14.182_11102].exe) to our FTP site – save this to Desktop for Remote Access

Upon executing the HMI program log in as follows:

A.) Full Access: A password window appears. Enter the following:
User name: BASF1
Password: admin
After a short delay the screens should appear. This allows complete remote operation.

B.) Limited Access: A password window appears. Enter the following:
User name: BASF2
Password: operator
After a short delay the screens should appear. This allows viewing and changing of screens only.

HMI SCREEN SUMMARY & REMOTE ACCESS

Downloading Data Log files from a web connected computer:

1.) Enter FTP: // 166.139.14.182 directly into the Microsoft Internet Explorer web address bar (do not use a search engine program) and press Enter.

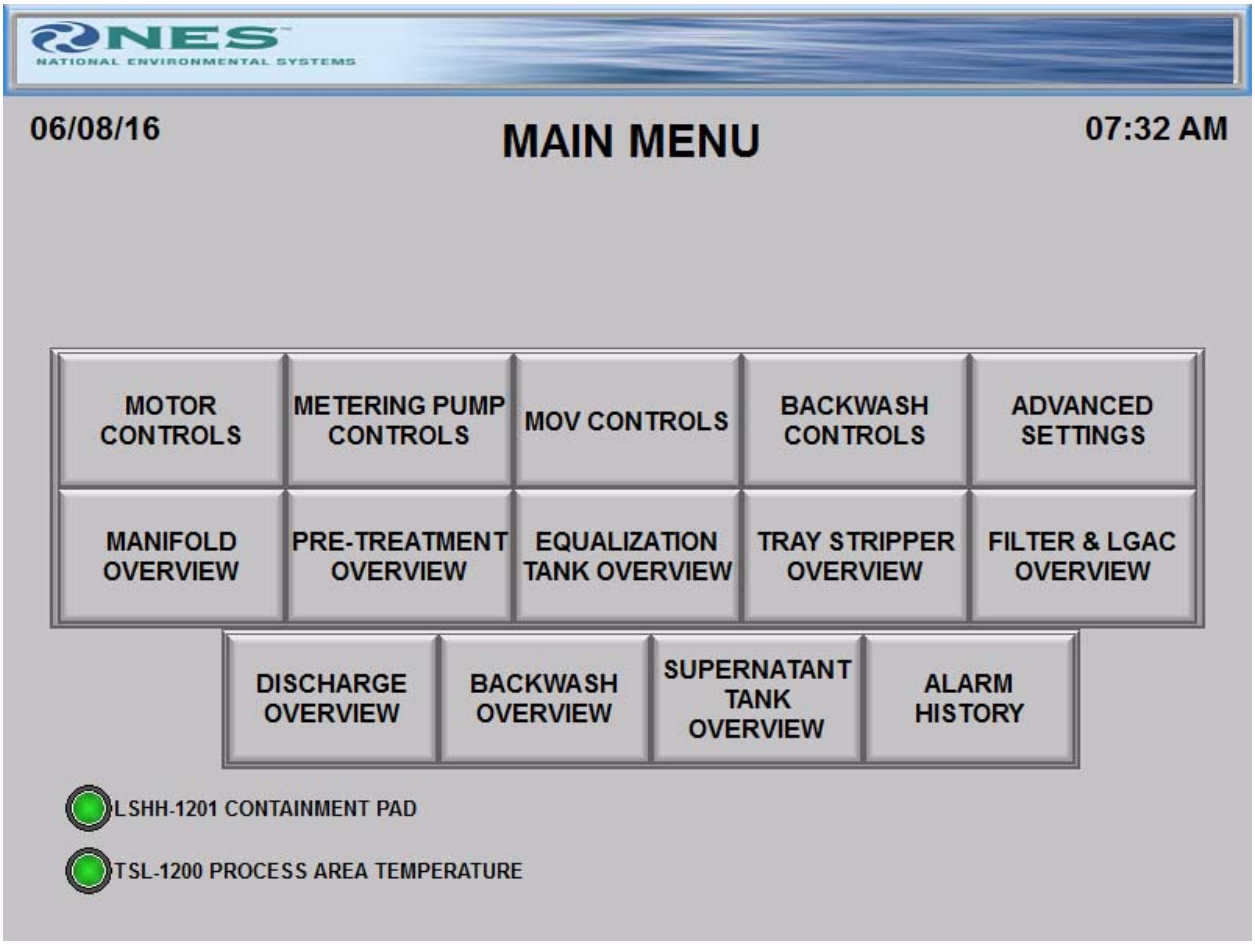
2.) Select Directory SD1

3.) Select Directory Log

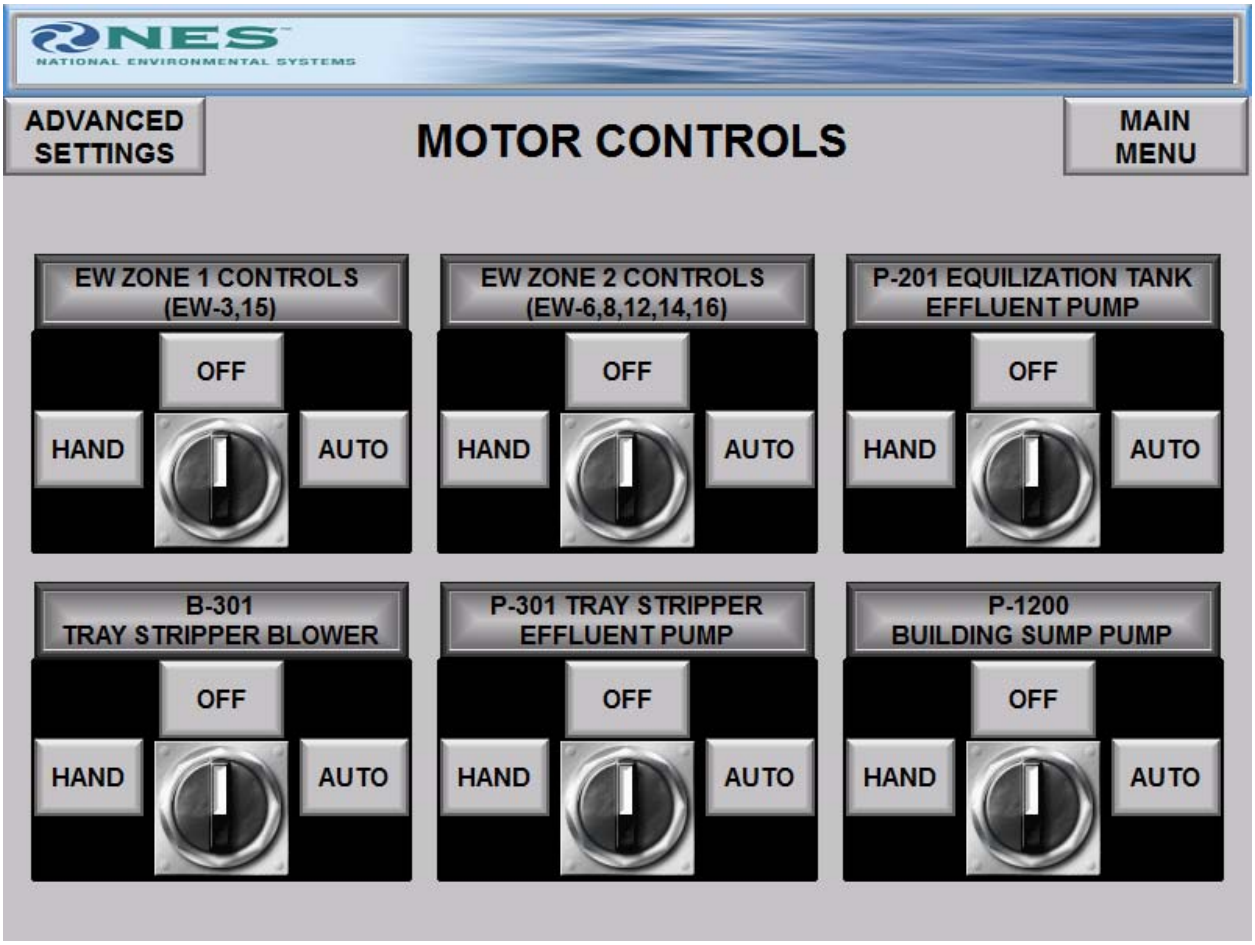
4.) A Directory of Data Files associated with dates will be displayed.

- Right Click any File.txt;
- Choose “Save target as”;
- Save file to desired location;
- Open with MS Excel, Word, Notepad or a similar program for data review / formatting.

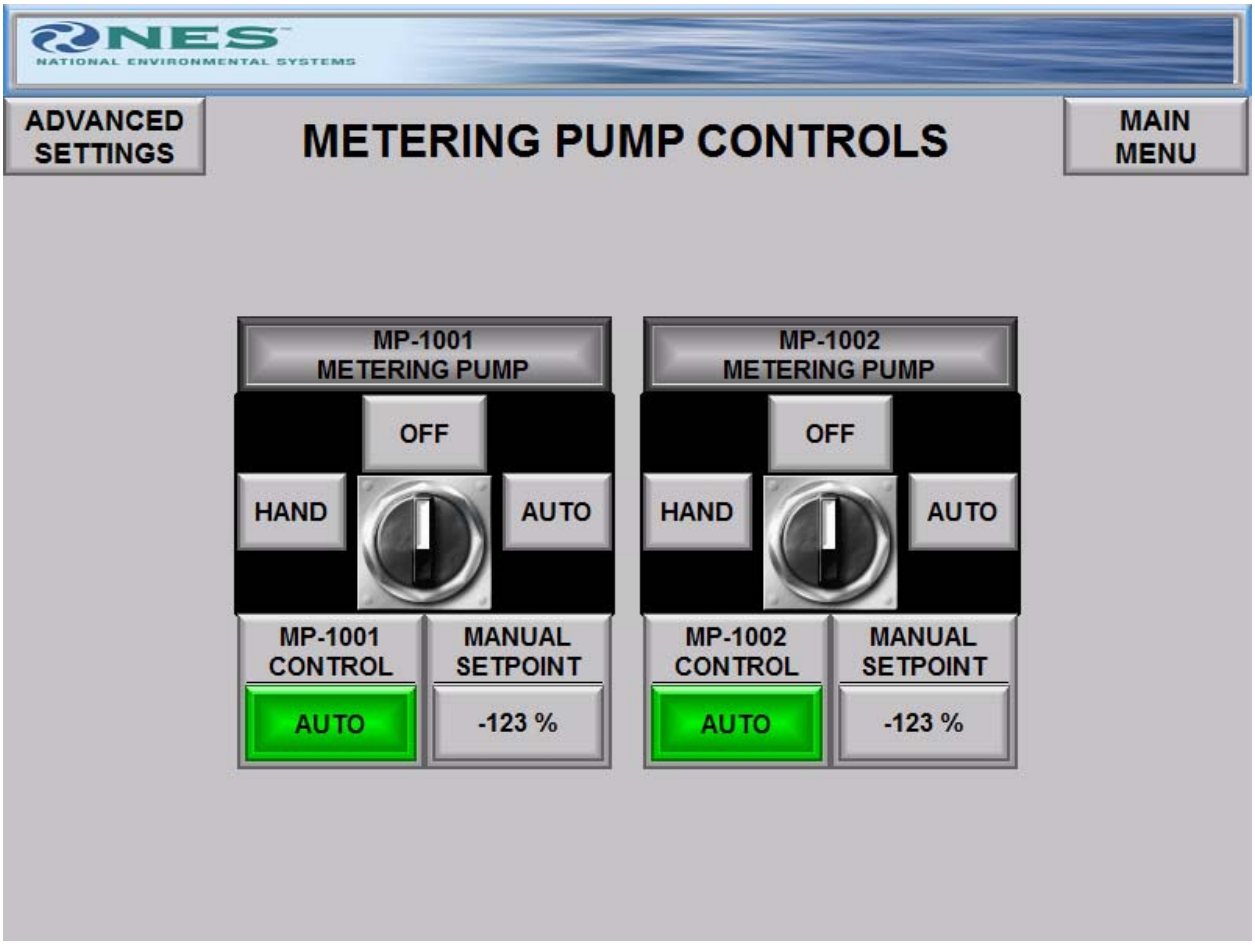
HMI SCREEN SUMMARY & REMOTE ACCESS



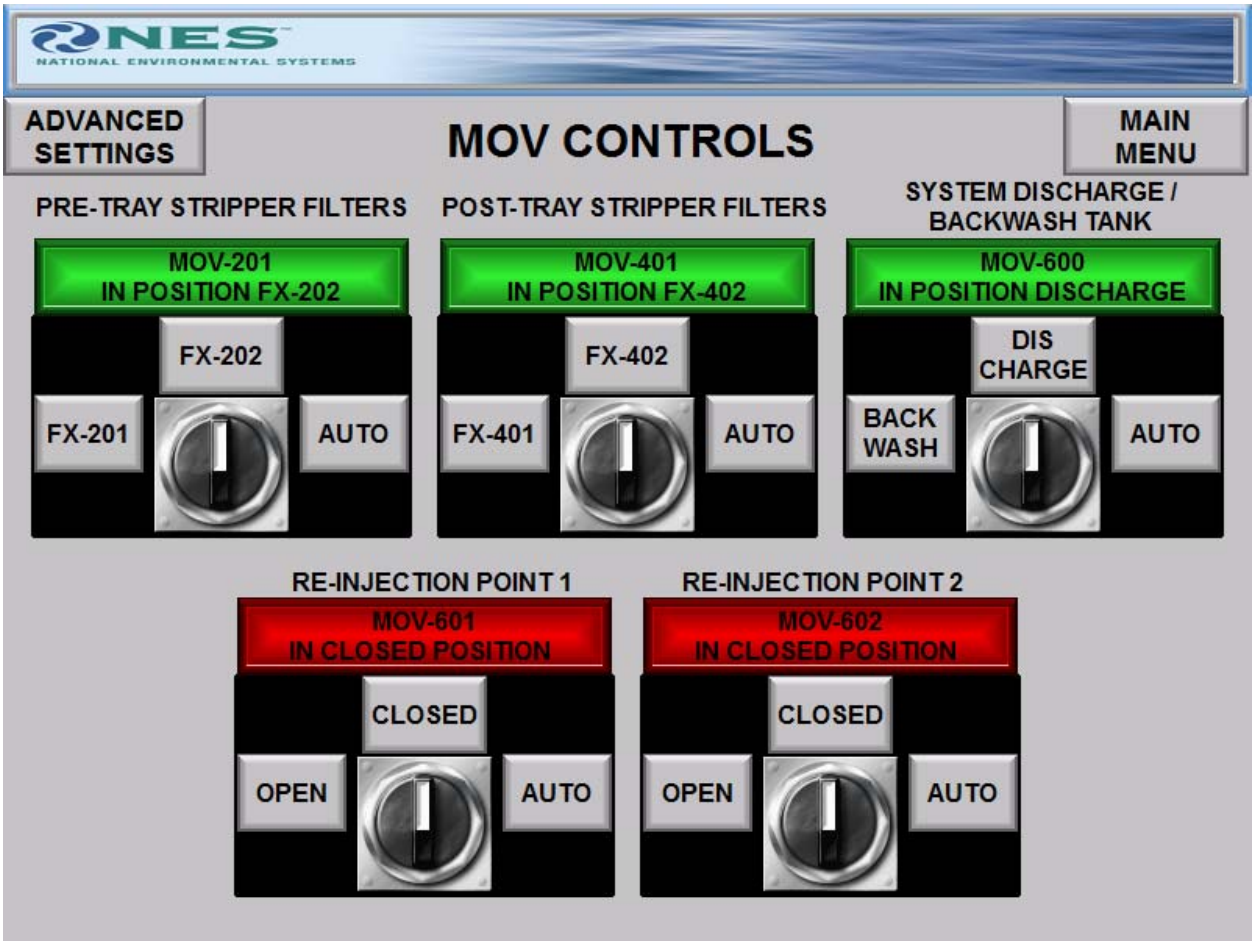
HMI SCREEN SUMMARY & REMOTE ACCESS



HMI SCREEN SUMMARY & REMOTE ACCESS



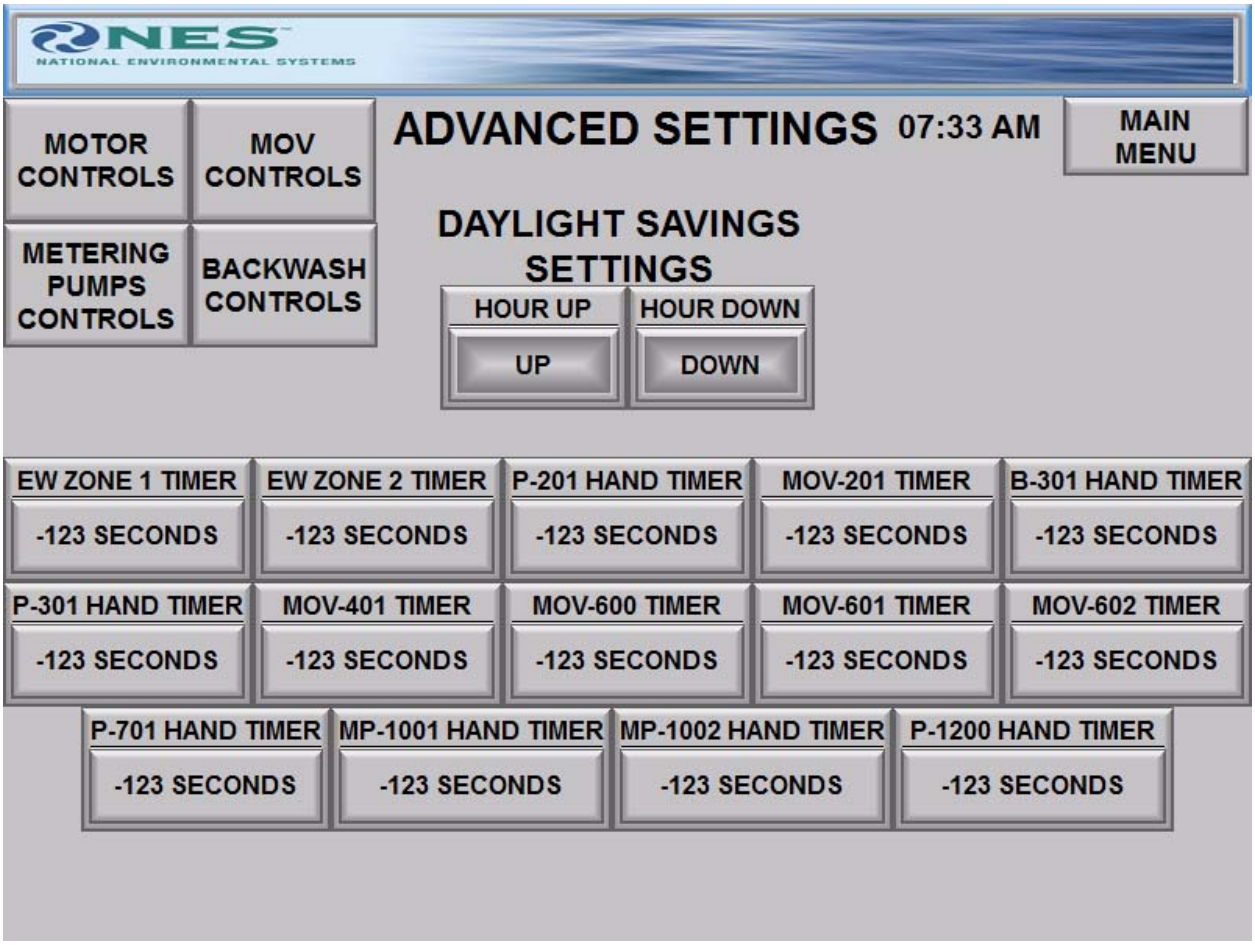
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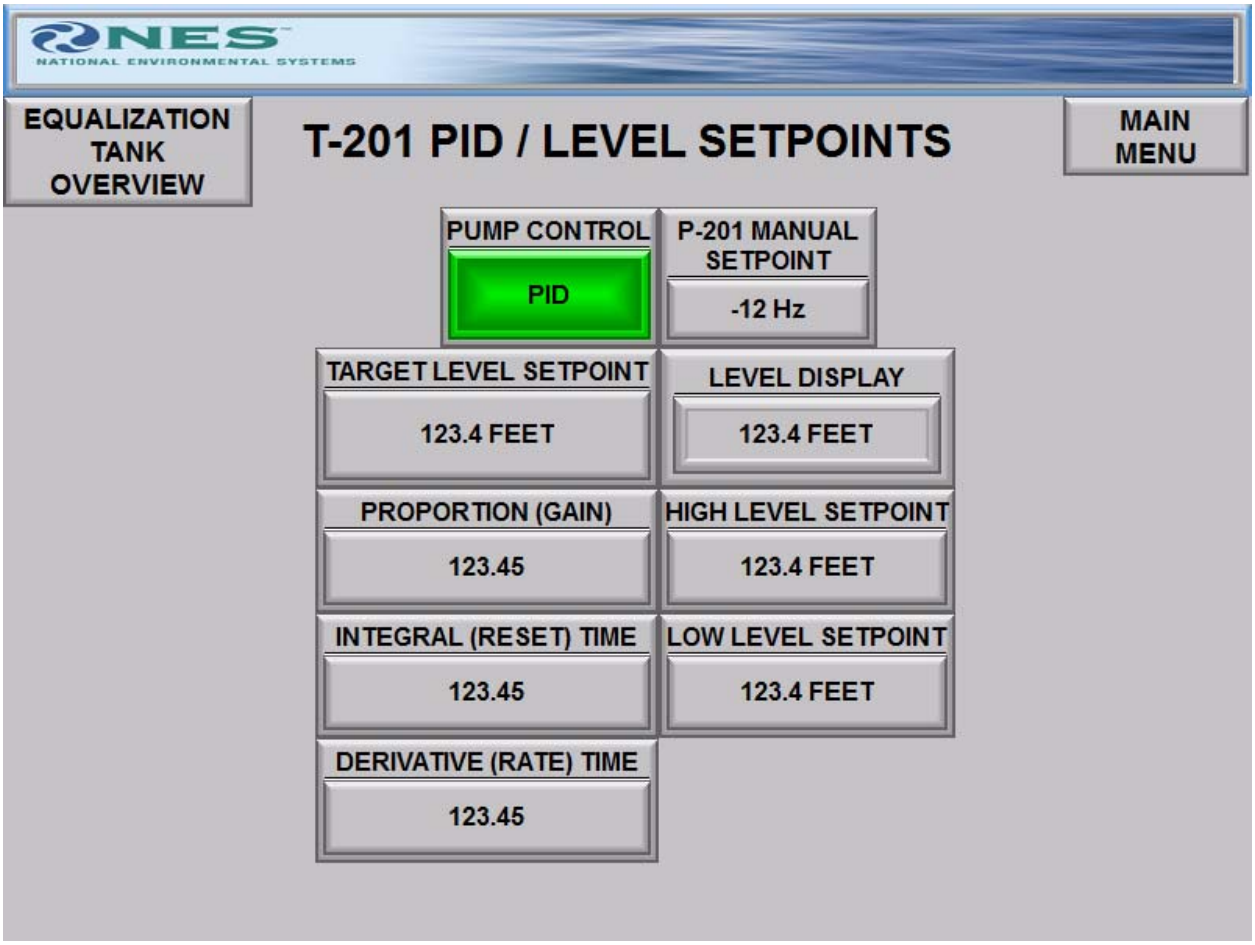
HMI SCREEN SUMMARY & REMOTE ACCESS



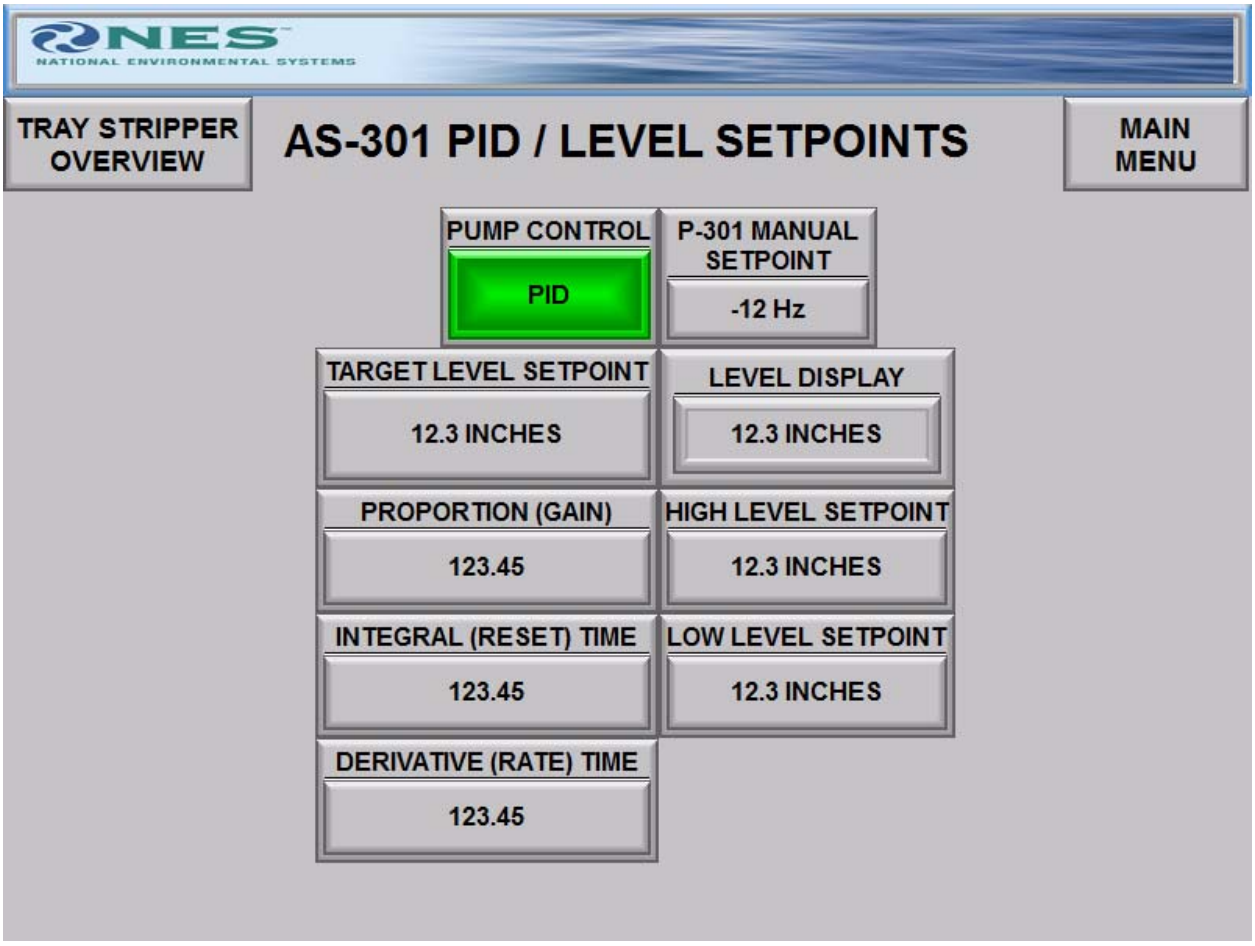
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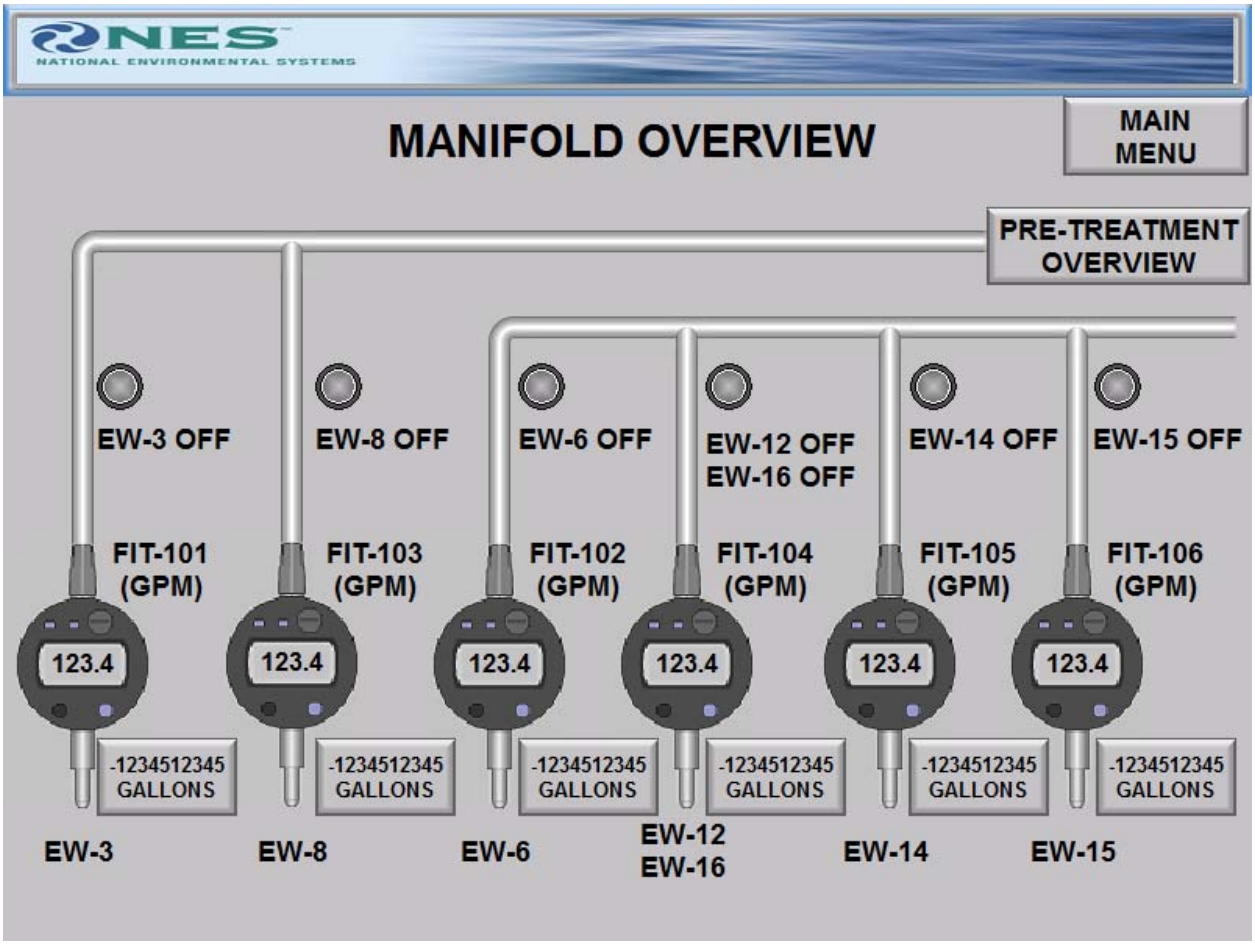
HMI SCREEN SUMMARY & REMOTE ACCESS



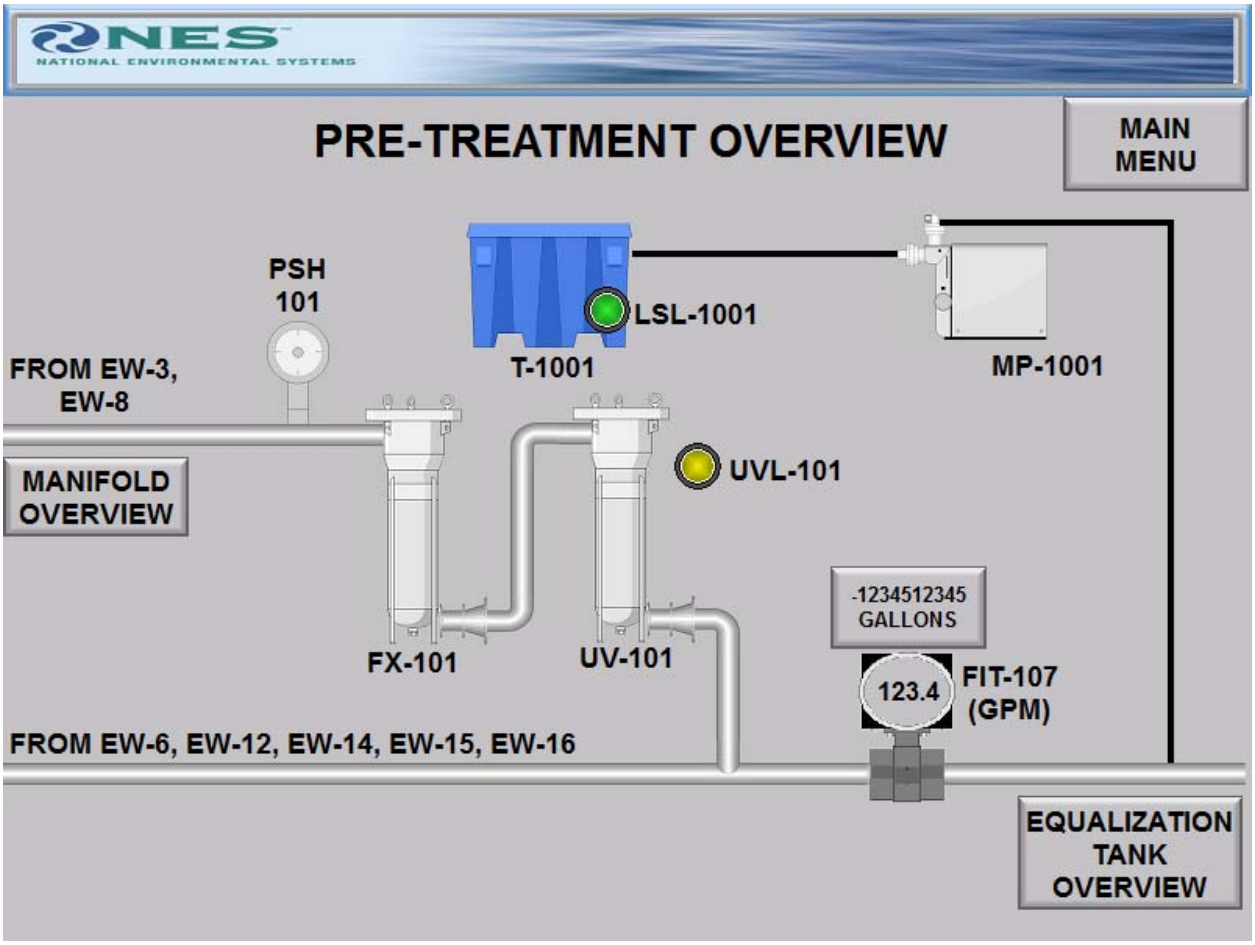
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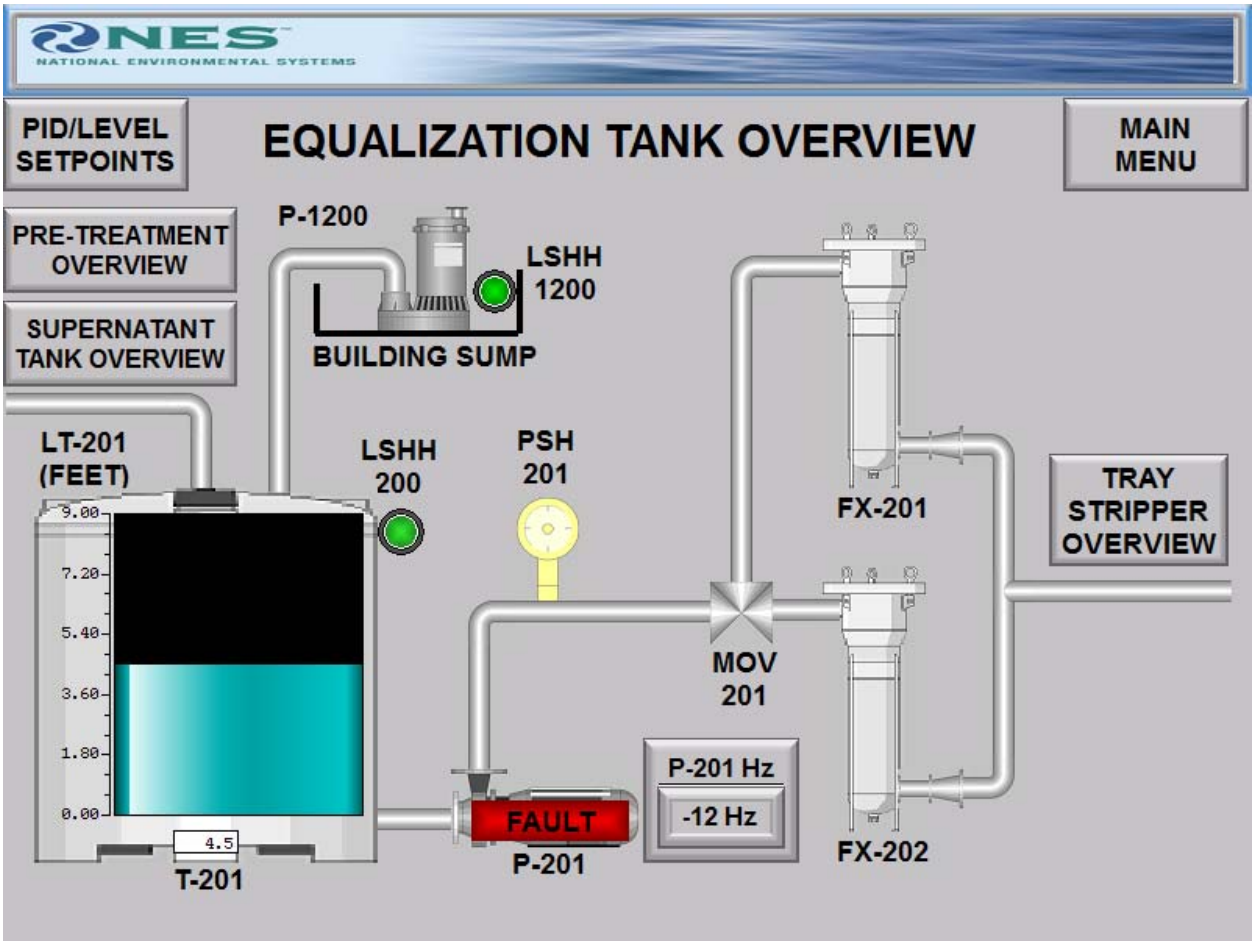
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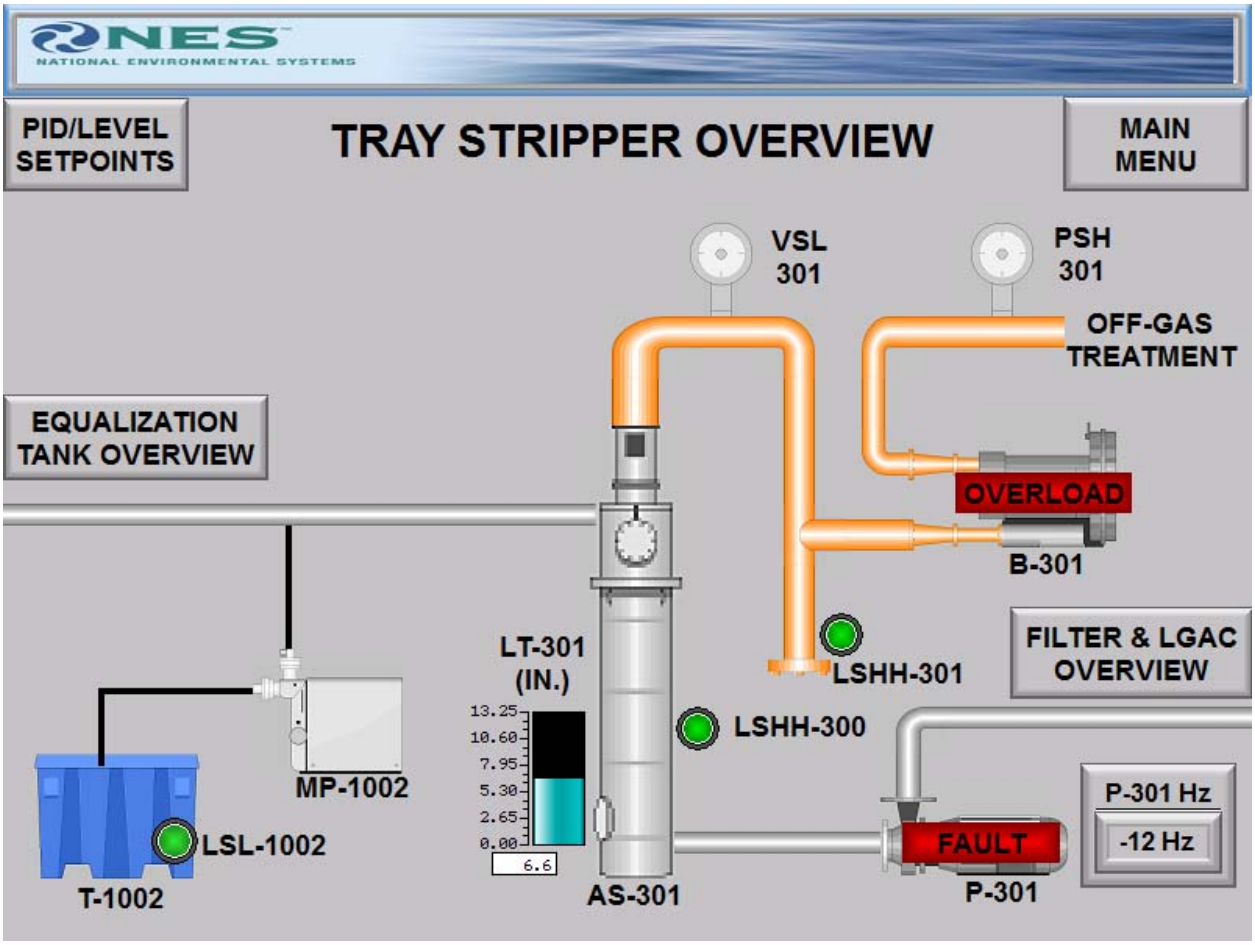
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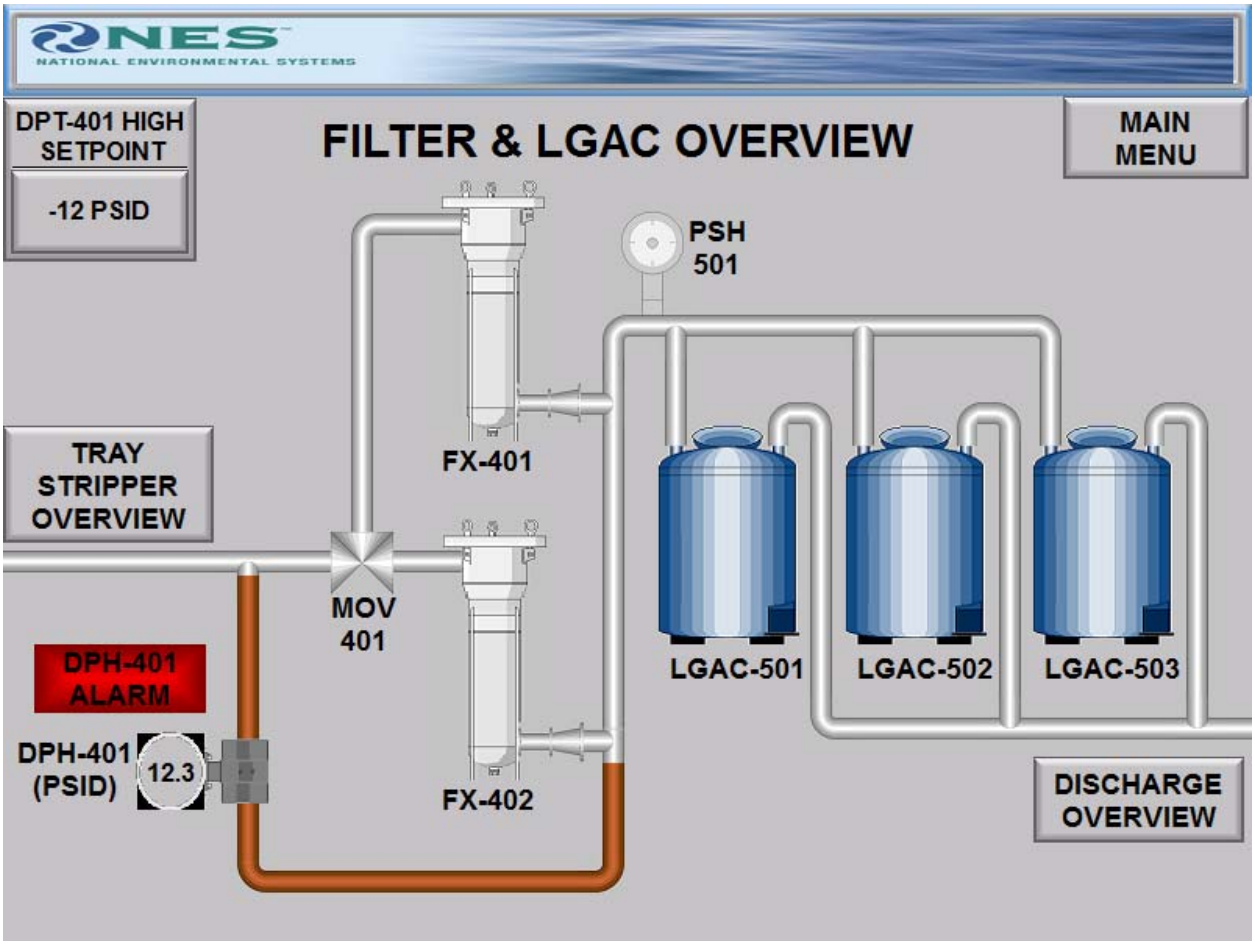
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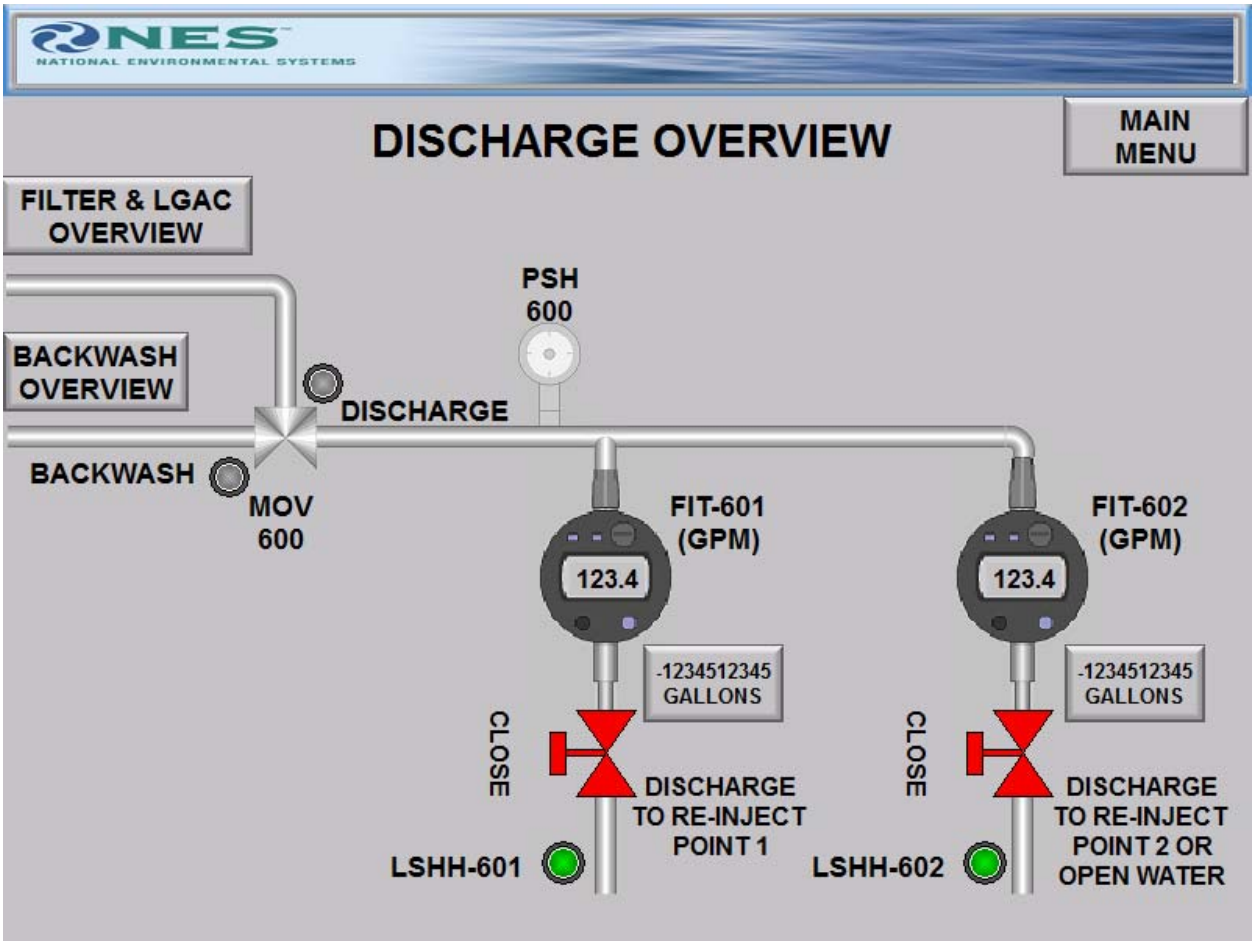
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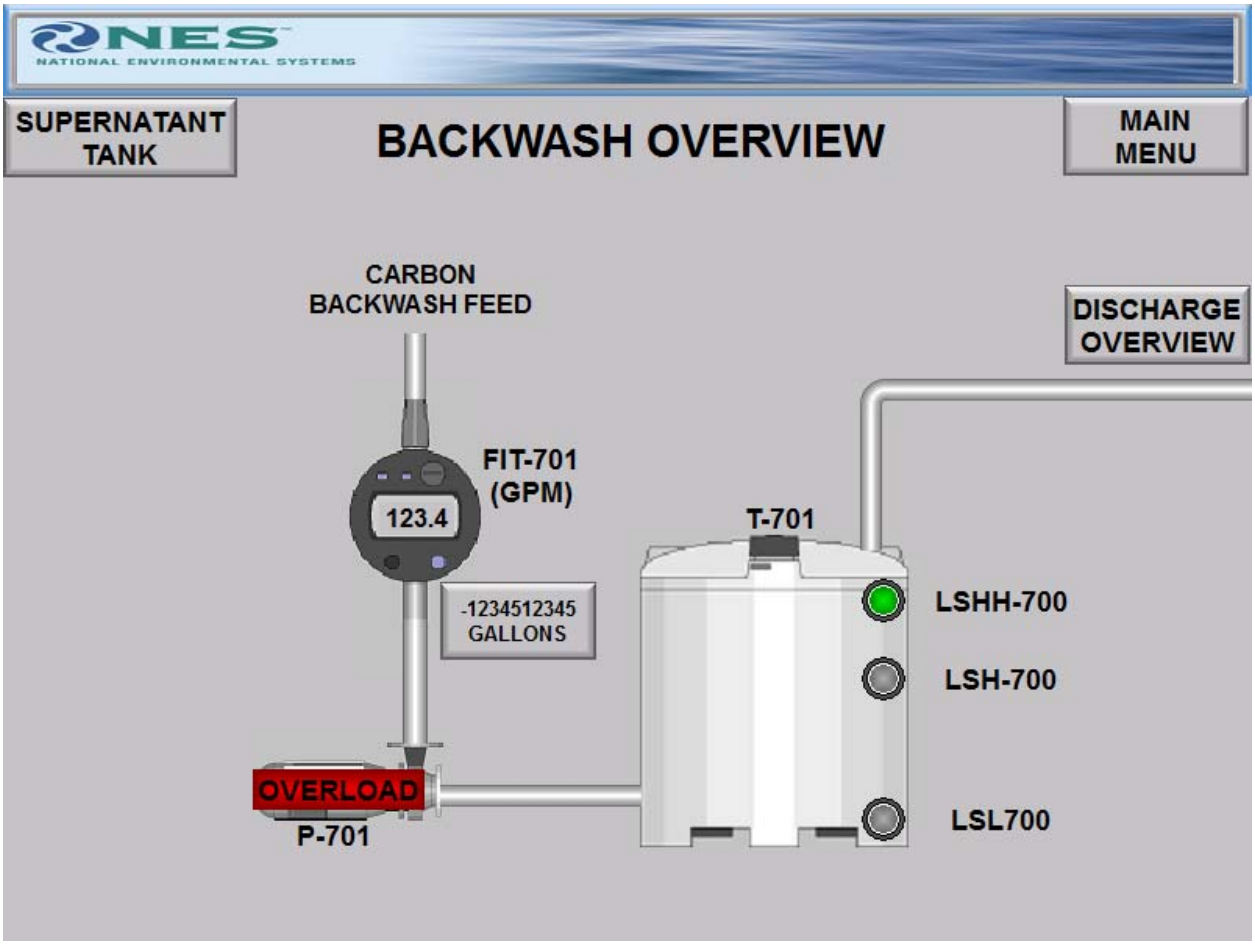
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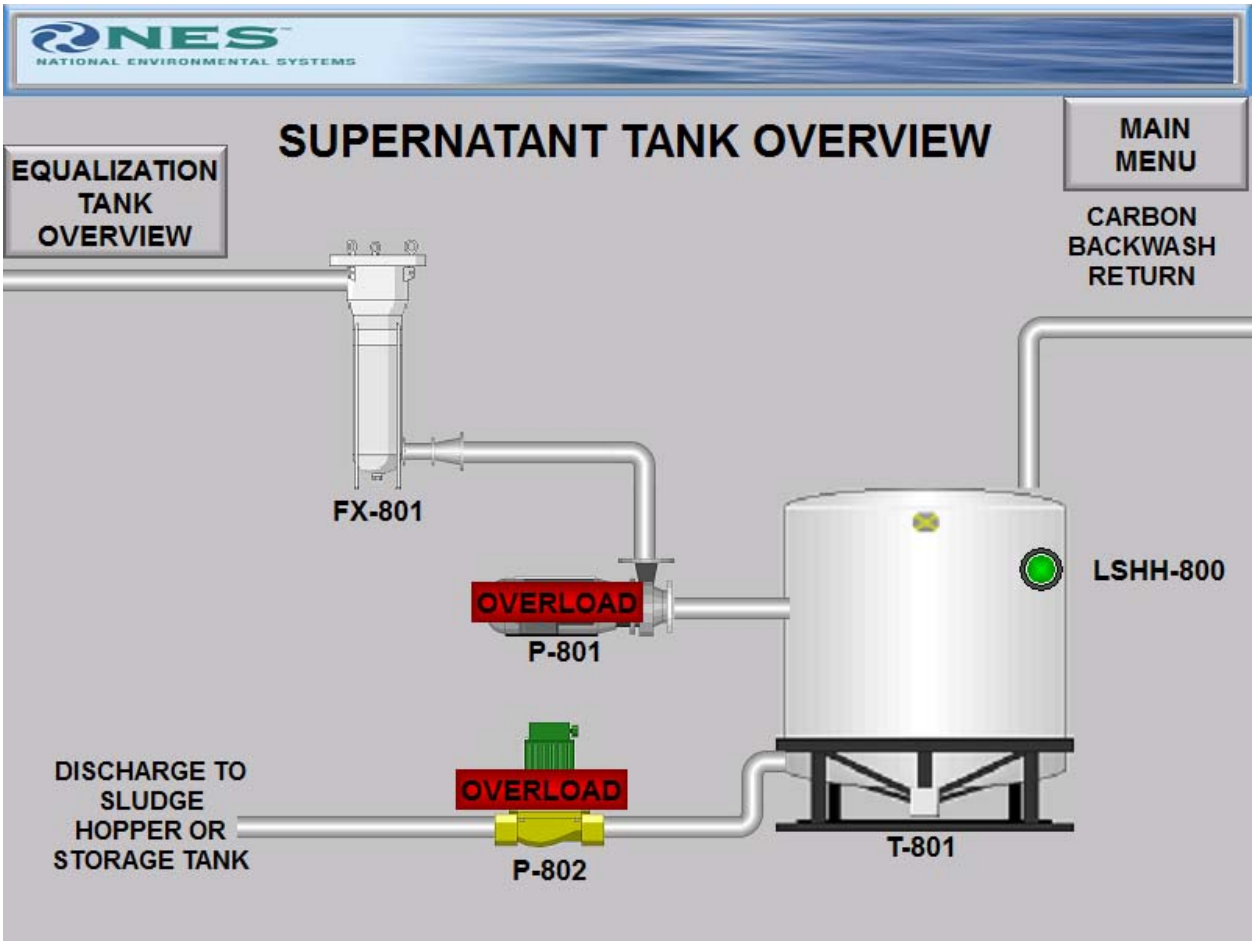
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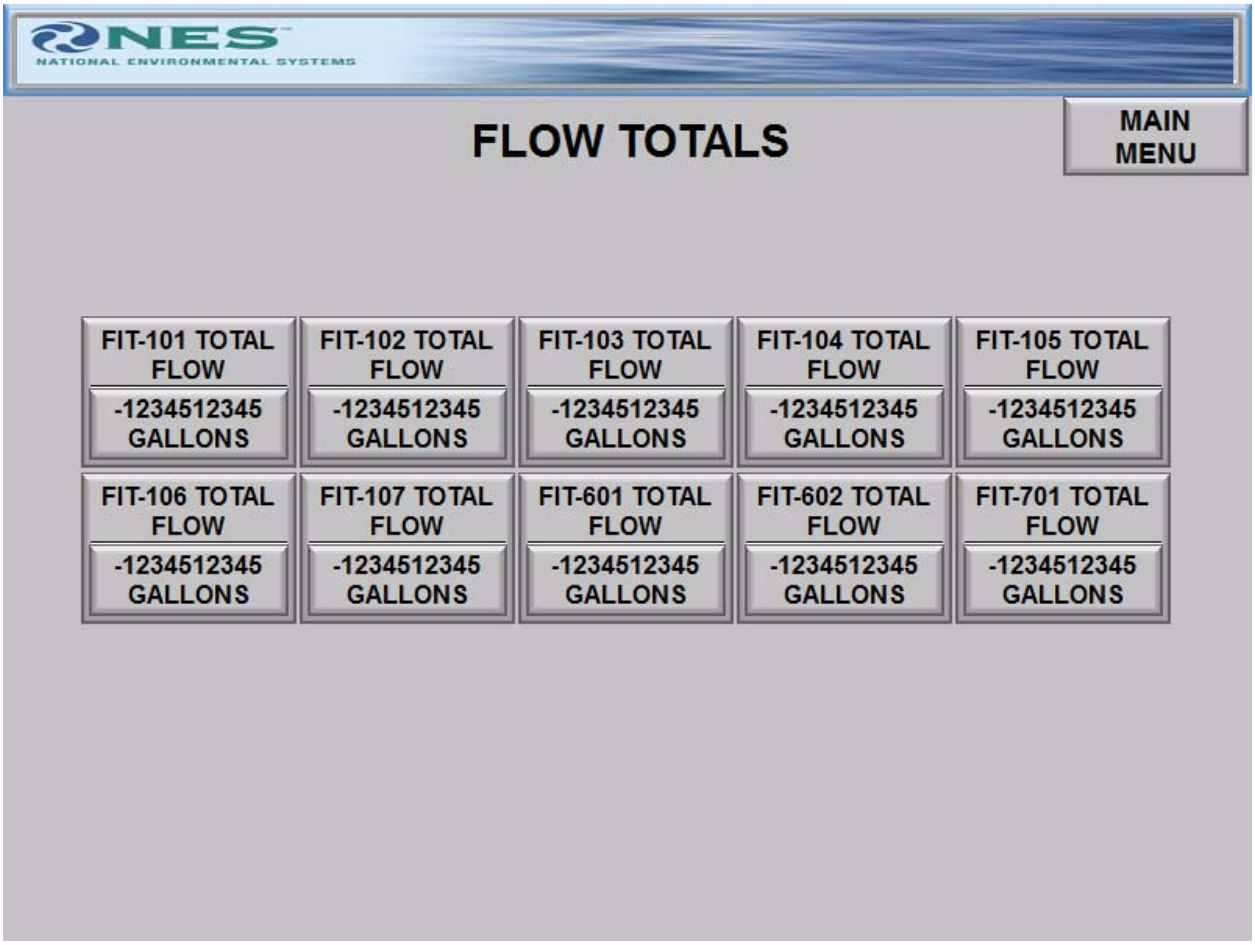
HMI SCREEN SUMMARY & REMOTE ACCESS



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HMI SCREEN SUMMARY & REMOTE ACCESS

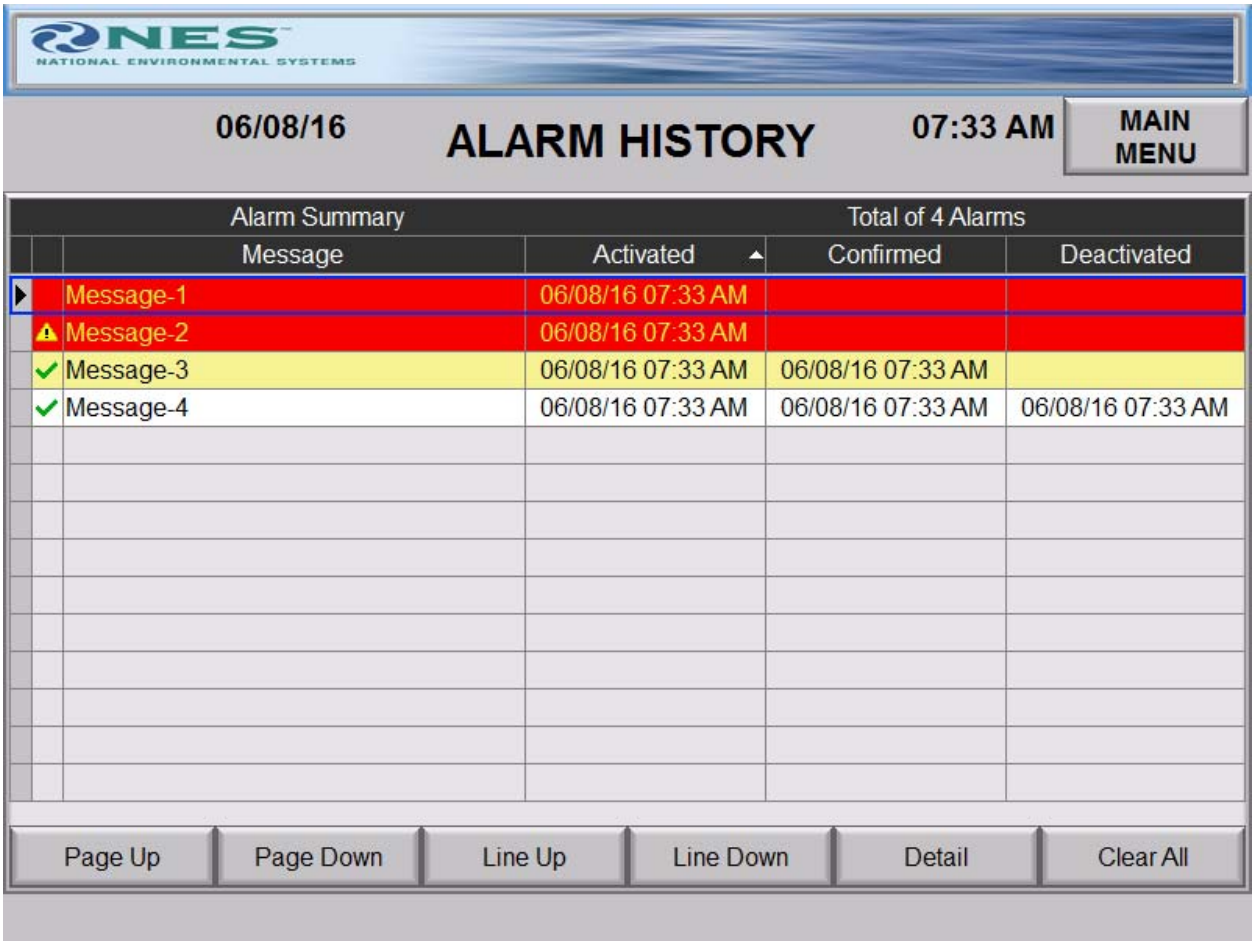


TABLE 2

NES 15-183, REVISION A (JUNE 2016) BY: EMB CHK: EJ
GES - GWTS / BASF FACILITY
RENSSELAER, NY

Interlock	Interlock ID	Interlock Description	Extraction Well Pumps Run Permissive (EW-3, EW-15)	Extraction Well Pumps Run Permissive (EW-6, EW-8, EW-12/16, EW-14)	P-201, Effluent Pump (Influent EQ Tank)	MOV-201, Motor Operated Valve (Pre-Tray Stripper Bag Filters)	B-301, Blower (Tray Stripper)	P-301, Effluent Pump (Tray Stripper)	MOV-401, Motor Operated Valve (Post-Tray Stripper Bag Filters)	MOV-600, Motor Operated Valve (Backwash Tank/System Effluent)	MOV-601, Motor Operated Valve (Reinjection Point 1)	MOV-602, Motor Operated Valve (Reinjection Point 2)	P-701, Effluent Pump (Backwash Supply Tank)	P-801, Effluent Pump (Backwash Supernatant Tank)	P-802, Diaphragm Pump (Backwash Supernatant Tank)	MP-1001, Chemical Metering Pump	MP-1002, Chemical Metering Pump	P-1200, Sump Pump (Building)	OPERATOR INTERFACE	Adjustable Set Point (HMI Screen Display)	Warning Notification (HMI Screen Display)	Alarm Notification (HMI Screen Display)	Warning Notification (Local Panel Display)	Alarm Notification (Local Panel Display)	Manual Reset (Warning / Alarm)	Remote Warning Notification	Remote Alarm Notification	Warning/Alarm Log	Data Log (10 Minutes)	INSTRUMENT TYPE	NES FACTORY TEST SET POINT
		Emergency Stop	O	O	O		O	O					O	O	O	O	O	O				Y		Y			Y	Y		D	
1		No alarms present	I	I			I				I	O	M	M	M	I		I/O													
2	FIT/FIQ-101	EW-3 Influent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-50gpm
3	FIT/FIQ-102	EW-6 Influent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-50gpm
4	FIT/FIQ-103	EW-8 Influent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-50gpm
5	FIT/FIQ-104	EW-12 & EW-16 Influent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-50gpm
6	FIT/FIQ-105	EW-14 Influent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-50gpm
7	FIT/FIQ-106	EW-15 Influent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-50gpm
8	FIT/FIQ-107	System Influent Flow Indicating Transmitter/Totalizer														P	P												Y	A/D	0-100gpm
9	PSH-101	Extraction Well Filter Housing (FX-101) Pressure Switch High	O	O												O	O					Y		Y	Y		Y	Y		D	50 PSI
10	UVL-101	Ultraviolet Disinfection Lamp Sensitivity Low																			Y		Y		Y	Y		Y		D	
11	LSHH-200	Influent Equalization Tank (T-201) Level Switch High-High	O	O									O			O	O	O				Y		Y	Y		Y	Y		D	
12	LT-201	Influent Equalization Tank (T-201) Level Transmitter			P															Y									Y	A	0-9FT
13	LTL-201	Influent Equalization Tank (T-201) Level Transmitter Low			O												O			Y										L	
14	LTH-201	Influent Equalization Tank (T-201) Level Transmitter High			I												I			Y										L	
15	PSH-201*	Pre-Tray Stripper Filter Housing (FX-201,FX-202) Pressure Switch High	O	O	O	I/O										O	O	O			Y	Y	Y	Y	Y	Y	Y	Y		D	50 PSI
16	LSHH-300	Tray Stripper (AS-301) Level Switch High-High	O	O	O											O	O	O				Y		Y	Y		Y	Y		D	
17	LSHH-301	Post-Tray Stripper Moisture Separator Level Switch High-High	O	O	O											O	O	O				Y		Y	Y		Y	Y		D	
18	LT-301	Tray Stripper (AS-301) Level Transmitter						P												Y									Y	A	0-13.2IN
19	LTL-301	Tray Stripper (AS-301) Level Transmitter Low						O												Y										L	
20	LTH-301	Tray Stripper (AS-301) Level Transmitter High						I												Y										L	
21	VSL-301	Tray Stripper Blower (B-301) Vacuum Switch Low	O	O	O		O									O	O	O				Y		Y	Y		Y	Y		D	4" WC
22	PSH-301	Tray Stripper Blower (B-301) Discharge Pressure Switch High	O	O	O		O									O	O	O				Y		Y	Y		Y	Y		D	50" WC
23	DPT-401	Post-Tray Stripper Filter Housing (FX-401,FX-402) Differential Pressure Transmitter																											Y	A	
24	DPTH-401*	Post-Tray Stripper Filter Housing (FX-401,FX-402) Differential Pressure Transmitter High	O	O	O			O	I/O							O	O	O		Y	Y	Y	Y	Y	Y	Y	Y	Y		L	
25	PSH-501	Liquid Phase Carbon Vessel (LGAC-501,LGAC-502) Pressure Switch High	O	O	O			O								O	O	O				Y		Y	Y		Y	Y		D	50 PSI
26	PSH-600	System Effluent Pressure Switch High	O	O	O			O								O	O	O				Y		Y	Y		Y	Y		D	50 PSI
27	FIT/FIQ-601	Reinjection Point 1 Effluent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-100gpm
28	FIT/FIQ-602	Reinjection Point 2 Effluent Flow Indicating Transmitter/Totalizer																											Y	A/D	0-100gpm
29	LSHH-601	Reinjection Point 1 Level Switch High-High									O	I										Y		Y	Y		Y	Y		D	
30	LSHH-602	Reinjection Point 2 Level Switch High-High									I	O										Y		Y	Y		Y	Y		D	
31	FITFIQ-701	Backwash Flow Indicating Transmitter/Totalizer																											Y	A/D	0-250gpm
32	LSL-700	Backwash Supply Tank (T-701) Level Switch Low								I			O																	D	
33	LSH-700	Backwash Supply Tank (T-701) Level Switch High								O			I																	D	
34	LSHH-700	Backwash Supply Tank (T-701) Level Switch High-High	O	O	O			O								O	O	O				Y		Y	Y		Y	Y		D	
35	LSHH-800	Backwash Supernatant Tank (T-801) Level Switch High-High											O									Y		Y	Y		Y	Y		D	
36	LSL-1001	Chemical Tote (T-1001) Low Switch Level														O					Y		Y		Y	Y		Y		D	
37	LSL-1002	Chemical Tote (T-1002) Low Switch Level															O				Y		Y		Y	Y		Y		D	
38	LSHH-1200	Building Sump Level Switch High-High	O	O	O		O	O					O	O	O	O	O	O				Y		Y	Y		Y	Y		D	
39	LSHH-1201	Containment Pad Sump Level Switch High-High																			Y		Y		Y	Y		Y		D	
40	TSL-1200	Process Area Temperature Switch Low																			Y		Y		Y	Y		Y		D	
41	SPD-VFD-201	Effluent Pump (P-201) Speed (Influent EQ Tank)																											Y	A	
42	FLT-VFD-201	Effluent Pump (P-201) VFD Fault (Influent EQ Tank)	O	O	O											O	O	O				Y		Y	Y		Y	Y		D	
43	O/L B-301	Tray Stripper Blower (B-301) Overload	O	O	O		O									O	O	O				Y		Y	Y		Y	Y		D	
44	SPD-VFD-301	Effluent Pump (P-301) Speed (Tray Stripper)																											Y	A	
45	FLT-VFD-301	Effluent Pump (P-301) VFD Fault (Tray Stripper)	O	O	O			O								O	O	O				Y		Y	Y		Y	Y	Y	D	
46	O/L P-701	Effluent Pump (P-701) Overload (Backwash Supply Tank)											O									Y		Y	Y		Y	Y		D	
47	O/L P-801	Effluent Pump (P-801) Overload (Backwash Supernatant Tank)												O								Y		Y	Y		Y	Y		D	
48	O/L P-802	Diaphragm Pump (P-802) Overload (Backwash Supernatant Tank)													O							Y		Y	Y		Y	Y		D	
49	FLT-PWR	Main Power Failure	O	O	O		O	O					O	O	O	O	O	O				Y		Y			Y	Y		D	

Note:

HMI - Human Machine Interface

O - Off
I - On
I/O - On / Off Control
M - Manual Operation
P- Proportional Control

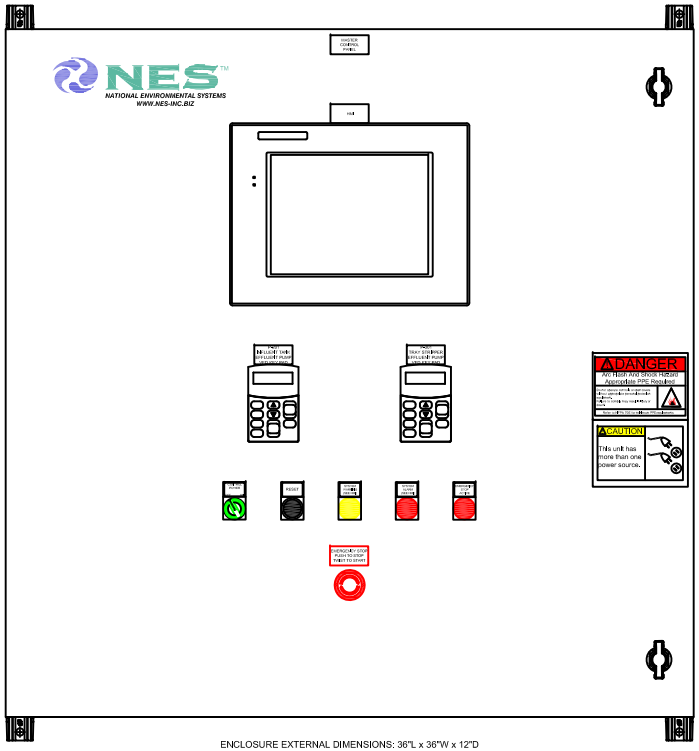
Y - Yes

A - Analog
D - Digital
L - Internal Logic

* Upon reaching the High Pressure Setpoint the online filter housing is switched to the standby filter housing and a "warning" message is initiated. The standby filter housing will now remain in the online position. After the fouled filters are changed and the Manual "RESET" button has been pushed the recently changed filter housing will now be in standby mode and the process will be repeated after the High Pressure Setpoint is reached. If the Manual "Reset" button is not pushed the online filter housing will remain in that position and after the High Pressure Setpoint is reached the GWTS is shutdown and an "alarm" message is initiated.

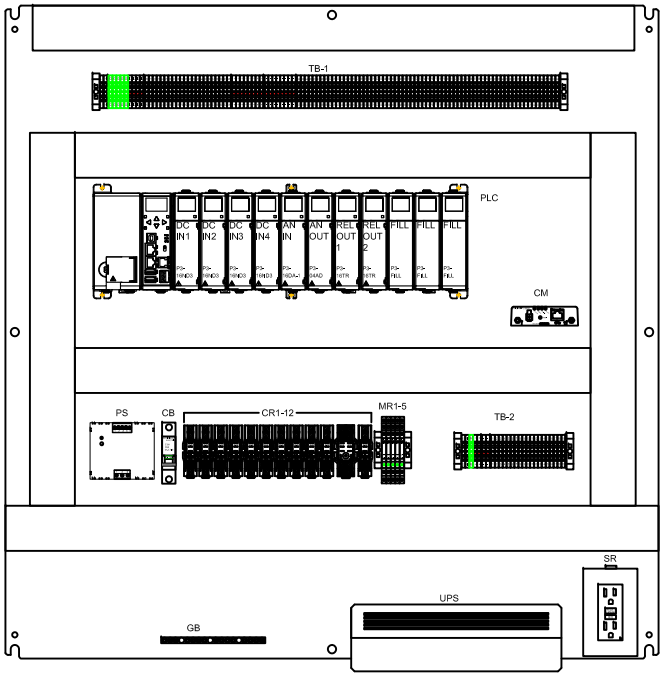
RapidTech LLC d/b/a National Environmental Systems
84 Dunham Street - Attleboro, MA 02703
Phone: (508)226-1100; Fax: (508)226-1180; Email: Info@nes-inc.biz

PANEL EXTERIOR



ENCLOSURE EXTERNAL DIMENSIONS: 36"L x 36"W x 12"D

PANEL INTERIOR



LEGEND	
ABBREV.	DESCRIPTION
CB	- CIRCUIT BREAKER
CM	- CELLULAR MODEM
CR	- CONTROL RELAY
GB	- GROUND BAR
HMI	- HUMAN MACHINE INTERFACE
MR	- MINIATURE RELAY
PLC	- PROGRAMMABLE LOGIC CONTROLLER
PS	- POWER SUPPLY
SR	- SERVICE RECEPTACLE
TB	- TERMINAL BLOCK
UPS	- UNINTERRUPTIBLE POWER SUPPLY

NOTES
1) REFER TO TABLE 3 FOR BILL OF MATERIALS.
2) H/O/A CONTROL VIA HMI SCREEN
3) ALL ALARM LIGHTS AND EMERGENCY STOP SWITCH LOCATED ON PANEL EXTERIOR.
4) MASTER CONTROL PANEL IS UL 508A LISTED.
5) GROUND IN ACCORDANCE WITH N.E.C. ARTICLE 250.122 & LOCAL AUTHORITY HAVING JURISDICTION.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	06-06-16	EMB

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DRWN BY	DATE	
EMB	03-23-16	
CHK BY	DATE	
APPR BY	DATE	

NES
NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

TITLE: MASTER CONTROL PANEL
INTERIOR / EXTERIOR LAYOUT DRAWING

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO.	SCALE	SIZE	DWG NO.	SHEET	REV
15-183	NTS	C	I-1A	1 OF 2	A

OPERATOR DETAILS

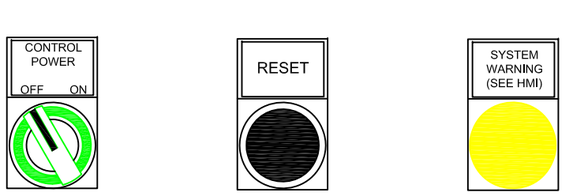
MAIN CONTROL PANEL

HMI

MOTOR CONTROL PANEL

P-201
INFLUENT TANK
EFFLUENT PUMP
VFD KEY PAD

P-301
TRAY STRIPPER
EFFLUENT PUMP
VFD KEY PAD



EMERGENCY STOP
PUSH TO STOP
TWIST TO START



REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	06-06-16	EMB

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DATE	

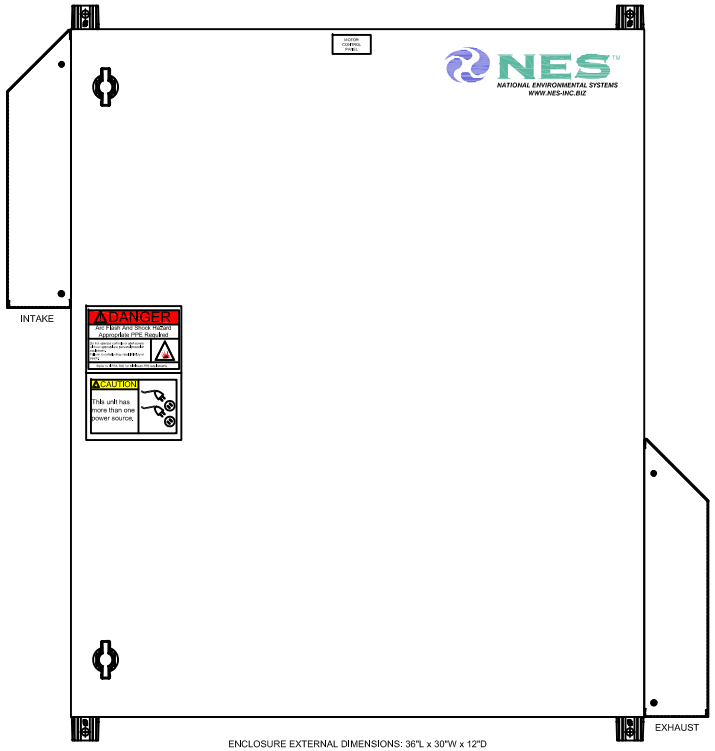
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TITLE: MASTER CONTROL PANEL
INTERIOR / EXTERIOR LAYOUT DRAWING

GES - GWTS
BASF FACILITY - RENSSELAER, NY

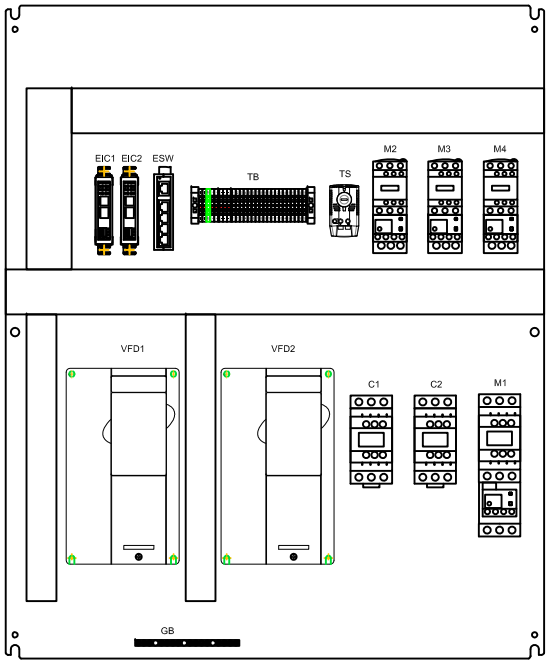
JOB NO.	SCALE	SIZE	DWG NO.	SHEET	REV
15-183	NTS	B	I-1A	2 OF 2	A

PANEL EXTERIOR



ENCLOSURE EXTERNAL DIMENSIONS: 36"L x 30"W x 12"D

PANEL INTERIOR



LEGEND	
ABBREV.	DESCRIPTION
C	- CONTACTOR
GB	- GROUND BAR
EIC	- ETHERNET INTERFACE CARD
ESW	- ETHERNET SWITCH
M	- MOTOR STARTER
TB	- TERMINAL BLOCK
TS	- TEMPERATURE SWITCH
VFD	- VARIABLE FREQUENCY DRIVE

NOTES
1) REFER TO TABLE 3 FOR BILL OF MATERIALS.
2) VFD KEYPADS MOUNTED ON THE MASTER CONTROL PANEL.
3) MOTOR CONTROL PANEL IS UL 508A LISTED.
4) GROUND IN ACCORDANCE WITH N.E.C. ARTICLE 250.122 & LOCAL AUTHORITY HAVING JURISDICTION.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
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TITLE: MOTOR CONTROL PANEL
INTERIOR / EXTERIOR LAYOUT DRAWING

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	C	I-1B	1 OF 1	A

TABLE 3
PANEL BILL OF MATERIALS

REVISION A JUNE 2016

15-183 GES - BASF FACILITY - RENSSELAER, NY

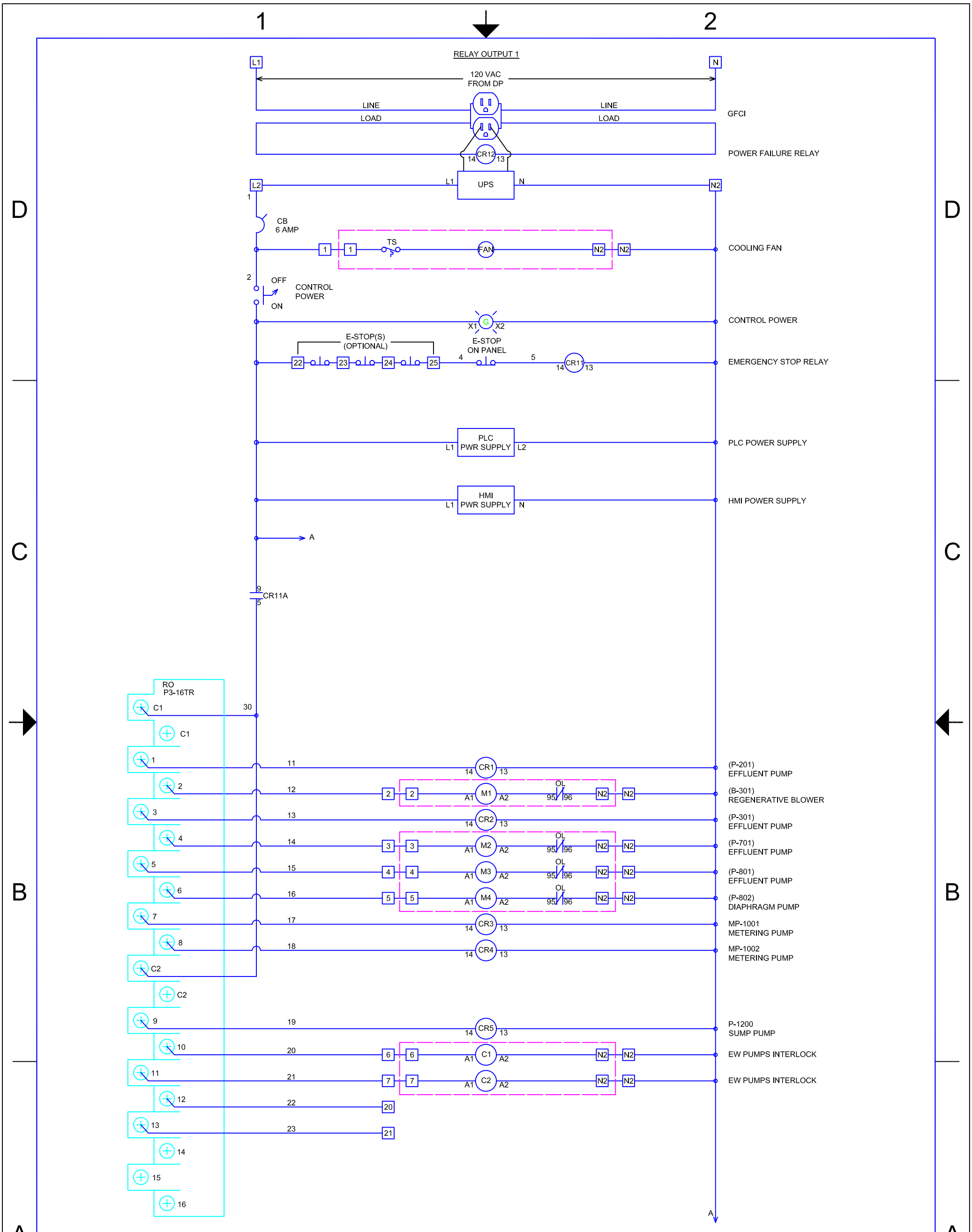
TAG	QUANTITY	ITEM	MODEL	MANUFACTURER
		SECTION 7 - MASTER CONTROL PANEL COMPONENTS		
ENCL	1	ENCLOSURE NEMA 4 36 X 36 X 12 - MILD STEEL/GRAY	EN4SD363612GY	HAMMOND
ENCL	1	BACK-PANEL 36 X 36 MILD STEEL/WHT	EP3636	HAMMOND
ENCL	1	MOUNTING FEET SET OF 4 - ZINC PLATED	EZPMFHD	HAMMOND
ENCL	2	PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	SCE-PLWKB	SCE
UPS	1	UPS 350VA 200W 120V 1PH 3 UPS & SURGE OUTLET 3 SURGE ONLY	BE350G	APC
CM	1	3G WIRELESS GATEWAY EVDO 800/1900 MHZ - VERIZON	LS300 - 1101489	SIERRA WIRELESS
CM	1	LS300 BRACKET-DIN MOUNT	6000558	SIERRA WIRELESS
CM	1	STATIC IP 12 IN MAGNET MOUNT ANTENNA 10FT RG174 CABLE SMA-MALE	301125	WILSON ELECTRONICS
CM	1	RF COAXIAL SURGE PROTECTOR 698 MHZ 2.7 GHZ	TSX-NFF	POLYPHASER
CM	1	FOR POLYPHASER 1 FT LMR-195 COAXIAL CABLE ASSEMBLY	GW195-12-SM-NM	GET WIRELESS
CM	1	FOR POLYPHASER N MALE TO SMA FEMALE ADAPTER	RSA-3478	RF INDUSTRIES
PLC	1	11-SLOT I/O BASE FOR P3000 PAC REQ P3-01AC OR P3-01DC	P3-11B	ADI
PLC	1	POWER SUPPLY 100-240VAC FOR P3000 PAC	P3-01AC	ADI
PLC	1	CPU 266 MHz PROCESSOR 50MB MEMORY FOR P3000 PAC	P3-550	ADI
PLC	4	16PT 12-24VDC INPUT SINK/SOURCE FOR P3000 PAC	P3-16ND3	ADI
PLC	1	16CH ANALOG CURRENT INPUT 16-BIT MODULE FOR P3000 PAC	P3-16AD-1	ADI
PLC	1	ANALOG 4-CH OUT VOLTAGE/CURRENT 16-BIT FOR P3000	P3-04DA	ADI
PLC	2	16PT RELAY OUTPUT SPST 6-27VDC / 6-240VAC FOR P3000 PAC	P3-16TR	ADI
PLC	3	FILLER MODULE FOR P3000 PAC	P3-FILL	ADI
PLC	8	TERMINAL BLOCK FOR ALL 8 & 16 POINT I/O MODULES FOR P3000 PAC	P3-RTB	ADI
HMI	1	CABLE C-MORE PANEL TO ADI PLC RJ12 PORT 10 FT RS232C	EA-2CBL	ADI
HMI	1	C-MORE TOUCH PANEL 10 IN COLOR TFT ETHERNET & USB	EA9-T10CL	ADI
HMI	1	C-MORE AC DC POWER ADAPTER FOR EA7 & EA9	EA-AC	ADI
HMI	1	VER97303 HMI MEMORY CARD 8 GB NON-VOLATILE DATA STORAGE	19NY57	VERBATIM
PS	1	POWER SUPPLY 24 VDC 5A 120W DIN RAIL SLIM LINE	PSP24-120S	ADI
CR1-10,12	11	RELAY 120V 1PDT W/LIGHT BLADE PARALLEL	RH1B-UL-AC120V	IDEC
CR1-10,12	11	SOCKET DIN RAIL/SURFACE 5-BLADE FOR RH1B	SH1B-05	IDEC
CR11	1	RELAY 2PDT 10AMP 120VAC W/INDICATOR LIGHT	RH2B-UL-AC120V	IDEC
CR11	1	SOCKET DIN RAIL/SURFACE 8-BLADE FOR RH2B	SH2B-05	IDEC
MR1-4	4	RELAY RV 6MM ASSEMBLED 110-120V AC/DC 6AMPS	RV8H-L-AD110	IDEC
MR5	1	RELAY 6MM ASSEMBLED 5VDC	1122740000	WEIDMULLER
SR	1	DUPLEX GFCI RECEPTACLE 125 VAC 15 AMP 2-POLE NEMA 5-15R WHITE	1595-TRWRW	LEGRAND
SR	1	1-GANG WEATHERPROOF RECEPT. BOX	IHD3- 1	RED DOT
CB	1	CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	MG24430_	SQUARE D
ESTOP	1	MUSHROOM SWITCH RED TRIGGER ACTION - TURN TO RELEASE	ZB5AS844_	SQUARE D
LT	2	PILOT LIGHT HEAD - RED	ZB5AV043_	SQUARE D
LT	1	PILOT LIGHT HEAD - YELLOW	ZB5AV053_	SQUARE D
PB	2	CONTACT BLOCK 1-N.O. SCREW CLAMP	ZBE101_	SQUARE D
PB	1	CONTACT BLOCK 1-N.C. SCREW CLAMP	ZBE102_	SQUARE D
PB	1	PUSH BUTTON OPERATOR NON-ILLUM BLACK	ZB5AA2_	SQUARE D
PB	2	MOUNTING COLLAR LATCH	ZB5AZ009_	SQUARE D
SW	1	MOUNTING BASE120V GREEN PROTECTED LED	ZB5AVG3_	SQUARE D

TABLE 3
PANEL BILL OF MATERIALS

REVISION A JUNE 2016

15-183 GES - BASF FACILITY - RENSSELAER, NY

TAG	QUANTITY	ITEM	MODEL	MANUFACTURER
SW	2	MOUNTING BASE120V RED PROTECTED LED	ZB5AVG4_	SQUARE D
SW	1	MOUNTING BASE120V YELLOW PROTECTED LED	ZB5AVG5_	SQUARE D
SW	1	2 POS SELECTOR SWITCH ILLUM. GREEN MAINTAINED	ZB5AK1233_	SQUARE D
TB	145	TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	NSYTRV22	SQUARE D
TB	9	TERMINAL BLOCK END BARRIERS GRAY	NSYTRAC22	SQUARE D
TB	6	TERMINAL BLOCK END ANCHORS	NSYTRAABV35	SQUARE D
TB	6	TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	NSYTRV22PE	SQUARE D
GB	1	LOAD CENTER GROUND BAR 15 TERMINALS	PK15GTA	SQUARE D
		SECTION 8 - MOTOR CONTROL PANEL COMPONENTS		
ENCL	1	ENCLOSURE NEMA 4 36 X 30 X 12 - MILD STEEL/GRAY	EN4SD363012GY	HAMMOND
ENCL	1	BACK-PANEL 36 X 30 MILD STEEL/WHT	EP3630	HAMMOND
ENCL	1	MOUNTING FEET SET OF 4 - ZINC PLATED	EZPMFHD	HAMMOND
ENCL	2	PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	SCE-PLWKB	SCE
VF	1	VENT FAN 210CFM 115VAC 6 IN	FAN150AC115	HAMMOND
VF	1	VENT FAN ADJ. 30-140F BI-METAL TEMP SWITCH N.O.	SKT011419NO	HAMMOND
VF	1	VENT FAN FINGER GUARD 6 IN	FAN150FG	HAMMOND
VF	2	VENT FAN 6 IN RAIN HOOD GRILL & SOLID COVER KIT	RHA40000G	HAMMOND
VF	2	VENT FAN 6 IN RAIN HOOD NEMA 3R	RHA40000GY	HAMMOND
VF	1	VENT FAN POWER CORD 24 IN	DNMFC	HAMMOND
VF	1	VENT FAN 6 IN FILTER FOR LOUVER KIT	AFLT66	HOFFMAN
C1, C2	2	CONTACTOR 3PST-NO 120VAC 50A DIN RAIL (EXISTING EXTRACTION WELLS)	LC1D50AG7	SQUARE D
M1	1	CONTACTOR 3PST-NO 120VAC 50A DIN RAIL	LC1D50AG7	SQUARE D
M1	1	3PH O/L RELAY 25-40 AMPS	LRD340L	SQUARE D
M2,M3,M4	3	CONTACTOR 3PST-NO 120VAC 20A DIN RAIL	LC1D09G7	SQUARE D
M2	1	3PH O/L RELAY 5.5-8 AMPS	LRD12	SQUARE D
M3	1	3PH O/L RELAY 1 - 1.6 AMPS	LRD06	SQUARE D
M4	1	3PH O/L RELAY 1.6-2.5 AMPS	LRD07	SQUARE D
ESW	1	ETHERNET SWITCH UNMANAGED 10/100 BASET RJ45 PORTS	SE-SW5U	ADI
VFD 1,2	2	DURAPULSE VFD 5 HP 9.6 AMP 460V 3-PHASE	GS3-45P0	ADI
VFD 1,2	2	GS3 VFD FLUSH MOUNT BEZEL FOR KEYPAD (MOUNT IN MCP)	GS3-BZL	ADI
VFD 1,2	2	DURAPULSE REMOTE VFD KEYPAD CABLE 16 FT	GS-CBL2-5L	ADI
VFD 1,2	2	CABLE GS DRIVE/EDRV 6.6FT RJ12-RJ12 6-WIRE RS485	GS-EDRV-CBL-2	ADI
EIC 1,2	2	ETHERNET MODULE 100Mbps FOR GS SERIES AC DRIVES	GS-EDRV100	ADI
TB	136	TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	NSYTRV22	SQUARE D
TB	3	TERMINAL BLOCK END BARRIERS GRAY	NSYTRAC22	SQUARE D
TB	2	TERMINAL BLOCK END ANCHORS	NSYTRAABV35	SQUARE D
TB	1	TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	NSYTRV22PE	SQUARE D
GB	1	LOAD CENTER GROUND BAR 15 TERMINALS	PK15GTA	SQUARE D



NOTES:
1) — — — INDICATES MOTOR CONTROL PANEL LIMITS
2) — · — · — INDICATES MOV LIMITS

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REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	06-06-16	EMB

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DRWN BY	EMB
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DATE	
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DATE	

TITLE: WIRING DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	1 OF 12	A

RELAY OUTPUT 2

120 VAC
(PRE-E-STOP)

3

24VDC
PWR SUPPLY
120 WATTS

L

N

24VDC POWER SUPPLY

28 (ORG)

+

-

29 (PRP)

24 VDC

SE-SW5U
ETHERNET
SWITCH

ETHERNET
ADAPTER
VFD 1

ETHERNET
ADAPTER
VFD 2

CELLULAR
MODEM

RED/WHT

BLK

FIT-101
FLOW
TRANSMITTER

FIT-102
FLOW
TRANSMITTER

FIT-103
FLOW
TRANSMITTER

FIT-104
FLOW
TRANSMITTER

FIT-105
FLOW
TRANSMITTER

FIT-106
FLOW
TRANSMITTER

FIT-107
FLOW
TRANSMITTER

FIT-601
FLOW
TRANSMITTER

FIT-602
FLOW
TRANSMITTER

FIT-701
FLOW
TRANSMITTER

V+

V-

B

RO
P3-16TR

C1

C2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

31 32 33 34 35 36 37 38

CR6 CR7 CR8 CR9 CR10

14 13

Y R R

X1 X2

(MOV-201)
MOTOR OPERATED VALVE

(MOV-401)
MOTOR OPERATED VALVE

(MOV-600)
MOTOR OPERATED VALVE

(MOV-601)
MOTOR OPERATED VALVE

(MOV-602)
MOTOR OPERATED VALVE

SYSTEM WARNING SEE HMI

SYSTEM ALARM SEE HMI

EMERGENCY STOP ACTIVE

A

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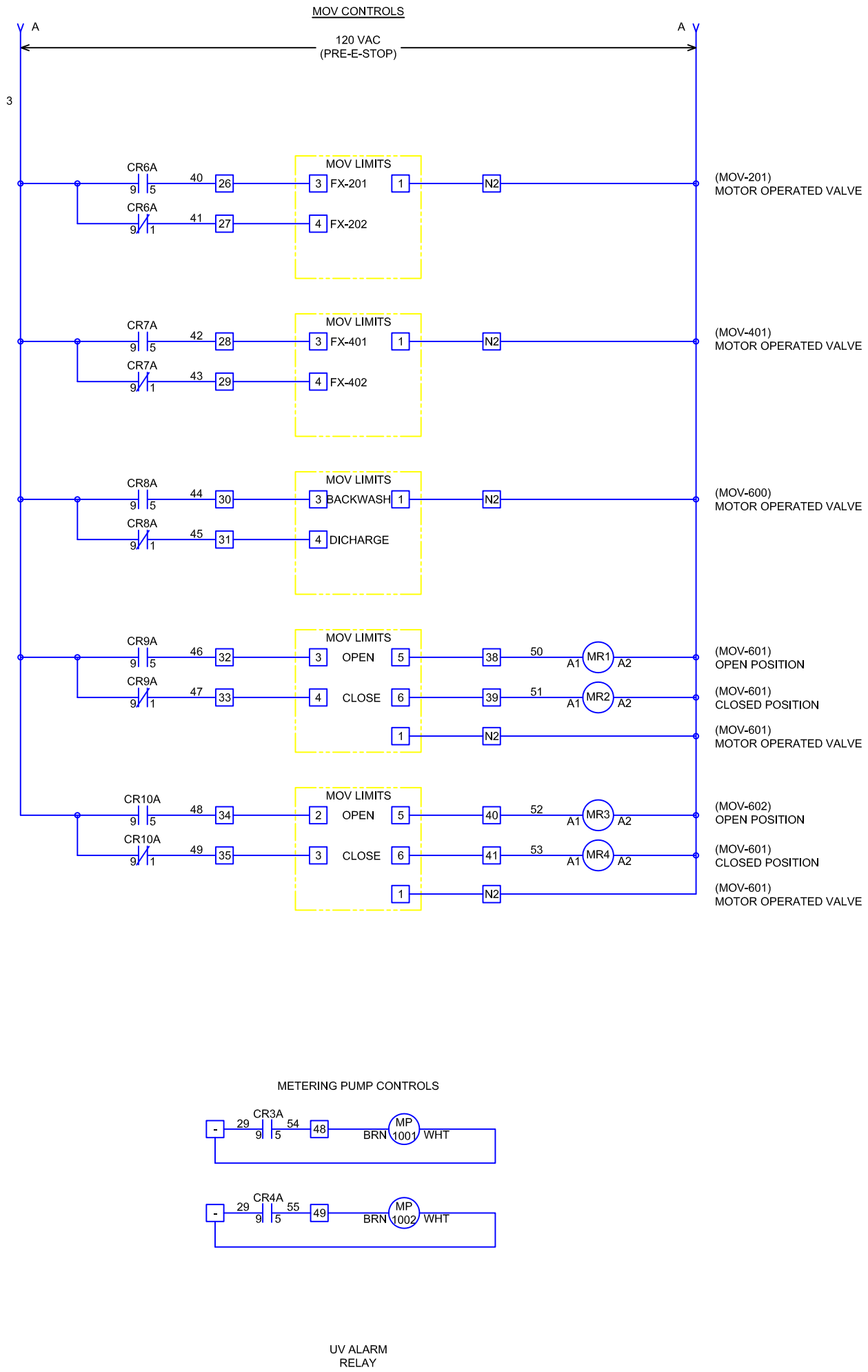
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TITLE: WIRING DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-83

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	2 OF 12	A



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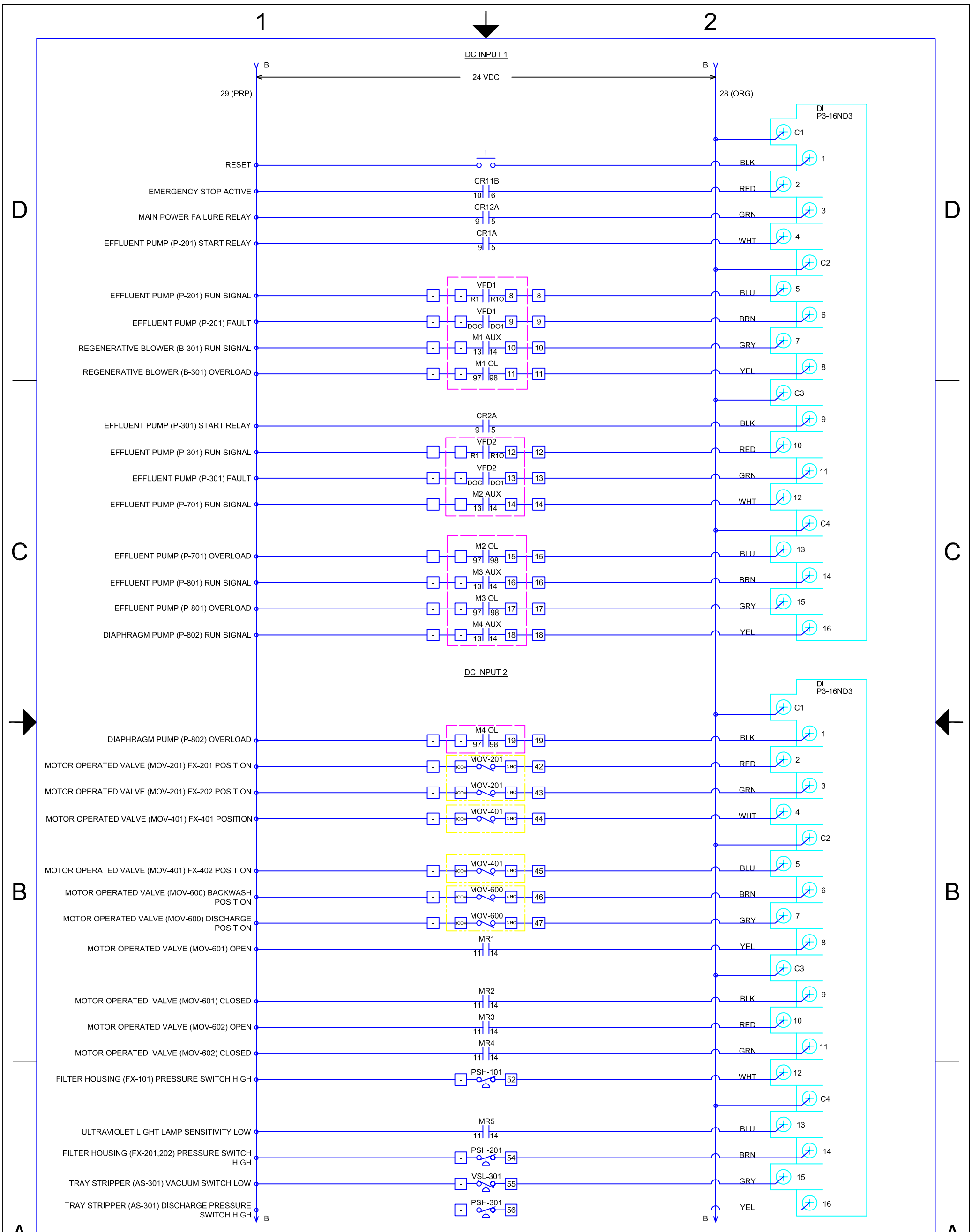
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TITLE
WIRING DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-83
SCALE NTS
SIZE B
DWG NO. I-2
SHEET 3 OF 12
REV A



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TITLE: WIRING DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	4 OF 12	A

DC INPUT 3

B — 24 VDC — B

29 (PRP) — 28 (ORG)

DI P3-16ND3

CARBON BEDS PRESSURE SWITCH HIGH	PSH-501	57	BLK	C1 / 1
SYSTEM DISCHARGE PRESSURE SWITCH HIGH	PSH-600	58	RED	2
EQUALIZATION TANK (T-201) LEVEL SWITCH HIGH-HIGH	LSHH-200	59	GRN	3
TRAY STRIPPER (AS-301) LEVEL SWITCH HIGH-HIGH	LSHH-300	60	WHT	4
MOISTURE SEPERATOR LEVEL SWITCH HIGH-HIGH	LSHH-301	61	BLU	C2 / 5
RE-INJECTION POINT 1 LEVEL SWITCH HIGH-HIGH	LSHH-601	62	BRN	6
RE-INJECTION POINT 2 LEVEL SWITCH HIGH-HIGH	LSHH-602	63	GRY	7
BACKWASH SUPPLY TANK (T-701) LEVEL SWITCH LOW	LSL-700	64	YEL	8
BACKWASH SUPPLY TANK (T-701) LEVEL SWITCH HIGH	LSH-700	65	BLK	C3 / 9
BACKWASH SUPPLY TANK (T-701) LEVEL SWITCH HIGH-HIGH	LSHH-700	66	RED	10
BACKWASH SUPERNATANT TANK (T-801) LEVEL SWITCH HIGH-HIGH	LSHH-800	67	GRN	11
CHEMICAL DRUM (T-1001) LEVEL SWITCH LOW	LSL-1001	68	WHT	12
CHEMICAL DRUM (T-1002) LEVEL SWITCH LOW	LSL-1002	69	BLU	C4 / 13
SUMP LEVEL SWITCH HIGH-HIGH	LSHH-1200	70	BRN	14
SUMP LEVEL SWITCH HIGH-HIGH	LSHH-1201	71	GRY	15
BUILDING TEMPERATURE SWITCH LOW	TSL-1200 (RED / YEL)	72	YEL	16

DC INPUT 4

DI P3-16ND3

EW-3 FLOW INDICATING TRANSMITTER PULSE	FIQ-101 (C3 / NO3)	73	BLK	C1 / 1
EW-6 FLOW INDICATING TRANSMITTER PULSE	FIQ-102 (C3 / NO3)	74	RED	2
EW-8 FLOW INDICATING TRANSMITTER PULSE	FIQ-103 (C3 / NO3)	75	GRN	3
EW-12 / EW-16 FLOW INDICATING TRANSMITTER PULSE	FIQ-104 (C3 / NO3)	76	WHT	4
EW-14 FLOW INDICATING TRANSMITTER PULSE	FIQ-105 (C3 / NO3)	77	BLU	C2 / 5
EW-15 FLOW INDICATING TRANSMITTER PULSE	FIQ-106 (C3 / NO3)	78	BRN	6
INFLUENT FLOW INDICATING TRANSMITTER PULSE	FIQ-107 (C3 / NO3)	79	GRY	7
RE-INJECTION POINT 1 FLOW INDICATING TRANSMITTER PULSE	FIQ-601 (C3 / NO3)	80	YEL	8
RE-INJECTION POINT 2 FLOW INDICATING TRANSMITTER PULSE	FIQ-602 (C3 / NO3)	81	BLK	C3 / 9
BACKWASH FLOW INDICATING TRANSMITTER PULSE	FIQ-701 (C3 / NO3)	82	RED	10
SPARE		83	GRN	11
SPARE		84	WHT	12
SPARE		85	BLU	C4 / 13
SPARE		86	BRN	14
SPARE		87	GRY	15
SPARE		88	YEL	16

B — B

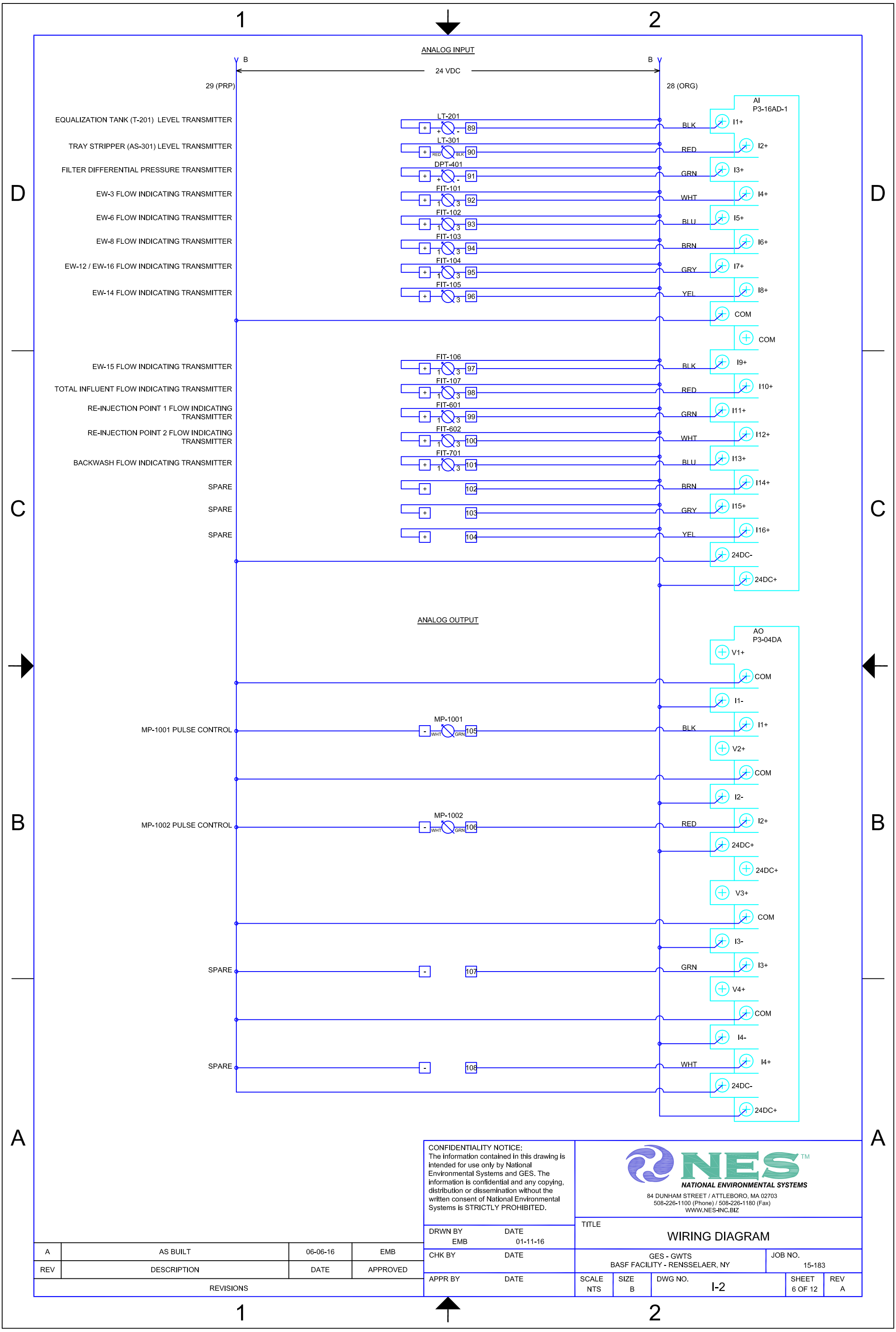
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EMB	01-11-16	WIRING DIAGRAM	
CHK BY	DATE	GES - GWTS BASF FACILITY - RENSSELAER, NY	JOB NO. 15-183
APPR BY	DATE	SCALE NTS / SIZE B / DWG NO. I-2	SHEET 5 OF 12 / REV A



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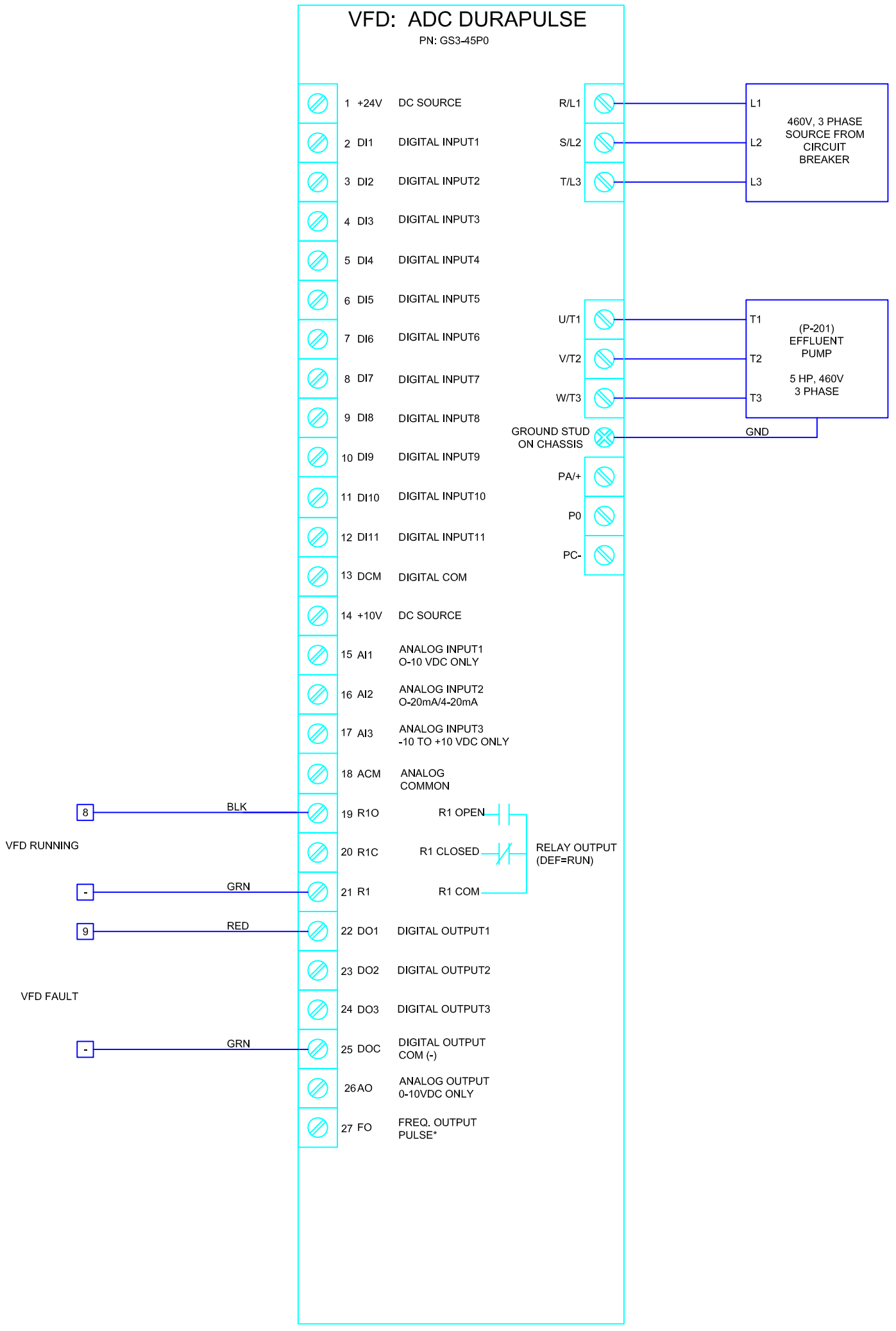
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VFD1 WIRING DIAGRAM EFFLUENT PUMP
(P-201)



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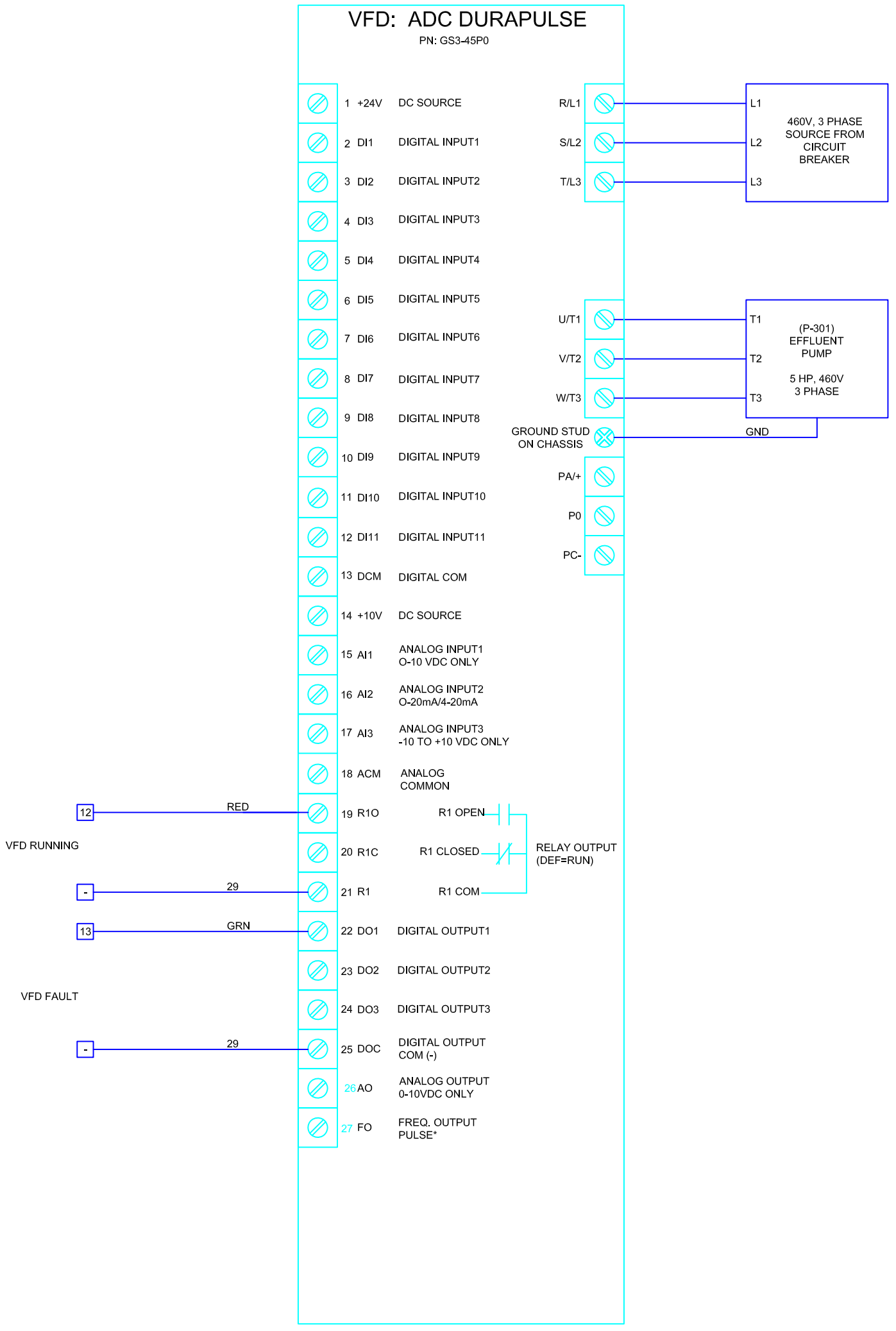
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WIRING DIAGRAMS

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	7 OF 12	A

VFD2 WIRING DIAGRAM EFFLUENT PUMP
(P-301)



REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	06-06-16	EMB

REVISIONS

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EMB	01-11-16
CHK BY	DATE
APPR BY	DATE

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TITLE
WIRING DIAGRAMS

GES - GWTS
BASF FACILITY - RENSSELAER, NY

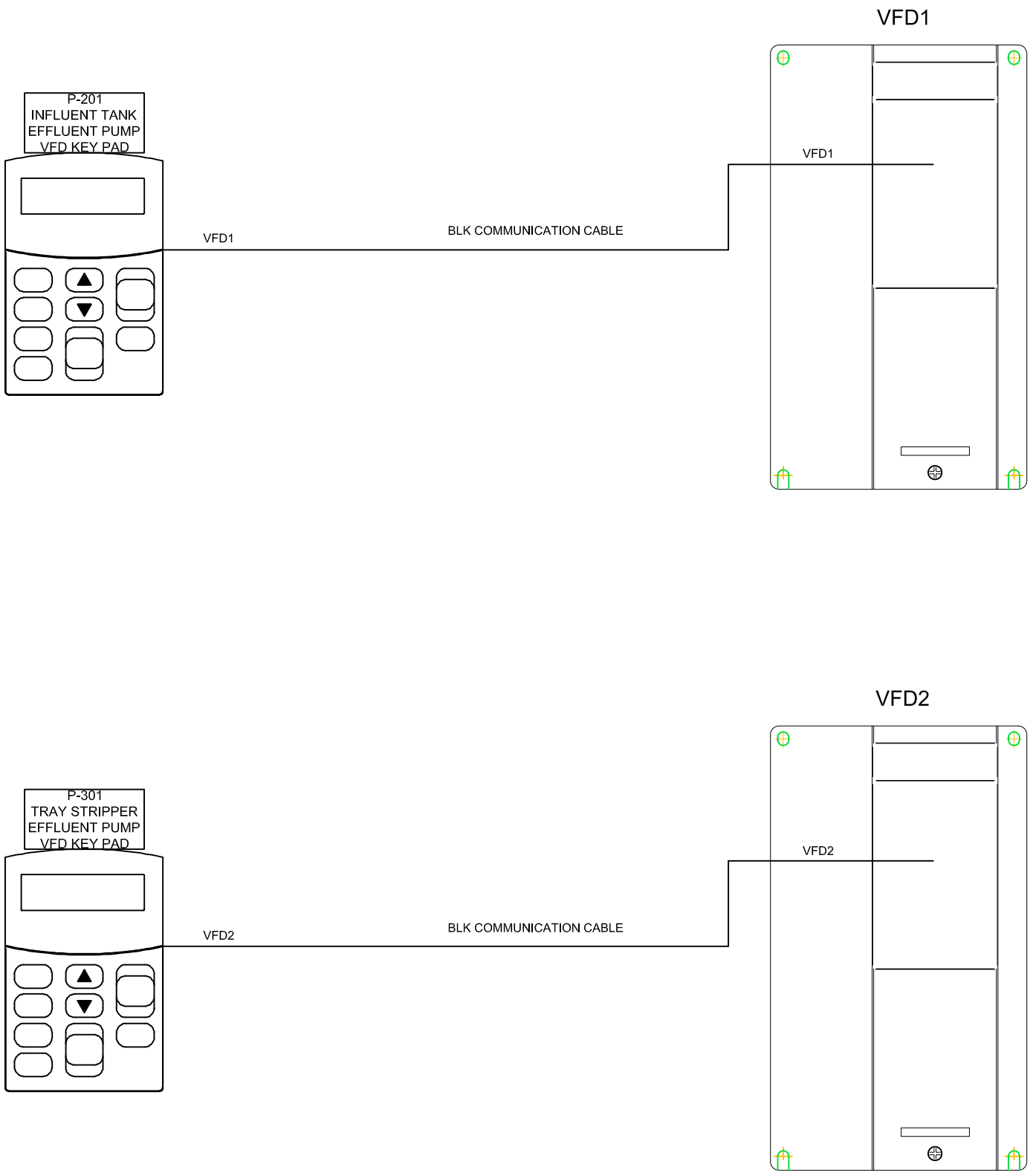
JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	8 OF 12	A

MASTER CONTROL PANEL TO MOTOR CONTROL PANEL VFD WIRING

MASTER CONTROL PANEL

MOTOR CONTROL PANEL



REV	DESCRIPTION	DATE	APPROVED
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TITLE

WIRING DIAGRAMS

GES - GWTS
BASF FACILITY - RENSSELAER, NY

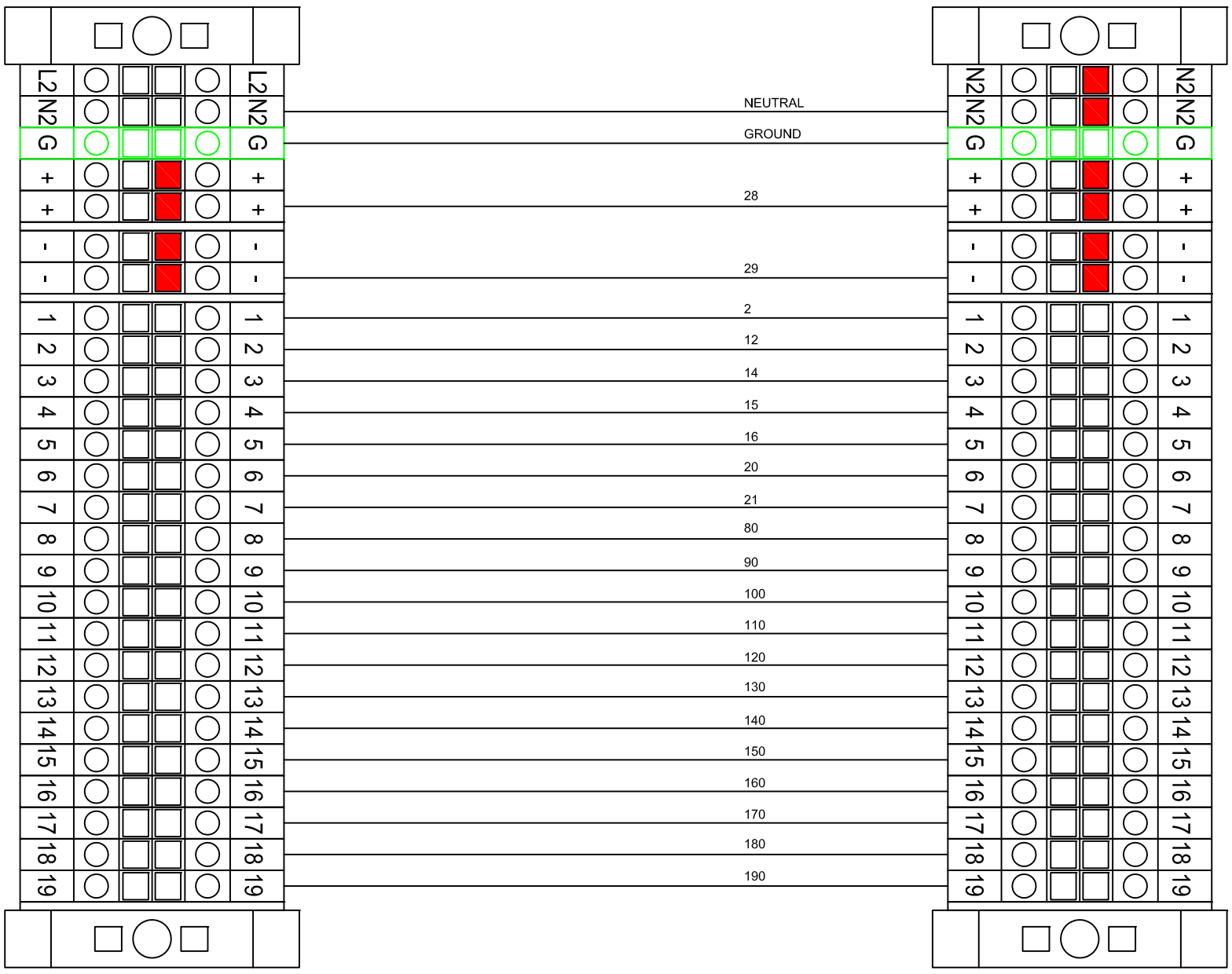
JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	9 OF 12	A

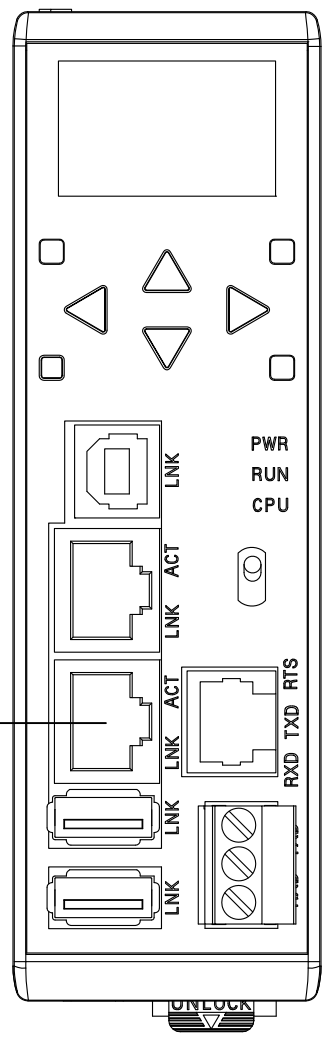
MASTER CONTROL PANEL TO MOTOR CONTROL PANEL FIELD WIRING

MASTER CONTROL PANEL FIELD TERMINALS

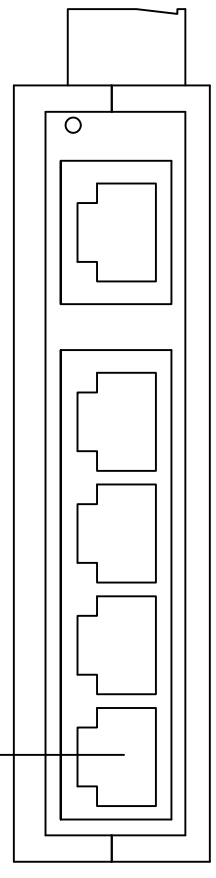
MOTOR CONTROL PANEL FIELD TERMINALS



P3000 CPU



SE-SW5U SWITCH



CAT5 CABLE

REV	DESCRIPTION	DATE	APPROVED
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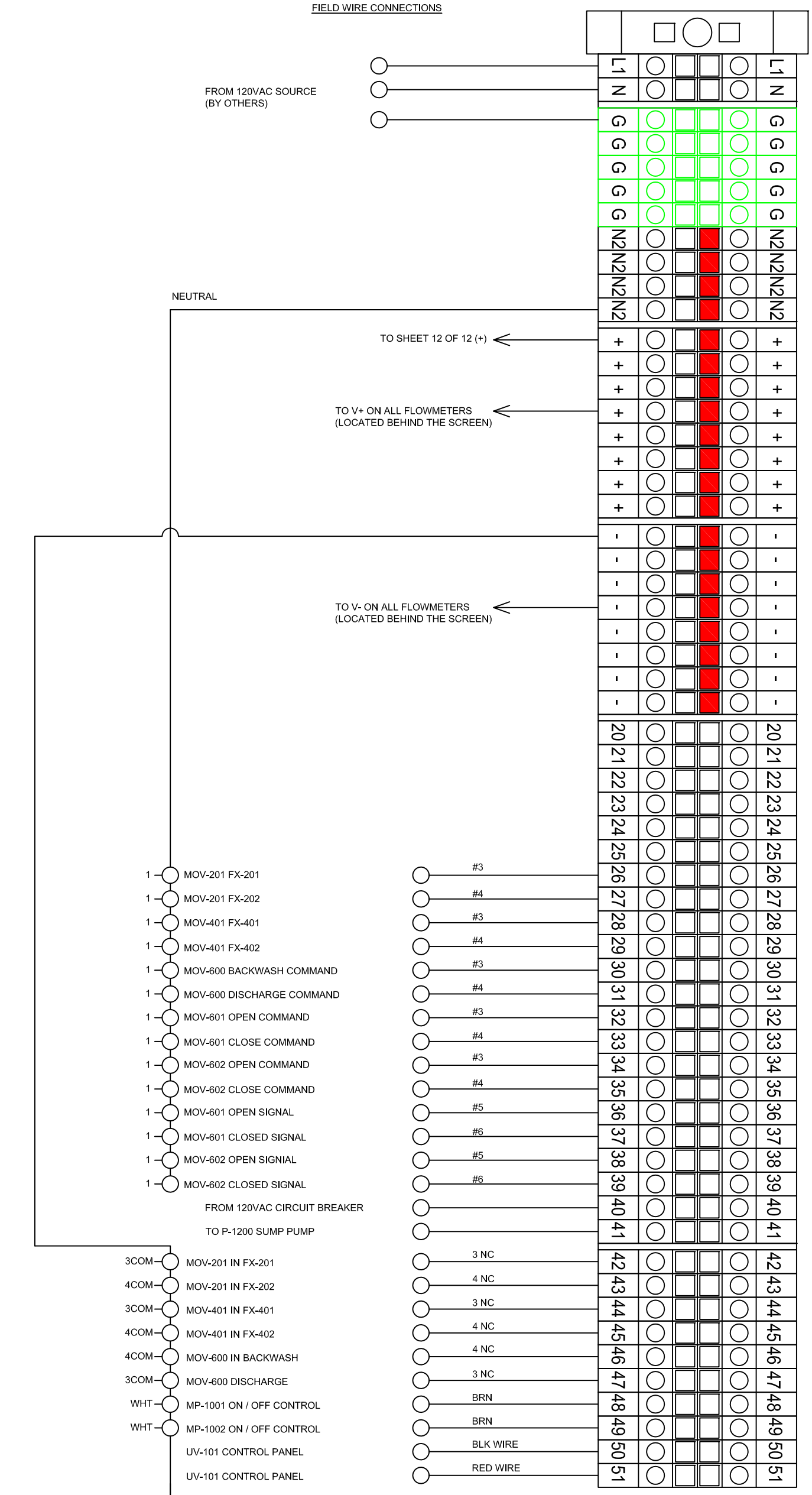
TITLE: WIRING DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	10 OF 12	A

FIELD WIRE CONNECTIONS



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A	AS BUILT	06-06-16	EMB

DRWN BY EMB	DATE 01-11-16	TITLE: WIRING DIAGRAM			
CHK BY	DATE	GES - GWTS BASF FACILITY - RENSSELAER, NY			JOB NO. 15-183
APPR BY	DATE	SCALE NTS	SIZE B	DWG NO. I-2	SHEET 11 OF 12 / REV A

FIELD WIRE CONNECTIONS

FROM SHEET 11 OF 12 (-)

COM	FILTER HOUSING (FX-101) PRESSURE SWITCH HIGH (PSH-101)	NC	52
COM	FILTER HOUSING (FX-201,202) PRESSURE SWITCH HIGH (PSH-201)	NC	53
COM	TRAY STRIPPER (AS-301) VACUUM SWITCH LOW (VSL-301)	NO	54
COM	TRAY STRIPPER (AS-301) DISCHARGE PRESSURE SWITCH HIGH (PSH-301)	NC	55
COM	CARBON BEDS PRESSURE SWITCH HIGH (PSH-501)	NC	56
COM	SYSTEM DISCHARGE PRESSURE SWITCH HIGH (PSH-600)	NC	57
BLK	EQUALIZATION TANK (T-201) LEVEL SWITCH HIGH-HIGH (LSHH-200)	WHT	58
BLK	TRAY STRIPPER (AS-301) LEVEL SWITCH HIGH-HIGH (LSHH-300)	WHT	59
BLK	MOISTURE SEPERATOR LEVEL SWITCH HIGH-HIGH (LSHH-301)	BLK	60
XXX	RE-INJECTION POINT 1 LEVEL SWITCH HIGH-HIGH (LSHH-601)	XXX	61
XXX	RE-INJECTION POINT 2 LEVEL SWITCH HIGH-HIGH (LSHH-601)	XXX	62
BLK	BACKWASH SUPPLY TANK (T-701) LEVEL SWITCH LOW (LSL-700)	WHT	63
BLK	BACKWASH SUPPLY TANK (T-701) LEVEL SWITCH HIGH (LSH-700)	WHT	64
BLK	BACKWASH SUPPLY TANK (T-701) LEVEL SWITCH HIGH-HIGH (LSHH-700)	WHT	65
BLK	BACKWASH SUPERNATANT TANK (T-801) LEVEL SWITCH HIGH-HIGH (LSHH-800)	WHT	66
BLK	CHEMICAL DRUM (T-1001) LEVEL SWITCH LOW (LSL-1001)	CLEAR	67
BLK	CHEMICAL DRUM (T-1002) LEVEL SWITCH LOW (LSL-1002)	CLEAR	68
RED	SUMP LEVEL SWITCH HIGH-HIGH (LSHH-1200)	RED	69
RED	SUMP LEVEL SWITCH HIGH-HIGH (LSHH-1201)	RED	70
RED	BUILDING TEMPERATURE SWITCH LOW (TSL-1200)	YEL	71
C3	EW-3 FLOW INDICATING TRANSMITTER PULSE (FIQ-101)	NO3	72
C3	EW-6 FLOW INDICATING TRANSMITTER PULSE (FIQ-102)	NO3	73
C3	EW-8 FLOW INDICATING TRANSMITTER PULSE (FIQ-103)	NO3	74
C3	EW-12 / EW-16 FLOW INDICATING TRANSMITTER PULSE (FIQ-104)	NO3	75
C3	EW-14 FLOW INDICATING TRANSMITTER PULSE (FIQ-105)	NO3	76
C3	EW-15 FLOW INDICATING TRANSMITTER PULSE (FIQ-106)	NO3	77
C3	TOTAL INFLUENT FLOW INDICATING TRANSMITTER PULSE (FIQ-107)	NO3	78
C3	RE-INJECTION POINT 1 FLOW INDICATING TRANSMITTER PULSE (FIQ-601)	NO3	79
C3	RE-INJECTION POINT 2 FLOW INDICATING TRANSMITTER PULSE (FIQ-602)	NO3	80
C3	BACKWASH FLOW INDICATING TRANSMITTER PULSE (FIQ-701)	NO3	81

FROM SHEET 11 OF 12 (+)

+	EQUALIZATION TANK (T-201) LEVEL TRANSMITTER (LT-201)	-	88
RED	TRAY STRIPPER (AS-301) LEVEL TRANSMITTER (LT-301)	BLK	89
1	FILTERS (FX-401, FX402) DIFFERENTIAL PRESSURE TRANSMITTER (DPT-401)	2	90
1	EW-3 FLOW INDICATING TRANSMITTER (FIT-101)	3	91
1	EW-6 FLOW INDICATING TRANSMITTER (FIT-102)	3	92
1	EW-8 FLOW INDICATING TRANSMITTER (FIT-103)	3	93
1	EW-12 / EW-16 FLOW INDICATING TRANSMITTER (FIT-104)	3	94
1	EW-14 FLOW INDICATING TRANSMITTER (FIT-105)	3	95
1	EW-15 FLOW INDICATING TRANSMITTER (FIT-106)	3	96
1	TOTAL INFLUENT FLOW INDICATING TRANSMITTER (FIT-107)	3	97
1	RE-INJECTION POINT 1 FLOW INDICATING TRANSMITTER (FIT-601)	3	98
1	RE-INJECTION POINT 2 FLOW INDICATING TRANSMITTER (FIT-602)	3	99
1	BACKWASH FLOW INDICATING TRANSMITTER (FIT-701)	3	100

WHT	MP-1001 PULSE CONTROL	GRN/YEL	101
WHT	MP-1002 PULSE CONTROL	GRN/YEL	102

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REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	06-06-16	EMB

REVISIONS

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DATE	01-11-16
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DATE	

TITLE: WIRING DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	12 OF 12	A

CUSTOMER SOURCE CONNECTIONS
480V VAC, 60HZ
3 PHASE

480V VAC, 60HZ 3 PHASE
480V VAC, 60HZ 3 PHASE
480V VAC, 60HZ 1 PHASE
480V VAC, 60HZ 1 PHASE
480V VAC, 60HZ 3 PHASE
480V VAC, 60HZ 3 PHASE
480V VAC, 60HZ 3 PHASE
480V VAC, 60HZ 3 PHASE

CB (BY OTHERS) ×8

VFD1 GS3-45P0

VFD2 GS3-45P0

C1

C2

M1

M2

M3

M4

2 4 6

MOTOR CONTROL PANEL LIMITS

DS ×6

P-201 EFFLUENT PUMP 5 HP, 460 VAC 3 PHASE, TEFC 6.2 A

P-301 EFFLUENT PUMP 5 HP, 460 VAC 3 PHASE, TEFC 6.2 A

EXTRACTION WELL EW-3, EW-15 480V 1 PHASE

EXTRACTION WELLS EW-6, EW-8, EW-12/16, EW-14 480V 1 PHASE

B-101 TRAY STRIPER BLOWER 25 HP, 480 VAC 3 PHASE, TEFC 34.8 A

P-701 EFFLUENT PUMP 5 HP, 480 VAC 3 PHASE, TEFC 6.2 A

P-801 EFFLUENT PUMP .75 HP, 480 VAC 3 PHASE, TEFC 2 A

P-802 DIAPHRAGM PUMP 1.5 HP, 208 VAC 3 PHASE, TEFC 2.2 A

	LEGEND
AWG	AMERICAN WIRE GAUGE
CB	CIRCUIT BREAKER
DS	DISCONNECT SWITCH
VFD	VARIABLE FREQUENCY DRIVE
— —	MOTOR CONTROL PANEL LIMITS
———	FIELD WIRING

NOTES:
1. CONTROL PANEL UL 508A LISTED.
2. DISCONNECT SWITCHES BY OTHERS
3. GROUND CONDUCTORS NOT SHOWN. INSTALL ALL GROUNDS PER NEC ARTICLES 250.122 , LOCAL ELECTRICAL CODES, AND PER THE AUTHORITY HAVING JURISDICTION.

REVISIONS			
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A	AS BUILT	06-06-16	EMB

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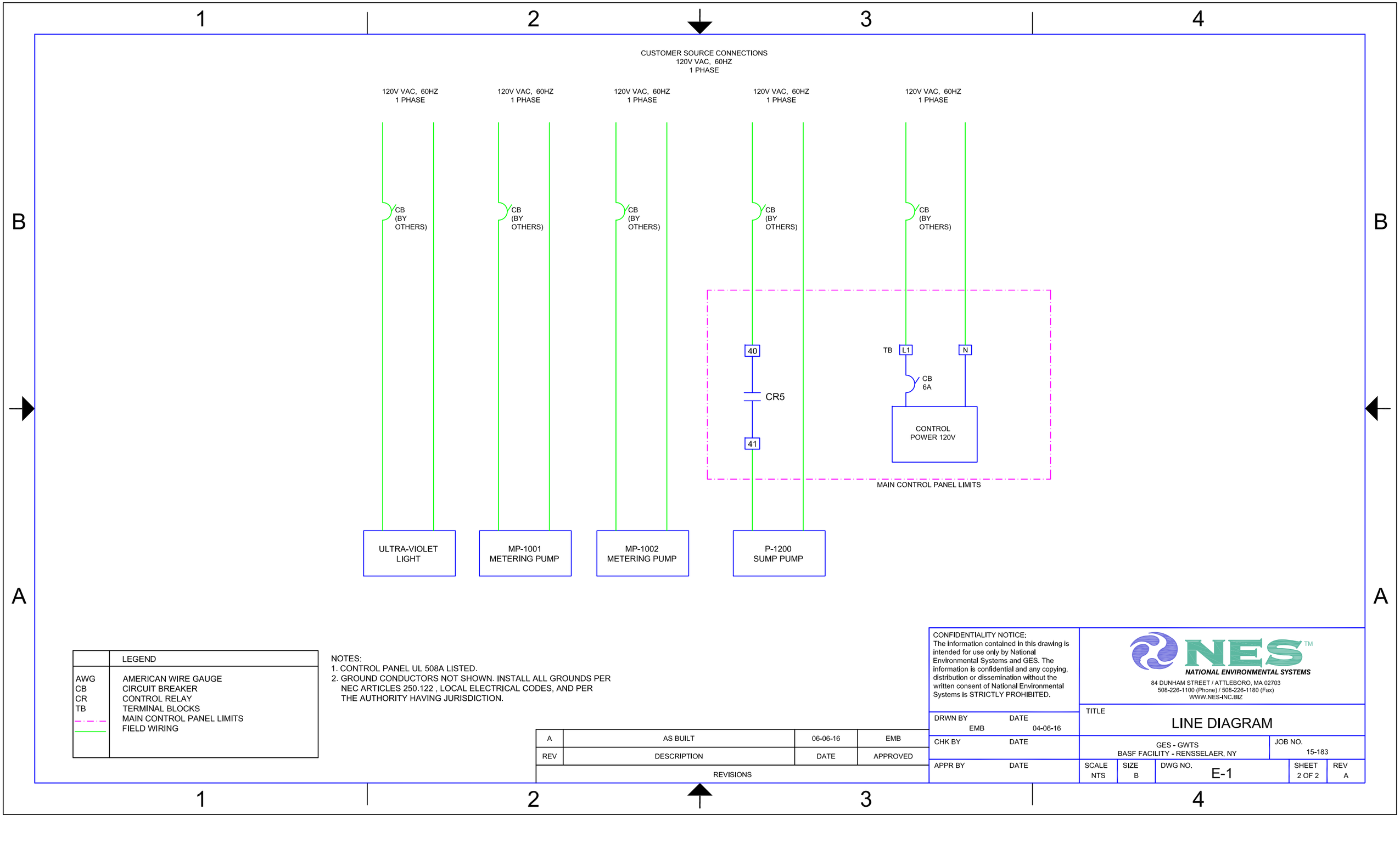
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DATE	
APPR BY	
DATE	

TITLE: LINE DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	E-1	1 OF 2	A



	LEGEND
AWG	AMERICAN WIRE GAUGE
CB	CIRCUIT BREAKER
CR	CONTROL RELAY
TB	TERMINAL BLOCKS
	MAIN CONTROL PANEL LIMITS
	FIELD WIRING

NOTES:
1. CONTROL PANEL UL 508A LISTED.
2. GROUND CONDUCTORS NOT SHOWN. INSTALL ALL GROUNDS PER NEC ARTICLES 250.122 , LOCAL ELECTRICAL CODES, AND PER THE AUTHORITY HAVING JURISDICTION.

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TITLE: LINE DIAGRAM

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	E-1	2 OF 2	A

TABLE 5
DURAPULSE

VFD SETTINGS
NES 15-183, REVISION A - (JUNE, 2016)
BASF FACILITY
RENSSELAER, NY

SETPOINTS LOADED BY NES - VIA VFD INTEGRAL KEYPAD

GROUP	PARAMETER CODE	DESCRIPTION	P-201 SETTINGS	P-301 SETTINGS
MOTOR	P0.01	MOTOR NAMEPLATE AMPS	6.2	6.2
MOTOR	P0.03	MOTOR BASE RPM'S	3450	3450
MOTOR	P0.07	MOTOR OVERLOAD	6.2	6.2
RAMPS	P1.00	STOP METHOD	1	1
RAMPS	P1.01	ACCELERATION TIME (RAMP UP)	3	3
V/Hz	P2.00	VOLTS/HERTZ SETTINGS	2	2
DIGITAL	P3.00	SOURCE OF OPERATION COMMAND	3	3
DIGITAL	P3.01	MULTI-FUNCTION INPUT TERMINALS (DI1-DI2)	0	0
DIGITAL	P3.11	MULTI-FUNCTION OUTPUT TERMINAL 1 (RELAY OUTPUT)	0	0
DIGITAL	P3.12	MULTI-FUNCTION OUTPUT TERMINAL 2 (DO1)	1	1
PROTECTION	P6.15	UPPER BOUND OF OUTPUT FREQUENCY	60	60
PROTECTION	P6.16	LOWER BOUND OF OUTPUT FREQUENCY	30	30

PLEASE NOTE: PARAMETERS NOT LISTED REMAIN AT FACTORY DEFAULT

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84 Dunham Street - Attleboro, MA 02703
(508) 226-1100 / info@nes-inc.biz

SECTION 7 - MASTER CONTROL PANEL COMPONENTS

ENCLOSURE NEMA 4 36 X 36 X 12 - MILD STEEL/GRAY - HAMMOND EN4SD363612GY

UPS 350VA 200W 120V 1PH 3 UPS & SURGE OUTLET 3 SURGE ONLY - APC BE350G

3G WIRELESS GATEWAY EVDO 800/1900 MHZ - VERIZON - SIERRA WIRELESS LS300 - 1101489

STATIC IP 12 IN MAGNET MOUNT ANTENNA 10FT RG174 CABLE SMA-MALE - WILSON ELECTRONICS 301125

RF COAXIAL SURGE PROTECTOR 698 MHZ 2.7 GHZ - POLYPHASER TSX-NFF

CPU 266 MHz PROCESSOR 50MB MEMORY FOR P3000 PAC - ADI P3-550

16PT 12-24VDC INPUT SINK/SOURCE FOR P3000 PAC - ADI P3-16ND3

16CH ANALOG CURRENT INPUT 16-BIT MODULE FOR P3000 PAC - ADI P3-16AD-1

ANALOG 4-CH OUT VOLTAGE/CURRENT 16-BIT FOR P3000 - ADI P3-04DA

16PT RELAY OUTPUT SPST 6-27VDC / 6-240VAC FOR P3000 PAC - ADI P3-16TR

C-MORE TOUCH PANEL 10 IN COLOR TFT ETHERNET & USB - ADI EA9-T10CL

POWER SUPPLY 24 VDC 5A 120W DIN RAIL SLIM LINE - ADI PSP24-120S

MUSHROOM SWITCH RED TRIGGER ACTION - TURN TO RELEASE - SQUARE D ZB5AS844_

HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Type 4 Mild Steel Wallmount Enclosure *Eclipse Series*

Hinge Door with Quarter Turn/Handle







Panel Sold Separately

Application

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

Standards

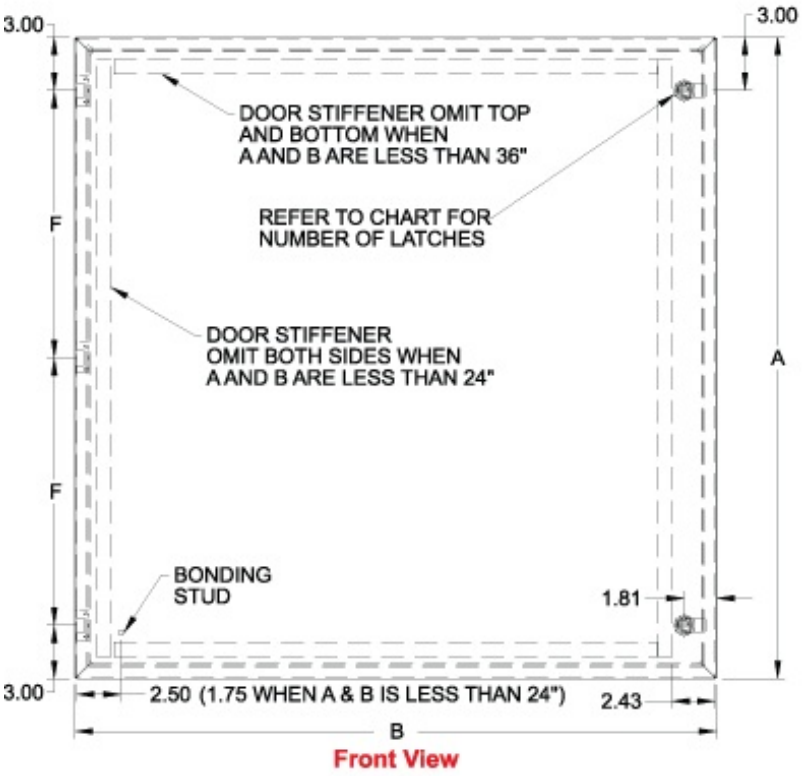
- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
  - NEMA Type 3R, 4, and 12
  - IEC 60529, IP66

Construction

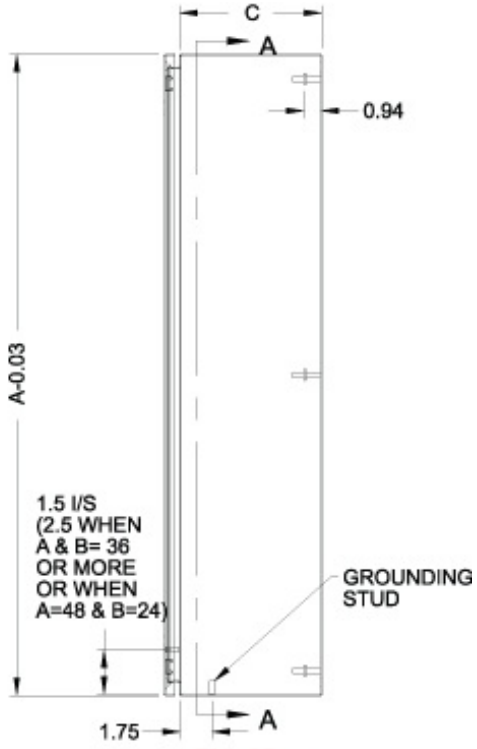
- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

Finish

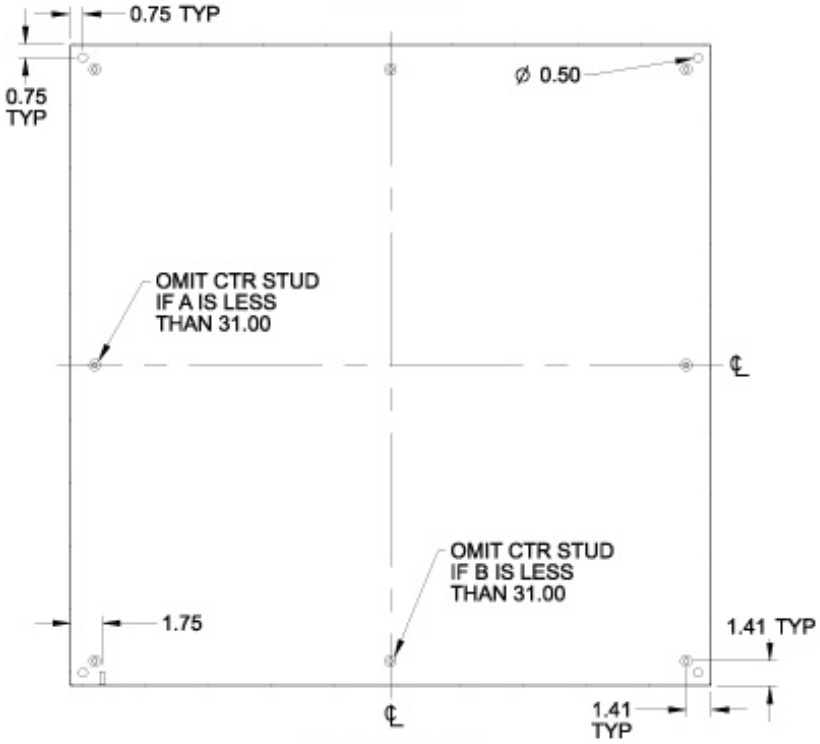
- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).



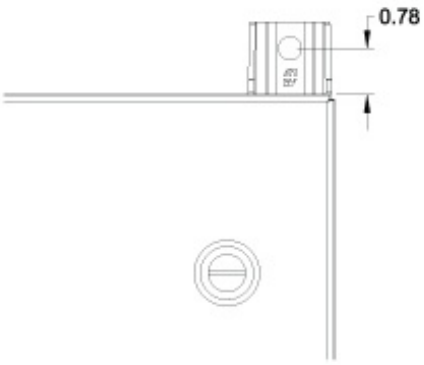
Front View



Side View



SECTION A-A



Mounting Foot Detail

Part No. (ANSI 61 Gray)	Part No. (RAL 7035 Light Gray)	Overall Dimensions A	B	C	Door/Body Gauge	Latches Qty	Type	Opt. Panel Part No.	Panel Size D	E	# Hinges	F	Ship Wt. (lbs)
EN4SD12126GY	**EN4SD12126LG**	12.00	12.00	6.00	16	1	Qtr Turn	**EP1212**	10.20	10.20	2	6.00	12
EN4SD12246GY	**EN4SD12246LG**	12.00	24.00	6.00	16	1	Qtr Turn	**EP1224**	10.20	22.20	2	18.00	24
EN4SD16126GY	**EN4SD16126LG**	16.00	12.00	6.00	16	1	Qtr Turn	**EP1612**	14.20	10.20	2	10.00	16
EN4SD16166GY	**EN4SD16166LG**	16.00	16.00	6.00	16	1	Qtr Turn	**EP1616**	14.20	14.20	2	10.00	19
EN4SD16206GY	**EN4SD16206LG**	16.00	20.00	6.00	16	1	Qtr Turn	**EP1620**	14.20	18.20	2	10.00	22
EN4SD20126GY	**EN4SD20126LG**	20.00	12.00	6.00	16	1	Qtr Turn	**EP2012**	18.20	10.20	2	14.00	20

EN4SD242410GY	**EN4SD242410LG**	24.00	24.00	10.00	14	2	Qtr. Turn	**EP2424**	22.20	22.20	2	18.00	45
EN4SD243010GY	**EN4SD243010LG**	24.00	30.00	10.00	14	2	Qtr. Turn	**EP2430**	22.20	28.20	2	18.00	53
EN4SD302010GY	**EN4SD302010LG**	30.00	20.00	10.00	14	2	Qtr. Turn	**EP3020**	28.20	18.20	3	12.00	47
EN4SD302410GY	**EN4SD302410LG**	30.00	24.00	10.00	14	2	Qtr. Turn	**EP3024**	28.20	22.20	3	12.00	53
EN4SD303010GY	**EN4SD303010LG**	30.00	30.00	10.00	14	2	Qtr. Turn	**EP3030**	28.20	28.20	3	12.00	75
EN4SD362410GY	**EN4SD362410LG**	36.00	24.00	10.00	14	2	Qtr. Turn	**EP3624**	34.20	22.20	3	15.00	70
EN4SD363010GY	**EN4SD363010LG**	36.00	30.00	10.00	14	2	Qtr. Turn	**EP3630**	34.20	28.20	3	15.00	84
EN4SD363610GY	**EN4SD363610LG**	36.00	36.00	10.00	14	2	Qtr. Turn	**EP3636**	34.20	34.20	3	15.00	100
EN4SD423010GY	**EN4SD423010LG**	42.00	30.00	10.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	107
EN4SD423610GY	**EN4SD423610LG**	42.00	36.00	10.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	117
EN4SD482410GY	**EN4SD482410LG**	48.00	24.00	10.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	95
EN4SD483010GY	**EN4SD483010LG**	48.00	30.00	10.00	14	1	3-point	**EP4830**	46.20	28.20	4	14.00	120
EN4SD483610GY	**EN4SD483610LG**	48.00	36.00	10.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	125
EN4SD603610GY	**EN4SD603610LG**	60.00	36.00	10.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	150
EN4SD201612GY	**EN4SD201612LG**	20.00	16.00	12.00	16	1	Qtr Turn	**EP2016**	18.20	14.20	2	14.00	32
EN4SD202012GY	**EN4SD202012LG**	20.00	20.00	12.00	16	1	Qtr Turn	**EP2020**	18.20	18.20	2	14.00	34
EN4SD242012GY	**EN4SD242012LG**	24.00	20.00	12.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	38
EN4SD242412GY	**EN4SD242412LG**	24.00	24.00	12.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	47
EN4SD302412GY	**EN4SD302412LG**	30.00	24.00	12.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	57
EN4SD303012GY	**EN4SD303012LG**	30.00	30.00	12.00	14	2	Qtr Turn	**EP3030**	28.20	28.20	3	12.00	80
EN4SD362412GY	**EN4SD362412LG**	36.00	24.00	12.00	14	2	Qtr Turn	**EP3624**	34.20	22.20	3	15.00	62
EN4SD363012GY	**EN4SD363012LG**	36.00	30.00	12.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	91
EN4SD363612GY	**EN4SD363612LG**	36.00	36.00	12.00	14	2	Qtr Turn	**EP3636**	34.20	34.20	3	15.00	104
EN4SD423012GY	**EN4SD423012LG**	42.00	30.00	12.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	111
EN4SD423612GY	**EN4SD423612LG**	42.00	36.00	12.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	121
EN4SD482412GY	**EN4SD482412LG**	48.00	24.00	12.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	98
EN4SD483612GY	**EN4SD483612LG**	48.00	36.00	12.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603612GY	**EN4SD603612LG**	60.00	36.00	12.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	165
EN4SD723012GY	**EN4SD723012LG**	72.00	30.00	12.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	190
EN4SD723612GY	**EN4SD723612LG**	72.00	36.00	12.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	195
EN4SD242016GY	**EN4SD242016LG**	24.00	20.00	16.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	52
EN4SD242416GY	**EN4SD242416LG**	24.00	24.00	16.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	66
EN4SD302416GY	**EN4SD302416LG**	30.00	24.00	16.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	85
EN4SD363016GY	**EN4SD363016LG**	36.00	30.00	16.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	102
EN4SD423616GY	**EN4SD423616LG**	42.00	36.00	16.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	140
EN4SD483616GY	**EN4SD483616LG**	48.00	36.00	16.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603616GY	**EN4SD603616LG**	60.00	36.00	16.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	200
EN4SD723016GY	**EN4SD723016LG**	72.00	30.00	16.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	215
EN4SD723616GY	**EN4SD723616LG**	72.00	36.00	16.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	217
EN4SD242420GY	**EN4SD242420LG**	24.00	24.00	20.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	70
EN4SD302420GY	**EN4SD302420LG**	30.00	24.00	20.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	82
EN4SD363020GY	**EN4SD363020LG**	36.00	30.00	20.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	117

APC Back-UPS® 350

Best Value Battery Backup & Protection for Home and Home Office Computers

APC's Back-UPS provides enough battery backup power so you can work through short length power outages. It also safeguards your equipment against damaging surges and spikes that travel along utility and phone lines. The Back-UPS series is also "greener" than ever, using an ultra-efficient design that consumes less power during normal operation than any other battery backup in its class, saving you money on your electricity bill. Coupled with all the standard features of the Back-UPS series, the 350 is the perfect unit to protect your productivity from the constant threat of bad power and lost data.





Product Features:

1. **4 "Battery Backup & Surge Protected" Outlets** keep a CPU, monitor and other critical devices running when the power goes out or fluctuates outside safe levels.
2. **3 "Surge Only" Outlets** provide surge protection for your non-critical devices.
3. **Data Line Surge Protection** guards against surges and spikes traveling over an analog phone line (phone, fax, modem, DSL).
4. **Combination Power Button/LED Indicator** provides visual and audible status of unit.
5. **An ultra efficient electrical design**, RoHS compliance and use of all recyclable packaging materials minimize impact on the environment and maximize efficiency.
6. **Building Wiring Fault Indicator** lets you know if there are problems in your building's wiring.
7. **Push Button Circuit Breaker** enables quick recovery from overloads.
8. **Automatic Diagnostic Testing** ensures your unit is ready when you need it.
9. **3 yr Warranty**, $75,000 Equipment Protection Policy, free technical phone and online support

APC by Schneider Electric

Back-UPS 350 Specifications

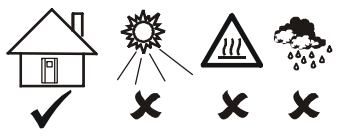
Model Number	BE350G
Output	
Output Capacity	350 VA / 210 Watts
Output Voltage / Frequency (On utility)	120V / 60Hz
Output Voltage / Frequency (On battery)	115V +/-8%, 60 Hz +/-3Hz
Output Connections	6 total NEMA 5-15R outlets: 3 battery backup & surge 3 surge protection only
Waveform Type	Stepped Approximation to Sine Wave
Input	
Input Voltage / Frequency	120V / 60 Hz +/-1 Hz
Input Connection	5 ft cord with right angle plug (NEMA 5-15P)
Surge Protection	
AC Power Surge Protection	All outlets
Data Line Surge Protection	Analog phone line, RJ-11 (single line, 2-wire). For phone, fax, modem, DSL
Physical	
Unit Dimensions (H x W x D)	3.5” x 6.25” x 11.0”
Unit Weight	8.0 lbs
Shipping Dimensions (H x W x D)	5.0” x 7.75” x 14.25”
Shipping Weight	9.6 lbs
Color	Black
UPC Code	731304258902
Battery	
Battery Type	Maintenance-free, sealed lead-acid battery, leakproof
Management	
Alarms	Visual (LED) and audible alarms
Auto-Shutdown Software	None
Safety	
Certification/Approvals	cUL Listed, FCC Part 15 Class B, FCC Part 68, NOM, UL 1778, UL 497A, UL 498

APC ***by Schneider Electric***
132 Fairgrounds Rd
West Kingston, RI 02892
Tel: 800-800-4272
www.apc.com

APC by Schneider Electric

User Manual Back-UPS® BE350G Series

Safety



This unit is intended for indoor use only.

Do not operate this unit in direct sunlight, in contact with fluids, or where there is excessive dust or humidity.

Connect the Back-UPS power cord directly to a wall outlet. Do not use a surge protector or an extension cord.

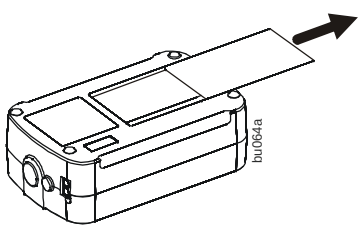
Specifications

Input	Voltage	120 Vac Nominal
	Frequency	60 Hz ± 3
	Brownout Transfers	92 Vac Typical
	Over-voltage Transfer	139 Vac Typical
Output	UPS Capacity (3 outlets)	350 VA, 200 W
	Total Amperage (6 outlets)	8 A (including UPS output)
	Voltage - On Battery	115 Vac ± 8%
	Frequency - On Battery	60 Hz ± 1
	Transfer Time	6 ms Typical, 10 ms maximum
Protection and Filtering	AC Surge Protection	Full time, 340 Joules
	EMI/RFI Filter	Full time
	AC Input	Resettable circuit breaker
Battery	Type	Sealed, maintenance-free, lead acid Replacement battery cartridge RBC35
	Average Life	3 - 5 years depending on the number of discharge cycles and environmental temperature
Physical	Net Weight	9 lb (4 kg)
	Dimensions Length x Width x Height	11 in x 6 in x 3 in 29 cm x 16 cm x 9 cm
	Operating Temperature	32º F to 104º F (0º C to 40º C)
	Storage Temperature	5º F to 113º F (–15º C to 45º C)
	Operating Relative Humidity	0 to 95% non-condensing humidity
	Operating Elevation	0 to 10,000 ft (0 to 3000 m)
EMC Compliance	This device complies with part 68 and part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.	

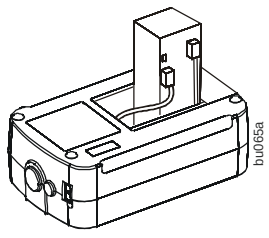
Connect the Battery

The Back-UPS is shipped with one battery cable disconnected. Remove the *"Stop! Connect the Battery"* label that covers the outlets. Prior to connecting any equipment to the unit, connect the battery cable to the unused battery terminal. It is normal for small sparks to be seen when the battery cable is connected to the battery terminal.

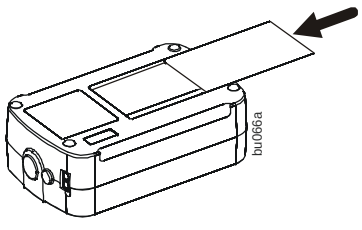
❶ Press the battery compartment cover release tab located on the rear side of the unit. Slide the battery cover off.



❷ Connect the battery cable securely to the battery terminal.



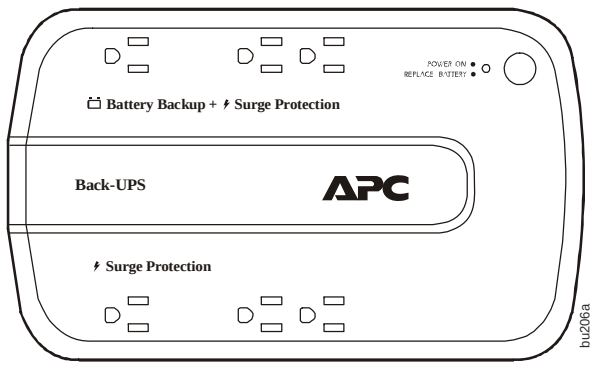
❸ Reinstall the battery compartment cover. Be sure that the release tab locks into place.



Wall Mount Installation

- Horizontal installation, use 2 screws 5.0" (127 mm) apart.
- Vertical installation, use 2 screws 4.3" (110.4 mm) apart.
- Allow 5/16" (8 mm), of the screw to protrude from the wall.

Connect Equipment



Battery Backup + Surge Protection Outlets

Battery backup outlets provide protection to connected equipment when the Back-UPS is turned on and connected to utility power.

Battery backup outlets receive power from the Back-UPS for a limited period of time when a power outage, or brownout condition occurs.

Battery backup outlets provide protection from power surges or spikes.

Connect a computer, monitor and other peripheral devices to the outlets.

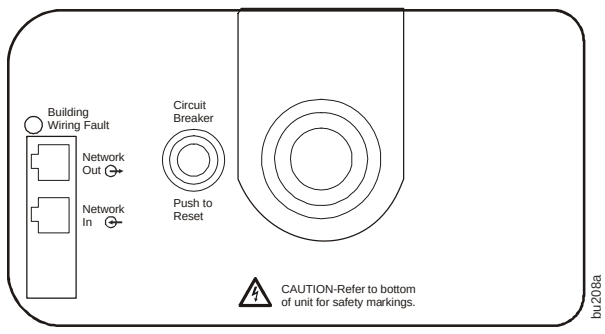
Surge Protection Outlets

Surge protection outlets provide protection to connected equipment when the Back-UPS is connected to utility power, and is switched on or off.

Surge protection outlets provide protection from power surges or spikes.

Connect a printer, scanner or other peripheral devices that do not need to remain on during power outages, or utility problems to the surge protection outlets.

Connect Network



The Back-UPS protects equipment connected to a 10/100 Base-T ethernet, from power surges when connected through the Back-UPS coaxial connectors.

Turn On the Back-UPS

Press the POWER ON button located on the top of the Back-UPS. **The Power On/ Replace Battery** LED will illuminate and a single short beep will be audible to indicate that the Back-UPS is providing protection for connected equipment.

The Back-UPS battery charges fully during the first 16 hours while connected to utility power. The Back-UPS battery will charge while the Back-UPS is switched on or off and is connected to utility power. Do not expect full battery run capability during the initial charge time.

If the red **Building Wiring Fault** LED located on the side of the Back-UPS illuminates, do not operate the Back-UPS. Have a qualified electrician correct the building wiring fault.

Voltage Sensitivity Adjustment (optional)

The Back-UPS detects and reacts to line voltage distortions by transferring to battery backup power to protect connected equipment. In situations where either the Back-UPS or the connected equipment is too sensitive for the input voltage level it is necessary to adjust the transfer voltage.

1. Connect the Back-UPS to a wall outlet. The Back-UPS will be in **Standby** mode, no indicators will be illuminated.
2. Press and hold the ON/OFF button for 10 seconds. The **OnLine** LED will illuminate alternately green-amber-red, to indicate that the Back-UPS is in **Program** mode.
3. The **Power On/Replace Battery** LED will flash either green, amber, or red to indicate the current sensitivity level. Refer to the table for an explanation of the transfer voltage sensitivity levels.
4. To select LOW sensitivity, press and hold the ON/OFF button until the LED flashes green.
5. To select MEDIUM sensitivity, press and hold the ON/OFF button until the LED flashes red.
6. To select HIGH sensitivity, press and hold the ON/OFF button until the LED flashes amber.
7. To exit **Program** mode wait five seconds and all LED indicators will extinguish. **Program** mode is no longer active.

LED Flashes	Sensitivity Setting	Input Voltage Range (Utility Operation)	Recommended Use
Green	LOW	88 Vac to 142 Vac	Use this setting with equipment that is less sensitive to fluctuations in voltage or waveform distortions.
Red	MEDIUM	92 Vac to 139 Vac	Factory default setting. Use this setting under normal conditions.
Amber	HIGH	96 Vac to 136 Vac	Use this setting when connected equipment is sensitive to voltage and waveform fluctuations.

Status Indicators

Status	LED Indicator	Audible Indicator On	Audible Indicator Terminates
Power On The Back-UPS is supplying utility power to connected equipment.	The green LED illuminates.	None	N/A
On Battery Back-UPS supplying battery power to battery backup outlets.	The green LED illuminates.The LED is not illuminated during the beeps.	Back-UPS beeps 4 times every 30 seconds.	Beeping stops when utility power is restored or the Back-UPS is turned off.
Low Battery warning The Back-UPS is supplying battery power to the battery backup outlets and the battery is near a total discharge state.	The green LED illuminates with rapid green flashes.	The Back-UPS emits rapid beeping, every 1/2 second.	Beeping stops when utility power is restored or the Back-UPS is turned off.
Replace Battery • The battery is disconnected. • The battery needs to be charged, or replaced.	• **Replace Battery** LED flashes. • **Replace Battery** and **Power On** LEDs flash alternately.	Constant tone Constant tone	Back-UPS is turned off.
Overload Shutdown While on battery power an overload condition has occurred in one or more of the battery backup outlets while the Back-UPS is operating on battery power.	None	Constant tone	Back-UPS is turned off.
Sleep Mode While on battery power the battery is completely discharged. The Back-UPS will “awaken” once utility power is restored.	None	The Back-UPS beeps once every four seconds.	The beeping stops when: • Utility power is restored • If utility power is not restored within 32 seconds • The Back-UPS is turned off
Building Wiring Fault The building wiring presents a shock hazard that must be corrected by a qualified electrical.	**Building Wiring Fault** LED illuminates red	None	The Back-UPS is unplugged from the wall outlet or is plugged into an improperly wired outlet.

Troubleshooting

Problem and Possible Cause	Solution
The Back-UPS will not turn on	
The Back-UPS has not been turned on.	Press the POWER ON button.
The Back-UPS is not connected to utility power, there is no utility power available at the wall outlet, or the utility power is experiencing a brownout or over voltage condition.	Make sure the power cord is securely connected to the wall outlet, and that there is utility power available at the wall outlet.Where applicable, check that the wall outlet is switched on.
The battery is not connected.	Connect the battery. Refer to “Connect the Battery” on page 1 of this manual. In the event that the Back-UPS receives no utility power and the battery is connected, a cold-start can be initiated. Press and hold the **Power On** button until the Back-UPS emits two beeps.
The Back-UPS is on, the Replace Battery LED flashes and the unit emits a constant tone	
The battery is disconnected.	Refer to the “Connect the Battery” on page 1.
Connected equipment loses power	
A Back-UPS overload condition has occurred.	Remove all nonessential equipment connected to the outlets. One at a time reconnect equipment to the Back-UPS.
The Back-UPS battery is completely discharged.	Connect the Back-UPS to utility power and allow the battery to recharge for eight hours.
PowerChute software has performed a shutdown due to a power failure.	This is normal Back-UPS operation.
Connected equipment does not accept the step-approximated sine waveform from the Back-UPS.	The output waveform is intended for computers and peripheral devices. It is not intended for use with motor driven equipment.
The Back-UPS may require service.	Contact APC Technical Support for more in depth troubleshooting.
The Power On LED is illuminated and the Back-UPS beeps 4 times every 30 seconds	
The Back-UPS is operating on battery power.	The Back-UPS is operating normally on battery power. At this point the user should save all open files, and shutdown the computer. When utility power is restored the battery will recharge.
The Power On LED flashes once every second while the Back-UPS beeps once every second	
The Back-UPS battery has approximately two minutes of remaining runtime.	The Back-UPS battery is near a total discharge state. At this point the user should save all open files, and shutdown the computer. When utility power is restored the battery will recharge.
The Building Wiring Fault LED illuminates	
The building wiring presents a shock hazard that must be corrected by a qualified electrical.	Do not operate the Back-UPS. Call a qualified electrician to correct the building wiring fault.
The Back-UPS has an inadequate battery runtime	
The battery is not fully charged. The battery is near the end of useful life and should be replaced.	Leave the Back-UPS connected to utility power for 16 hours while the battery charges to full capacity. As a battery ages, the runtime capability decreases. Contact APC at the Web site **www.apc.com**, to order replacement batteries.
The connection from the Back-UPS to the internet is lost during a power outage	
The modem has lost power.	Connect the modem cable into one of the Battery Backup + Surge Protection outlets.

Replace Battery

Use only approved APC replacement battery cartridges.

Deliver used batteries to a battery replacement facility in the packaging provided by APC with the replacement battery cartridge.

To order replacement battery cartridges contact APC through the Web site www.apc.com

Warranty

The standard warranty is 3 years in the USA and Canada, 2 years in all other regions from the date of purchase. APC standard procedure is to replace the original unit with a factory reconditioned unit. Customers who must have the original unit back due to assigned asset tags and set depreciation schedules must declare such a need at first contact with APC Technical Support. APC will ship the replacement unit once the defective unit is received by the repair department or cross-ship upon the provision of a valid credit card number. The customer pays for shipping to APC, and APC pays ground freight transportation costs back to the customer.

Service

If the unit requires service, do not return it to the dealer. Follow these steps:

1. Review the *Troubleshooting* section of the manual to eliminate common problems.
2. If the problem persists, contact APC Customer Support.
   a. Note the model number and serial number and the date of purchase. The model and serial numbers are located on the rear panel of the unit and are available through the LCD display on select models.
   b. Call APC Customer Support and a technician will attempt to solve the problem over the phone. If this is not possible, the technician will issue a Returned Material Authorization Number (RMA#).
   c. If the unit is under warranty, the repairs are free.
   d. Service procedures and returns may vary internationally. Refer to the APC Web site for country specific instructions.
3. Pack the unit properly to avoid damage in transit. Never use foam beads for packaging. Damage sustained in transit is not covered under warranty. **Always DISCONNECT THE UPS BATTERY before shipping in compliance with U.S. Department of Transportation (DOT) and IATA regulations.** The battery may remain in the unit.
4. Write the RMA# provided by Customer Support on the outside of the package.
5. Return the unit by insured, pre-paid carrier to the address provided by Customer Support.

Contact

APC Web site, **www.apc.com**

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990-3950B
7/2011

Sierra Wireless AirLink® LS300 Gateway

Small, rugged, and intelligent 3G gateway.

Want to remotely control, monitor, or track the location of field equipment? Need a reliable alternative to landlines when they go down or are not an option in remote or temporary locations?

ONE GATEWAY, MULTIPLE POSSIBILITIES

The AirLink LS300 gateway is the smallest, most compact 3G gateway from Sierra Wireless. Designed to be the next generation, all-in-one successor to the market leading Raven series, the intelligent LS300 gateway comes standard with multiple interfaces (Ethernet, Serial, USB), GPS, and all features that AirLink customers have come to rely on for over 15 years:

- Best-in-class session persistence keep AirLink gateways connected to the cellular network 24/7
- Rugged, military spec design keep AirLink gateways operating in the harshest environments
- AirVantage™ Management Service provides remote device management to centrally configure, deploy, and monitor AirLink gateways over-the-air (OTA)
- Industry-leading warranties and world class support keep AirLink customers coming back

QUICKLY CONFIGURE AND DEPLOY

The comprehensive set of configurable options makes the LS300 quick and easy to deploy in the field. With ALEOS™ embedded intelligence powering AirLink gateways, the LS300 can be deployed in most industrial, enterprise, and transportation applications out-of-the-box.

In addition to configuring connection settings, ALEOS enables users to setup custom security, networking, and routing parameters, GPS location tracking, and events reporting without any programming. With over a decade of experience in real-world deployments, ALEOS has been developed to ease integration and configuration for a wide range of deployment scenarios.

ADD CUSTOM LOGIC WITHOUT ANY EMBEDDED EXPERTISE

ALEOS Application Framework makes it easy to add custom logic to the LS300 gateway for collecting information from connected equipment or optimizing data transfers. This scripting framework allows users to create applications without deep embedded expertise or C/C++ programming skills.



USE CASE EXAMPLES

- Industrial: remotely monitor and control pipelines, meters, pumps, valves in any energy or utility application.
- Enterprise: instantly deploy reliable internet connectivity to remote point-of-sale locations, temporary installations, or retail operations.
- Transportation: track the location and speed of vehicles or heavy equipment and provide reliable internet to a mobile workforce.



SIERRA WIRELESS™ | AirLink®

Sierra Wireless AirLink® LS300 Gateway

Technical Specifications

HSPA+ MODELS

fallback to quad-band GSM/GPRS/EDGE

- HSPA+ North America 800/850/1900/2100 MHz
- HSPA+ EMEA 900/2100 MHz

EV-DO MODELS

fallback to CDMA 1xRTT

- Dual Band EV-DO Rev. A 800/1900 MHz

HOST INTERFACES

- 10/100 Base-T RJ45 Ethernet
- RS-232 Serial Port
- USB V2.0 Micro-B Connector
- 2 SMA Antenna Connectors (RF, GPS/Rx Diversity)
- Support for active antenna

PROTOCOLS

- Network: TCP/IP, UDP/IP, DNS
- Routing: NAT, Host Port Routing, DHCP, PPPoE, VLAN, VRRP
- Application: SMS, Telnet/SSH, SMTP, SNMP, SNTP
- Serial: TCP/UDP PAD Mode, Modbus (ASCII, RTU, Variable), PPP
- GPS: TAIP, NMEA, RAP

INPUT/OUTPUT

- Configurable I/O on power connector
- Input ON Voltage 3.3 to 30 VDC
- Input OFF Voltage 0 to 1.2 VDC
- Output max. switching capability 200mA @ 30VDC

DIMENSIONS

- 3.0 in x 3.5 in x 1.0 in (76 mm x 90 mm x 25 mm)
- 6.7 oz (190G)

POWER CONSUMPTION

All figures in mA @ 12VDC

- HSPA+: Min 219, Peak 624, Idle 104
- CDMA: Min 164, Peak 280, Idle 132
- Low Power Standby Mode: <35

GPS TECHNOLOGY

HSPA+ Models

- Acquisition Time: <3 Sec Hot Start, <45 Sec Cold Start
- Accuracy: <10m
- Tracking Sensitivity: -155 dBm

EV-DO Models

- 12 Channel, Continuous tracking
- Acquisition Time: 9 sec Hot Start, 39 Sec Cold Start
- Accuracy: <3m (50%), <8m (90%)
- Tracking Sensitivity: -160 dBm

EVENTS REPORTING

- Event Types: Digital Input, GPS/AVL, Network Parameters, Data Usage, Timer, Power, Device Temperature
- Report/Action Types: SMS, Email, SNMP Trap, Relay Output, GPS Rap Report, Events Protocol Message to Server

VPN/SECURITY

- IPsec, SSL, and GRE VPN Client
- Up to 5 VPN Tunnels
- IKE Encryption
- Port Forwarding and DMZ
- Port Filtering
- Trusted IP
- MAC Address Filtering

DEVICE MANAGEMENT

- AirVantage Management Service next-generation device management application
- ACEManager device configuration utility

ALEOS APPLICATION FRAMEWORK

- Lua language coding platform
- Remote application management
- Eclipse-based IDE
- Integrated real-time debugging

ENVIRONMENTAL

- Operating Temperature: -30°C to +70°C / -22°F to +158°F
- Storage Temperature: -40°C to +85°C / -40°F to +185°F
- Humidity: 90% RH @ 60 °C
- Military Spec MIL-STD-810 conformance to thermal, mechanical shock and humidity

INDUSTRY CERTIFICATIONS

- PTCRB
- FCC, Industry Canada
- CE, E-Mark
- RoHS Compliant
- Class I, Div 2

CARRIER APPROVALS

- AT&T
- Sprint
- Verizon Wireless

WARRANTY

- 3-year

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SIERRA WIRELESS™ | AirLink®

Wilson Electronics
Say Goodbye to Dropped Calls

General Mobile External Antennas

Stay Connected on the Road with Wilson Electronics Mobile Antennas

Designed for use with our mobile signal boosters, Wilson Electronics wide range of mobile antennas offers top performance and multiple mounting options. Our best-selling magnet-mount antennas install in seconds and are transferable between vehicles. For a more permanent installation, users can choose from glass- or NMO-mount options.



301103 • 301125 • 301128 • 301703 • 304202
Magnet-Mount Antenna



301113 • 301126 • 301131 • 301132
Mini Magnet-Mount Antenna

FEATURES

- Perfect for cars, vans and light trucks
- Mobile and indoor use

SPECIFICATIONS

	Magnet-Mount Antennas					Mini Magnet-Mount Antennas			
Part Number	HOT 301103	301125	301128	301703	304202	301113	301126	301131 WHITE	301132 WHITE
Frequency Range (MHz)	Refer to table on page 40								
Impedance	50 ohms								
Antenna Gain	Refer to table on page 40								
Signal Pattern	Omni								
Polarization	Vertical								
Ground Plane	Metal ground plane required								
Connector	FME Female	SMA Male	TNC Male	FME Female	FME Female	FME Female	SMA Male	FME Male	N Male
Material	Whip - Stainless Steel					Whip - Plastic Coated Steel Wire			
Coax Cable	RG174 - 10 feet / 3.05 meters								
Height	12.25 inches / 31.12 cm					4.175 inches / 10.60 cm			
Mount	Rare earth magnet					Rare earth magnet			

Wilson Electronics
Say Goodbye to Dropped Calls

Antenna Frequency Specific Gain Chart (dBi)

		FREQUENCY IN MHz					
		700-800	824-894	880-960	1710-1880	1850-1990	2110-2170
MAGNET MOUNT ANTENNAS	301103	1.9	5.1	3.1	-4.0	6.1	2.3
	301125	1.9	5.1	3.1	-4.0	6.1	2.3
	301128	1.9	5.1	3.1	-4.0	6.1	2.3
	304202	1.9	5.1	3.1	-4.0	6.1	2.3
	301703	-1.9	4.8	4.6	0.3	4.1	0.6
MINI MAGNET MOUNT ANTENNAS	301113	1.7	2.1	0.5	2.2	3.1	1.4
	301126	1.7	2.1	0.5	2.2	3.1	1.4
	301131	1.7	2.1	0.5	2.2	3.1	1.4
	301132	1.7	2.1	0.5	2.2	3.1	1.4
DUAL BAND TRUCKER ANTENNAS	301101		5.1			6.1	
	301701			5.1	6.1		
RV TRUCKER W/SPRING ANTENNAS	301119	3.1	4.1	2.0	-1.8	5.1	-2.6
	301133	3.1	4.1	2.0	-1.8	5.1	-2.6
GLASS MOUNT ANTENNAS	301102	1.8	3.5	2.8	-1.5	4.8	1.0
	304201	1.8	3.5	2.8	-1.5	4.8	1.0
MINI GLASS MOUNT ANTENNAS	301114		1.4			2.4	
NMO ANTENNAS	301104	2.0	4.9	0.0	-3.1	5.9	1.3
	301112	2.4	5.5	-0.9	-1.2	5.5	1.7
	304203	3.7	4.4	4.3	-4.1	3.7	0.3
	301105	4.1	1.4	2.4	-3.5	-7.0	-10.2
DUAL BAND LOW PROFILE ANTENNAS	301106	3.4	2.2	1.2	1.4	3.2	4.3
	301127	3.4	2.2	1.2	1.4	3.2	4.3
	301208	-0.8	1.5	1.2	2.4	3.4	1.2
	301209	-0.8	1.5	1.2	2.4	3.4	1.2
YAGI ANTENNAS	301111	10.0	10.8	8.8	-16.4	-14.9	-13.8
	301124	-18.7	-23.4	-21.6	9.1	12.5	-10.6
	301129	-0.9	10.1	-7.9	-10.3	-11.9	-8.7
	301142	-3.6	3.7	10.1	-12.1	-10.2	-13.4
	304411	7.3	8.1	7.4	9.2	10.6	10.4
	304475	7.3	8.1	7.4	9.2	10.6	10.4
DOME ANTENNAS	301121	-2.5	2.5	-0.5	3.5	4.1	1.5
	301123	3.3	5.4	-2.3	-4.3	0.5	-8.0
MARINE ANTENNAS	301130	3.4	4.1	3.5	3.1	5.1	0.2
PANEL ANTENNAS	301135	5.2	4.4	4.2	10.1	10.6	8.2
	301155	5.2	4.4	4.2	10.1	10.6	8.2
	304451	5.2	4.4	4.2	10.1	10.6	8.2
	304471	5.2	4.4	4.2	10.1	10.6	8.2
	304452	5.2	4.4	4.2	10.1	10.6	8.2
	304472	5.2	4.4	4.2	10.1	10.6	8.2
	304453	5.2	4.4	4.2	10.1	10.6	8.2
	304473	5.2	4.4	4.2	10.1	10.6	8.2
ULTRA SLIM ANTENNAS	301143	-5.7	-6.8	-9.5	3.1	3.9	5.0
	301149	-5.7	-6.8	-9.5	3.1	3.9	5.0
CRADLE PLUS - PHONE CRADLE	301146	-5.0	0.7	-0.8	2.3	2.6	1.5
	301148	-5.0	0.7	-0.8	2.3	2.6	1.5
EXTERIOR BUILDING ANTENNAS	301141	0.7	4.0	3.6	-1.7	5.5	4.7
	301201	3.2	4.1	2.7	0.6	5.1	-7.5
	301202	3.2	4.1	2.7	0.6	5.1	-7.5

Cellular Data Cards

Adapter plugs into the adapter port on the end of the cellular data card or plugs in as an antenna replacement for data cards with this feature. Check the model for a specific adapter type.

For information about Wilson's cellular adapters for modems and data cards visit www.WilsonElectronics.com







Dual-Band Magnet Mount Installation Instructions

1. Antenna Adapter Required *(Sold Separately)*

In order to attach your antenna to your cell phone you will need an adapter. The adapter connects the phone to the antenna cable and transfers power to and from the antenna. If you need help locating an adapter for your phone, call Wilson toll-free at 1-866-294-6996.

2. Installing the Magnet Mount Antenna

Attach the Magnet Mount Antenna to any metal area on top of the roof of the vehicle. The best location is clear of obstacles and as high on the vehicle as possible. Although small, the rare earth magnet is quite strong and won't fall off at high speeds. Make sure the area under the magnet is clean so as not to damage the vehicle's paint and to ensure a strong connection. Bring the cable into the vehicle through a door frame - the cable is protected by the doors rubber molding. **Do not run the cable through a window** because when the window is rolled up and the door is opened the antenna's cable will be pulled - this is likely to destroy your antenna and/or scratch your paint. Connect the magnet mount antenna's cable to the adapter cable.



1

2

Item List

- Various examples of Adapters are shown - yours may vary.
(Adapter Sold Separately)

Items for Magnet Mount
1 - Magnet Mount Antenna
2 - Antenna Adapter ***(Sold Separately)***

Technical Support

Additional help may be obtained at tech@wilsonelectronics.com or by calling Toll-Free 866-294-1660 Monday through Friday between 7:00 AM and 6:00 PM Mountain Time. Wilson Electronics is closed Saturday, Sunday, and Holidays.

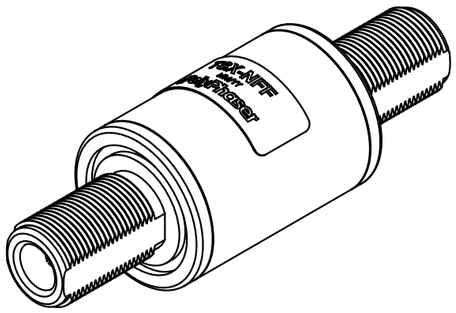
90 Day Warranty

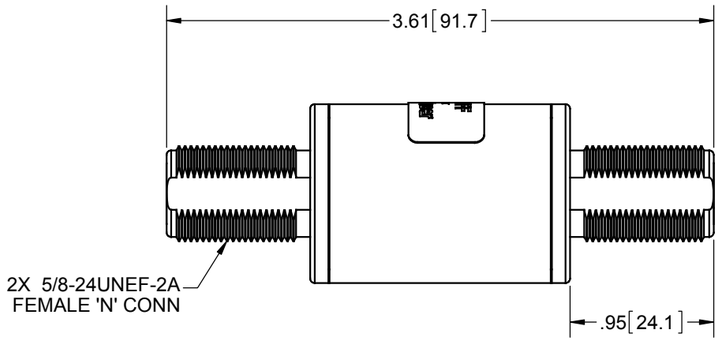
The Wilson Electronics Dual-Band Magnet Mount is warranted for 90 days against defects in workmanship and/or materials and will be repaired or replaced, at the discretion of the manufacturer, to the original purchaser with dated sales receipt. The antenna and a copy of the receipt must be sent to the factory at purchaser's expense where it will be repaired or replaced and returned shipping paid. Warranty does not cover damages caused by abuse, misuse, negligence, improper installation, etc. These are considered to be avoidable circumstances and are not covered by warranty. All Wilson warranties are limited to the specific Wilson product only and do not include phone, vehicle or other external product.

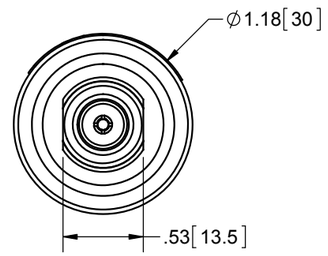
Wilson
Electronics, Inc.
1-866-294-6996
wilsonelectronics.com
info@wilsonelectroincs.com

Part # 103019 DBMM 003 / 09.06.07

REVISIONS				
REV.	DESCRIPTION	ECN	DATE	APPROVED
A	PRE-PRODUCTION RELEASE		5/15/12	CP

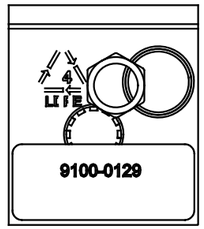






MAXIMUM CHARACTERISTICS

APPLICATION:
DC SHORT/RF ONLY (NO POWER SUPPLY PROVISIONS)
BULKHEAD MOUNT BI-DIRECTIONAL
WEATHERPROOF WHEN INSTALLED
FREQUENCY RANGE:
698MHz TO 2.7GHz @ -26dB RETURN LOSS
MAX SURGE:
IEC 61000-4-5 8/20µs WAVEFORM
40kA MAX
20kA MULTIPLE
INSERTION LOSS:
≤0.1dB
CONTINUOUS POWER:
500W @ 920MHz
(750W @ 50°C)
LET THROUGH VOLTAGE:
≤±200mV FOR 3kA @ 8/20µs WAVEFORM
THROUGHPUT ENERGY:
≤5nJ FOR 3kA @ 8/20µs WAVEFORM
TEMPERATURE:
-50°C TO +85°C STORAGE/OPERATING
VIBRATION:
1G @ 5Hz TO 100Hz
MATERIAL:
BODY: TRI-PLATED BRASS
PTFE: DIELECTRIC
CENTER PINS: GOLD PLATED
ENVIRONMENTAL:
MEETS IEC 60529 IP67
MEETS BELLCORE #TA-NWT-000487
PROCEDURE 4.11, 120MPH WIND DRIVEN
RAIN INTRUSION TEST
RoHS COMPLIANT



QTY	DESCRIPTION
1	5/8 MOUNTING NUT
1	INT TOOTH LOCKWASER
1	O-RING

CUSTOMER APPROVAL: _____ DATE: _____

ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.

UNLESS OTHERWISE SPECIFIED
LEADING DIMENSIONS ARE INCHES
DIMENSIONS IN [ ] ARE MILLIMETERS

TOLERANCES:
FRACTIONS=± 1/32 .XX=± .01
ANGLES=± 1 ° .XXX=± .005

MATERIAL
.

THIRD-ANGLE PROJECTION

DRAWN	RD	DATE 02/09/2012
ENG APPD	JJ	5/15/12
PRODUCT MGR	CP	5/15/12
MARKETING APPD	LJ	5/15/12
PROJECT NO.	.	

PolyPhaser®

TITLE
BI-DIRECTIONAL BROADBAND DC SHORT FILTER 'N'
CUSTOMER SPECIFICATION

SIZE	CAGE	DOCUMENT NAME	REV
B	61114	TSX-NFF-C	A

SCALE	PROD CAT	PART NUMBER	SHEET
1:1	RFP	TSX-NFF	1 OF 1

protection technology group
POLYPHASER | TRANSTECTOR | DOWIN | LEA | RO ASSOCIATES

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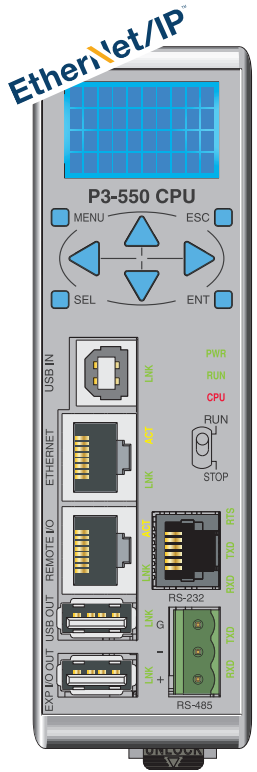
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CPU Specifications

User Memory	50M (Includes program, data and documentation)		
Memory Type	Flash and Battery Backed RAM		
Retentive Memory*	Models C3 and earlier: 100K Models D and later: 492K		
Scan Time	650µs (3K Boolean, 1K I/O)		
Display	LCD, 4x10 characters, backlit, 8 control buttons; LCD characters are 5x7 with a dot pitch of 0.45mm; 2.25mm x 3.15mm		
Communications 7 Integrated Ports	**USB IN:** Programming, Monitoring, Debug, Firmware **ETHERNET**:** (10/100Mbps Ethernet) Programming, Monitoring, Debug, Firmware, Email SMTP Client, Modbus TCP Client (32 Slaves) and Server (32 Masters), EtherNet/IP Scanner (128 connections) and Adapter (16 connections) **REMOTE I/O:** (10/100Mbps Ethernet) 16 P3-RS or RX Remote Base Groups, and 32 GS-EDRV100 (GS Drives) **USB OUT:** (2.0) Data Logging or Project Transfer using SDCZ4-2048-A10 Pen Drive **EXP I/O OUT:** (2.0 Proprietary) 4 P3-EX Local Expansion Bases **RS-232:** Modbus RTU and ASCII (half and full duplex) **RS-485:** Removable Terminal Included, (1200-115.2k Baud) ASCII, Modbus		
Hardware Limits of System	**17 Base Groups:** 1 Local (P3-550) + 16 Remote (P3-RS / P3-RX) **5 Bases per Base Group:** 1 P3-550, P3-RS or P3-RX + 4 Expansion (P3-EX) **85 Bases Total:** 1 (CPU) + 16 (Remote) + 68 (Expansion) **59,840 Hardware I/O Points** (All 64-point I/O Modules) **32 GS Series Drives** as Remote I/O		
Instruction Types	Application Functions Array Functions Counters/Timers Communications Data Handling	Drum Sequencers Math Functions PID Program Control	String Functions System Functions Contacts Coils HSI/HSO
Real Time Clock Accuracy	+/- 5s per day typical at 25°C +/- 15s per day maximum at 60°C		

*To utilize the 492K of retentive memory in the P3-550 rev. D or later CPU, you must use Productivity3000 software version 1.0.7.XX and firmware version 1.1.13.XX or later.

**For EtherNet/IP support in the P3-550 CPU, you must use ProductivitySuite software version 1.10.0.11 and firmware version 1.1.15.97 or later.



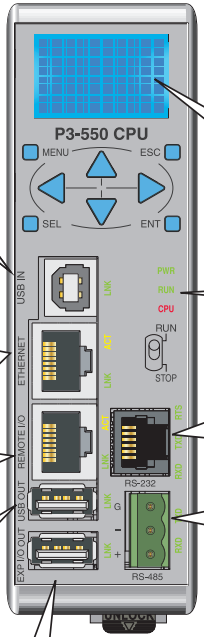
P3-550 CPU

The P3-550 is a full-featured, high-performance CPU for use with the Productivity3000 Programmable Automation Controller.

CPU Specifications 1
CPU Front Panel 2
CPU Installation Procedure 2
Battery Installation Procedure 3
USB Out Port Specifications 3
Exp I/O Out Port Specifications 3
RS-232 Port specifications 4
RS-485 Port specifications 4
Ethernet Port Specifications 5
Remote I/O Port Specifications 5
USB In Port Specifications 5
Front Panel LCD Display Monitoring and Configuration 6
Front Panel LCD Message Display 7
Safety Information 8
CPU Status Indicators 8
CPU Run/Stop Switch Specifications 8
General Specifications 8
Hot Swap Information 8

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

CPU Front Panel



LCD
- 4 x 10 character
- 8 control buttons
- User defined messages
- User adjustable settings
- PAC system errors / information

USB 2.0 (Type B) Port
- Programming
- Online monitoring

CPU Status Indicators

10/100 MB Ethernet Port
- Programming
- Online monitoring
- Email (SMTP client)
- Modbus TCP Client and Server
- EtherNet/IP Scanner and Adapter

RS-232 Serial Port (RJ12)
- Modbus/ASCII (master or slave, half or full duplex) peripheral device

Local Ethernet Network
- GS Series drives
- Remote IO

RS-485 Serial Port (TB Style)
- Modbus/ASCII (master peripheral device or multiple slave devices) using the same protocol

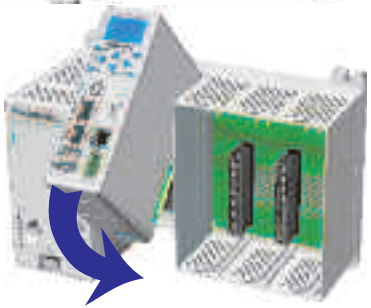
USB 2.0 (Type A) Port
- USB Flash Drive data logger
- Project Transfer

USB 2.0 (Type A) Port
Local expansion bases (connect up to 4 expansion bases per base group)

CPU Installation Procedure



Step One:
Locate the two sockets next to the power supply; the CPU will be inserted into this location.



Step Two:
Insert the CPU at a 45° angle into the notch located at the top of the base and rotate down until seated.



Step Three:
Snap retaining tab into the locked position.

WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot swap.

AVERTISSEMENT: Risque d'explosion: ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud.

Battery Installation Procedure

Step One:
Press spring lock and swing battery compartment away from CPU.

Step Two:
Insert battery and close compartment.



Battery (Optional)

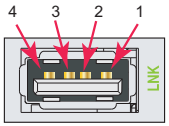
D2-BAT-1	Coin type, 3.0V Lithium battery, 560mA, battery number CR2354

Note: Although not needed for program backup, an uninstalled battery is included with the P3-550. Install this battery if you want the CPU to retain the Time and Date along with any Tagname values that you have set up as retentive.

Port Specifications

USB Type A Master Output Specifications

Port Name	USB OUT	EXP I/O OUT
Description	Standard USB 2.0 Master output for connection to high-speed Flash drive (Sandisk SDCZ4-2048-A10) for data logging or program transfer with built-in surge protection. Not compatible with older full speed USB devices. A 0.5m male-to-female "port extender" cable is included to assist with Flash drive connection.	Proprietary USB 2.0 Master output for connection with up to four P3-EX local expansion bases, with built-in surge protection.
Transfer Rate	480 Mbps	
Port Status LED	Green LED is illuminated when LINK is established to connected device	
Cables	None required	USB Type A to USB Type B: 6 ft. cable part # P3-EX-CBL6 (included with P3-EX module)



Mating face of USB type A female

USB OUT

Pin #	Signal
1	+5
2	– Data
3	+ Data
4	GND

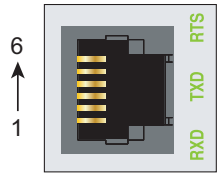
EXP I/O OUT

Pin #	Signal
1	Reset
2	– Data
3	+ Data
4	GND

Port Specifications

RS-232 Specifications

Port Name	RS-232
Description	Non-isolated RS-232 DTE port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Data Rates	Selectable,1200, 2400, 4800, 9600, 19200, 33600, 38400, 57600, and 115200.
+5V Cable Power Source	210mA maximum at 5V, +/- 5%. Reverse polarity and overload protected.
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for flow control.
GND	Logic ground
Maximum Output Load (TXD/RTS)	3K Ω, 1,000pf
Minimum Output Voltage Swing	+/-5V
Output Short Circuit Protection	+/-15mA
Port Status LED	Green LED is illuminated when active for TXD, RXD and RTS



6-pin RJ12 Female Modular Connector

Pin #	Signal	
1	GND	Logic Ground
2	+5V	210 mA Maximum
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground

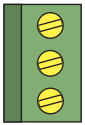
RS-485 Port Specifications

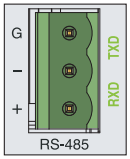
Port Name	RS-485
Description	Non-isolated RS-485 port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active.
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600, 38400, 57600, and 115200.
TXD+/RXD+	RS-485 transceiver high
TXD-/RXD-	RS-485 transceiver low
GND	Logic ground
Input Impedance	19K Ω
Maximum load	50 transceivers, 19K Ω each, 60 Ω termination
Output Short Circuit Protection	+/- 250mA, thermal shut-down protection
Electrostatic Discharge Protection	+/-8KV per IEC1000-4-2
Electrical Fast Transient Protection	+/-2KV per IEC1000-4-4.
Minimum Differential Output Voltage	1.5V with 60 Ω load
Fail safe inputs	Logic high input state if inputs are unconnected
Maximum Common Mode Voltage	-7.5V to 12.5V.
Port Status LED	Green LED illuminated when active for TXD and RXD
Cable Options	L19827-100, L19827-500, L19827-1000 or Belden 9841 equivalent.

Termination Connector Specifications

Number of Positions	Pitch	Screw Driver Width	Screw Size	Screw Torque
3	5 MM	1/8 Inch (3.175mm) maximum	M2.5	4.5 Lb-in
Wire Range		28-12 AWG Solid Conductor – 30-12AWG Stranded Conductor		

Removable Terminal Connector included. Spare connectors available (part no. P3-RS485CON).





Pin #	Signal
G	GND
–	TXD-/RXD-
+	TXD+/RXD+

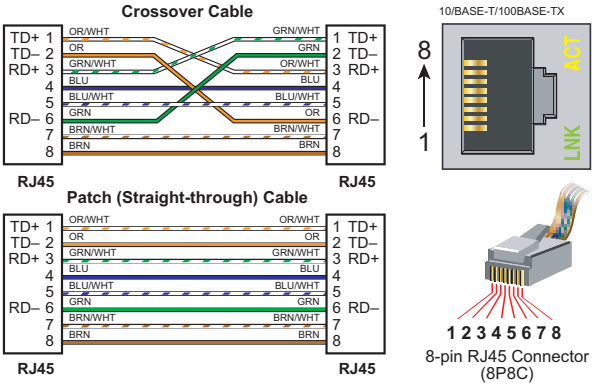
Port Specifications

Ethernet Specifications

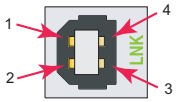
Port Name	ETHERNET	REMOTE I/O
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, Email (SMTP client), Modbus/TCP client/server connections (fixed IP or DHCP) and EtherNet/IP Scanner/Adapter.	Standard transformer isolated Ethernet port with built-in surge protection for connection to the P3-RS/RX Remote I/O system. Supports 16 Remote I/O slaves and 32 GS Series drives.
Transfer Rate	10/100 Mbps	
Port Status LED	Green LED illuminated when network LINK is established. Yellow LED is illuminated when port is active (ACT).	
Cables	Use a Patch (straight through) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used.	

USB Type B Slave Input Specifications

Port Name	USB IN
Description	Standard USB 2.0 Slave input for programming and online monitoring, with built-in surge protection. Not compatible with older full speed USB devices.
Transfer Rate	480 Mbps
Port Status LED	Green LED is illuminated when LINK is established to programming software.
Cables	USB Type A to USB Type B: 3 ft. cable part # USB-CBL-AB3 6 ft. cable part # USB-CBL-AB6 10 ft. cable part # USB-CBL-AB10 15 ft. cable part # USB-CBL-AB15



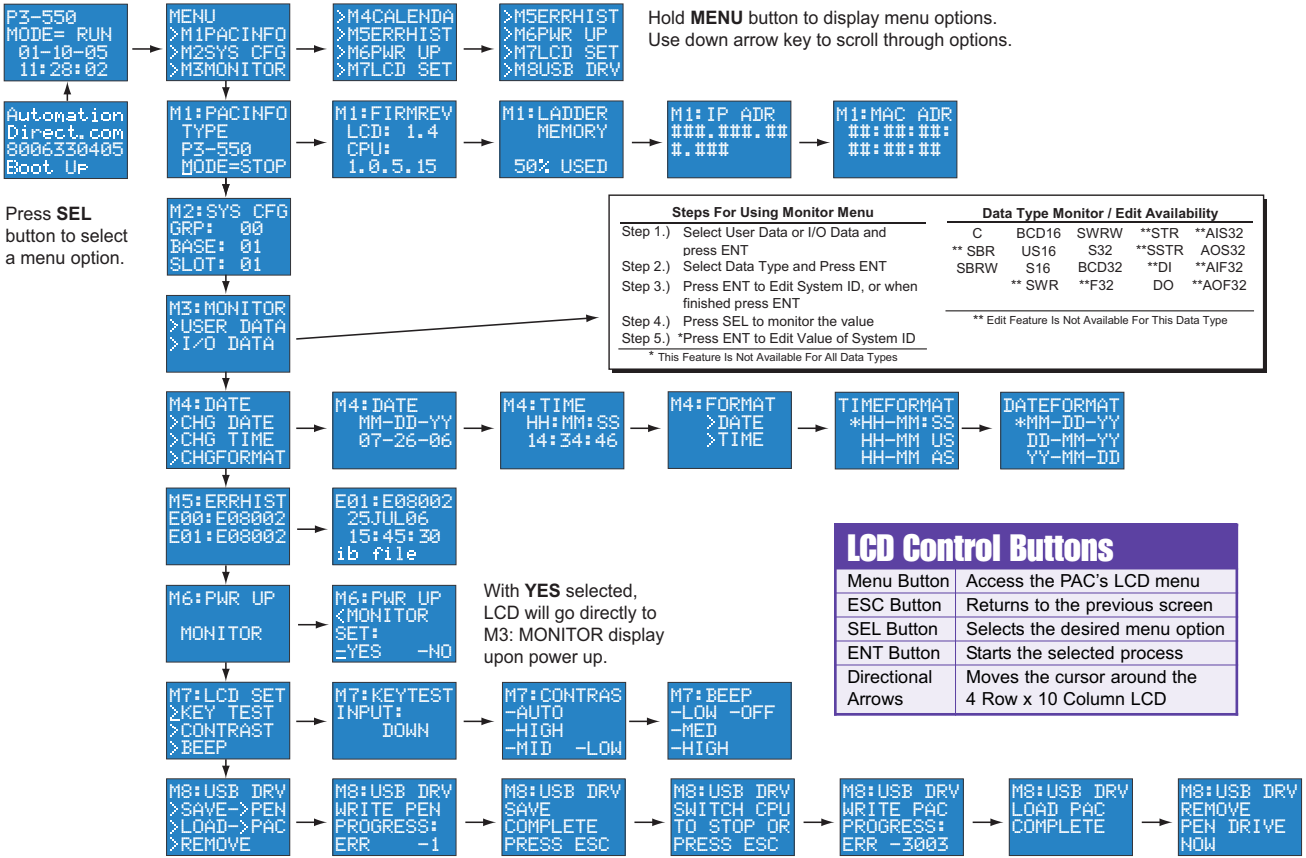
8-pin RJ45 Connector (8P8C)



Mating face of USB type B female

Pin #	Signal
1	+5
2	–Data
3	+Data
4	GND

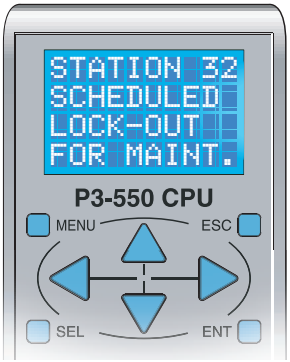
Front Panel LCD Display Monitoring and Configuration



LCD Control Buttons

Menu Button	Access the PAC's LCD menu
ESC Button	Returns to the previous screen
SEL Button	Selects the desired menu option
ENT Button	Starts the selected process
Directional Arrows	Moves the cursor around the 4 Row x 10 Column LCD

Front Panel LCD Message Display





The CPU incorporates a 4 line x 10 character LCD for PAC system alarms and information and for displaying user defined messages.

LCD characters are 5x7 with a dot pitch of 0.45mm; 2.25mm x 3.15mm.

LCD control buttons located beneath the display allow the user to navigate through a menu and arrow buttons allow for configuration of time and date settings.

For user-defined messages, the display is configured using the Productivity3000 Programming Software. An LCD Page instruction allows the user to program text into user-defined tags and display the messages based on the ladder execution.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

This publication is based on information that was available at the time it was printed. At AutomationDirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

CPU Status Indicators

PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, power down, or watch-dog time-out.



CPU Run/Stop Switch Specifications

RUN position	Executes user program, run-time edits possible
STOP position	Does not execute user program, normal program load position

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Heat Dissipation	7W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Location	Controller slot in the local base in a Productivity3000 System
EU Directive	See the "EU Directive" topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Weight	260g (9 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d'explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Document Name	Edition/Revision	Date
P3-CPU-M	1st Ed. Revision K	3/3/2015

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Input Specifications

Inputs per Module		16 (sinking / sourcing)
Operating Voltage Range (Tolerance)	CE	12-24 VDC (± 10%)
	UL	12-24 VDC (± 10%)
Peak Voltage		26.4 VDC
Input Current (Typical)		5 mA @ 12 VDC 11 mA @ 24 VDC
Maximum Input Current @ Temp		12.5 mA @ 60° C (26.4 VDC)
Input Impedance		2.7k Ω @ 12-24 VDC
ON Voltage Level		> 10 VDC
OFF Voltage Level		< 3 VDC
Minimum ON Current		4 mA
Maximum OFF Current		2 mA
OFF to ON Response		Max. 2 ms Typical 1ms
ON to OFF Response		Max. 2 ms Typical 1ms
Status Indicators		Logic Side (16 points)
Terminal Type (not included)		20 position removable terminal block
Commons		4 Isolated (4 points / common)

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d'explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

Document Name	Edition/Revision	Date
P3-16ND3-M	1st Ed. Rev. A	12/30/2013

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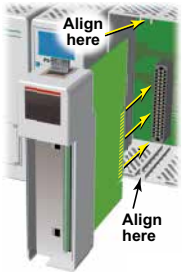
P3-16ND3 Sinking/ Sourcing Input

The P3-16ND3 DC Input Module provides 16 12-24 VDC sinking or sourcing inputs with 4 isolated commons for use with the Productivity3000 Programmable Automation Controller.

Input Specifications 1
Module Installation Procedure.....2
Terminal Block Removal 2
Hot Swap Information.....2
Wiring Options.....3
Schematic and Wiring Diagram.....3
Safety Information 4
Removable Terminal Block Specifications 4
General Specifications 4

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 3).

Module Installation Procedure

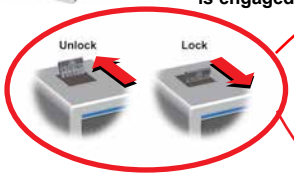


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.

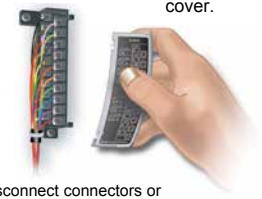




Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



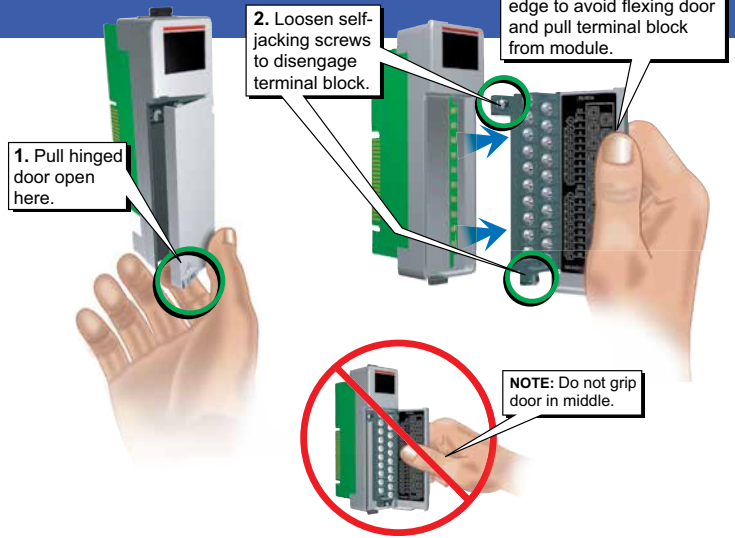
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 **ZIPLink Connection System**
Cable + ZIPLink Module = Complete System



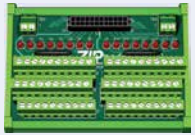
ZIPLink pre-wired terminal block cables

0.5m (1.6FT) cable	ZL-P3-CBL20-L
1.0m (3.3FT) cable	ZL-P3-CBL20-1L
2.0m (6.6FT) cable	ZL-P3-CBL20-2L



ZIPLink Modules

Feed through	ZL-RTB20



LED Sensor Input	ZL-LTB16-24

2 **Terminal Block with pigtail cable**



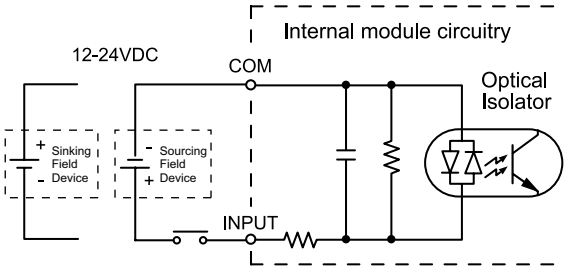
0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

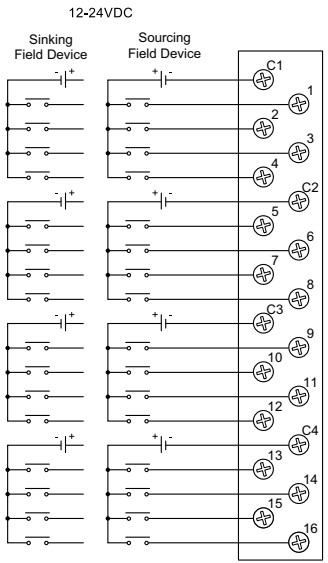
3 **Terminal Block only**



P3-RTB
(Quantity 1)

Schematic and Wiring Diagrams





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Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum “USE COPPER CONDUCTORS, 60°C” or equivalent*.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	5.61W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable Terminal Block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 3.
EU Directive	See the “EU Directive” topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Weight	80g (2.82 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

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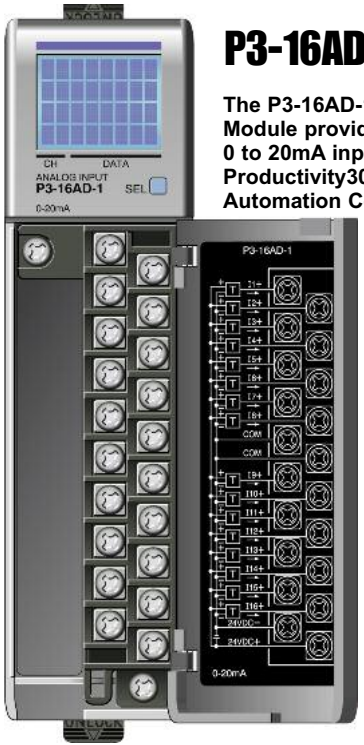
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Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum "USE COPPER CONDUCTORS, 60°C" or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

P3-16AD-1 Analog Input

The P3-16AD-1 Current Analog Input Module provides 16 channels for receiving 0 to 20mA input signals for use with the Productivity3000 Programmable Automation Controller.



Safety Information 1
Removable Terminal Block Specifications 1
General Specifications 2
Input Specifications 2
Schematic and Wiring Diagram . . . 3
Module Installation Procedure 4
Terminal Block Removal 4
Hot Swap Information 4
Wiring Options 5
Module Configuration 5
Linear Scaling 6
Non-Linear Scaling 6
LCD Panel Display Menus 7

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 5).

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1 second
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	2.1 W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable terminal block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 5.
EU Directive	See the "EU Directive" topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

Input Specifications

Input Channels	16 sinking
Module Signal Input Range	0 - 20mA
Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	0-20mA = 305µA per count (1 LSB = 1 count)
Data Range	0-65535 counts
Input Type	Single-ended (1 common)
Maximum Continuous Overload	±31mA
Input Impedance	250 Ω ±0.1% ¼W
Filter Characteristics	Low Pass, -3dB @ 100Hz
Sample Duration Time	7 ms per channel (does not include ladder scan time)
All Channel Update Rate	112 ms
Open Circuit Detection Time	Zero reading within 1s
Conversion Method	Successive approximation
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Inaccuracy	0.1% of range (including temperature drift)
Linearity Error (end to end)	±10 LSB maximum (±0.015% of range) Monotonic with no missing codes
Input Stability and Repeatability	±10 LSB
Full Scale Calibration Error (not including offset)	±10 LSB maximum (±0.015% of range)
Offset Calibration Error	±10 LSB maximum
Max Crosstalk	-76 dB, ±10 LSB
Recommended Fuse (external)	Edison S500-32-R, .032A fuse
External DC Power Required	24VDC (-20% / + 25%) 20mA

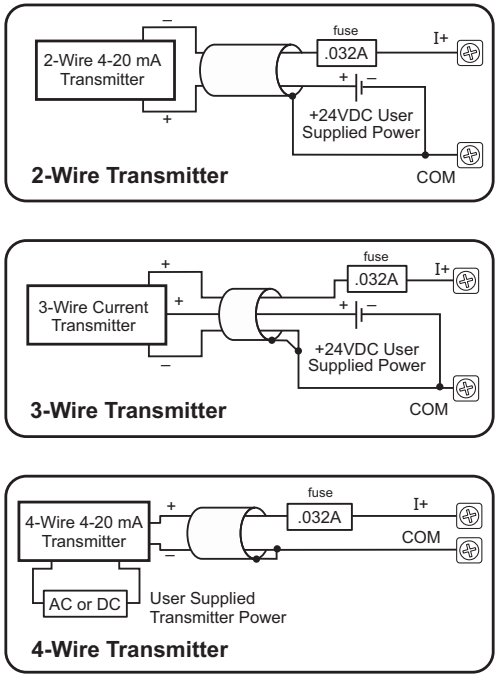
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d’explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Wiring Diagram

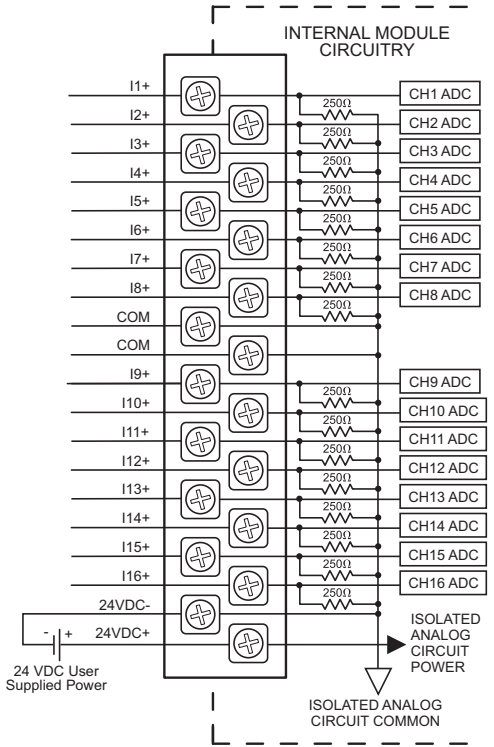
Current Input Circuits

An Edison S500-32-R 0.032A fast-acting fuse is recommended for current loops.

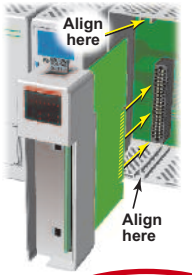


Note: Do not connect both ends of shield.

Schematic



Module Installation Procedure

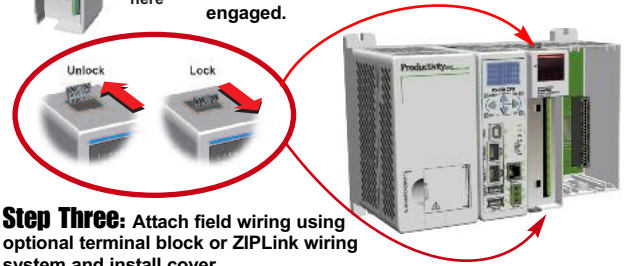


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

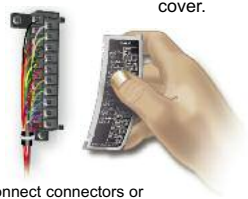
Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



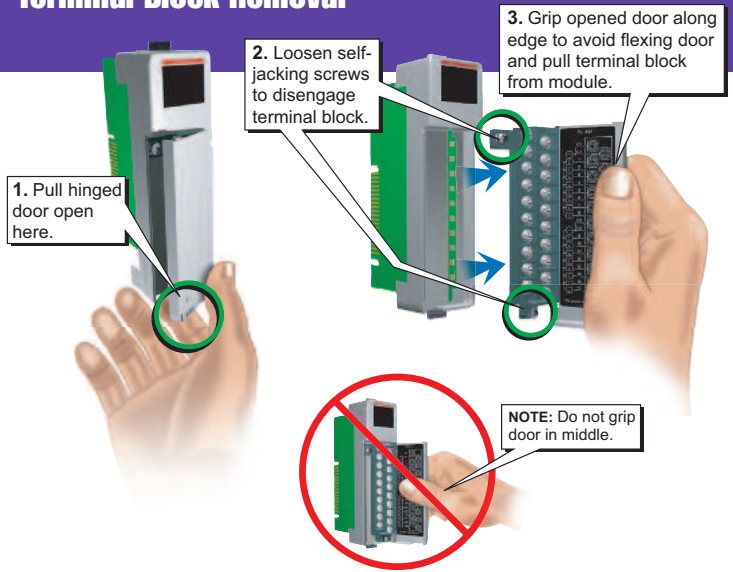
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 ZIPLink Connection System
Cable + ZIPLink Module = Complete System

ZIPLink pre-wired terminal block cables



0.5m (1.6FT) cable	ZL-P3-CBL20-L
1.0m (3.3FT) cable	ZL-P3-CBL20-1L
2.0m (6.6FT) cable	ZL-P3-CBL20-2L

ZIPLink Modules



Feed through	ZL-RTB20

2 Terminal Block with pigtail cable



0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

3 Terminal Block only

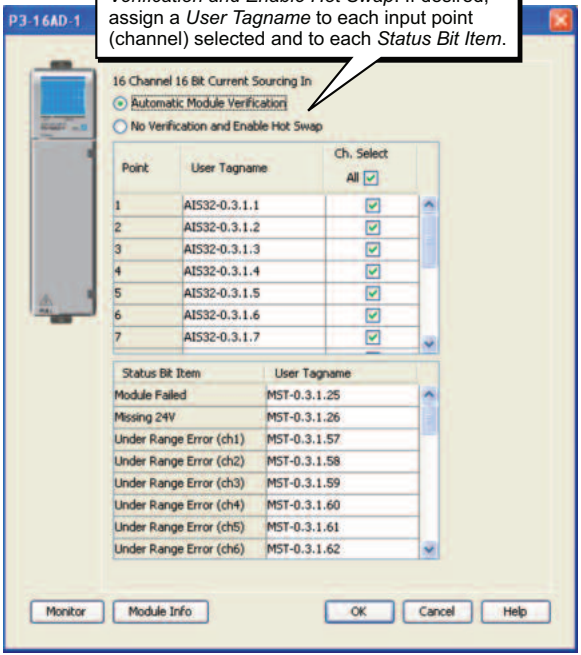


P3-RTB
(Quantity 1)

Module Configuration

Using the Hardware Configuration tool in the Productivity Suite programming software, drag and drop the P3-16AD-1 module into the base configuration.

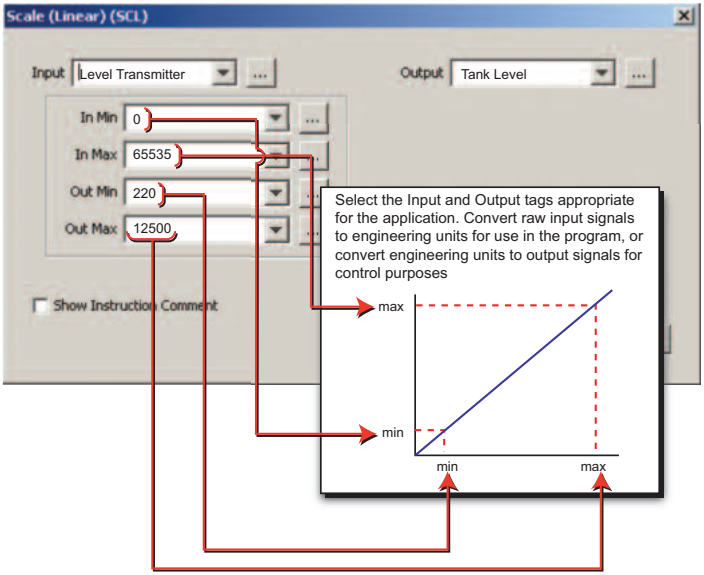
Select *Automatic Module Verification* or *No Verification and Enable Hot Swap*. If desired, assign a *User Tagname* to each input point (channel) selected and to each *Status Bit Item*.



Linear Scaling

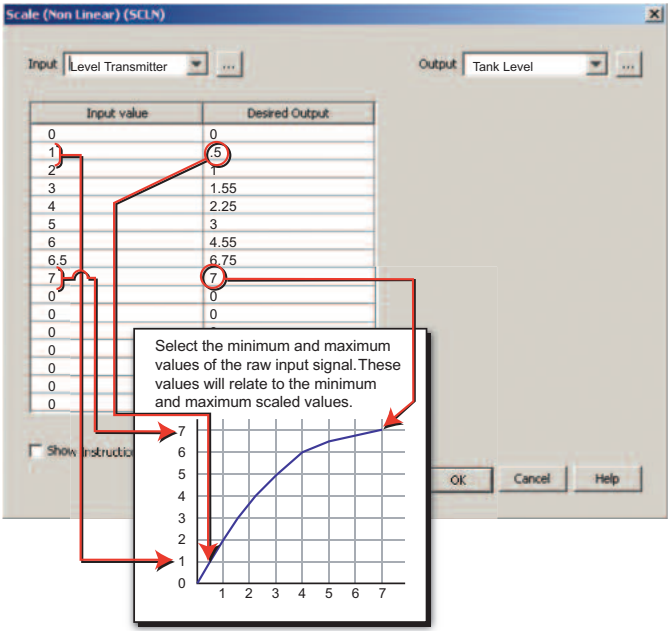
The Scale (Linear) function can be used to:

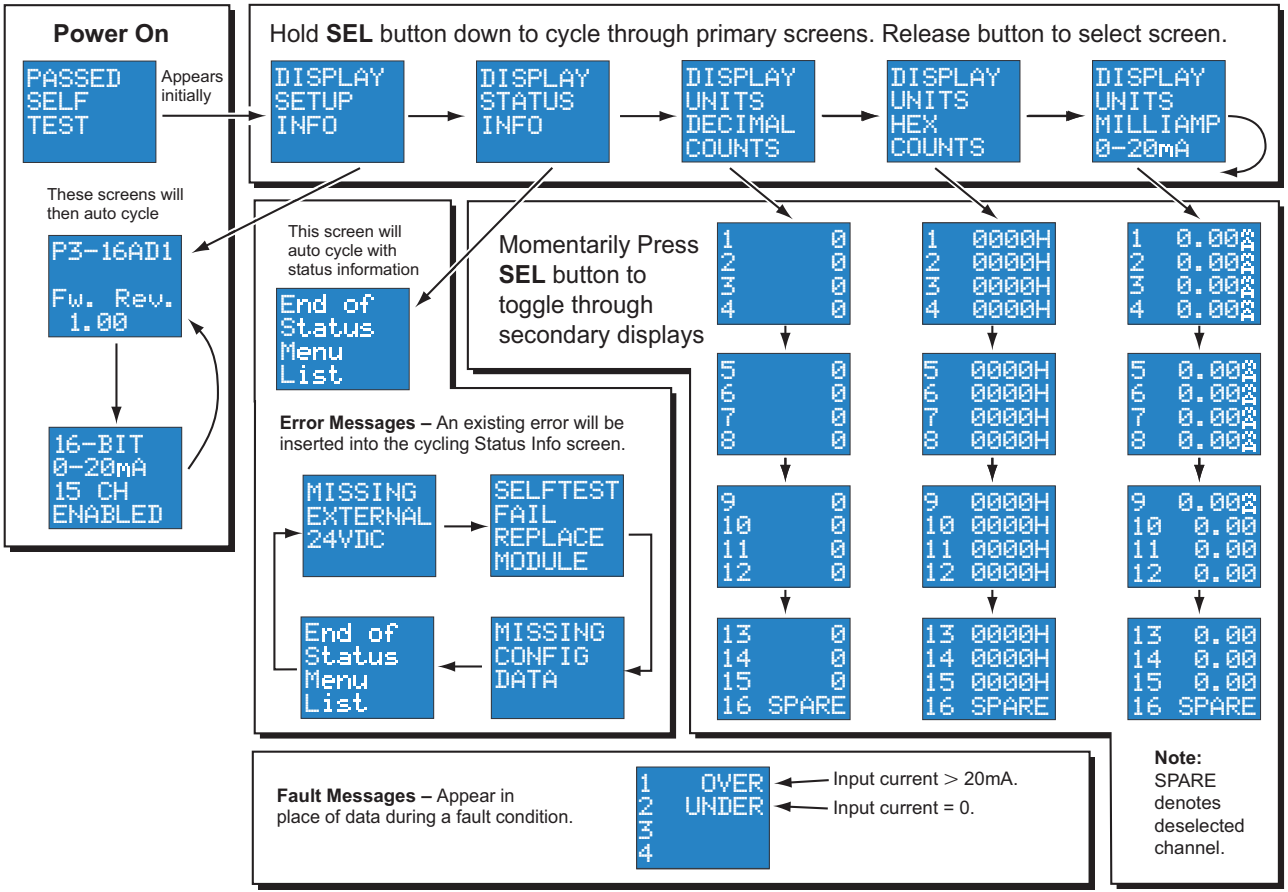
- **Convert analog field input signals from the range which is native to the analog input module to an application specific range.**
- **Make other linear conversions in ranges appropriate to the application.**



Non-Linear Scaling

The Scale (Non-Linear) function can be used for Non-Linear applications.




Power On
PASSED SELF TEST
Appears initially
These screens will then auto cycle
P3-16AD1
Fw. Rev. 1.00
16-BIT 0-20mA 15 CH ENABLED
Hold SEL button down to cycle through primary screens. Release button to select screen.
DISPLAY SETUP INFO
DISPLAY STATUS INFO
DISPLAY UNITS DECIMAL COUNTS
DISPLAY UNITS HEX COUNTS
DISPLAY UNITS MILLIAMP 0-20mA
This screen will auto cycle with status information
End of Status Menu List
Momentarily Press SEL button to toggle through secondary displays
Error Messages – An existing error will be inserted into the cycling Status Info screen.
MISSING EXTERNAL 24VDC
SELFTEST FAIL REPLACE MODULE
MISSING CONFIG DATA
End of Status Menu List
1 0
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 SPARE
1 0000H
2 0000H
3 0000H
4 0000H
5 0000H
6 0000H
7 0000H
8 0000H
9 0000H
10 0000H
11 0000H
12 0000H
13 0000H
14 0000H
15 0000H
16 SPARE
1 0.00%
2 0.00%
3 0.00%
4 0.00%
5 0.00%
6 0.00%
7 0.00%
8 0.00%
9 0.00%
10 0.00
11 0.00
12 0.00
13 0.00
14 0.00
15 0.00
16 SPARE
Fault Messages – Appear in place of data during a fault condition.
1 OVER
2 UNDER
3
4
Input current > 20mA.
Input current = 0.
Note: SPARE denotes deselected channel.

Document Name	Edition/Revision	Date
P3-16AD-1-M	1st Ed. Rev. A	12/20/2013

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Output Specifications

Outputs per Module		16
Operating Voltage Range (Tolerance)	(CE)	6.25 - 24 VDC (-15% / + 20%) 6 - 240 VAC (-15% / + 10%)
	(UL)	6 - 27 VDC (-15% / + 10%) 6 - 240 VAC (-10% / + 10%)
Output type		Relay, form A (SPST)
AC Frequency		47 - 63 Hz
Maximum Output Current @ Temp		1.25A / point, 6.3A / common @ 60°C for both AC and DC
Minimum Load Current		5 mA @ 5 VDC
Maximum Inrush Current		4A for 10 ms
OFF to ON Response		≤ 10 ms
ON to OFF Response		≤ 10 ms
Status Indicators		Logic Side (16 points)
Error Status Indicator		Blown Fuse (one for each common)
Terminal Type (not included)		20 position removable terminal block
Commons per module		2 Isolated (8 point / common)
Fuses		6.3A user replaceable fuse per common For replacement, order P3-FUSE-2. (Qty. 5/pkg.)

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d'explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

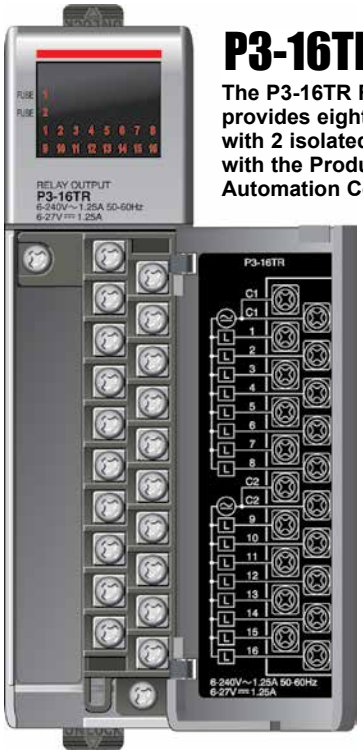
Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

Document Name	Edition/Revision	Date
P3-16TR-M	1st Ed. Rev. B	12/30/2013

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P3-16TR Relay Output

The P3-16TR Relay Output Module provides eight 1.25 amp relay outputs with 2 isolated fused commons for use with the Productivity3000 Programmable Automation Controller.



Output Specifications 1
Module Installation Procedure.....2
Terminal Block Removal 2
Hot Swap Information.....2
Wiring Options.....3
Schematic and Wiring Diagram.....3
Replacement Fuses 3
Safety Information 4
Typical Relay Life.....4
Removable Terminal Block Specifications 4
General Specifications 4

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 3).

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

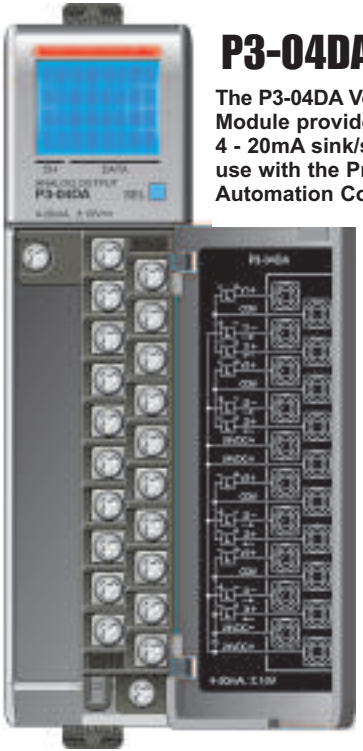
This publication is based on information that was available at the time it was printed. At AutomationDirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum "USE COPPER CONDUCTORS, 60°C" or equivalent*.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

P3-04DA Analog Output

The P3-04DA Voltage/Current Analog Output Module provides 4 channels of ± 10 VDC or 4 - 20mA sink/source selectable outputs for use with the Productivity3000 Programmable Automation Controller.



Safety Information 1
Removable Terminal Block Specifications 1
General Specifications 2
Output Specifications 2
Schematic and Wiring Diagram . . .3
Module Installation Procedure 4
Terminal Block Removal 4
Hot Swap Information 4
Wiring Options 5
Module Configuration 5
Linear Scaling 6
Non-Linear Scaling 6
LCD Panel Display Menus 7

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 5).

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1 second
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	2.6 W voltage outputs 3.4 W current outputs
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable terminal block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 5.
EU Directive	See the "EU Directive" topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

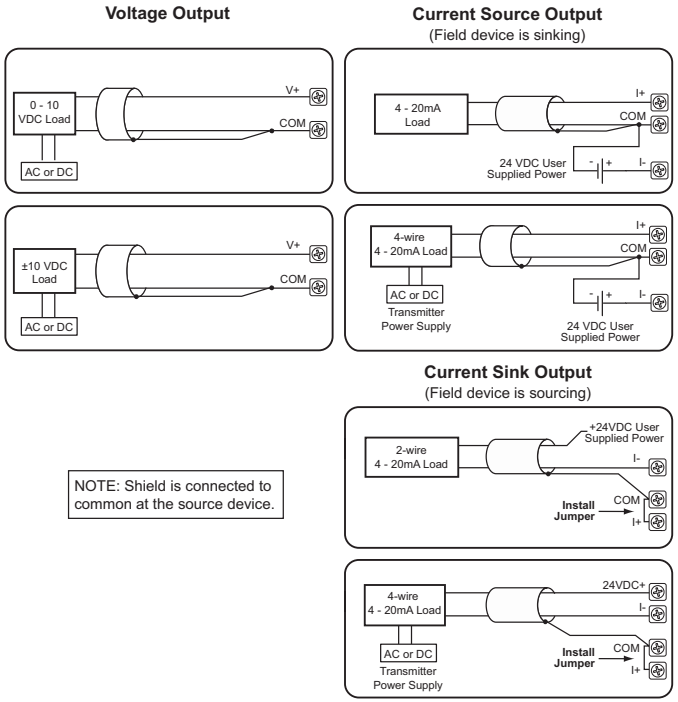
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d’explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Output Specifications

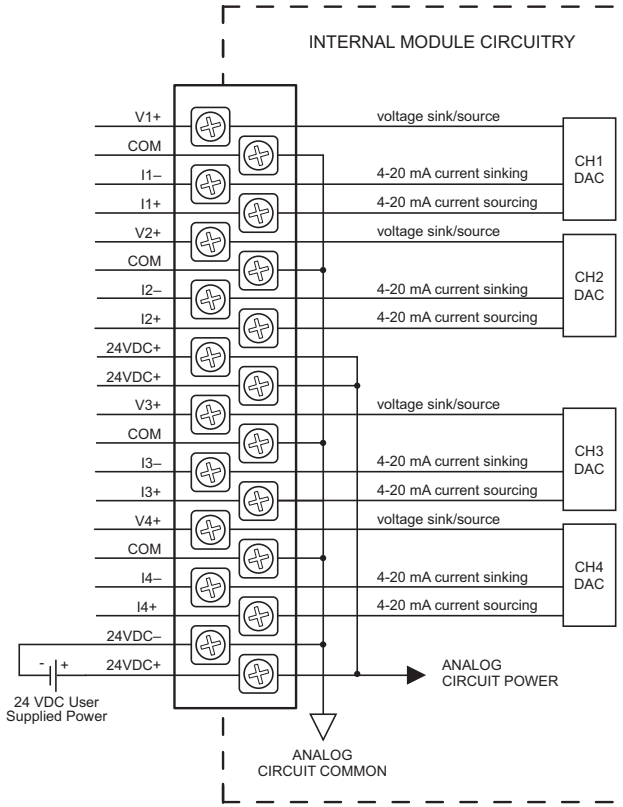
Output Channels	4
Module signal output range	±10V or 4-20mA sink or source selectable each channel
Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	± 10V = 305µV/ count 4-20mA = 0.244µA/ count 1 LSB = 1 count
Data Range	0 - 65535 counts uni-polar and -32768 to + 32767 counts bi-polar
Output Type	Voltage outputs sourcing/sinking at 10mA max, or Current outputs sink or source at 20mA max.
Output Value in Fault Mode	Voltage outputs 0V or 0mA current outputs
Load Impedence (Minimum External Power Supply)	>1000Ω voltage outputs)(19.2 - 30 VDC) 0-755Ω Sinking, 0-600Ω Sourcing (19.2 VDC) 0-875Ω Sinking, 0-700Ω Sourcing (21.6 VDC) 0-1000Ω Sinking, 0-855Ω Sourcing (24.0 VDC) 0-1110Ω Sinking, 0-970Ω Sourcing (26.4 VDC) 0-1350Ω Sinking, 0-1150Ω Sourcing (30 VDC)
Maximum Capacitive Load	.01µF maximum voltage outputs
Maximum Inductive Load	1 mH maximum current outputs
Allowed Load Type	Grounded
Maximum Inaccuracy (% of range)	0.1% voltage, 0.1% current (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±.025% of range maximum voltage outputs ±.025% of range maximum current outputs
Maximum Offset Calibration Error	±.025% of range maximum
Accuracy vs. Temperature	±25 ppm/ °C max f.s. calibration change (± .0025% of range / °C)
Max Crosstalk	-80 dB, 6 LSB
Linearity Error (End to End)	±16 LSB maximum (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 minute warm-up (typical)
Output Ripple	.05% of Full Scale
Output Settling Time	0.3 ms max, 5 µs min (full scale change)
All Channel Update Rate	0.6ms
Maximum Continuous Overload	Voltage Outputs current limited to 35mA typical. Current Outputs open circuit protected
Type of Output Protection	15VDC Peak Output Voltage Current outputs current limited to <=20mA
Output Signal (power-up, -down)	0V voltage outputs, 0mA current outputs
External DC Power Required	94mA voltage operation 4 channels 126mA current operation 4 channels 24VDC -20% / + 25%

Wiring Diagram

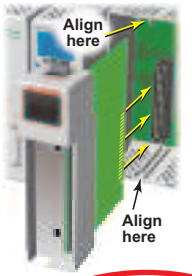


NOTE: Shield is connected to common at the source device.

Schematic



Module Installation Procedure

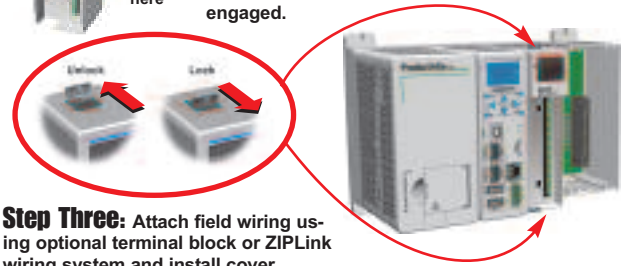


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

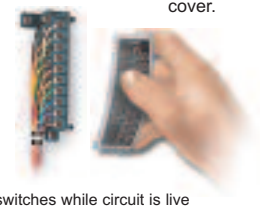
Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



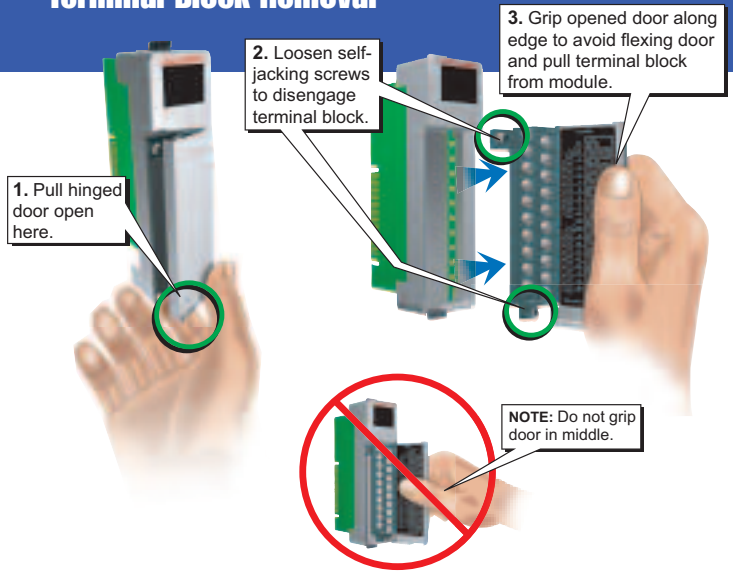
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 **ZIPLink Connection System**
Cable + ZIPLink Module = Complete System

ZIPLink pre-wired terminal block cables



0.5m (1.6FT) cable	ZL-P3-CBL20-L
1.0m (3.3FT) cable	ZL-P3-CBL20-1L
2.0m (6.6FT) cable	ZL-P3-CBL20-2L

ZIPLink Modules



Feed through	ZL-RTB20

2 **Terminal Block with pigtail cable**



0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

3 **Terminal Block only**

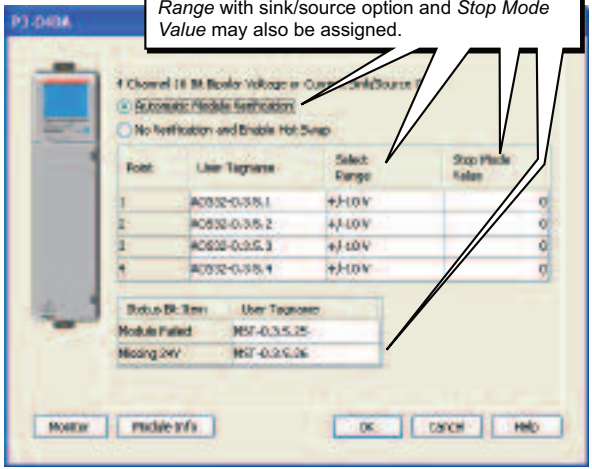


P3-RTB
(Quantity 1)

Configuration Settings

Using the Hardware Configuration tool in the Productivity Suite programming software, drag and drop the P3-04DA module into the base configuration.

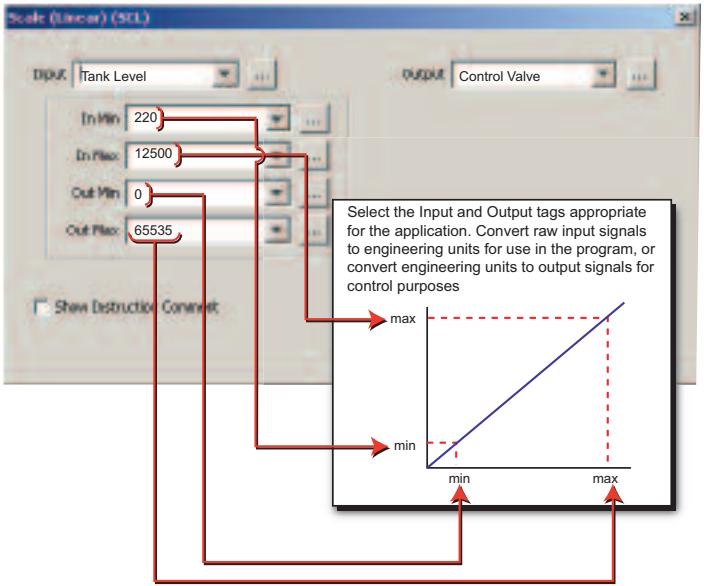
Select *Automatic Module Verification* or *No Verification and Enable Hot Swap*. If desired, assign a *User Tagname* to each output point (channel) selected and to each *Status Bit Item*. *Range* with sink/source option and *Stop Mode Value* may also be assigned.



Linear Scaling

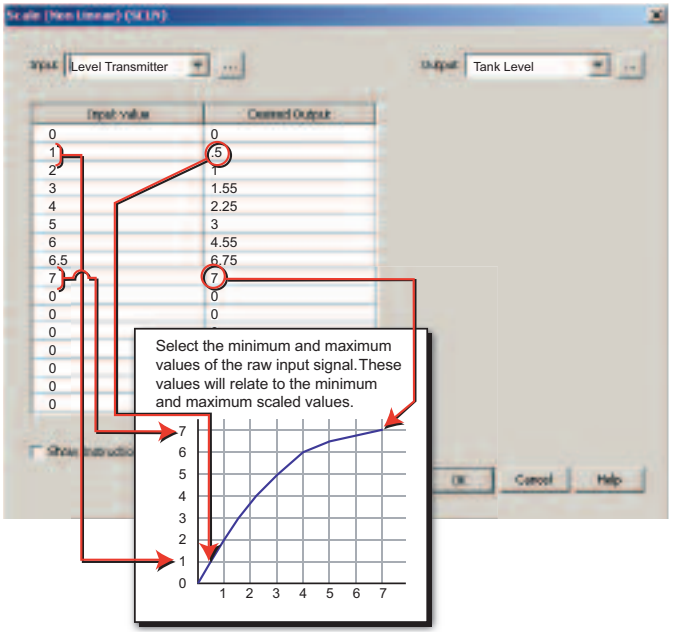
The Scale (Linear) function can be used to:

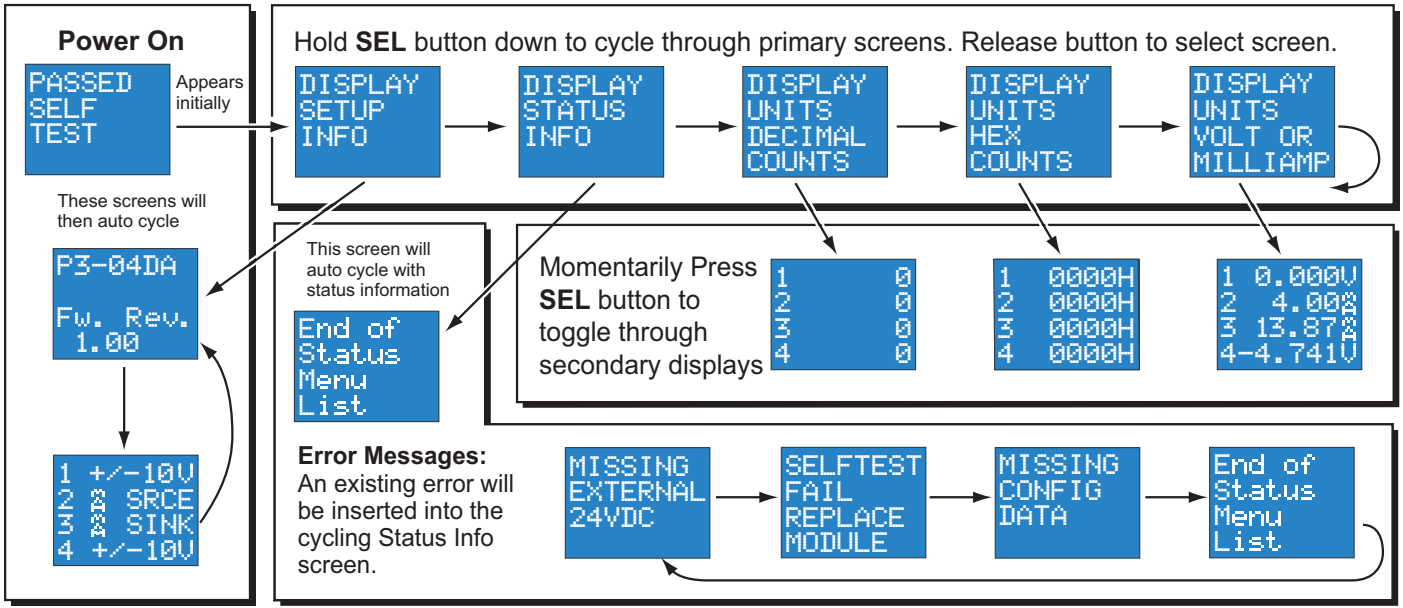
- **Convert an application specific range to a range which is native to the analog output module.**
- **Make other linear conversions in ranges appropriate to the application.**



Non-Linear Scaling

The Scale (Non-Linear) function can be used for Non-Linear applications.

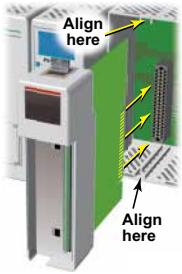



Power On
PASSED SELF TEST
Appears initially
These screens will then auto cycle
P3-04DA
Fw. Rev. 1.00
1 +/-10V
2 4 SRCE
3 4 SINK
4 +/-10V
Hold SEL button down to cycle through primary screens. Release button to select screen.
DISPLAY SETUP INFO
DISPLAY STATUS INFO
DISPLAY UNITS DECIMAL COUNTS
DISPLAY UNITS HEX COUNTS
DISPLAY UNITS VOLT OR MILLIAMP
This screen will auto cycle with status information
End of Status Menu List
Momentarily Press SEL button to toggle through secondary displays
1 0
2 0
3 0
4 0
1 0000H
2 0000H
3 0000H
4 0000H
1 0.000V
2 4.00mA
3 13.87mA
4 -4.741V
Error Messages:
An existing error will be inserted into the cycling Status Info screen.
MISSING EXTERNAL 24VDC
SELFTEST FAIL REPLACE MODULE
MISSING CONFIG DATA
End of Status Menu List

Document Name	Edition/Revision	Date
P3-04DA-M	1st Ed.Revision A	12/18/2013

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Module Installation Procedure

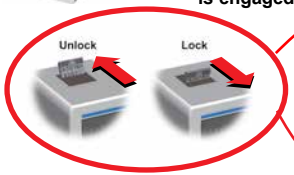


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: **Align circuit card with slot and press firmly to seat module into connector.**

Step Two: **Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.**

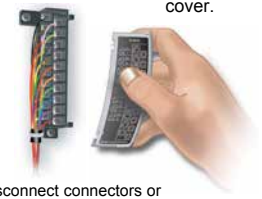




Step Three: **Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.**



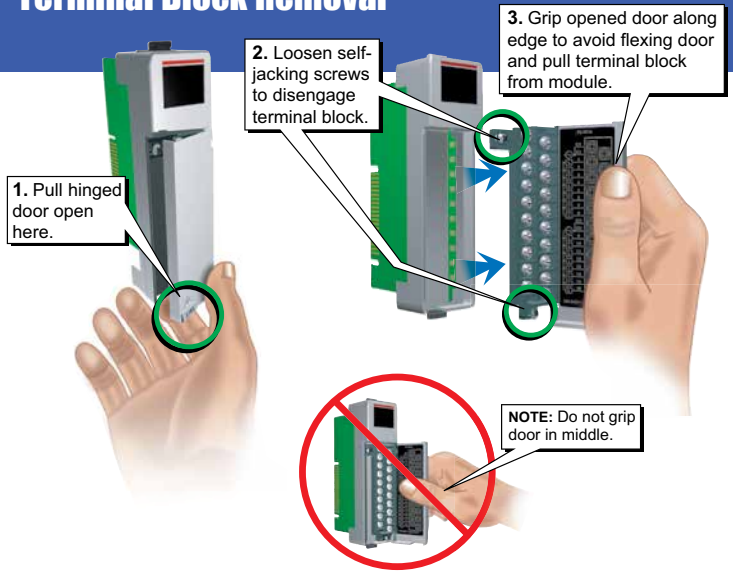
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 **ZIPLink Connection System**
Cable + ZIPLink Module = Complete System



ZIPLink pre-wired terminal block cables

0.5m (1.6FT) cable	ZL-P3-CBL20
1.0m (3.3FT) cable	ZL-P3-CBL20-1
2.0m (6.6FT) cable	ZL-P3-CBL20-2



ZIPLink Modules

Feedthrough	ZL-RTB20



Remote Fuse	ZL-RFU20

2 **Terminal Block with pigtail cable**



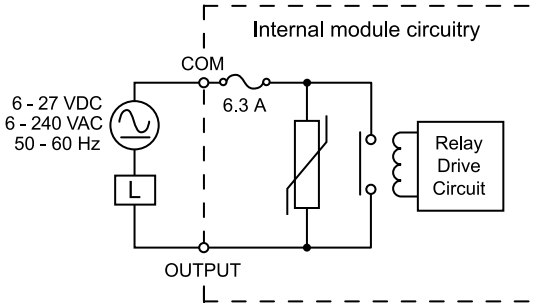
0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

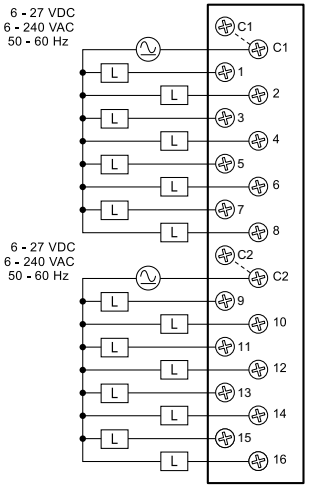
3 **Terminal Block only**



P3-RTB
(Quantity 1)

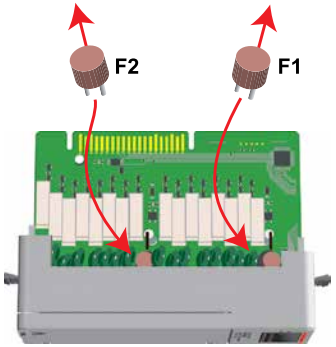
Schematic and Wiring Diagram





Replaceable Fuses

Order Part Number P3-FUSE-2. (Qty. 5 per pkg.) One spare included with this module.



To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

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If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

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Typical Relay Life

Voltage & Type of Load	Operations at 1.25A Load Current
30VDC Resistive	240K
30VDC Solenoid	110K
120VAC Resistive	320K
120VAC Solenoid	210K
240VAC Resistive	240K
240VAC Solenoid	140K

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum “USE COPPER CONDUCTORS, 60°C” or equivalent*.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	3.93W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable Terminal Block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 3.
EU Directive	See the “EU Directive” topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Weight	160g (5.64 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

WARNING: Exposure to some chemicals may degrade the sealing properties of materials used in the Sealed Relay Device.

AVERTISSEMENT: L’exposition à certains produits chimiques peut dégrader les propriétés d’étanchéité des matériaux employés dans le dispositif de relais étanche.

C-more Operator Panels Overview

Getting started

Installing the software and configuring the *C-more* panel is simple. You will need the following to successfully connect, configure and send a project to the panel:

- ***C-more*** touch panel - 6", 8", 10", 12" or 15" model
- ***C-more*** Programming Software, p/n EA9-PGMSW
- ***C-more*** programming cable, USB or Ethernet
- 12-24 VDC switching power supply or the optional ***C-more*** AC Power Adapter, p/n EA-AC
- Personal Computer - to run ***C-more*** programming software
- PLC communications cable (serial or Ethernet) to connect the ***C-more*** Touch Panel to your controller

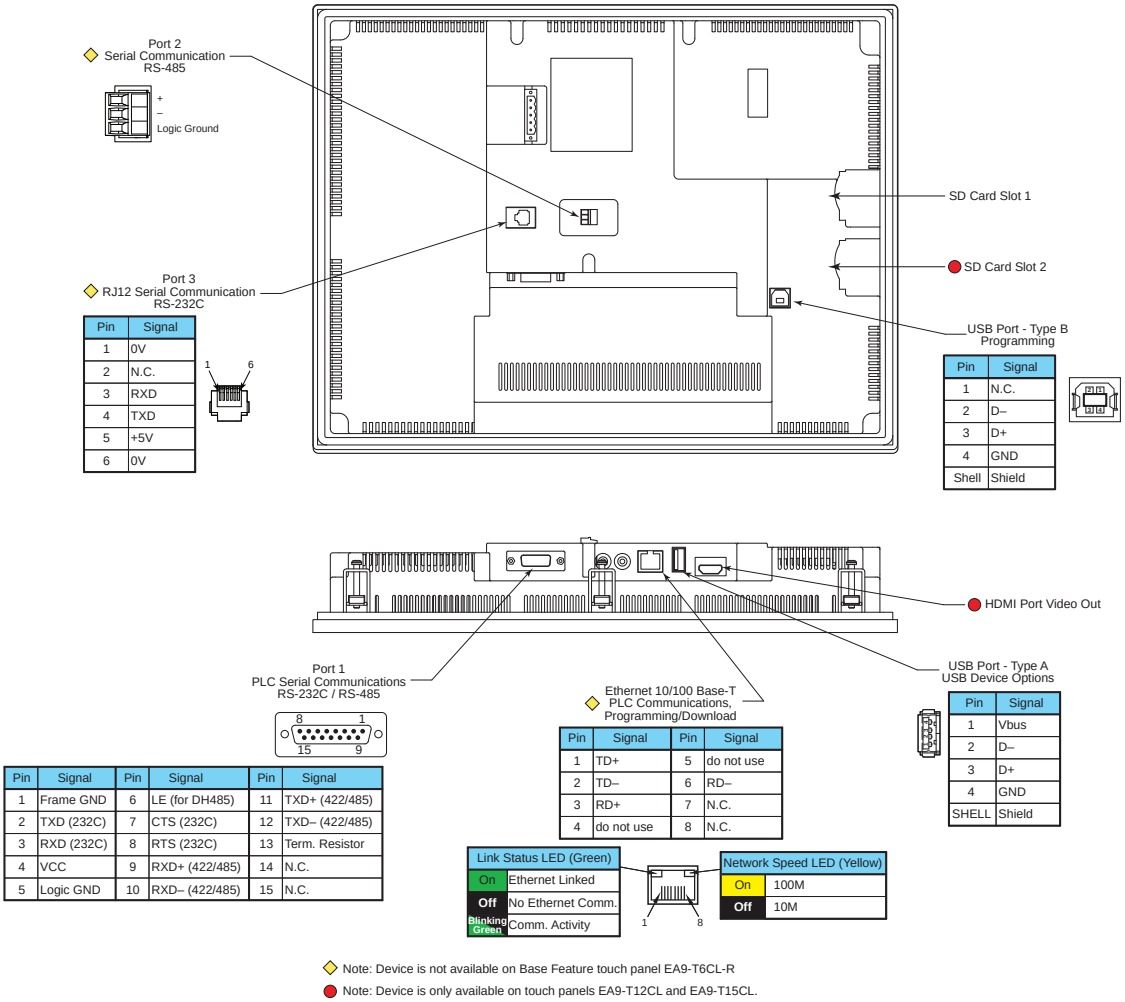
Part Number	Description	Price
EA9-T6CL-R	***C-more*** EA9 series touch screen interface panel, 6-inch color TFT (5.7 inch viewable screen), base model, 64k colors, 320 x 240 pixel QVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (1) serial port, USB 2.0 Type A and B ports, supports SD memory card, no Ethernet support. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T6CL	***C-more*** EA9 series touch screen interface panel, 6-inch color TFT (5.7 inch viewable screen), 64k colors, 320 x 240 pixel QVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T8CL	***C-more*** EA9 series touch screen interface panel, 8-inch color TFT (8.4 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T10CL	***C-more*** EA9 series touch screen interface panel, 10-inch color TFT (10.4 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T12CL	***C-more*** EA9 series touch screen interface panel, 12-inch color TFT (12.1 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports (2) SD memory cards. Includes HDMI video out. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T15CL	***C-more*** EA9 series touch screen interface panel, 15-inch color TFT (15 inch viewable screen), 64k colors, 1024 x 768 pixel XGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB <None>2.0 Type A and B ports and Ethernet port; supports (2) SD memory cards. Includes HDMI video out. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-PGMSW	***C-more*** Windows-based programming software on CD for the ***C-more*** EA9 series touch panels. Requires Windows XP Pro 32-bit, Windows 7 (Pro, Ultimate, 32 or 64-bit) or Windows 8 (Pro, Ultimate, 32 or 64-bit). Requires USB or Ethernet connection to touch panel. Cables sold separately. (Does not support ***C-more*** EA7 series panels.)	<--->
USB-CBL-AB3	Standard 3-ft. (0.9m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->
USB-CBL-AB6	Standard 6-ft. (1.8m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->
USB-CBL-AB10	Standard 10-ft (3 meter) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->
USB-CBL-AB15	Standard 15-ft. (4.6m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->

C-more Selection Guide & Specifications

Specification \ Model	6" TFT color w/ base features	6" TFT color w/ full features	8" TFT color w/ full features	10" TFT color w/ full features	12" TFT color w/ full features	15" TFT color w/ full features
Part Number	EA9-T6CL-R	EA9-T6CL	EA9-T8CL	EA9-T10CL	EA9-T12CL	EA9-T15CL
Price	<--->	<--->	<--->	<--->	<--->	<--->
Display Actual Size and Type	5.7" TFT color		8.4" TFT color	10.4" TFT color	12.1" TFT color	15.0" TFT color
Display Viewing Area	4.54" x 3.40" [115.2 mm x 86.4 mm]		6.71" x 5.03" [170.4 mm x127.8mm]	8.31" x 6.24" [211.2 mm x 158.4 mm]	9.69" x 7.26" [246.0 mm x 184.5 mm]	11.97" x 8.98" [304.1 mm x 228.0 mm]
Weight	1.56 lb [710g]	1.59 lb [720g]	2.93 lb [1330g]	4.19 lb [1900g]	4.89 lb [2200g]	6.50 lb [2950g]
Screen Pixels	320 x 240 (QVGA)		800 x 600 (SVGA)			1024 x 768 (XGA)
Display Brightness	280 nits (typ)		310 nits (typ)	280 nits (typ)		
LCD Panel Dot Pitch	0.18 mm x 0.18 mm		0.213 mm x 0.213 mm	0.264 mm x 0.264 mm	0.3075 mm x 0.3075 mm	0.297 mm x 0.297 mm
Color Scale	65,536 colors					
Backlight Average Lifetime*	50,000 hours @ 25°C					
Touch Panel Type	Four-wire analog resistive					
Project Memory	26MB				82MB	
Number of Screens	Up to 999 screens – limited by project memory					
Realtime Clock	Realtime Clock Built into panel, backed up for 30 days at 25°C					
Calendar - Month / Day / Year	Yes - monthly deviation 60 sec (Reference)					
Serial Port 1	15-pin D-sub female - RS232C, RS-422/485					
Serial Port 2	N/A	3-wire terminal block - RS-485				
Serial Port 3	N/A	RJ-12 modular jack - RS-232C				
USB Port - Type B	USB 2.0 High speed (480 Mbps) Type B - Download/Program					
USB Port - Type A	USB 2.0 High speed (480 Mbps) Type A -for USB device options					
Ethernet Port	N/A	Ethernet Port Ethernet 10/100 Base-T, auto MDI/MDI-X				
Audio Line Out	N/A	3.5 mm mini jack – requires amplifier and speaker(s)				
Mic In	N/A	3.5 mm mini jack				
SD Card Slot	1 slot supports max 2 GB (SD,) max 32 GB (SDHC)				2 slots support max 2 GB (SD), max 32 GB (SDHC)	
HDMI Out	N/A				Yes	
Supply Power	12-24 VDC Class 2, or use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz power source. Reverse Polarity Protected					
Power Consumption	16.0 W 1.30 A @ 12VDC 0.66 A @ 24VDC		18.0 W 1.50 A @ 12VDC 0.75 A @ 24VDC	18.0 W 1.50 A @ 12VDC 0.75 A @ 24VDC	21.0 W 1.75 A @ 12VDC 0.88 A @ 24VDC	29.0 W 2.40 A @ 12VDC 1.20 A @ 24VDC
Internal Fuse (non-replaceable)	4.0 A		6.3 A			
Operating Temperature	0 to 50 °C (32 to 122 °F) Maximum surrounding air temperature rating: 50°C (122°F) IEC 60068-2-14 (Test Nb, Thermal Shock)					
Storage Temperature	–20 to +60°C (–4 to +140 °F) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)					
Humidity	5–95% RH (non-condensing)					
Environment	For use in Pollution Degree 2 environment, no corrosive gases permitted					
Noise Immunity	NEMA ICS3-304 (EN61131-2) RFI, (145MHz, 440Mhz 10W @ 10cm) Impulse 1000V @ 1mS pulse EN61000-4-2 (ESD), EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Serge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity)					
Withstand Voltage	1000 VAC, 1 min. (FG to Power supply)					
Insulation Resistance	> 10M ohm @ 500VDC (FG to Power supply)					
Vibration	IEC60068-2-6 (Test Fc)					
Shock	IEC60068-2-27 (Test Ea)					
Emission	EN55011 Class A (Radiated RF emission)					
Enclosure	NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 indoor use only (When mounted correctly)					
Agency Approvals	UL508, E157382 CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2					

**** NOTE: The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.***

C-more Communication Ports



Pin	Signal
1	0V
2	N.C.
3	RXD
4	TXD
5	+5V
6	0V

Pin	Signal
1	N.C.
2	D–
3	D+
4	GND
Shell	Shield

Pin	Signal	Pin	Signal	Pin	Signal
1	Frame GND	6	LE (for DH485)	11	TXD+ (422/485)
2	TXD (232C)	7	CTS (232C)	12	TXD– (422/485)
3	RXD (232C)	8	RTS (232C)	13	Term. Resistor
4	VCC	9	RXD+ (422/485)	14	N.C.
5	Logic GND	10	RXD– (422/485)	15	N.C.

Pin	Signal	Pin	Signal
1	TD+	5	do not use
2	TD–	6	RD–
3	RD+	7	N.C.
4	do not use	8	N.C.

Pin	Signal
1	Vbus
2	D–
3	D+
4	GND
SHELL	Shield

◇ Note: Device is not available on Base Feature touch panel EA9-T6CL-R

● Note: Device is only available on touch panels EA9-T12CL and EA9-T15CL.

Ethernet Port

The Ethernet port has several uses:

- **Download program to panel**
- **Communicate to PLCs/PCs**
- **Send e-mail**
- **Access FTP server**
- **Act as a Web server**
- **Remote Internet Access**

The Ethernet port has an RJ-45 8-wire modular connector with green and yellow LEDs.

- **The yellow LED indicates network speed; off for a 10 Mbps connection and illuminated for a 100 Mbps connection.**
- **The green LED indicates link status and illuminates when a link is established.**

Note: The base panels (-R part numbers) do not include an Ethernet port, and do not have these capabilities.

USB Port B

Program *C-more* via the USB programming port. It's fast and easy, with no baud rate settings, parity, or stop bits to worry about. We stock standard USB cables for your convenience. USB Port B can be used to upload or download projects to and from a PC.

USB Port A

The Universal Serial Bus (USB) Port A is a standard feature for all models and can be used to connect various USB HID (Human Input Device) devices to the panel, such as:

- **USB pen drives, (USB-FLASH)**
- **USB keyboards**
- **USB barcode scanners**
- **USB card scanners**

C-more can log data to the USB pen drive as well as load projects to the panel from the pen drive. You can also back up project files and panel firmware.

Sound Interface (Audio Line Out)

When attached to an amplifier and speaker(s), *C-more* can play warning sounds or pre-recorded messages such as: "conveyor is jammed". *C-more* supports WAV type files. The output is stereo.

Serial Port

Port 1 - Connect to your serial controller network via Port 1. Port 1 is a 15-pin port that supports RS-232 or RS-422/485.

Port 2 - Connect your RS-485 network via Port 2. Port 2 is provided with a 3-wire removable terminal block.

Port 3 - Connect to your RS-232C device via Port 3. Port 3 is an RJ12 connection.

HDMI Port

EA9-T12CL and EA9-T15CL include an HDMI Type A port to provide video output to a projector or remote monitor.

C-more Communication Protocols & Cables

Compatibility Table			
PLC Family	**Model**		**Protocols**
Allen-Bradley	MicroLogix 1000/1100/1200/1400/1500, SLC 5-/01/02/03, PLC5		DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500		DF1 Half Duplex; DF1 Full Duplex
	SLC 5-/03/04/05		
	ControlLogix™, CompactLogix™, FlexLogix™		
	PLC-5		DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Tag Based		DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging		EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based		EtherNet/IP Client
	MicroLogix 1100 & SLC 5/05, both via native Ethernet port		
	MicroLogix 1000, 1100, 1200, 1400,1500 & SLC 5-03/04/05, all via ENI Adapter		
	Micro 800 series		Modbus RTU
			Modbus TCP
Modbus TCP/IP	Modbus TCP/IP devices		Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro		SNPX
Mitsubishi	FX Series		FX Direct
	Q02, Q02H, Q06H, Q12H, Q25H		Q CPU
	Q, QnA Serial		QnA Serial
	Q, QnA Ethernet		QnA Ethernet
Omron	C200 Adapter, C500		Host Link
	CJ1/CS1 Serial, CJ1/CS1 Ethernet		FINS
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx		Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial		PPI
	S7-200 CPU, S7-300 CPU, S7-400, S7-1200 CPU; Ethernet		Ethernet ISO over TCP
Productivity Series	Productivity3000 Serial (P3-550)		AutomationDirect P3000 Serial
	Productivity3000 Ethernet (P3-550)		AutomationDirect P3000 Ethernet
Do-more	all		Do-more Serial
			Do-more Ethernet
CLICK	all		AutomationDirect Modbus (CLICK)
***Direct*LOGIC**	DL05/DL06	all	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		H0-ECOM/H0-ECOM100	***Direct*LOGIC Ethernet**
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			***Direct*NET**
		D2-250/D2-250-1/D2-260	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 using D2-DCM	***Direct*NET**
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	***Direct*LOGIC Ethernet**
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	***Direct*NET**
		D3-340	***Direct*NET**
		D3-350	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		D3-350 using D3-DCM	***Direct*NET**
			Modbus (Koyo addressing)
	DL405	D4-430	K-Sequence
			***Direct*NET**
		D4-440	K-Sequence
			***Direct*NET**
		D4-450	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		All with D4-DCM	***Direct*NET**
			Modbus (Koyo addressing)
		H4-ECOM/H4-ECOM100	***Direct*LOGIC Ethernet**
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version		Think & Do Modbus RTU (serial port)
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later		Think & Do Modbus TCP/IP (Ethernet port)

Cable Description	Cable Part Number	Price
AutomationDirect Productivity Series, Do-more, CLICK, ***Direct*LOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WinPLC (RS-232C)	***EA-2CBL***	<--->
***Direct*LOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	***EA-2CBL-1***	<--->
***Direct*LOGIC PLC RJ-11 port, D3-340 (RS-232C)	***EA-3CBL***	<--->
***Direct*LOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	***EA-4CBL-1***	<--->
***Direct*LOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C)	***EA-4CBL-2***	<--->
Allen-Bradley MicroLogix 1000, 1100, 1200, 1400 & 1500 (RS-232C)	***EA-MLOGIX-CBL***	<--->
Allen-Bradley SLC 5-03/04/05 ControlLogix, CompactLogix, FlexLogix, DF1 port (RS-232C)	***EA-SLC-232-CBL***	<--->
Allen-Bradley PLC-5 DF1 port (RS-232C)	***EA-PLC5-232-CBL***	<--->
Allen-Bradley SLC 500 DH485 port (RS-485A)	***EA-DH485-CBL***	<--->
GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A)	***EA-90-30-CBL***	<--->
MITSUBISHI FX Series 25-pin port (RS-422A)	***EA-MITSU-CBL***	<--->
MITSUBISHI FX Series 8-pin mini-DIN (RS-422A)	***EA-MITSU-CBL-1***	<--->
OMRON Host Link C200 Adapter, C500 (RS-232C)	***EA-OMRON-CBL***	<--->

Example Cables:

EA-2CBL



EA-2CBL-1



C-more Computer Programming Connections

Using the *C-more* Programming Software EA9-PGMSW for project development, the touch panel can be connected to a PC (personal computer) in one of several ways:

- Connect a USB Programming Cable such as (USB-CBL-AB15) from a USB port type A on the PC to the USB type B programming port on the C-more touch panel. The USB connection is for direct connection only and does not support USB hubs.
- Connect the ***C-more*** touch panel to a PC with a Cat5 Ethernet cable via an Ethernet switch. Multiple panels can be programmed in this configuration.

Following are the minimum system requirements for running *C-more* Programming Software, p/n EA9-PGMSW, on a PC:

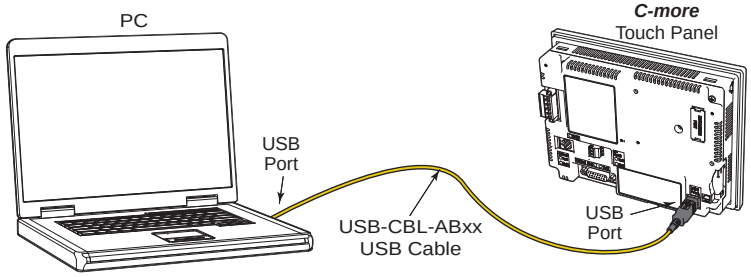
- Keyboard and Mouse or compatible pointing device
- Super VGA color video adapter and monitor with at least 800 x 600 pixels resolution (1024 x 768 pixels recommended) 64K color minimum
- 300 MB free hard-disk space
- CD-ROM or DVD drive for installing software from the CD
- USB port or Ethernet 10/100 Mbps port for project transfer from software to touch panel (Ethernet port not available on -R models)
- Operating System - Windows® XP Professional Edition (32 bit), Windows 7 (32 or 64 bit) or Windows 8 (32 or 64 bit)

NOTE: Regarding Ethernet access to a C-more panel.

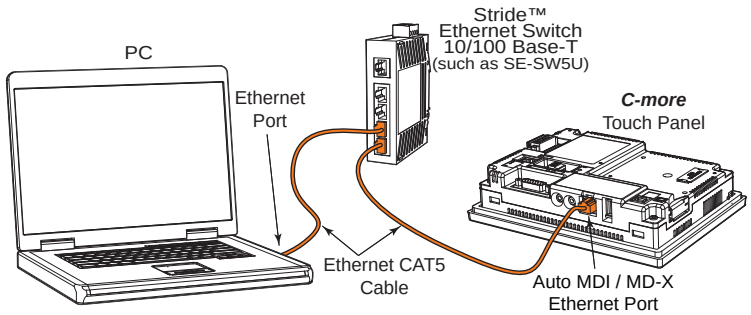
If you intend to take advantage of the methods of remote access to the panel, including the web server, PC remote access, FTP, iPhone or iPad app, you need to consider the security exposure in order to minimize the risks to your process and your C-more panel.

Security measures may include password protection, changing the ports exposed on your network, including a VPN in your network, and other methods. Security should always be carefully evaluated for each installation.

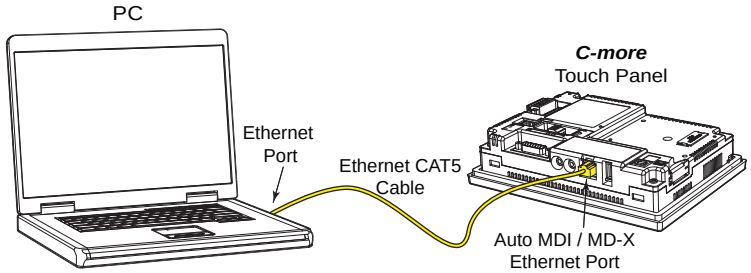
USB Connectivity



Ethernet Connectivity via a Hub or Switch



Ethernet Direct Connection



USB Programming Cable



Part No. USB-CBL-AB15

<--->

Other lengths available see
USB-CBL-AB3, USB-CBL-AB6, USB-CBL-AB10

Stride™ Ethernet Switch



Part No. SE-SW5U

<--->

Ethernet Configuration Kit



Part No. RT-CNFGKIT

<--->

The Ethernet Configuration Kit includes a five-port 10/100 Base-T Ethernet switch, four straight-through cables, and one crossover cable. (The cables are at least five feet in length.) The kit provides a great convenience for configuring systems, demonstration systems or basic control projects using Ethernet.

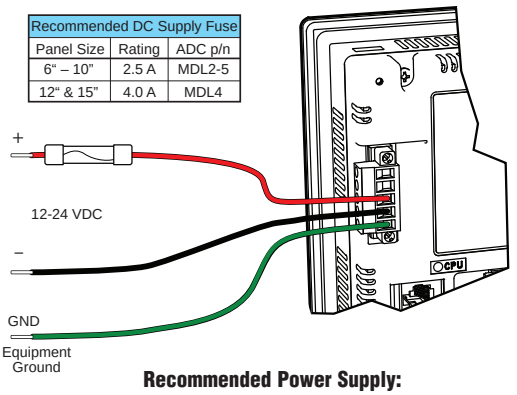
C-more Power Connection Wiring

Providing Power to the Touch Panel

- Connect a dedicated 12–24 VDC Class 2 power supply to the DC connector on the rear of the ***C-more*** touch panel. Connect the ground terminal to a proper equipment ground.
- or, install a ***C-more*** AC Power Adapter (EA-AC) to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60 Hz, to its AC connector.
- then, turn on the power source and check the LED status indicators on the front and rear of the ***C-more*** touch panel for proper operation.

DC Wiring

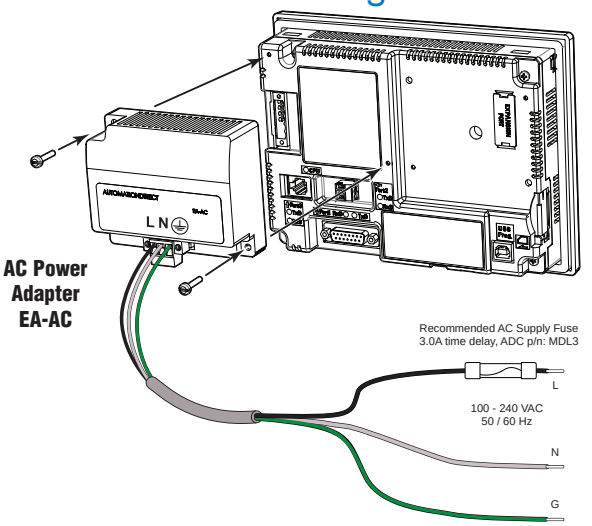
Recommended DC Supply Fuse		
Panel Size	Rating	ADC p/n
6" – 10"	2.5 A	MDL2-5
12" & 15"	4.0 A	MDL4



Recommended Power Supply:
AutomationDirect Part No. PSC-24-060

DC-CON Tightening Torque	
Power connector screw torque	70.4 oz-in [0.5 Nm]
Power connector mounting torque	56 oz-in [0.4 Nm]

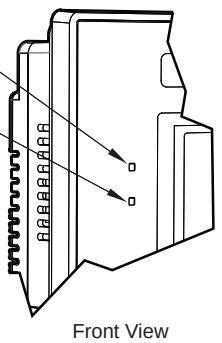
AC Wiring



EA-AC Tightening Torque	
Power supply cable torque	71 - 85 oz-in [0.5 - 0.6 Nm]
Power connector mounting torque	71 - 85 oz-in [0.5 - 0.6 Nm]
Mounting flange screw torque	57 - 71 oz-in [0.4 - 0.5 Nm]

Power LED (Green)	
On	Power On
Off	Power Off

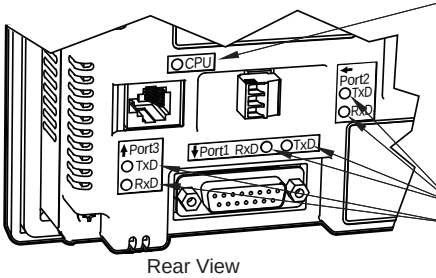
User Defined LED (Green, Orange & Red)	
Off	User Defined (Refer to online help file for further details)
Green	
Red	
Orange	
Blinking Red	
Blinking Orange	
Blinking Green	



Front View

CPU Status LED (Green, Orange & Red)	
Off	Power Off
Green	Normal – CPU Run State
Red	Memory Error
Blinking Red	Watchdog Timer Error
Blinking Orange	OS Error
Blinking Green	Power Loss Detection

Serial TxD/RxD LED (Green)	
On	Comm. is active
Off	No communication



Rear View

WARNING: To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 1-800-633-0405 or 770-844-4200.

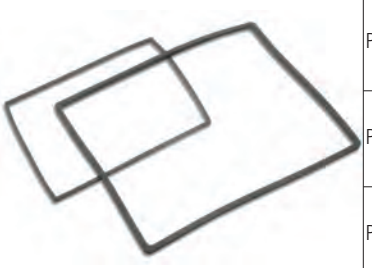
This publication is based on information that was available at the time it was printed.

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C-more Replacement Parts

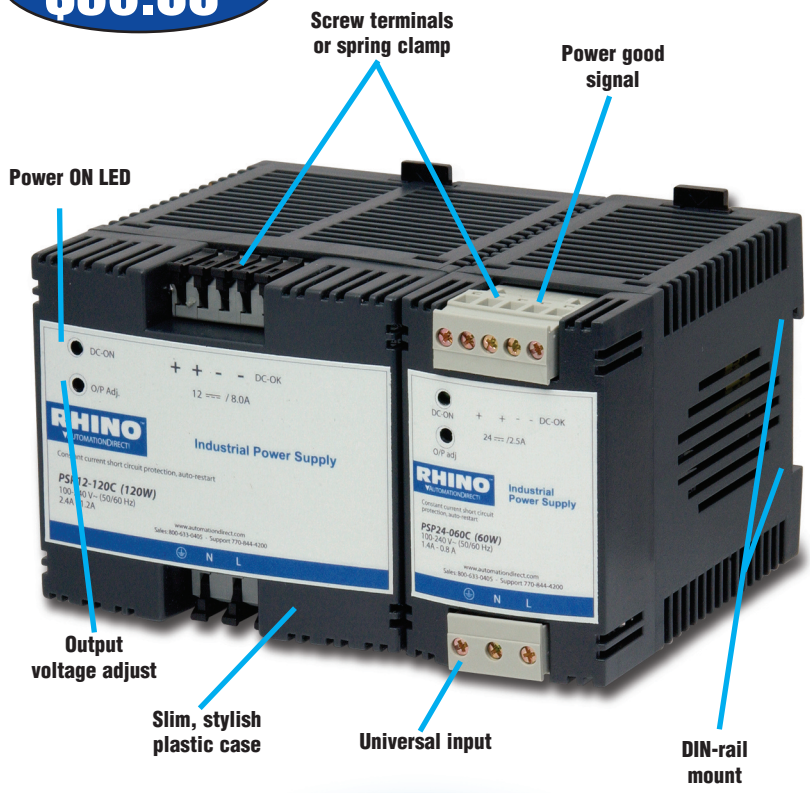
The optional replacement parts can be used to replace damaged, worn or lost *C-more* components.

Replacement parts at a glance:

Part Number		Description
EA9-BRK		Panel mounting brackets, replacement, for C-more EA9 series touch panels. Package of 8 brackets and screws.
EA9-LBL		Blank label insert for front bezel, replacement, for C-more EA9 series touch panels. Package of 10.
EA9-3TB		3-pole terminal block, replacement, for 3-wire RS485 communications port on C-more EA9 series panels. Package of 2.
EA-DC-CON		5-terminal DC power connector, replacement, for C-more EA7 and EA9 series touch panels
EA-AC-CON		3-terminal AC power connector, replacement, for C-more EA7 and EA9 series touch panels
EA9-15-GSK		Panel mounting gasket, replacement, for C-more EA9-T15CL 15-inch touch panel, NEMA 4/4X
EA9-12-GSK		Panel mounting gasket, replacement, for C-more EA9-T12CL 12-inch touch panel, NEMA 4/4X
EA9-10-GSK		Panel mounting gasket, replacement, for C-more EA9-T10CL 10-inch touch panel, NEMA 4/4X
EA9-8-GSK		Panel mounting gasket, replacement, for C-more EA9-T8CL 8-inch touch panel, NEMA 4/4X
EA9-6-GSK		Panel mounting gasket, replacement, for C-more EA9-T6CL(-R) 6-inch touch panels, NEMA 4/4X

RHINO PSP Series 5,12 & 24 VDC Power Supplies

Starting at $56.00





Slimline Power Supplies

RHINO PSP series power supplies are plastic housed ultracompact switching supplies available in 5V, 12V and 24V adjustable models. There are 13 models available with power ratings of 20W to 240W and up to 10A output current. They are DIN rail or panel-mountable and feature universal inputs, adjustable DC voltage outputs, power good signal and feature low output ripple along with short circuit, overvoltage and overload protection.

The RHINO PSP series of switching power supplies offer an excellent price/performance ratio. They provide tightly regulated output voltage for sensitive loads in industrial environments. The slim plastic case is lightweight and compact, and comes in both screw and spring clamp terminal versions. The constant-current, short-circuit protection limits the output current as the voltage is reduced, to safely protect the control components from direct shorts and device failures. Once a fault is corrected, the power supply automatically resumes supplying full-voltage power. (PSPxx-024x models have foldback current protection with auto-recovery.)

The RHINO PSP power supplies have a **Power ON** LED for easy visual indication of operation as well as a **Power Good** signal for feedback to your system controller.

With a UL 508C rating, the RHINO PSP series is the right choice for space limited applications.

Features

- Regulated switch mode type
- Ultra-compact plastic case
- Finger-safe terminals
- Reliable snap-on mounting on DIN-rails
- Wall mounting bracket included
- Universal input 85-264 VAC, 50/60 Hz or 85-375 VDC (85-132/187-264 VAC only for PSP24-240S input)
- Models with 5, 12 or 24 VDC output
- Output voltage adjustable
- Parallel operation up to five units (not PSP24-240S)
- Power good signal (some models)
- Low ripple and noise
- Overload and short-circuit protection
- UL/cUL 508 listed, UL/cUL 60950 recognized*
- Worldwide safety approvals
- 3-year product warranty

**** Note: PSP24-240S is not cUL listed. PSP05-020S, PSP12-024S, and PSP24-240S are not UL 60950 recognized.***

Company Information
Terminal Blocks
Power Distribution Blocks
Wiring Accessories
ZIPLink Connection System
Multi-wire Connectors
Sensor Cables and Connectors
M12 Junction Blocks
Panel Interface Connectors
Wiring Duct
Cable Ties
Wire
Flexible Cord
Multi-conductor Flex Cable
Data Cables
Wire Management Products
Power Supplies
DC Converters
Transformers and Filters
Circuit Protection
Tools
Test Equipment
Enclosures
Enclosure Climate Control
Safety: Electrical Components
Safety: Protective Wear
Terms and Conditions

RHINO PSP Series Power Supplies Specifications



PSP05-020S
PSP12-024S
PSP24-024S



PSP24-024C



PSP12-060S
PSP24-060S



PSP12-060C
PSP24-060C



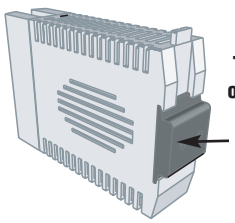
PSP12-120C
PSP24-120C



PSP24-120S
PSP12-120S



PSP24-240S



The unit can be mounted on a chassis or wall using the included mounting bracket.

Input Specifications

Part Number	Input Voltage Range		Input Freq. Range	Input Current (Typical) at full load		Efficiency (Typ.)	C-Curve Circuit Breaker or Slow-blow Fuse
				115 VAC	230 VAC		
PSP05-020S	85-264 VAC 85-375 VDC	30% output derating below 93 VAC/ 130 VDC	47-63 Hz	0.35 A	0.2A	88%	5.0 A
PSP12-024S		20% output derating below 93 VAC/ 130 VDC					
PSP24-024S				0.35 A	0.2 A		
PSP24-024C							
PSP12-060S		15% output derating below 93 VAC/ 130 VDC		1.2 A	0.6 A	88%	
PSP12-060C							
PSP24-060S							
PSP24-060C							
PSP12-120S				2.0 A	1.0 A	88%	
PSP12-120C							
PSP24-120S							
PSP24-120C							
PSP24-240S	85-132/ 187-264 VAC	20% output derating below 93 VAC		4.7 A	2.0 A		

Output Specifications

Part Number	Price	Output Voltage	Output Volt. Adjust. Range	Output Current (Max.)	Output Power (Max.)	Hold-Up Time		MTBF (IEC 1709 @ 25°C)
						115 VAC	230 VAC	
PSP05-020S	$77.00	5.1 VDC	5-5.25 VDC	4.0 A	20 W	15 ms	125 ms	2,681,000 hours
PSP12-024S	$73.00	12 VDC	12-16 VDC	2.0 A	24 W			
PSP24-024S	$56.00	24 VDC	24-28 VDC	1.0 A	24 W			
PSP24-024C	$59.00							
PSP12-060S	$97.00	12 VDC	12-15 VDC	4.0 A	60 W			2,947,000 hours
PSP12-060C	$107.00							
PSP24-060S	$85.00	24 VDC	24-28 VDC	2.5 A				
PSP24-060C	$86.00							
PSP12-120S	$153.00	12 VDC	12-15 VDC	8.0 A	120 W			1,620,000 hours
PSP12-120C	$158.00							
PSP24-120S	$135.00	24 VDC	24-28 VDC	5.0 A				
PSP24-120C	$142.00							
PSP24-240S	$180.00			10.0 A	240 W			1,912,000 hours

Part numbering system

PSP24-024S

- PSP: Series Name
- Output Volts
- Output Watts
- Terminal Connector Type:
  C: Clamp
  S: Screw

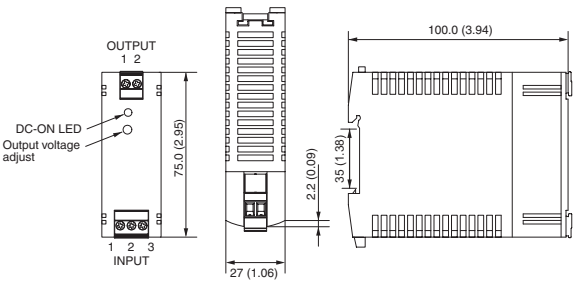
RHINO PSP Series Power Supplies Dimensions

General Specifications		
Temperature	**Operating:** -10°C to +70°C (14°F to 158°F), Derating at 93-132 VAC or 130-187 VDC: -1.10%/C above 40°C, Derating at 187-264 VAC or 265-375 VDC: -1.67%/C above 50°C, Derating at 85-93 VAC or 85-130 VDC: -1.30%/C above 30°C, Temperature Coefficient: 0.02%/C **Storage:** -25°C to +85°C (-13°F to 185°F)	
Humidity	95% (non-condensing) relative humidity max.	
Output Regulation	2.5% (1% for PSP12-060x), 10 to 90% load variation	
Switching Frequency	55 - 180 kHz depending on load	
Safety Standards	IEC/EN 60950 (output SELV), UL 60950, UL 508, EN 50178, EN 60204, EN 61558-2-8	
Output Voltage Ripple	<50 mV peak-to-peak	
Output Protection	Current Limit at 120% typ., constant current, auto recovery (PSPxx-024x foldback, auto-recovery), Voltage Limit <40 VDC	
Power Good Signal*	Trigger Point 12 VDC Models: >11 V 24 VDC Models: >22 V	Output Signal (reference to -Vout) 11.0 V+/- 1.0 V @ 60 mA max. 22.0 V+/- 2.0 V @ 30 mA max.
Electromagnetic Compatibility (EMC)	EN 61000-3-2, EN 61000-6-2, EN 61000-6-3	
Enclosure Rating	IP 20	
Enclosure Material	Plastic FR2010-110C (UL 94 V-0 rated)	
Mounting	35 mm DIN rails, snap on with self-locking spring or wall mount adapter included	
Connection	S models: Plug-in Screw Terminals, C Models: Clamp Terminals. For 28-12 AWG wire	
Agency Approvals	UL/cUL 508 listed File E197592(PSP24-240S not cUL), UL 60950 recognized, file E198298 (except PSP05-020S, PSP12-024S and PSP24=240S).	

Note: PSP05-020S, PSP12-024S and PSP24-024x models do not have Power Good output.

Note: All specifications are valid at nominal input voltage, full load and +25°C after warmup time, unless otherwise stated.

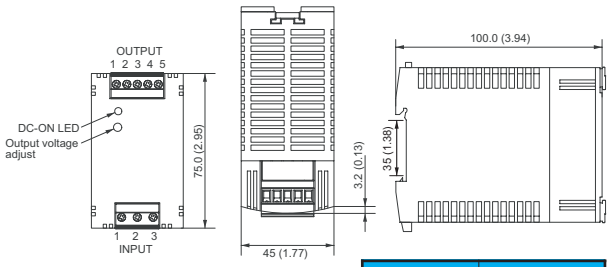
PSP05-020S, PSP12-024S, PSP24-024x



Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	-Vout
3	Line		

Weight: 140g (4.9 oz.)

PSPxx-060x

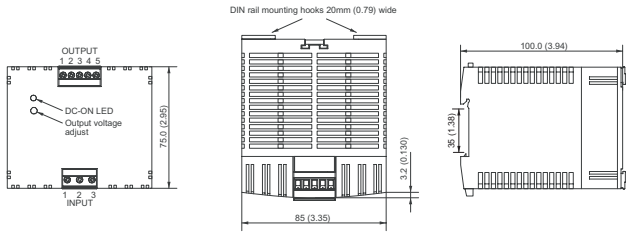


Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	+Vout
3	Line	3	-Vout
		4	-Vout
		5	Power Good

Weight: 265g (9.4 oz.)

Note: All dimensions are in millimeters (inches).

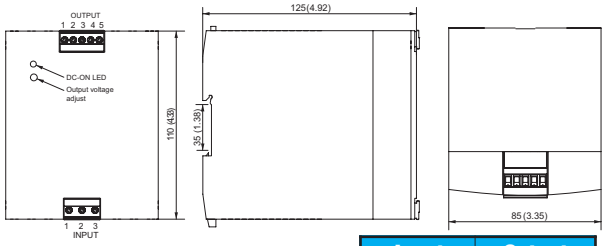
PSPxx-120x



Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	+Vout
3	Line	3	-Vout
		4	-Vout
		5	Power Good

Weight: 440g (15.5 oz.)

PSP24-240S



Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	+Vout
3	Line	3	-Vout
		4	-Vout
		5	Power Good

Weight: 950g (33.5 oz.)

Product Data Sheet

ZB5AS54

MUSHROOM PB



List Price	$78.00 USD
Availability	**Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Bezel Material	Black Plastic
Approvals	UL Listed File Number E164353 CCN NKCR - CSA Certified File Number LR44087 Class 321103 - CE Marked
Color	Red
Enclosure Rating	NEMA 1/2/3/4/4X/13
Degree of Protection	IP 65
Operator Type	Non-Illuminated
Markings	Unmarked
Style	Mushroom Button: 40mm
Operator Action	Maintained - Turn-to-Release
Shape of Head	Round
Size	22mm
Type	XB5

Shipping and Ordering

Category	22467 - Push Buttons, Plastic, 22mm, ZB5, XB5
Discount Schedule	I
GTIN	00785901354819
Package Quantity	1
Weight	0.08 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	FR

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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SECTION 8 - MOTOR CONTROL PANEL COMPONENTS

ENCLOSURE NEMA 4 36 X 30 X 12 - MILD STEEL/GRAY - HAMMOND EN4SD363012GY

VENT FAN 210CFM 115VAC 6 IN - HAMMOND FAN150AC115

VENT FAN ADJ. 30-140F BI-METAL TEMP SWITCH N.O. - HAMMOND SKT011419NO

VFD ETHERNET SWITCH UNMANAGED 10/100 BASET RJ45 PORTS - ADI SE-SW5U

DURAPULSE VFD 5 HP 9.6 AMP 460V 3-PHASE - ADI GS3-45P0

VFD ETHERNET MODULE 100Mbps FOR GS SERIES AC DRIVES - ADI GS-EDRV100

HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Type 4 Mild Steel Wallmount Enclosure *Eclipse Series*

Hinge Door with Quarter Turn/Handle







Panel Sold Separately

Application

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

Standards

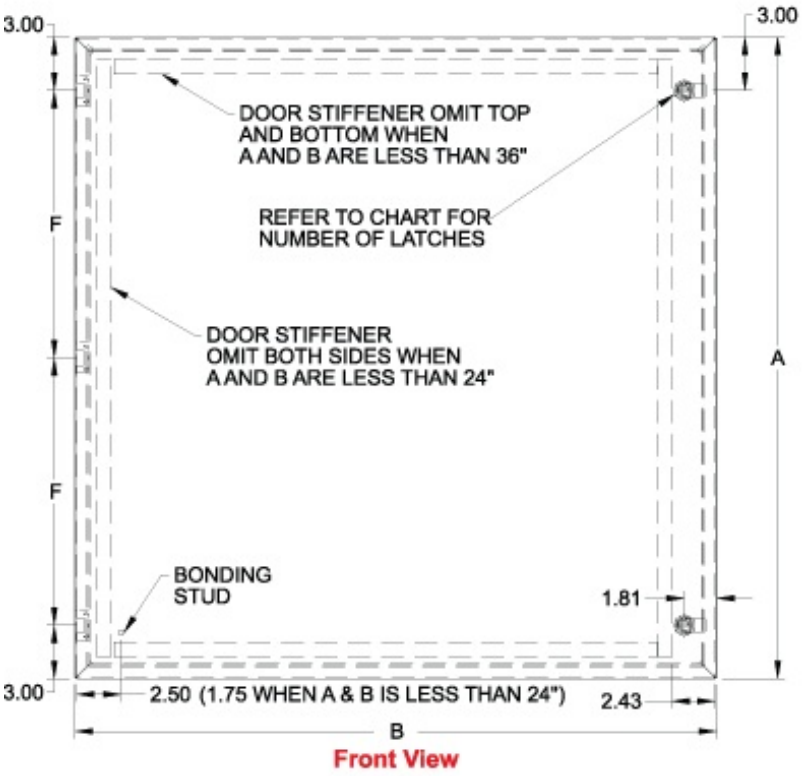
- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
  - NEMA Type 3R, 4, and 12
  - IEC 60529, IP66

Construction

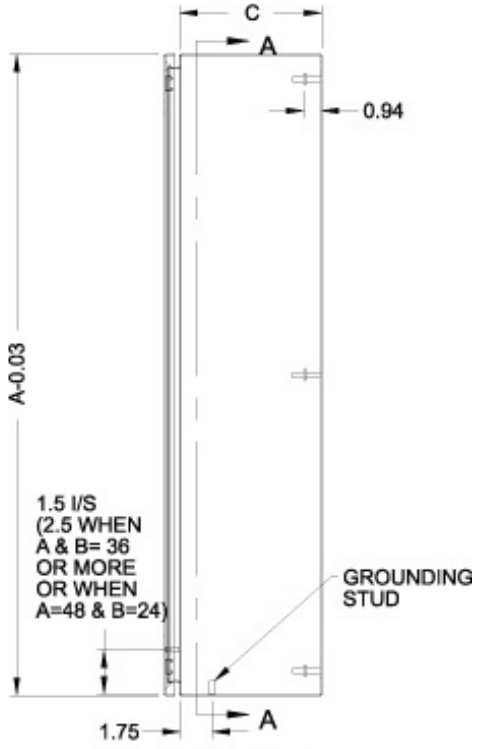
- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

Finish

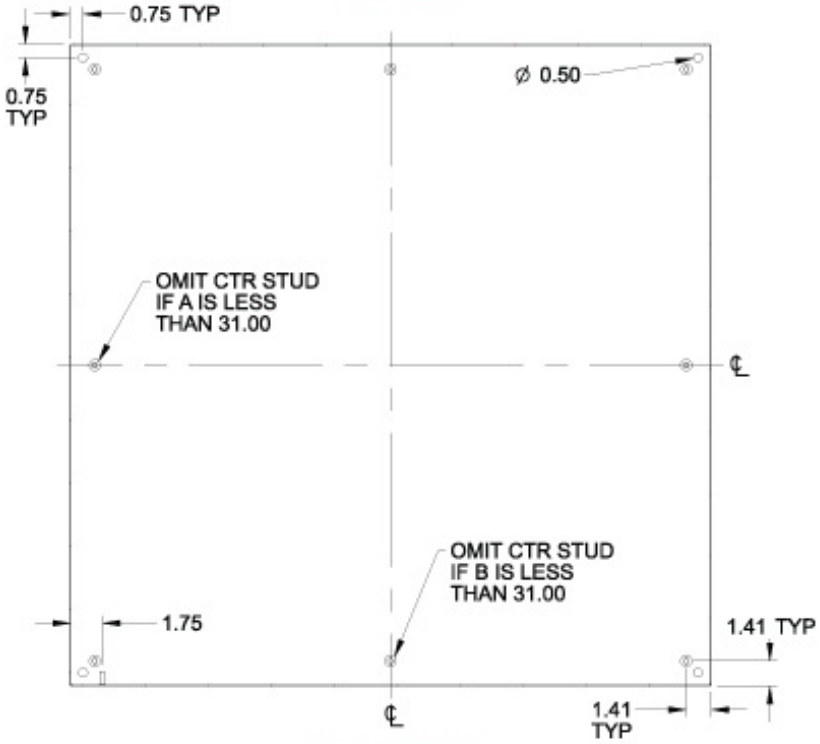
- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).



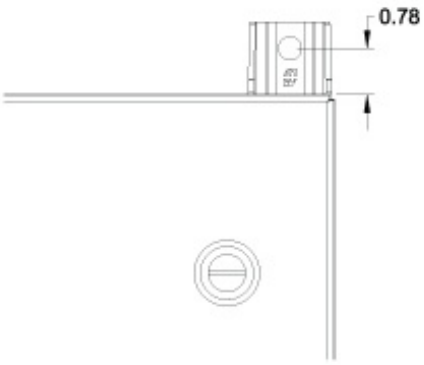
Front View



Side View



SECTION A-A



Mounting Foot Detail

Part No. (ANSI 61 Gray)	Part No. (RAL 7035 Light Gray)	Overall Dimensions A	B	C	Door/Body Gauge	Latches Qty	Type	Opt. Panel Part No.	Panel Size D	E	# Hinges	F	Ship Wt. (lbs)
EN4SD12126GY	**EN4SD12126LG**	12.00	12.00	6.00	16	1	Qtr Turn	**EP1212**	10.20	10.20	2	6.00	12
EN4SD12246GY	**EN4SD12246LG**	12.00	24.00	6.00	16	1	Qtr Turn	**EP1224**	10.20	22.20	2	18.00	24
EN4SD16126GY	**EN4SD16126LG**	16.00	12.00	6.00	16	1	Qtr Turn	**EP1612**	14.20	10.20	2	10.00	16
EN4SD16166GY	**EN4SD16166LG**	16.00	16.00	6.00	16	1	Qtr Turn	**EP1616**	14.20	14.20	2	10.00	19
EN4SD16206GY	**EN4SD16206LG**	16.00	20.00	6.00	16	1	Qtr Turn	**EP1620**	14.20	18.20	2	10.00	22
EN4SD20126GY	**EN4SD20126LG**	20.00	12.00	6.00	16	1	Qtr Turn	**EP2012**	18.20	10.20	2	14.00	20

EN4SD242410GY	**EN4SD242410LG**	24.00	24.00	10.00	14	2	Qtr. Turn	**EP2424**	22.20	22.20	2	18.00	45
EN4SD243010GY	**EN4SD243010LG**	24.00	30.00	10.00	14	2	Qtr. Turn	**EP2430**	22.20	28.20	2	18.00	53
EN4SD302010GY	**EN4SD302010LG**	30.00	20.00	10.00	14	2	Qtr. Turn	**EP3020**	28.20	18.20	3	12.00	47
EN4SD302410GY	**EN4SD302410LG**	30.00	24.00	10.00	14	2	Qtr. Turn	**EP3024**	28.20	22.20	3	12.00	53
EN4SD303010GY	**EN4SD303010LG**	30.00	30.00	10.00	14	2	Qtr. Turn	**EP3030**	28.20	28.20	3	12.00	75
EN4SD362410GY	**EN4SD362410LG**	36.00	24.00	10.00	14	2	Qtr. Turn	**EP3624**	34.20	22.20	3	15.00	70
EN4SD363010GY	**EN4SD363010LG**	36.00	30.00	10.00	14	2	Qtr. Turn	**EP3630**	34.20	28.20	3	15.00	84
EN4SD363610GY	**EN4SD363610LG**	36.00	36.00	10.00	14	2	Qtr. Turn	**EP3636**	34.20	34.20	3	15.00	100
EN4SD423010GY	**EN4SD423010LG**	42.00	30.00	10.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	107
EN4SD423610GY	**EN4SD423610LG**	42.00	36.00	10.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	117
EN4SD482410GY	**EN4SD482410LG**	48.00	24.00	10.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	95
EN4SD483010GY	**EN4SD483010LG**	48.00	30.00	10.00	14	1	3-point	**EP4830**	46.20	28.20	4	14.00	120
EN4SD483610GY	**EN4SD483610LG**	48.00	36.00	10.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	125
EN4SD603610GY	**EN4SD603610LG**	60.00	36.00	10.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	150
EN4SD201612GY	**EN4SD201612LG**	20.00	16.00	12.00	16	1	Qtr Turn	**EP2016**	18.20	14.20	2	14.00	32
EN4SD202012GY	**EN4SD202012LG**	20.00	20.00	12.00	16	1	Qtr Turn	**EP2020**	18.20	18.20	2	14.00	34
EN4SD242012GY	**EN4SD242012LG**	24.00	20.00	12.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	38
EN4SD242412GY	**EN4SD242412LG**	24.00	24.00	12.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	47
EN4SD302412GY	**EN4SD302412LG**	30.00	24.00	12.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	57
EN4SD303012GY	**EN4SD303012LG**	30.00	30.00	12.00	14	2	Qtr Turn	**EP3030**	28.20	28.20	3	12.00	80
EN4SD362412GY	**EN4SD362412LG**	36.00	24.00	12.00	14	2	Qtr Turn	**EP3624**	34.20	22.20	3	15.00	62
EN4SD363012GY	**EN4SD363012LG**	36.00	30.00	12.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	91
EN4SD363612GY	**EN4SD363612LG**	36.00	36.00	12.00	14	2	Qtr Turn	**EP3636**	34.20	34.20	3	15.00	104
EN4SD423012GY	**EN4SD423012LG**	42.00	30.00	12.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	111
EN4SD423612GY	**EN4SD423612LG**	42.00	36.00	12.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	121
EN4SD482412GY	**EN4SD482412LG**	48.00	24.00	12.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	98
EN4SD483612GY	**EN4SD483612LG**	48.00	36.00	12.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603612GY	**EN4SD603612LG**	60.00	36.00	12.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	165
EN4SD723012GY	**EN4SD723012LG**	72.00	30.00	12.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	190
EN4SD723612GY	**EN4SD723612LG**	72.00	36.00	12.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	195
EN4SD242016GY	**EN4SD242016LG**	24.00	20.00	16.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	52
EN4SD242416GY	**EN4SD242416LG**	24.00	24.00	16.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	66
EN4SD302416GY	**EN4SD302416LG**	30.00	24.00	16.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	85
EN4SD363016GY	**EN4SD363016LG**	36.00	30.00	16.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	102
EN4SD423616GY	**EN4SD423616LG**	42.00	36.00	16.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	140
EN4SD483616GY	**EN4SD483616LG**	48.00	36.00	16.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603616GY	**EN4SD603616LG**	60.00	36.00	16.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	200
EN4SD723016GY	**EN4SD723016LG**	72.00	30.00	16.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	215
EN4SD723616GY	**EN4SD723616LG**	72.00	36.00	16.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	217
EN4SD242420GY	**EN4SD242420LG**	24.00	24.00	20.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	70
EN4SD302420GY	**EN4SD302420LG**	30.00	24.00	20.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	82
EN4SD363020GY	**EN4SD363020LG**	36.00	30.00	20.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	117

HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Tube Axial Fans *DNMF Series*









Features

- Choice of 4.70" (120mm), 3.15" (80mm), 5.91" (150mm) or 10" (254mm).
- Choice of either 115 or 230 VAC, 50/60 Hz.
- Impedance protected motor.
- Class-B insulated.
- Ball bearing construction, metal or plastic blades.
- Diecast aluminum body.
- DNMF100AC, FAN150AC and FAN10A fans have male plug terminations (requires fan cords).
- FAN80AC fans have 11" long lead wires.
- Fan is cooled by incoming air.
- Fan component is recognized to UL 507 and CSA certified.
- Includes mounting hardware.

Accessories

- Fan Cords

Part No. 115 VAC	Part No. 230 VAC	Overall Dimensions Height	Width	Depth	CFM	Wattage 50Hz	60Hz	Speed (RPM)	Noise (dB)	Use With Fan Guard Part No.	Use With Filter Grill Part No.
FAN80AC115	**FAN80AC230**	3.15	3.15	1.50	32	11	10	3100	34	FAN80FG	XPFA80*
DNMF100AC115	**DNMF100AC230**	4.70	4.70	1.50	105	24	22	3000	50	DNFG	XPFA120*
FAN150AC115	**FAN150AC230**	5.75 & 5.90	6.72	2.00 & 2.20	210 & 230	27 & 46	26 & 40	3100 & 3400	63 & 53	FAN150FG	n/a
FAN10A115	**FAN10A220**	10.00 dia.		3.50	550	30	35	1650	55	FAN10FG	XPFA254*

Data subject to change without notice

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Thermostats *SKT Series*



Features

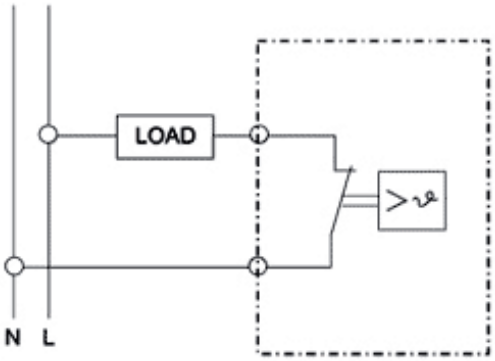
- Designed to provide air temperature control and monitoring in cabinets.
- Thermostat NC (Normally Closed) for the control of heaters and heater fans
- Thermostat NO (Normally Open) for the control of cooling units, or for switching signal transmitters in case of overheating.
- Available in Fahrenheit or Celsius.

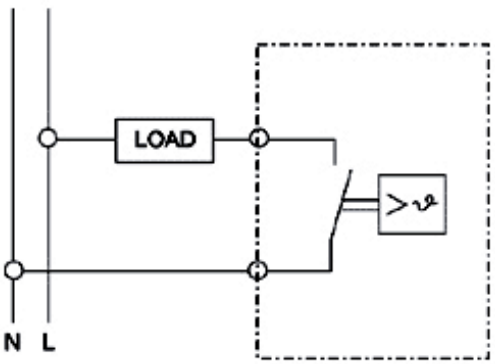
NC - Normally Closed (Red)

- Used in conjunction with heaters.
- Contact opens when rising temperatures reach the set point temperature, shutting heater off.

NO - Normally open (Blue)

- Used in conjunction with fans.
- Contact closes when rising temperatures reach the set point temperature, turning fan on.





Part No.	Scale	Contact Type	Dimensions Height x Width x Depth	Switching Capacity	Ship Wt. lbs
SKT011409NC	F°	Normally Closed	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1

Part No.	Scale	Contact Type	Dimensions Height x Width x Depth	Switching Capacity	Ship Wt. lbs
SKT011409NC-C	C°	Normally Closed	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1
SKT011419NO	F°	Normally Open	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1
SKT011419NO-C	C°	Normally Open	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1

Sensor Element:	Thermostatic bi-metal
Switching difference (hysteresis):	+ or - 4°F (+or- 3°K)
Adjustment Range:	30 - 140°F
Noise Suppression:	N (according to VDE 0875)
Connection:	2 pole terminal for AWG 14 (2.5 mm²)
Mounting:	Easily installed by clip mounting on 35 or 38mm DIN rail (included)
Housing:	Flame retardant plastic UL94VO
Color:	Gray (SB)
Protection:	IP20
Approval:	UL Recognized Component, cUL Recognized Component, CE

Data subject to change without notice

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Stride® Unmanaged Industrial Ethernet Switches

5-Port Ethernet Switch - Plastic Case

STRIDE SlimLine Industrial Unmanaged Ethernet Switch, plastic case, -10 to +60 °C operating temperature range, five 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection, auto-crossover, DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL1604 (Class I, Div. 2, Groups A, B, C, D) and CE marked.



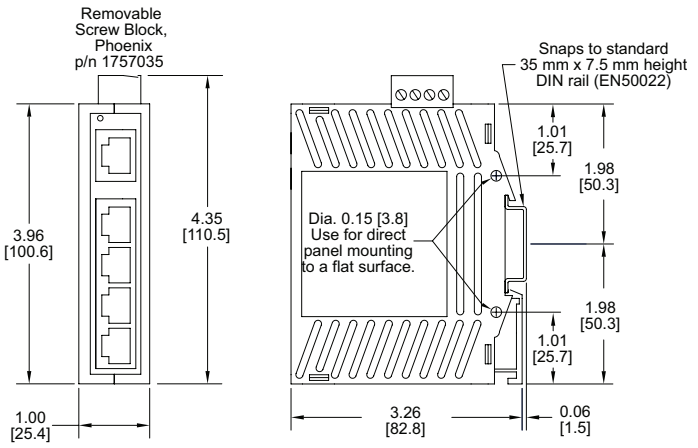
SE-SW5U

$99.00

Dimensions

Inches [mm]

5 Port – SE-SW5U



ACT/LNK LED

This is the **Yellow** LED on models with a Yellow and a Green LED per RJ45 port.

ON (yellow) (not flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, but no communications activity is detected.
ON (yellow) (flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, and that there is communications activity.
OFF	Indicates that there is not a proper Ethernet connection (Link) between the port and another Ethernet device. Make sure the cable has been plugged securely into the ports at both ends.

Speed 10/100 LED

This is the **Green** LED on models with a Yellow and a Green LED per RJ45 port.

ON (green)	A 100 Mbps (100BaseT) connection is detected.
OFF	A 10 Mbps (10BaseT) connection is detected.

Specifications

The following are specifications relevant to the SE-SW5U 5-Port Ethernet Switch.

Input power (typical with all ports active at 100 Mbps)	2.0 W
Weight	4 oz (0.11 kg)
Power connector max. screw torque	5.0 lb-in (0.57 Nm)

Stride® Unmanaged Industrial Ethernet Switches & Media Converter

General Specifications		
Ethernet switch type	Up to 9 ports	
Operating mode	Store and forward wire speed switching, non-blocking	
Devices supported	All IEEE 802.3 compliant devices are supported	
Standards	IEEE 802.3, 802.3u, 802.3x	
MAC addresses	1024 addresses	
Memory bandwidth	3.2 Gbps	
Latency for 10 Mbps ports	16 us + frame time (typical)	
Latency for 100 Mbps ports	5 us + frame time (typical)	
Power input	Redundant Input Terminals	
Input power (typical with all ports active at 100 Mbps)	SE-MC2U-ST SE-MC2U-SC SE-SW5U SE-SW5U-WT	2.0 W
	SE-SW5U-ST SE-SW5U-SC SE-SW5U-ST-WT SE-SW5U-SC-WT	3.0 W
	SE-SW8U SE-SW8U-WT	4.0 W
	SE-SW9U-ST SE-SW9U-SC SE-SW9U-ST-WT SE-SW9U-ST-WC	5.0 W
Input voltage	10-30 VDC (continuous) - Class 2 Power Supply	
Reverse power protection	Yes	
Transient protection	15,000 watts peak	
Spike protection	5,000 watts (10x for 10 uS)	
Ethernet isolation	1500 VRMS 1 minute	
Operating temperature range	SE-MC2U-ST SE-MC2U-SC SE-SW5U SE-SW8U SE-SW5U-ST SE-SW5U-SC SE-SW9U-ST SE-SW9U-SC	-10 to +60 °C (+14 to +140 °F), cold startup at -10 °C (+14 °F)
	SE-SW5U-WT SE-SW8U-WT SE-SW5U-ST-WT SE-SW5U-SC-WT SE-SW9U-ST-WT SE-SW9U-SC-WT	-40 to +85 °C (-40 to +185 °F), cold startup at -40 °C (-40 °F)
Storage temperature range	-40 to +85 °C (-40 to +185 °F)	
Humidity (non-condensing)	5 to 95% RH	
Environmental Air	No corrosive gasses permitted	
Vibration, shock & freefall	IEC68-2-6, -27, -32	
Agency Approvals	UL/cUL 508, CSA C22 per EN61010-1, UL/cUL 1604 (Class 1, Div. 2, Groups A, B, C, D), CSA C 22.2/213 9 per EN50021/EN60079-15 (Zone 2, Category 3), CE (ATEX)	
EMI emissions	FCC part 15, ICES-003, EN55022	
EMC immunity	IEC61326-1	
RoHS and WEEE	RoHS (Pb free) and WEEE compliant	
Environmental Air	For use in Pollution Degree 2 environment	

General Specifications Cont'd		
Packaging and protection	SE-MC2U-ST SE-MC2U-SC SE-SW5U SE-SW8U SE-SW5U-ST SE-SW5U-SC SE-SW9U-ST SE-SW9U-SC	UL94V0 Lexan, IP30
	SE-SW5U-WT SE-SW8U-WT SE-SW5U-ST-WT SE-SW5U-SC-WT SE-SW9U-ST-WT SE-SW9U-SC-WT	Aluminum IP30
Dimensions (L x W x H)	See mechanical diagrams for details	

Copper RJ45 Ports: (10/100BaseT)	
10/100BaseT ports	Shielded RJ45
Protocols supported	All standard IEEE 802.3
Ethernet compliancy	IEEE 802.3, 802.3u, 802.3x
Auto-crossover	Yes, allows you to use straight-through or crossover wired cables
Auto-sensing operation	Yes, Full and half duplex
Auto-negotiating	Yes, 10BaseT and 100BaseT
Auto-polarity	Yes, on the TD and RD pair
Flow control	Automatic
Ethernet isolation	1500 VRMS 1 minute
Plug and play	Yes
Cable requirements	Twisted pair (Cat. 5 or better) (shielded recommended)
Max. cable distance	100 meters

Fiber Port: (100BaseFX multimode)	
100BaseFX ports	1
Fiber port mode	Multimode (mm)
Fiber port connector	ST – models SE-XXXX-ST and SE-XXXX-ST-WT SC – models SE-XXXX-SC and SE-XXXX-SC-WT
Optimal fiber cable	50/125 or 62.5/125 µm
Center wavelength	1300 nm
Multimode	Links up to 4 km typ.; 1300 nm; use with 50 or 62.5/125 um fiber > Transmitter power (dB): -21 min, -17 typ, -14 max > Receiver sensitivity (dB): -34 typ, -31 max
Nominal max. distance (full duplex)	4 km
Half and full duplex	Full duplex
Ethernet compliance	100BaseFX
Eye safety (laser)	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11

Complete documentation

Documentation can be downloaded from www.automationdirect.com.

DURAPULSE AC Drives – Introduction



DURApulse Drives																
Motor Rating	*Hp*	*1*	*2*	*3*	*5*	*7.5*	*10*	*15*	*20*	*25*	*30*	*40*	*50*	*60*	*75*	*100*
	kW	*.75*	*1.5*	*2.2*	*3.7*	*5.5*	*7.5*	*11*	*15*	*18.5*	*22*	*30*	*37*	*45*	*55*	*75*
Single/Three-Phase Input 230V		✔	✔	✔												
Three-Phase 230VClass					✔	✔	✔	✔	✔	✔	✔	✔	✔			
Three-Phase 460V Class		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Overview

The *DURAPULSE* series of AC drives offers all of the features of our GS2 series of drives including dynamic braking, PID, removable keypad and RS-485 Modbus communication. The *DURAPULSE* AC drive also offers sensorless vector control with the option of encoder feedback for enhanced speed control. The standard **smart** keypad (or Human Interface Module) is designed with defaults for the North American customer and allows you to configure the drive, set the speed, start and stop the drive, and monitor critical parameters for your application. In addition, this keypad has internal memory that allows **four** complete programs to be stored and transferred to any *DURAPULSE* drive. The *DURAPULSE* series offers three analog inputs, eleven digital inputs, and one SPDT relay output.

Features

- Simple Volts/Hertz control
- Sensorless vector control with autotune
- Sensorless vector control with optional encoder feedback card, for better speed control
- Sinusoidal pulse width modulation (PWM)
- Variable carrier frequency, depending on model
- IGBT technology
- Starting torque: 125% @ 0.5 Hz/150% @ 1Hz
- 150% rated current for one minute
- Electronic overload protection
- Stall prevention
- Adjustable accel and decel ramps with linear and S-curve settings
- Automatic torque and slip compensation
- Internal dynamic braking circuit for models under 20 hp; optional baking units available for models 20 hp and above
- DC braking
- Five skip frequencies
- Trip history
- Programmable jog speed
- Integral PID control
- Removable **smart** keypad with parameter upload/download
- Keypad with memory to store up to four programs of any *DURAPULSE* drive
- Eleven programmable digital inputs
- Three programmable analog inputs
- Three digital and one SPDT relay programmable outputs
- One programmable analog output
- One digital frequency output
- RS-485 Modbus communications
- Ethernet communication optional
- Two-year warranty
- UL/cUL/CE listed

Accessories

- AC line reactors
- EMI filters
- RF filter
- Braking resistors
- Braking units (for models 20 hp and above)
- Fuse kits and replacement fuses
- Replacement cooling fans
- Remote panel adapter
- Replacement keypad
- Keypad cables in 1, 3, and 5-meter lengths
- Ethernet interface
- Four and eight-port RS-485 multi-drop termination boards
- KEP***Direct*** I/O or OPC Server
- GSoft drive configuration software
- GS3-FB – feedback card
- GS-485HD15-CBL – ***ZIP***Link RS485 communication cable for connection to the DL06 and D2-260 15-pin ports
- USB-485M – USB to RS-485 PC adapter (see "Communications Products" chapter for detailed information)

Detailed descriptions and specifications for GS accessories are available in the "GS/DURAPULSE Accessories" section.

DURAPULSE part numbering system

GS3 - 2 020

Applicable Motor Capacity

1P0: 1HP	2P0: 2HP
3P0: 3HP	5P0: 5HP
7P5: 7.5HP	010: 10HP
015: 15HP	020: 20HP
025: 25HP	030: 30HP
040: 40HP	050: 50HP
060: 60HP*	075: 75HP*
100: 100HP*	

* 60, 75 and 100HP models available in GS3-4xxx only

Input Voltage

2: 200-240VAC
4: 380-480VAC

Series Name

Typical Applications

- Conveyors
- Fans
- Pumps
- Compressors
- HVAC
- Material handling
- Mixing
- Shop tools
- Extruding
- Grinding

DURApulse AC Drives Specifications

230V Class													
Model Name: GS3-xxx			21P0	22P0	23P0	25P0	27P5	2010	2015	2020	2025	2030	2040	2050
Price			$242.00	$293.00	$347.00	$400.00	$549.00	$698.00	$889.00	$1,104.00	$1,298.00	$1,486.00	$2,177.00	$2,637.00
Output Rating	**Maximum Motor Output**	**HP**	1.0	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50
		kW	.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37
	Rated Output Current (A)		5	7	11	17	25	33	49	65	75	90	120	145
	Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)											
	Rated Frequency		0.1 to 400 Hz											
*** Input Rating**	**Rated Voltage/Frequency**		Single/Three-phase			Three-phase								
			200/208/220/230/240 VAC, 50/60Hz											
	Rated Input Current (A)		11.9 / 5.7	15.3 / 7.6	22 / 15.5	20.6	26	34	50	60	75	90	110	142
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%											
Watt Loss @ 100% I (W)			60	82	130	194	301	380	660	750	920	1300	1340	1430
Weight (lb [kg])			4.5 [2.034]	4.5 [2.034]	9.4 [4.24]	9.4 [4.24]	13.3 [6.031]	13.3 [6.031]	14.3 [6.487]	26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]

** All 3-phase power sources must be symmetrical.*
Do not connect any DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

460V Class – Three-Phase															
Model Name: GS3-xxx			41P0	42P0	43P0	45P0	47P5	4010	4015	4020	4025	4030	4040	4050	4060	4075	4100
Price			$323.00	$360.00	$385.00	$427.00	$513.00	$734.00	$957.00	$1,165.00	$1,383.00	$1,570.00	$2,001.00	$2,436.00	$2,788.00	$3,130.00	$3,498.00
Output Rating	**Maximum Motor Output**	**HP**	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100
		kW	.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
	Rated Output Current (A)		2.7	4.2	5.5	8.5	13	18	24	32	38	45	60	73	91	110	150
	Maximum Output Voltage		Three-phase 380 to 480V (proportional to input voltage)														
	Rated Frequency		0.1 to 400 Hz														
***Input Rating**	**Rated Voltage/ Frequency**		Three-phase, 380/400/415/440/460/480VAC, 50/60Hz														
	Rated Input Current (A)		3.2	4.3	5.9	11.2	14	19	25	32	39	49	60	63	90	130	160
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%														
Watt Loss @ 100% I (W)			70	102	132	176	250	345	445	620	788	1290	1420	1680	2020	2910	3840
Weight (lb [kg])			3.9 [1.759]	4.4 [1.994]	4.1 [1.857]	9.4 [4.24]	13.2 [6.002]	13.5 [6.106]	14.4 [6.525]	26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]	77.2 [35]	116.8 [53]	116.8 [53]

** All 3-phase power sources must be symmetrical.*
Do not connect any DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

DURAPULSE AC Drives General Specifications

General Specifications			
Control Characteristics			
Control System			Pulse Width Modulation, Carrier frequency adjustable from 1k–15kHz depending on the model. This system determines the control methods of the AC drive. 00: V/Hz open loop control 01: V/Hz closed loop control 02: Sensorless Vector 03: Sensorless Vector with external feedback
Rated Output Frequency			0.1 to 400.0 Hz
Output Frequency Resolution			0.1 Hz
Overload Capacity			150% of rated current for 1 minute
Torque Characteristics			Includes auto-torque boost, auto-slip compensation, starting torque 125% @ 0.5 Hz / 150% @ 1.0 Hz
Braking Torque			20% without braking resistor, 125% with optional braking resistor (braking circuit built-in only for units under 20 hp)
DC Braking			Operation frequency 60–0 Hz, 0–100% rated current, Start time 0.0–5.0 seconds, Stop time 0.0–25.0 seconds
Acceleration/Deceleration Time			0.1 to 600 seconds (linear or non-linear acceleration/deceleration), second acceleration/deceleration available
Voltage/Frequency Pattern			Settings available for Constant Torque - low & high starting torque, Variable Torque - low & high starting torque, and user configured
Stall Prevention Level			20 to 200% of rated current
Operation Specifications			
Inputs	**Frequency Setting**	**Keypad**	Setting by <UP> or <DOWN> buttons
		External Signal	Potentiometer - 3 to 5 kΩ, 0 to 10 VDC (input impedance 10 kΩ), -10 to +10 VDC, 4 to 20 mA (input impedance 250Ω), 0 to 20 mA; Multi-Speed Inputs 1 to 4, RS-232C/RS-485 communication interface
	Operation Setting	**Keypad**	Setting by <RUN>, <STOP>, <JOG> , <FWD>, <REV> buttons
		External Signal	Forward/Stop, Reverse/Stop (run/stop, fwd/rev), 3-wire control, Serial Communication RS-232C & RS-485 (Modbus RTU)
	Input Terminals	**Digital Sink/Source Selectable**	11 user-programmable: FWD/STOP, REV/STOP, RUN/STOP, REV/FWD, RUN momentary (N.O.), STOP momentary (N.C.), External Fault (N.O./N.C.), External Reset, Multi-Speed Bit (1-4), Manual Keyboard Control, Jog, External Base Block (N.O./N.C.), Second Accel/Decel Time, Speed Hold, Increase Speed, Decrease Speed, Reset Speed to Zero, PID Disable (N.O.), PID Disable (N.C.), Input Disable
		Analog	3 user-configurable, 0 to 10V (input impedance 10 kΩ), 0 to 20 mA, 4 to 20 mA (input impedance 250Ω), 10 bit resolution -10V to +10V, 10 bit resolution
Outputs	**Output Terminals**	**Digital 3 transistors 1 relay**	4 user-programmable: Inverter Running, Inverter Fault, At Speed, Zero Speed, Above Desired Frequency, Below Desired Frequency, At Maximum Speed, Over Torque Detected, Above Desired Current, Below Desired Current, PID Deviation Alarm, Heatsink Overheat Warning (OH), Soft Braking Signal, Above desired Frequency 2, Below desired Frequency 2, Encoder Loss
		Digital Square Wave	One digital square wave output representing drive frequency
		Analog	1 user-programmable, 0 to 10V, 8 bit resolution frequency, current, process variable PV
Operating Functions			Automatic voltage regulation, voltage/frequency characteristics selection, non-linear acceleration/deceleration, upper and lower frequency limiters, 15-stage speed operation, adjustable carrier frequency (1 to 15 kHz), PID control, 5 skip frequencies, analog gain & bias adjustment, jog, electronic thermal relay, automatic torque boost, trip history, software protection
Protective Functions			Electronic Thermal, Overload Relay, Auto Restart after Fault, Momentary Power Loss, Reverse Operation Inhibit, Auto Voltage Regulation, Over-Voltage Stall Prevention, Auto Adjustable Accel/Decel, Over-Torque Detection Mode, Over-Torque Detection Level, Over-Torque Detection Time, Over-Current Stall Prevention during Acceleration, Over-Current Stall Prevention during Operation
Operator Interface	**Operator Devices**		9-key, 2 line x 16 character LCD display, 5 status LEDs
	Programming		Parameter values for setup and review, fault codes
	Status Display		Output Frequency, Motor Speed, Scaled Frequency, Output Current, Motor Load, Output Voltage, DC Bus Voltage, PID Setpoint, PID Feedback, Frequency Setpoint
	Key Functions		RUN, STOP/RESET, FWD/REV, PROGRAM, DISPLAY, <UP>, <DOWN>, ENTER
Environment	**Enclosure Rating**		Protected Chassis, IP20
	Ambient Temperature		-10°C to 40°C (14°F to 104°F)
	Storage Temperature		-20°C to 60°C (-4°F to 140°F) – during short term transportation period
	Ambient Humidity		20 to 90% RH (non-condensing)
	Vibration		9.8 m/s^2 (1G) less than 10 Hz; 5.9 m/s^2 (0.6G) 10 to 60 Hz
	Installation Location		Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust
Options			Noise filter, input AC reactor, output AC reactor, cable for remote operator, programming software, dynamic braking resistor, dynamic braking unit; RF filter; remote panel adapter; Ethernet interface; four and eight port RS-485 multi-drop termination boards, replacement keypads, fuse kits and replacement fuses

DURAPULSE Drives Specifications – Installation

Understanding the installation requirements for your *DURAPULSE* AC drive will help to ensure that it operates within its environmental and electrical limits.

Note: Never use only this catalog for installation instructions or operation of equipment; refer to the user manual, GS3-M.

Environmental Specifications	
Protective Structure [1]	IP20
Ambient Operating Temperature [2]	-10 to 40°C (14°F to 104°F) f
Storage Temperature [3]	-20 to 60°C (-4°F to 140°F)
Humidity	To 90% (no condensation)
Vibration [4]	9.8 m/s² (1g), less than 10 Hz 5.9 m/s² (0.6g),10 to 60 Hz
Location	Altitude 1,000 m or less, indoors (no corrosive gases, liquids or dust)

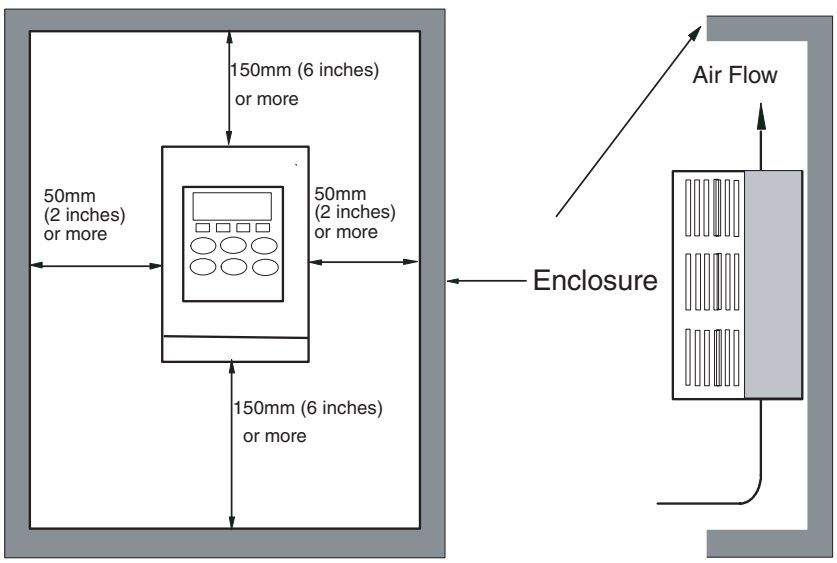
1: Protective structure is based upon EN60529

2: The ambient temperature must be in the range of -10° to 40°C. If the range will be up to 50°C, you will need to set the carrier frequency to 2.1 kHz or less and derate the output current to 80% or less.

3: The storage temperature refers to the short-term temperature during transport.

4: Conforms to the test method specified in JIS CO911 (1984)

Watt-loss Chart	
GS3 Drive Model	***At full load***
GS3-21P0	60
GS3-22P0	82
GS3-23P0	130
GS3-25P0	194
GS3-27P5	301
GS3-2010	380
GS3-2015	660
GS3-2020	750
GS3-2025	920
GS3-2030	1300
GS3-2040	1340
GS3-2050	1430
GS3-41P0	70
GS3-42P0	102
GS3-43P0	132
GS3-45P0	176
GS3-47P5	250
GS3-4010	345
GS3-4015	445
GS3-4020	620
GS3-4025	788
GS3-4030	1290
GS3-4040	1420
GS3-4050	1680
GS3-4060	2020
GS3-4075	2910
GS3-4100	3840



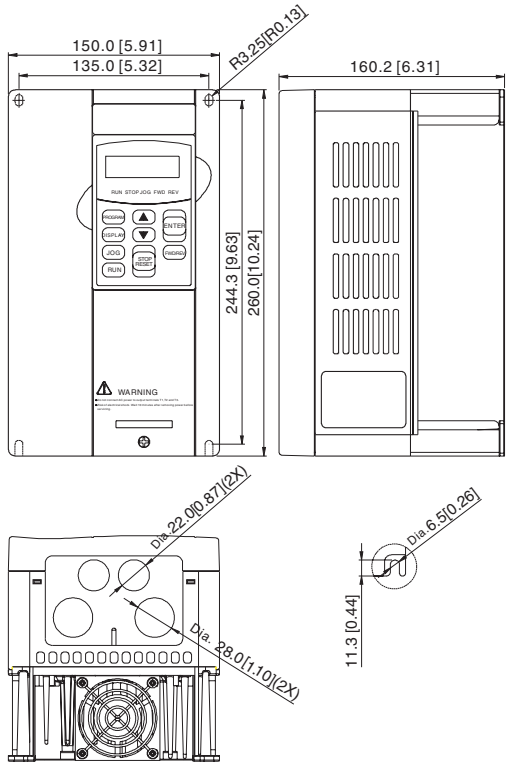
Minimum Clearances and Air Flow

Warning: AC drives generate a large amount of heat which may damage the AC drive. Auxiliary cooling methods are typically required in order not to exceed maximum ambient temperatures.

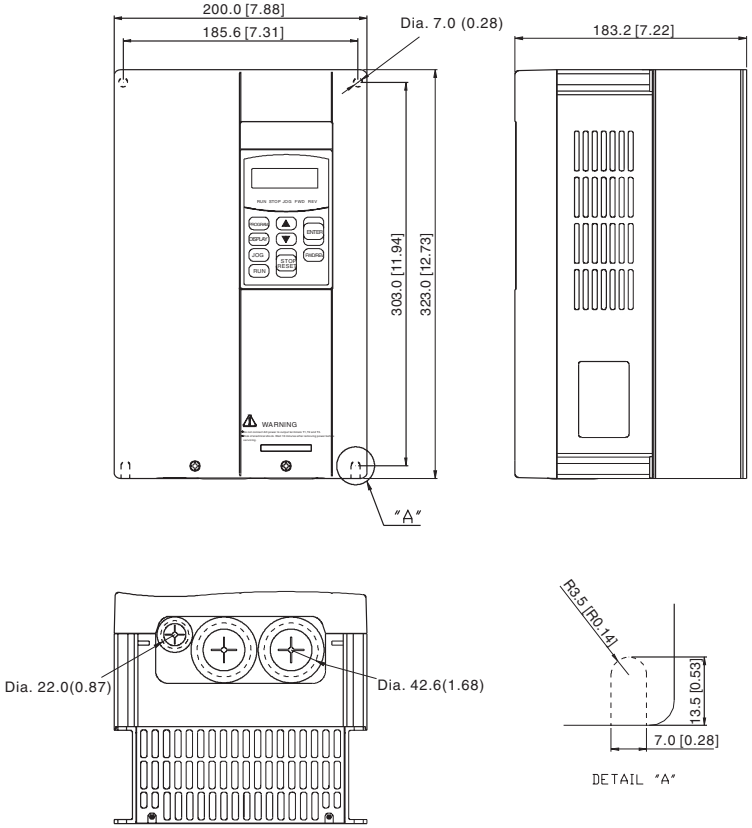
Warning: Maximum ambient temperatures must not exceed 50°C (122°F), or 40°C (104°F) for models 7.5 hp (5.5 kW) and higher!

DURAPULSE AC Drives — Dimensions

GS3-23P0, GS3-25P0, GS3-45P0



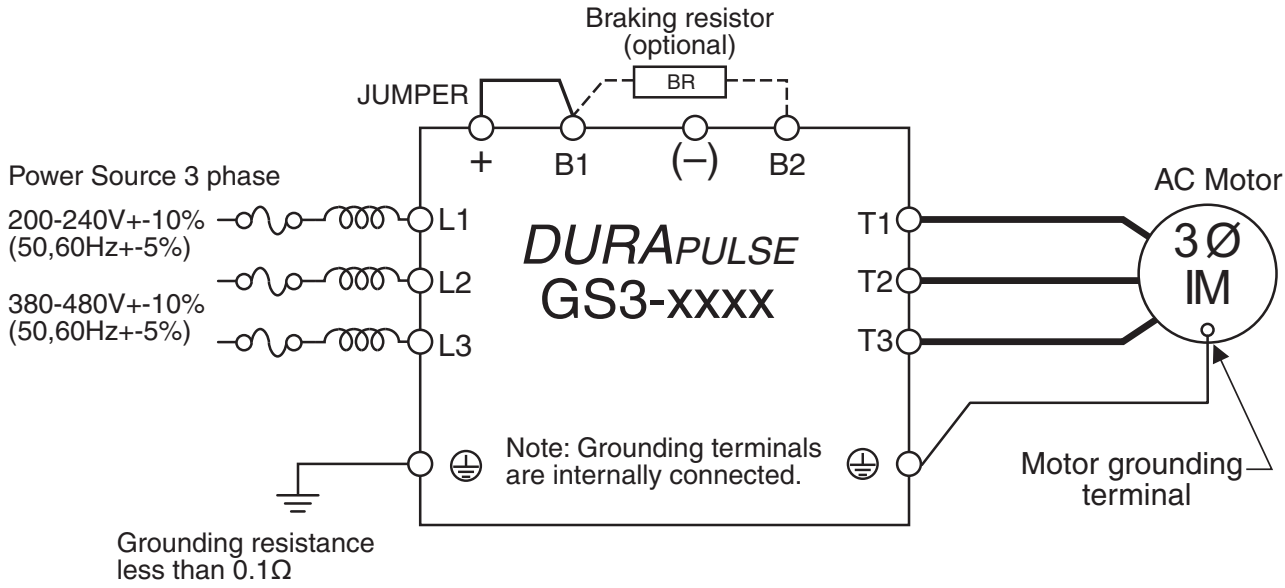
GS3-27P5, GS3-2010, GS3-2015, GS3-47P5, GS3-4010, GS3-4015



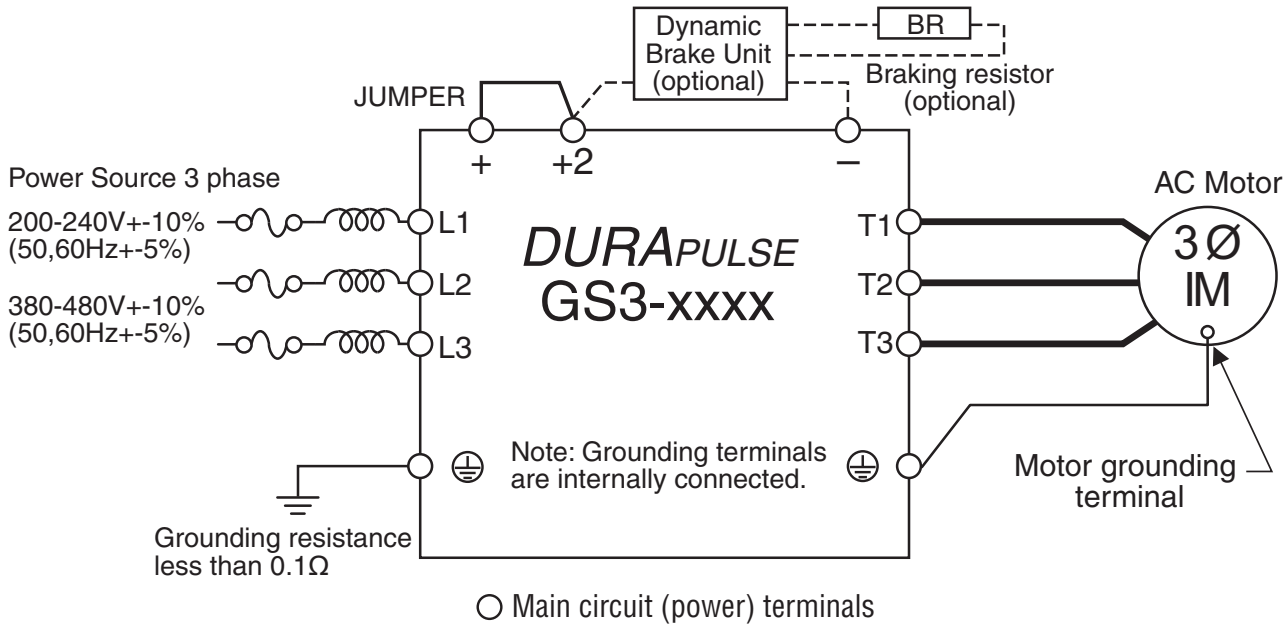
unit: mm(in)

DURAPULSE AC Drives Quick Reference

Power Wiring Diagram for drives under 20HP

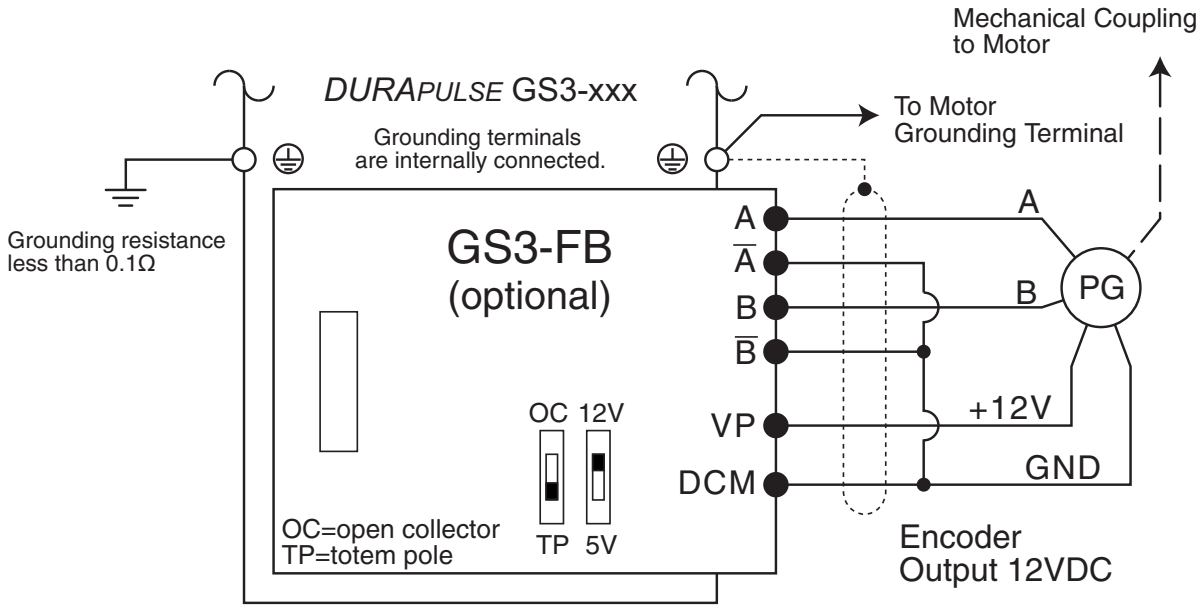


Power Wiring Diagram: 20-30HP(230VAC) & 20-60HP(460VAC)



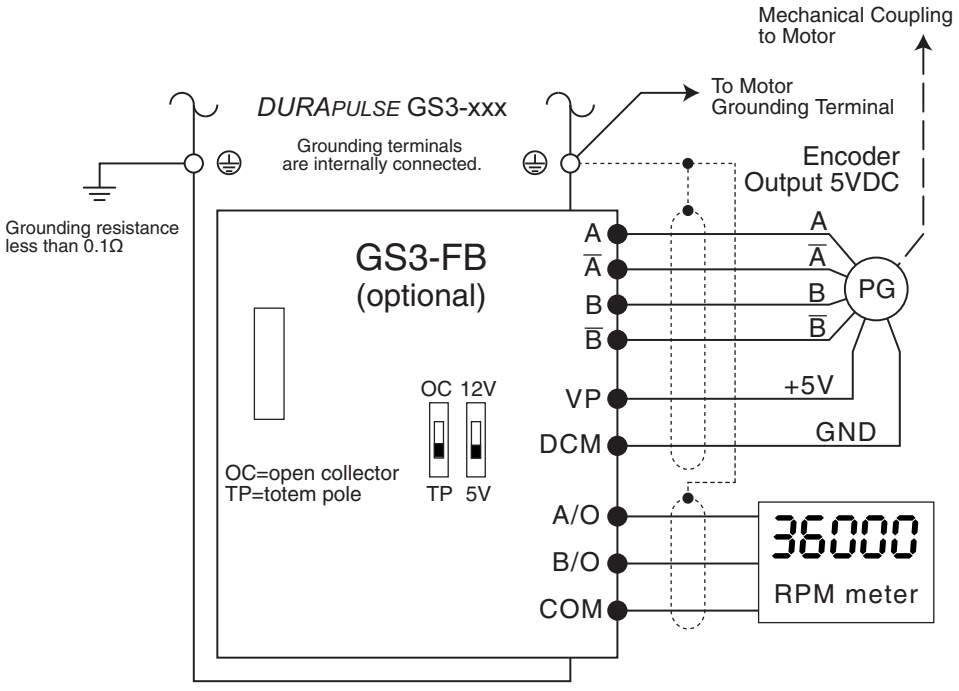
"3Ø IM" denotes three phase induction motor.

GS3-FB - Wiring Diagram - Output Voltage or Complimentary type Encoder



○ Main circuit (power) terminals ● Control circuit terminal Shielded leads

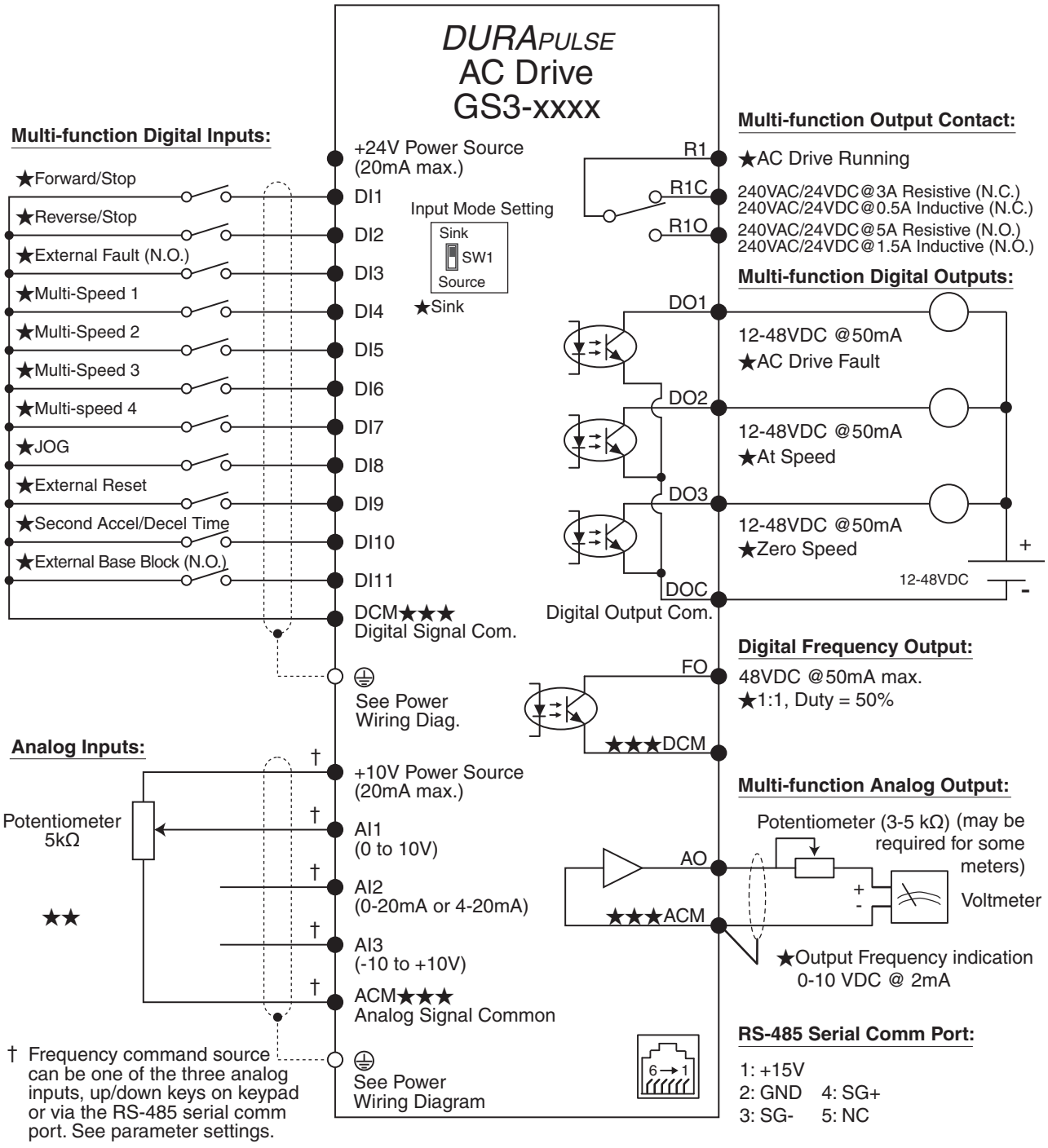
GS3-FB - Wiring Diagram - Line Drive type Encoder with RPM Meter



○ Main circuit (power) terminals ● Control circuit terminal Shielded leads

"3Ø IM" denotes three phase induction motor.
"PG" denotes encoder pulse generator.

CONTROL WIRING DIAGRAM FOR SINKING INPUTS



★ Factory default setting

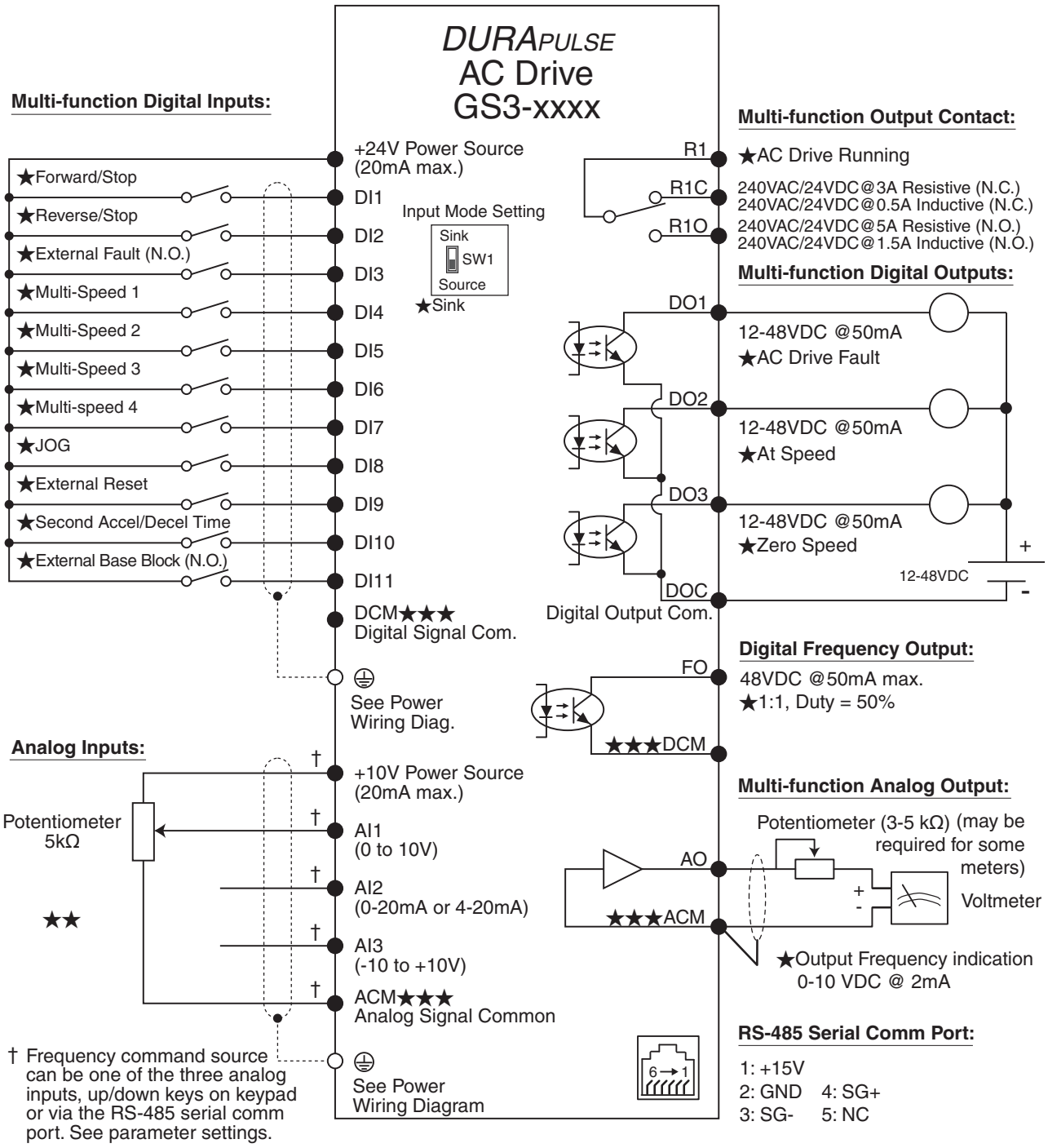
★★ Factory default source of frequency command is via the keypad up/down keys

★★★ ACM and DCM are isolated from each other

○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

WARNING: Do not plug a modem or telephone into the *DURAPULSE* RJ-12 Serial Comm Port, or permanent damage may result.

CONTROL WIRING DIAGRAM FOR SOURCING INPUTS



★ Factory default setting

★★ Factory default source of frequency command is via the keypad up/down keys

★★★ ACM and DCM are isolated from each other

○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

WARNING: Do not plug a modem or telephone into the *DURAPULSE* RJ-12 Serial Comm Port, or permanent damage may result.

DURAPULSE ABBREVIATED PARAMETER LIST

This abbreviated parameter list contains only the most commonly used parameters. For the complete *DURAPULSE* parameter listing, see the *DURAPULSE* Drives User Manual, GS3-M.



To prevent the "Duplicate Function" error, you must first change parameter P4.13 to any value between 03 and 06 BEFORE changing P4.00 to 02.

Parameter	Description	Range	
P0.00	Motor Nameplate Voltage	230V class: 200/208/220/230/240 460V class: 380/400/415/440/460/480	
P0.01	Motor Nameplate Amps	Drive Rated Amps x 0.4 to 1.0	
P0.02	Motor Base Frequency	50/60/400	
P0.03	Motor Base RPM	375 to 24,000 rpm	
P0.04	Motor Maximum RPM	P 0.03 to 24,000 rpm	
P1.00	Stop Methods	00: Ramp to Stop	01: Coast to Stop
P1.01	Acceleration Time 1	0.1 to 600.0 sec	
P1.02	Deceleration Time 1	0.1 to 600.0 sec	
P2.00	Volts/Hertz Settings	00: General Purpose 01: High Starting Torque	02: Fans and Pumps 03: Custom
P2.02	Auto-torque Boost	00 to 10	
P3.00	Source of Operation Command	00: Operation determined by digital keypad 01: Operation determined by external control terminals, keypad STOP is enabled 02: Operation determined by external control terminals, keypad STOP is disabled	03: Operation determined by RS-485 interface, keypad STOP is enabled 04: Operation determined by RS-485 interface, keypad STOP is disabled
***P3.31**	2nd Source of Operation Command		
P3.01	Multi-function Inputs (DI1 - DI2)	00: DI1 - FWD / STOP; DI2 - REV / STOP 01: DI1 - RUN / STOP; DI2 - REV / FWD	02: DI1 RUN momentary (N.O.) DI2 REV / FWD DI3 STOP momentary (N.C.)
P3.02	Multi-function Input (DI3)	00: External Fault (N.O.) 01: External Fault (N.C.) 02: External Reset 03: Multi-Speed Bit 1 04: Multi-Speed Bit 2 05: Multi-Speed Bit 3 06: Multi-Speed Bit 4 07: Manual Keyboard Control 09: Jog 10: External Base Block (N.O.)	11: External Base Block (N.C.) 12: Second Accel/Decel Time 13: Speed Hold 14: Increase Speed 15: Decrease Speed 16: Reset Speed to Zero 17: PID Disable (N.O.) 18: PID Disable (N.C.) *19: 1st/2nd Source Select (N.O.) *20: 1st/2nd Source Select (N.C.) 99: Input Disable
P3.03	Multi-function Input (DI4)		
P3.04	Multi-function Input (DI5)		
P3.05	Multi-function Input (DI6)		
P3.06	Multi-function Input (DI7)		
P3.07	Multi-function Input (DI8		
P3.08	Multi-function Input (DI9)		
P3.09	Multi-function Input (DI10)		
P3.10	Multi-function Input (DI11)		

* ***Marked parameters and settings are available only with firmware v1.04 or higher.***

Parameter	Description	Range	
P3.11	Multi-Function Output (RO)	00: AC Drive Running 01: AC Drive Fault 02: At Speed 03: Zero Speed 04: Above Desired Frequency 05: Below Desired Frequency 06: At Maximum Speed 07: Over torque detected	08: Above Desired Current 09: Below Desired Current 10: PID Deviation Alarm 11: Heatsink Overheat Warning 12: Soft Braking Signal 13: Above Desired Frequency 2 14: Below Desired Frequency 2 15: Encoder Loss *16: PID Feedback Loss Warning
P3.12	Multi-Function Output (DO1)		
P3.13	Multi-Function Output (DO2)		
P3.14	Multi-Function Output (DO3)		
P4.00	Source of Frequency Command	01: Frequency determined by digital keypad up/down 02: Frequency determined by 0 to +10V input on AI1 terminal 03: Frequency determined by 4 to 20mA input on AI2 terminal 04: Frequency determined by 0 to 20mA input on AI2 terminal 05: Frequency determined by RS-485 communication interface 06: Frequency determined by 10V - +10V input on (AI3) terminal	
***P4.13**	2nd Source of Frequency Command		
P 4.01	AI Offset Polarity	00: Offset disabled 01: Positive Offset	02: Negative Offset
***P4.14**	2nd AI Offset Polarity		
P4.02	Analog Input Offset	0.0 to 100.0%	
***P4.15**	2nd Analog In Offset		
P4.03	Analog Input Gain	0.0 to 300.0%	
***P4.16**	2nd Analog In Gain		
P4.11	Analog Output Signal	00: Frequency Hz 01: Current A	02: PV
P4.12	Analog Output Gain	00 to 200%	
P7.00	Input Terminal for PID Feedback	00: Inhibit PID operation 01: Forward Acting PID feedback; PV from AI1 (0 to + 10V) 02: Forward Acting PID feedback; PV from AI2 (4 to 20mA)	03: Reverse Acting PID feedback; PV from AI1 (0 to + 10V) 04: Reverse Acting PID feedback; PV from AI2 (4 to 20mA)
P7.02	PID Setpoint Source	00: Keypad 02: AI1 (0 to +10V)	01: Serial Communications 03: AI2 (4 to 20mA)
P7.20	Proportional Control	0.0 to 10.0	
P7.21	Integral Control	0.00 to 100.0 sec	0.00: Disable
P7.22	Derivative Control	0.00 to 1.00 sec	
P8.00	User Defined Display Function	00: Output Frequency (Hz) 01: Motor Speed (rpm) 02: Output Freq. x Scaled Freq 03: Output Current (A) 04: Motor Load (%)	05: Output Voltage (V) 06: DC Bus Voltage (V) 07: PID Setpoint 08: PID Feedback (PV) 09: Frequency Setpoint
P8.01	FrequencyScaleFactor	0.01 to 160.0	
P9.08	**Restore to Default**	**99: Restores ALL parameters to factory defaults**	
****P9.39**	Firmware Version	#.##	

** **Marked parameters and settings are available only with firmware v1.04 and higher.***
*** **P9.39 is available only with firmware v1.02 and higher**.*

Parameter	Description	Range
P 6.31	Present Fault Record	00: No Fault occurred 01: Over-current (oc) 02: Over-voltage (ov) 03: Over-temperature 04: Overload (oL) 05: Thermal Overload (oL1) 06: Over-torque (oL2) 07: External Fault (EF) 08: CPU Failure 1 (CF1) 09: CPU Failure 2 (CF2) 10: CPU Failure 3 (CF3) 11: Hardware Protection Failure (HPF) 12: Over-current during accel (OCA) 13: Over-current during decel (OCd) 14: Over-current during steady state (OCn) 15: Ground Fault or Fuse Failure (GFF) 17: Input Power Three-phase Loss 19: Auto Ramp Fault 20: Parameters Locked 21: PID Feedback Loss (FbE) 22: Encoder Feedback Loss 23: Output Shorted(OCC) 24: Momentary Power Loss
P 6.32	Second Most Recent Fault Record	
P 6.33	Third Most Recent Fault Record	
P 6.34	Fourth Most Recent Fault Record	
P 6.35	Fifth Most Recent Fault Record	
P 6.36	Sixth Most Recent Fault Record	

Technical Support

Telephone: **770-844-4200**
(Mon.-Fri., 9:00 a.m. - 6:00 p.m. E.T.)

Web: **www.automationdirect.com**

Our technical support group is glad to work with you in answering your questions. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call technical support at **770-844-4200**. We are available weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time.

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GS3-QR, Revision A, 06/2007

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DURA PULSE

AC Drive
User Manual

230V Class:
1 - 50 Hp

460V Class:
1 - 100 Hp



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WARNING

WARNING: Read this manual thoroughly before using *DURAPULSE* Series AC Motor Drives.

WARNING: AC input power must be disconnected before performing any maintenance. Do not connect or disconnect wires or connectors while power is applied to the circuit. Maintenance must be performed only by a qualified technician.

WARNING: There are highly sensitive MOS components on the printed circuit boards, and these components are especially sensitive to static electricity. To avoid damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.

WARNING: A charge may still remain in the DC-link capacitor with hazardous voltages, even if the power has been turned off. To avoid personal injury, do not remove the cover of the AC drive until all "DISPLAY LED" lights on the digital keypad are off. Please note that there are live components exposed within the AC drive. Do not touch these live parts.

WARNING: Ground the *DURAPULSE* AC Drive using the ground terminal. The grounding method must comply with the laws of the country where the AC drive is to be installed. Refer to "Basic Wiring Diagram" in CHAPTER 2.

WARNING: The mounting enclosure of the AC drive must comply with EN50178. Live parts shall be arranged in enclosures or located behind barriers that meet at least the requirements of the Protective Type IP20. The top surface of the enclosures or barrier that is easily accessible shall meet at least the requirements of the Protective Type IP40. Users must provide this environment for *DURAPULSE* Series AC Drive.

WARNING: The AC drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals. Never connect the AC drive output terminals T1, T2, and T3 directly to the AC main circuit power supply.

All DURApulse drives require a symmetrical 3-phase power source.
Do not connect them to grounded, center-tapped delta transformers of the type typically used for lighting circuits.

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DURAPULSE AC DRIVE USER MANUAL REVISION HISTORY

Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

Manual Number: **GS3-M**

Issue: **First Edition, Revision D**

Issue Date: **05/2013**

Publication History		
Issue	**Date**	**Description of Changes**
First Edition	12/08/2003	Original
First Edition, Revision A	2/26/2004	Corrected Watt loss information in Chapter One. Minor changes, corrections, and addtn'l information throughout.
First Edition, Revision B	06/2007	Minor changes and corrections throughout; Ch4 - New parameters & revised parameter explanations; Ch5 - New PLC program.
First Edition, Revision C	06/24/2011	Minor changes and corrections throughout. Ch2 – Wiring diagram & terminal spec modifications. Ch4 – Parameter description modifications (P2.10, P3.11-3.14, P6.00, P6.18, P9.04). Ch5 – PLC communication cable notes. AppxA – New accessories: LR-xxxx line reactors; 1-phase EMI filters; 1-phase fuses & blocks; GS-EDRV100; GS replacement cooling fans. AppxB – CLICK PLCs & connections.
First Edition, Revision D	05/2013	Minor changes and corrections throughout. Ch1 – New info for "Selecting the Proper Drive Rating." Ch2 – Storage conditions, capacitor recharge, and short-circuit information. Ch3 – Clarification of P4.00 in examples. Ch4 – New parameter info, especially for firmware v1.05; new analog input example. Ch5 – New and revised info regarding parameters, wiring and cabling, and CLICK and DirectLOGIC PLC programming. Ch6 – Storage conditions; capacitor recharge info. AppxA – Fusing and SCCR specs; *ZIP*Link™ GS cables. AppxB – New PLC components.

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CHAPTER 1

GETTING STARTED

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Manual Overview

Overview of this Publication

The *DURAPULSE* AC Drive User Manual describes the installation, configuration, and methods of operation of the *DURAPULSE* Series AC Drive.

Who Should Read This Manual

This manual contains important information for those who will install, maintain, and/or operate any of the GS3 Series AC Drives.

Supplemental Publications

The National Electrical Manufacturers Association (NEMA) publishes many different documents that discuss standards for industrial control equipment. Global Engineering Documents handles the sale of NEMA documents. For more information, you can contact Global Engineering Documents at:

15 Inverness Way East
Englewood, CO 80112-5776
1-800-854-7179 (within the U.S.)
303-397-7956 (international)
www.global.ihs.com

NEMA documents that might assist with your AC drive systems are:

- **Application Guide for AC Adjustable Speed Drive Systems**
- **Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.**

Technical Support

By Telephone: 770-844-4200
(Mon.-Fri., 9:00 a.m.-6:00 p.m. E.T.)
On the Web: www.automationdirect.com

Our technical support group is glad to work with you in answering your questions. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call technical support at **770-844-4200**. We are available weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time.

We also encourage you to visit our web site where you can find technical and non-technical information about our products and our company. Visit us at **www.automationdirect.com**.

Special Symbols



When you see the "notepad" icon in the left-hand margin, the paragraph to its immediate right will be a special note.



When you see the "exclamation mark" icon in the left-hand margin, the paragraph to its immediate right will be a WARNING. This information could prevent injury, loss of property, or even death (in extreme cases).

*DURA*PULSE AC Drive Introduction

Purpose of AC Drives

AC drives are generally known by many different names: Adjustable Frequency Drives (AFD), Variable Frequency Drives (VFD), and Inverters. Drives are used primarily to vary the speed of three phase AC induction motors, and they also provide non-emergency start and stop control, acceleration and deceleration, and overload protection. By gradually accelerating the motor, drives can reduce the amount of motor startup inrush current.

AC drives function by converting incoming AC power to DC, which is then synthesized back into three phase output power. The voltage and frequency of this synthesized output power is directly varied by the drive, where the frequency determines the speed of the three phase AC induction motor.

Selecting the Proper Drive Rating

A. Determine motor full-load amperage (FLA)

Motor FLA is located on the nameplate of the motor.
Note: FLA of motors that have been rewound may be higher than stated.

B. Determine motor overload requirements

Many applications experience temporary overload conditions due to starting requirements or impact loading. Most AC drives are designed to operate at 150% overload for 60 seconds. If the application requires an overload greater than 150% or longer than 60 seconds, the AC drive must be oversized.
NOTE: Applications that require replacement of existing motor starters with AC drives may require up to 600% overload.

C. Installation altitude

AC drives rely upon the cooling properties of air for cooling. As the altitude increases, the air becomes less dense, and this decrease in air density decreases the cooling properties of the air. Therefore, the AC drive must be oversized to compensate for the decrease in cooling. Most AC drives are designed to operate at 100% capacity up to altitudes of 1000 meters. Above 1000m, the AC drive must be derated.

D. Determine max enclosure internal temp

AC drives generate a significant amount of heat and will cause the internal temperature of an enclosure to exceed the rating of the AC drive, even when the ambient temperature is less than 104 °F (40 °C). Enclosure ventilation and/or cooling may be required to maintain a maximum internal temperature of 104 °F (40 °C) or less. Ambient temperature measurements/calculations should be made for the maximum expected temperature.

Selecting the Proper Drive Rating (continued)

E. Calculate required output amperage

Use the chart below to calculate the required FLA of the AC drive, as shown by the following examples. Select the rating that equals the motor's voltage and equals or exceeds the calculated amperage.

- Example 1 (GS1 or GS2 drive):
  Motor FLA = 6A; Overload = 200% @ 45s; Altitude = 800m; MEIT = 45°C
- Example 2 (*DURAPULSE* GS3 drive):
  Motor FLA = 8A; Overload = 135% @ 75s; Altitude = 1100m; MEIT = 35°C

Calculating Required Drive Current				
If		**Then Enter**	**Example 1 GS1 or GS2**	**Example 2 GS3 *DURAPULSE***
Overload Derate (overload %)				
If overload is < 150% and < 60 seconds		1	1.33	1.35
If overload is > 150% and < 60 seconds		(overload / 150)%		
If overload is > 60 seconds		(overload / 100)%		
Overload Result	Multiply FLA x overload entry		**8.0**	**10.8**
Altitude Derate (meters)				
Altitude is < 1,000m		1	1	1.01
Altitude is > 1,000m and < 3,000m		1 + ((altitude - 1,000m) x 0.0001)		
Altitude Result	Multiply overload result x altitude entry		**8.0**	**10.91**
Ambient Temperature (°C)				
Maximum enclosure internal temperature (MEIT) is < 40°C		1	1	1
40°C < MEIT < 50° and GS1/2 AC drive up to 5hp		1		
40°C < MEIT < 50° and GS1/2 AC drive > 5hp or *DURAPULSE* AC drive		1.2		
Required Drive FLA	Multiply altitude result x MEIT entry		**8.0**	**10.91**

Model Number Explanation

GS3 - 2 020

Applicable Motor Capacity

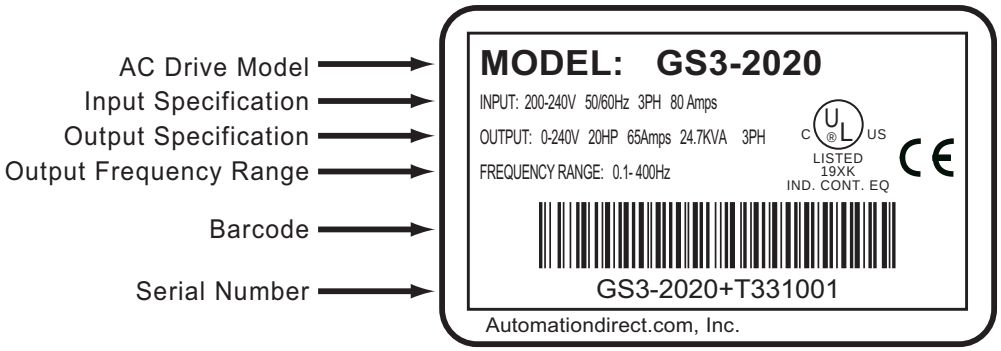
1P0: 1hp	2P0: 2hp	3P0: 3hp
5P0: 5hp	7P5: 7.5 hp	010: 10 hp
015: 15 hp	020: 20 hp	025: 25 hp
030: 30 hp	040: 40 hp	050: 50 hp
060: 60* hp	075: 75* hp	100: 100* hp

* 60, 75 and 100HP models available in GS3-4xxx only

Input Voltage
2: 200-240VAC
4: 380-480VAC

Series Name

Nameplate Information



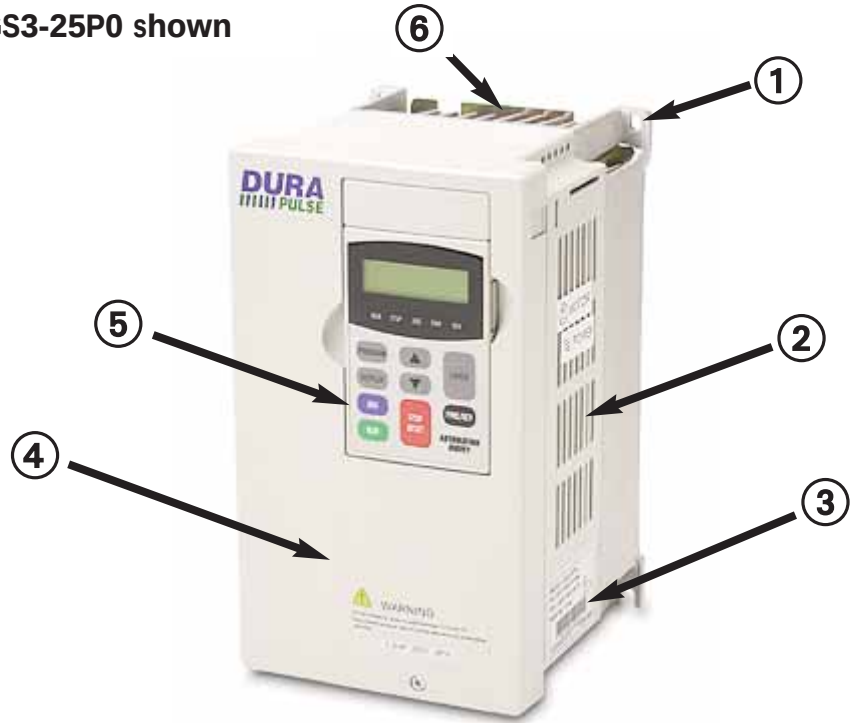
Drive Package Contents

After receiving the AC motor drive, please check for the following:

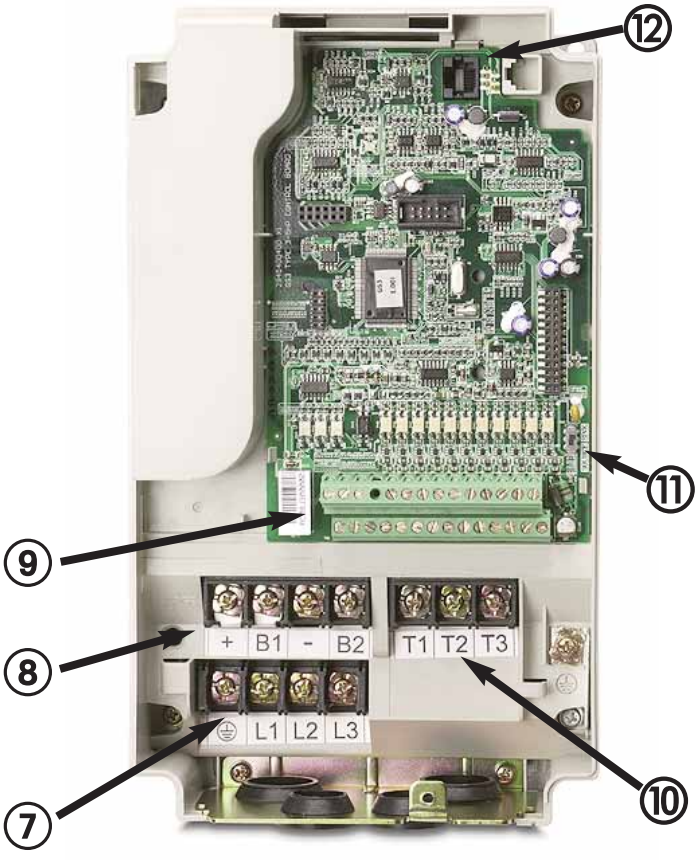
- Make sure that the package includes an AC drive, the *DURAPULSE* AC Drive User Manual, and the *DURAPULSE* AC Drive Quick Reference.
- Inspect the unit to insure it was not damaged during shipment.
- Make sure that the part number indicated on the nameplate corresponds with the part number of your order.

External Parts and Labels

GS3-25P0 shown



① Mounting Screw Holes
② Ventilation Slots
③ Nameplate Label
④ Cover
⑤ Digital Keypad
⑥ Heat Sink Fins
⑦ Input Power Terminals
⑧ Braking Terminals
⑨ Control Terminals
⑩ Output Power Terminals
⑪ Input Mode Switch (Sink/Source)
⑫ Serial Communication Port



DURAPULSE AC Drive Specifications



Please review the AutomationDirect Terms and Conditions for this product.
*There is **no** 30-day money-back guarantee on any drive over 10 hp.*

230V Class							
Model Name: GS3-xxx			**21P0**	**22P0**	**23P0**	**25P0**	**27P5**
Output Rating	**Maximum Motor Output**	**hp**	1.0	2.0	3.0	5.0	7.5
		kW	0.75	1.5	2.2	3.7	5.5
	Rated Output Current (A)		5	7	11	17	25
	Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)				
	Rated frequency		0.1 to 400 Hz				
*** Input Rating**	**Rated Voltage/Frequency**		Single/Three-phase; 50/60 Hz; 200/208/220/230/240 VAC			Three-phase; 50/60 Hz; 200/208/220/230/240 VAC	
	Rated Input Current (A)		11.9 / 5.7	15.3 / 7.6	22 / 15.5	20.6	26
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%				
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 240 VAC				
Watt Loss 100% I (W)			60	82	130	194	301
Weight (lb [kg])			4.5 [2.034]	4.5 [2.034]	9.4 [4.24]	9.4 [4.24]	13.3 [6.031]

**** All 3-phase power sources must be symmetrical. Do not connect DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).***

230V Class (continued)									
Model Name: GS3-xxx			**2010**	**2015**	**2020**	**2025**	**2030**	**2040**	**2050**
Output Rating	**Maximum Motor Output**	**hp**	10	15	20	25	30	40	50
		kW	7.5	11	15	18.5	22	30	37
	Rated Output Current (A)		33	49	65	75	90	120	145
	Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)						
	Rated frequency		0.1 to 400 Hz						
*** Input Rating**	**Rated Voltage/Frequency**		Three-phase, 200/208/220/230/240 VAC; 50/60 Hz						
	Rated Input Current (A)		34	50	60	75	90	110	142
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%						
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 240 VAC						
Watt Loss 100% I (W)			380	660	750	920	1300	1340	1430
Weight (lb [kg])			13.3 [6.031]	14.3 [6.487]	26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]

**** All 3-phase power sources must be symmetrical. Do not connect DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).***

460V Class – Three Phase									
Model Name: GS3-xxx			**41P0**	**42P0**	**43P0**	**45P0**	**47P5**	**4010**	**4015**
Output Rating	**Maximum Motor Output**	**HP**	1	2	3	5	7.5	10	15
		kW	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Output Current (A)		2.7	4.2	5.5	8.5	13	18	24
	Maximum Output Voltage		Three-phase 380 to 480V (proportional to input voltage)						
	Rated frequency		0.1 to 400 Hz						
*** Input Rating**	**Rated Voltage/Frequency**		Three-phase, 380/400/415/440/460/480VAC; 50/60 Hz						
	Rated Input Current (A)		3.2	4.3	5.9	11.2	14	19	25
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%						
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 480 VAC						
Watt Loss 100% I (W)			70	102	132	176	250	345	445
Weight (lb [kg])			3.9 [1.759]	4.4 [1.994]	4.1 [1.857]	9.4 [4.24]	13.2 [6.002]	13.5 [6.106]	14.4 [6.525]

**** All 3-phase power sources must be symmetrical. Do not connect DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).***

460V Class – Three Phase (continued)									
Model Name: GS3-xxx			**4020**	**4025**	**4030**	**4040**	**4050**	**4060**	**4075**	**4100**
Output Rating	**Maximum Motor Output**	**HP**	20	25	30	40	50	60	75	100
		kW	15	18.5	22	30	37	45	55	75
	Rated Output Current (A)		32	38	45	60	73	91	110	150
	Maximum Output Voltage		Three-phase 380 to 480V (proportional to input voltage)							
	Rated frequency		0.1 to 400 Hz							
*** Input Rating**	**Rated Voltage/Frequency**		Three-phase, 380/400/415/440/460/480; 50/60 Hz							
	Rated Input Current (A)		32	39	49	60	63	90	130	160
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%							
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 480 VAC					10 kA @ 480 VAC		
Watt Loss 100% I (W)			620	788	1290	1420	1680	2020	2910	3840
Weight (lb [kg])			26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]	77.2 [35]	116.8 [53]	116.8 [53]

**** All 3-phase power sources must be symmetrical. Do not connect DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).***



Please review the AutomationDirect Terms and Conditions for this product.
*There is **no** 30-day money-back guarantee on any drive over 10 hp.*

General Specifications			
Control Characteristics			
Control System			Pulse Width Modulation, Carrier frequency 1-15 kHz, adjustable, depending on the model. This system determines the control methods of the AC drive. 00: V/Hz open loop control, 01: V/Hz closed loop control, 02: Sensorless Vector 03: Sensorless Vector with external feedback
Rated Output Frequency			0.1 to 400.0 Hz
Output Frequency Resolution			0.1 Hz
Overload Capacity			150% of rated current for 1 minute
Torque Characteristics			Includes auto-torque boost, auto-slip compensation, starting torque 125% @ 0.5 Hz / 150% @ 1.0 Hz
Braking Torque			20% without dynamic braking, 125% with optional braking resistor (braking circuit built-in only for units under 20 hp)
DC Braking			Operation frequency 60-0 Hz, 0 - 100% rated current, Start time 0.0 - 5.0 seconds, Stop time 0.0 - 25.0 seconds
Acceleration/Deceleration Time			0.1 to 600 seconds (linear or non-linear acceleration/deceleration), second acceleration/deceleration available
Voltage/Frequency Pattern			Settings available for Constant Torque - low & high starting torque, Variable Torque - low & high starting torque, and user configured
Stall Prevention Level			20 to 200% of rated current
Operation Specification			
Inputs	**Frequency Setting**	**Keypad**	Setting by <UP> or <DOWN> buttons
		External Signal	Potentiometer - 3-5 kΩ, 0 to 10 VDC (input impedance 10 kΩ), 0 to 20 mA / 4 to 20 mA (input impedance 250Ω). Multi-Speed Inputs 1 to 4, RS-232C/RS-485 communication interface
	Operation Setting	**Keypad**	Setting by <RUN>, <STOP>, <JOG> buttons
		External Signal	Forward/Stop, Reverse/Stop (run/stop, fwd/rev), 3-wire control, Serial Communication RS-232C & RS-485 (Modbus RTU)
	Input Terminals	**Digital Sink/Source Selectable**	11 user-programmable: FWD/STOP, REV/STOP, RUN/STOP, REV/FWD, RUN momentary (N.O.), STOP momentary (N.C.), External Fault (N.O./N.C.), External Reset, Multi-Speed Bit (1-4), Manual Keyboard Control, Jog, External Base Block (N.O./N.C.), Second Accel/Decel Time, Speed Hold, Increase Speed, Decrease Speed, Reset Speed to Zero, PID Disable (N.O.), PID Disable (N.C.), Input Disable
		Analog	3 user-configurable, 0 to 10 VDC (input impedance 10 kΩ), 0 to 20mA / 4 to 20mA (input impedance 250Ω), 10 bit resolution -10V to +10V, 10 bit resolution
Outputs	**Output Terminals**	**Digital 3 transistors 1 relay**	4 user-programmable: Inverter Running, Inverter Fault, At Speed, Zero Speed, Above Desired Frequency, Below Desired Frequency, At Maximum Speed, Over Torque Detected, Above Desired Current, Below Desired Current, PID Deviation Alarm, Heatsink Overheat Warning (OH), Soft Braking Signal, Above desired Frequency 2, Below desired Frequency 2, Encoder Loss
		Analog	1 user-programmable, 0 to 10 VDC, 8 bit resolution frequency, current, process variable PV
	Operating Functions		Automatic voltage regulation, voltage/frequency characteristics selection, non-linear acceleration/deceleration, upper and lower frequency limiters, 15-stage speed operation, adjustable carrier frequency (1 to 15 kHz), PID control, 5 skip frequencies, analog gain & bias adjustment, jog, electronic thermal relay, automatic torque boost, trip history, software protection

General Specifications (cont.)		
Protective Functions		Electronic Thermal, Overload Relay, Auto Restart after Fault, Momentary Power Loss, Reverse Operation Inhibit, Auto Voltage Regulation, Over-Voltage Stall Prevention, Auto Adjustable Accel/Decel, Over-Torque Detection Mode, Over-Torque Detection Level, Over-Torque Detection Time, Over-Current Stall Prevention during Acceleration, Over-Current Stall Prevention during Operation
Operator Interface	**Operator Devices**	9-key, 2 line x 16 character LCD display, 5 status LEDs
	Programming	Parameter values for setup and review, fault codes
	Status Display	Output Frequency, Motor Speed, Scaled Frequency, Output Current, Motor Load, Output Voltage, DC Bus Voltage, PID Setpoint, PID Feedback, Frequency Setpoint
	Key Functions	RUN, STOP/RESET, FWD/REV, PROGRAM, DISPLAY, <UP>, <DOWN>, ENTER
Environment	**Enclosure Rating**	Protected Chassis, IP20
	Ambient Temperature	-10°C to 40°C (14°F to 104°F)
	Ambient Humidity	20 to 90% RH (non-condensing)
	Vibration	9.8 m/s^2 (1G) less than 10 Hz, 5.9 m/s^2 (0.6G) 10 to 60 Hz
	Installation Location	Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust
Options		Noise filter, input AC reactor, output AC reactor, cable for remote operator, programming software, Dynamic braking resistor, input fuses

Installation and Wiring



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Ambient Conditions

Ambient environmental conditions for use:

Ambient Conditions	
Ambient Temperature	-10°C to 40°C (14°F to 104°F)
Relative Humidity	0 to 90% (non-condensing)
Atmosphere Pressure	86 kPa to 106 kPa
Vibration	9.8 m/s^2 (1G) less than 10 Hz, 5.9 m/s^2 (0.6G) 10 to 60 Hz
Installation Location	Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust
Enclosure Rating	IP20: Protection against contact by fingers. Protection against medium-size foreign objects

Storage Conditions

The AC drives should be kept in their shipping cartons or crates until they are installed. In order to retain their warranty coverage, they should be stored as described below if they are not to be installed and used within three months.

- Store in a clean and dry location free from direct sunlight and corrosive fumes.
- For storage of longer than 3 months, store within an ambient temperature range of -20 °C to 30 °C (-4°F to 86°F).
- For storage of 3 months or less, store within an ambient temperature range of -20 °C to 60 °C (-4°F to 140°F).
- Store within a relative humidity range of 0% to 90% and non-condensing environment.
- Store within an air pressure range of 86 kPA to 106 kPA.
- DO NOT store in an area with rapid changes in temperature. (It may cause condensation and frost.)
- DO NOT place directly on the ground.



If the drive is stored or is otherwise unused for more than a year, the drive's internal DC link capacitors should be recharged before use. Otherwise, the capacitors may be damaged when the drive starts to operate. We recommend recharging the capacitors of any unused drive at least once per year. (Refer to Chapter 6, "Maintenance and Troubleshooting" for information about recharging DC link capacitors.)

Installation

Install the AC drive in an enclosure that is specifically designed to house electrical and electronic control equipment. Provide proper spacing within the enclosure to allow the dissipation of heat produced by the drive and any other included electrical and electronic equipment. Ventilation or air conditioning may also be required, depending upon the application.

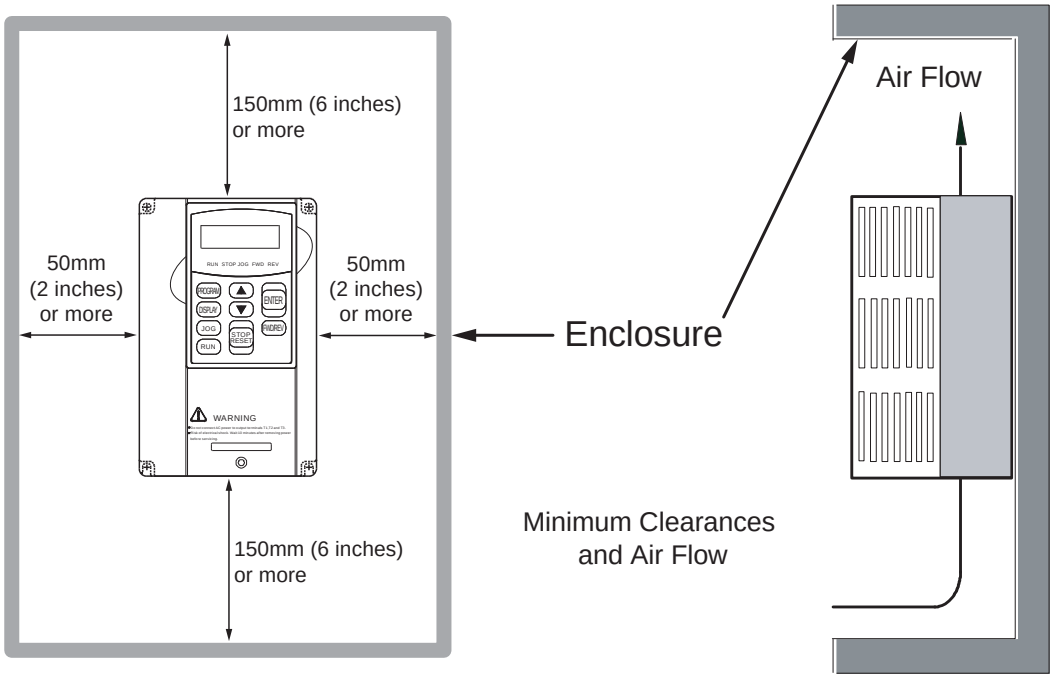
WARNING: Failure to observe these precautions may damage the drive and void the warranty!

Improper installation of the AC drive will greatly reduce its life. Observe the following precautions when installing the drive:

- Do not mount the AC drive near heat-radiating elements or in direct sunlight.
- Do not install the AC drive in a place subjected to high temperature, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.
- Mount the AC drive securely on a flat, rigid, non-flammable surface.
- Mount the AC drive vertically and do not restrict the air flow to the heat sink fins.

WARNING: AC drives generate a large amount of heat which may damage them. Auxiliary cooling methods are typically required in order not to exceed maximum ambient temperatures.

Minimum Clearances and Air Flow

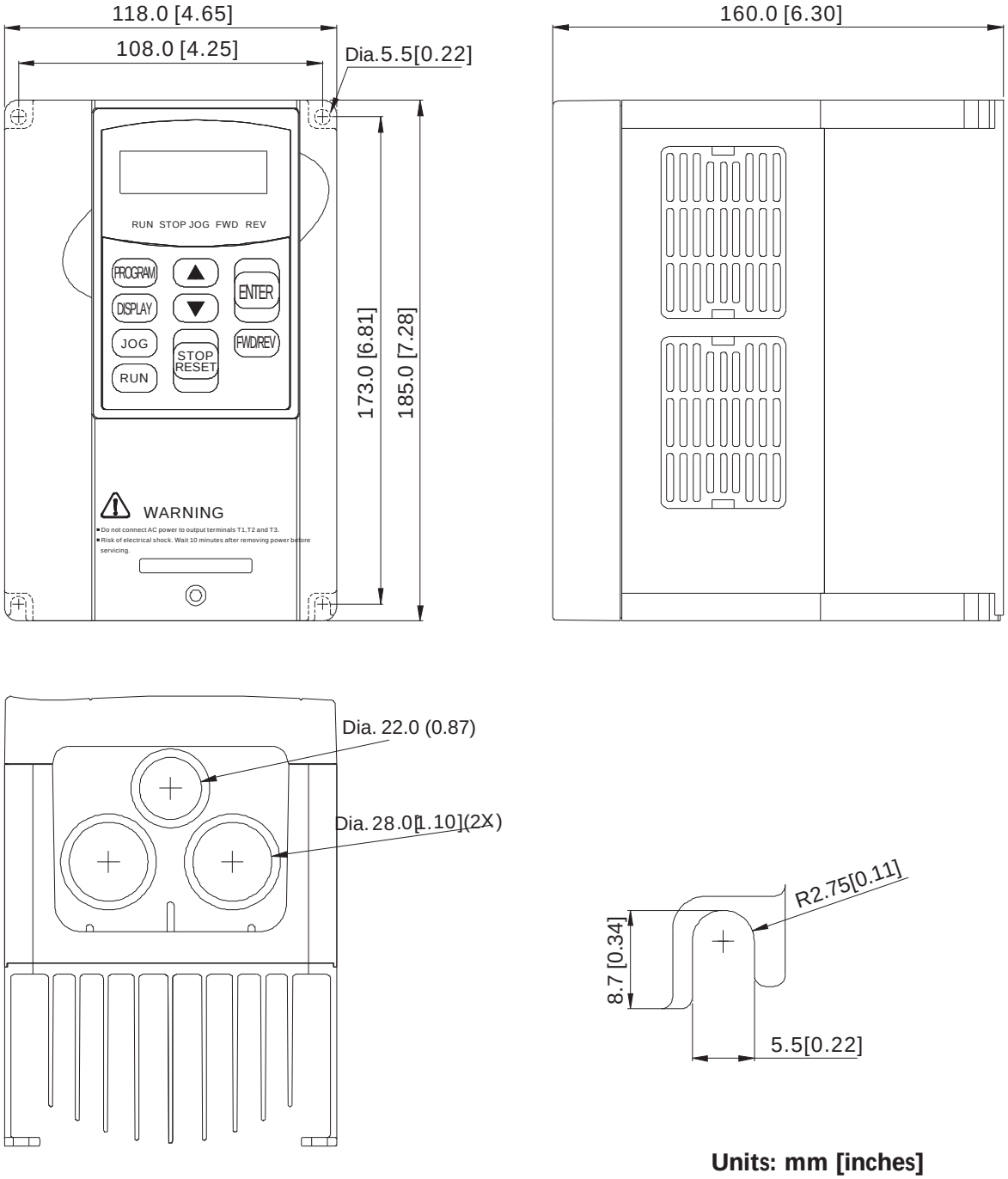


MAXIMUM AMBIENT TEMPERATURES MUST NOT EXCEED 40°C (104°F)!

Dimensions

Frame A

Part numbers: GS3-21P0, GS3-22P0, GS3-41P0, GS3-42P0

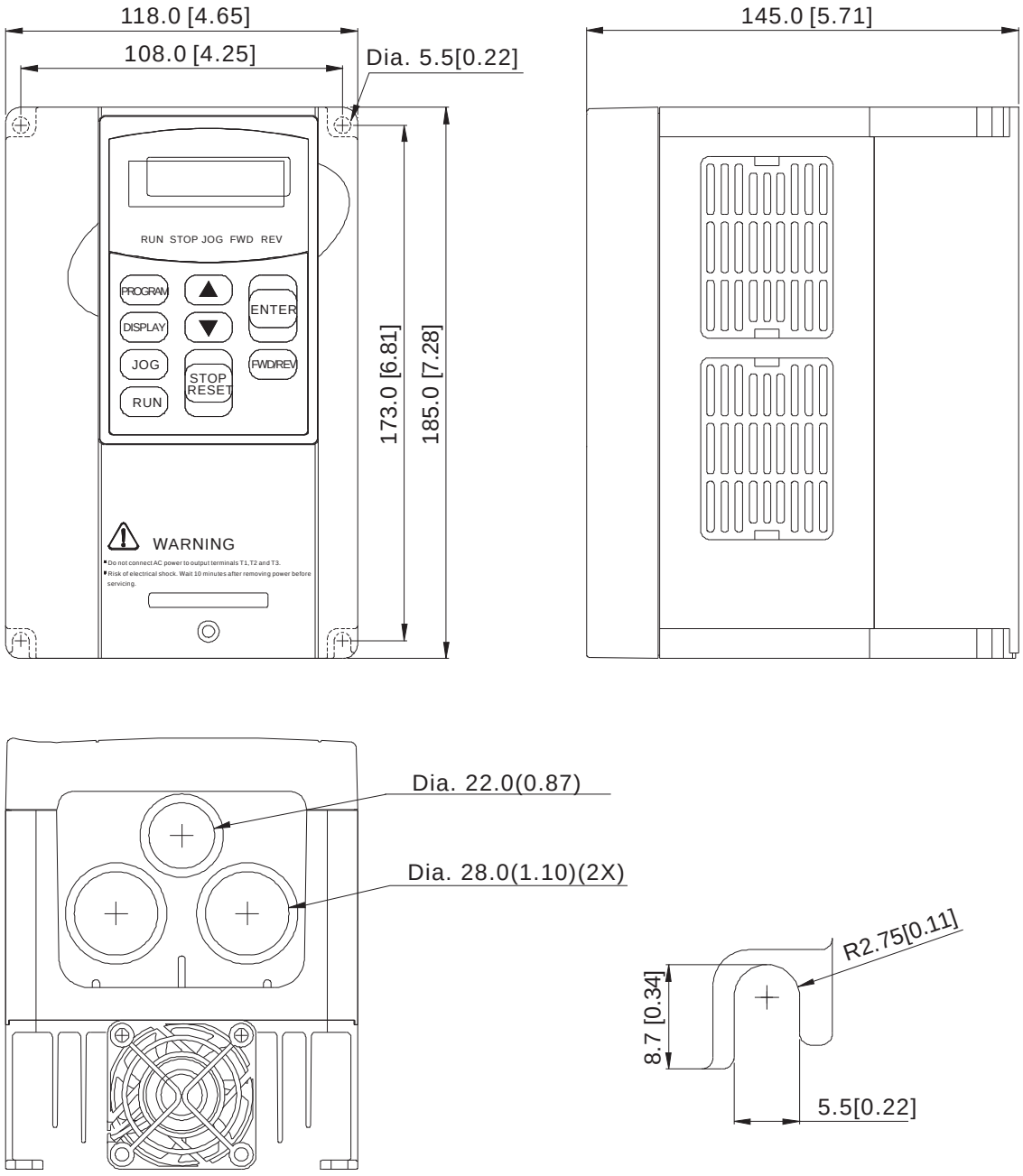


Units: mm [inches]

Dimensions (continued)

Frame A with Fan

Part Numbers: GS3-43P0

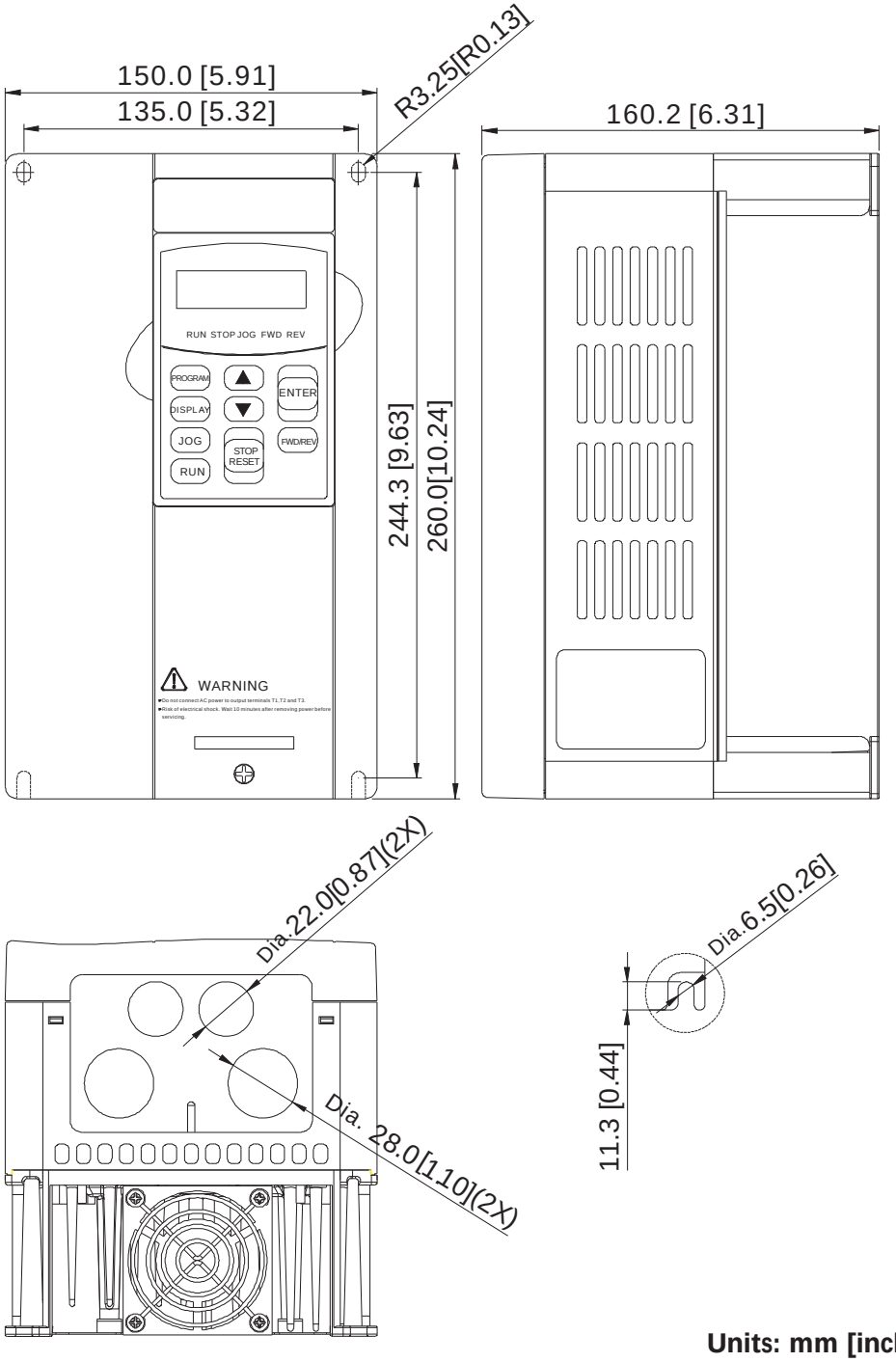


Units: mm [inches]

Dimensions (continued)

Frame B

Part numbers: GS3-23P0, GS3-25P0, GS3-45P0

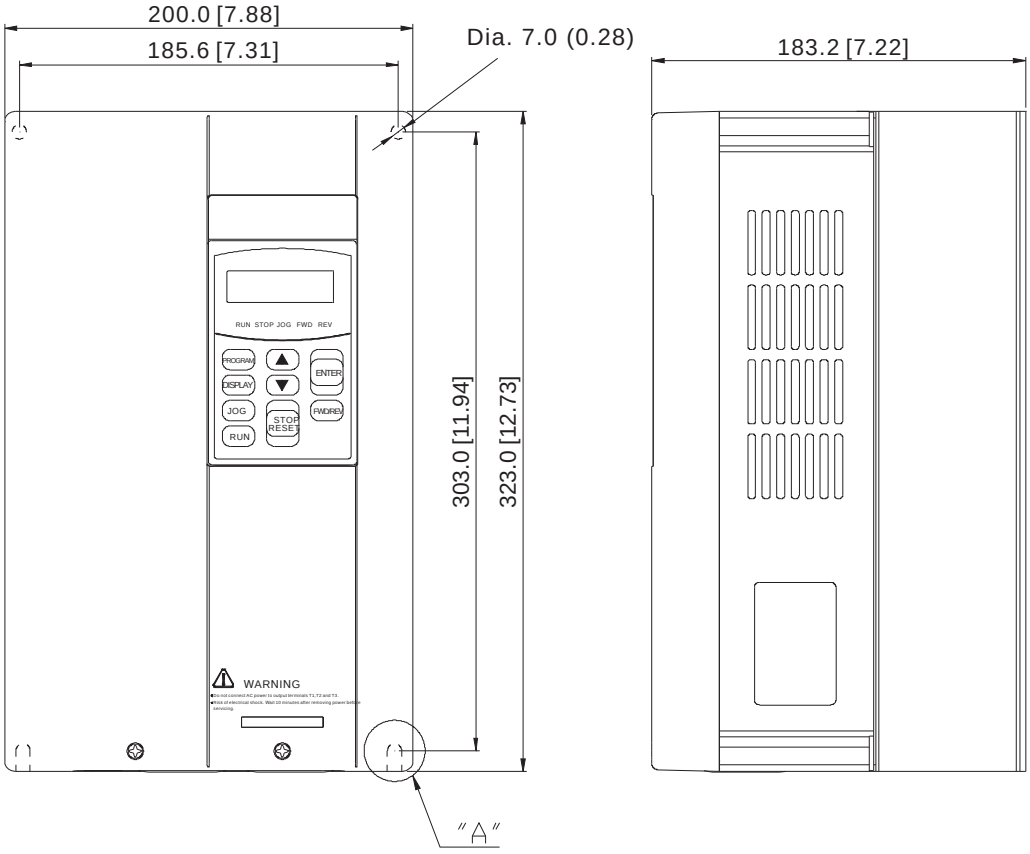


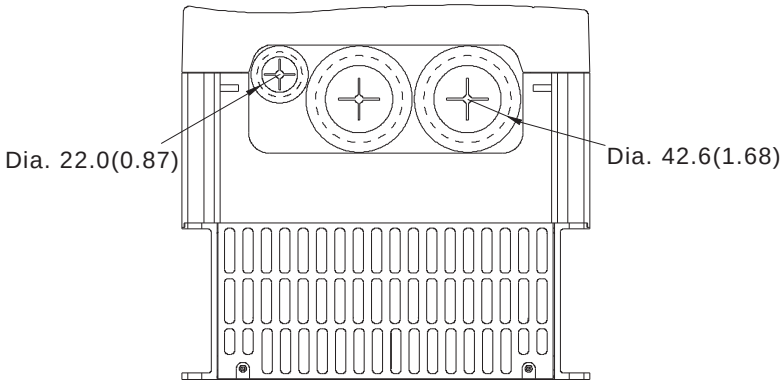
Units: mm [inches]

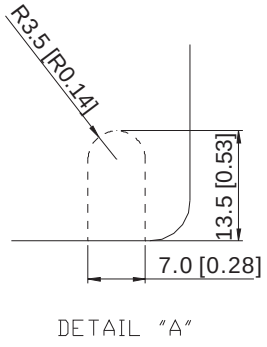
Dimensions (continued)

Frame C

Part numbers: GS3-27P5, GS3-2010, GS3-2015
GS3-47P5, GS3-4010, GS3-4015





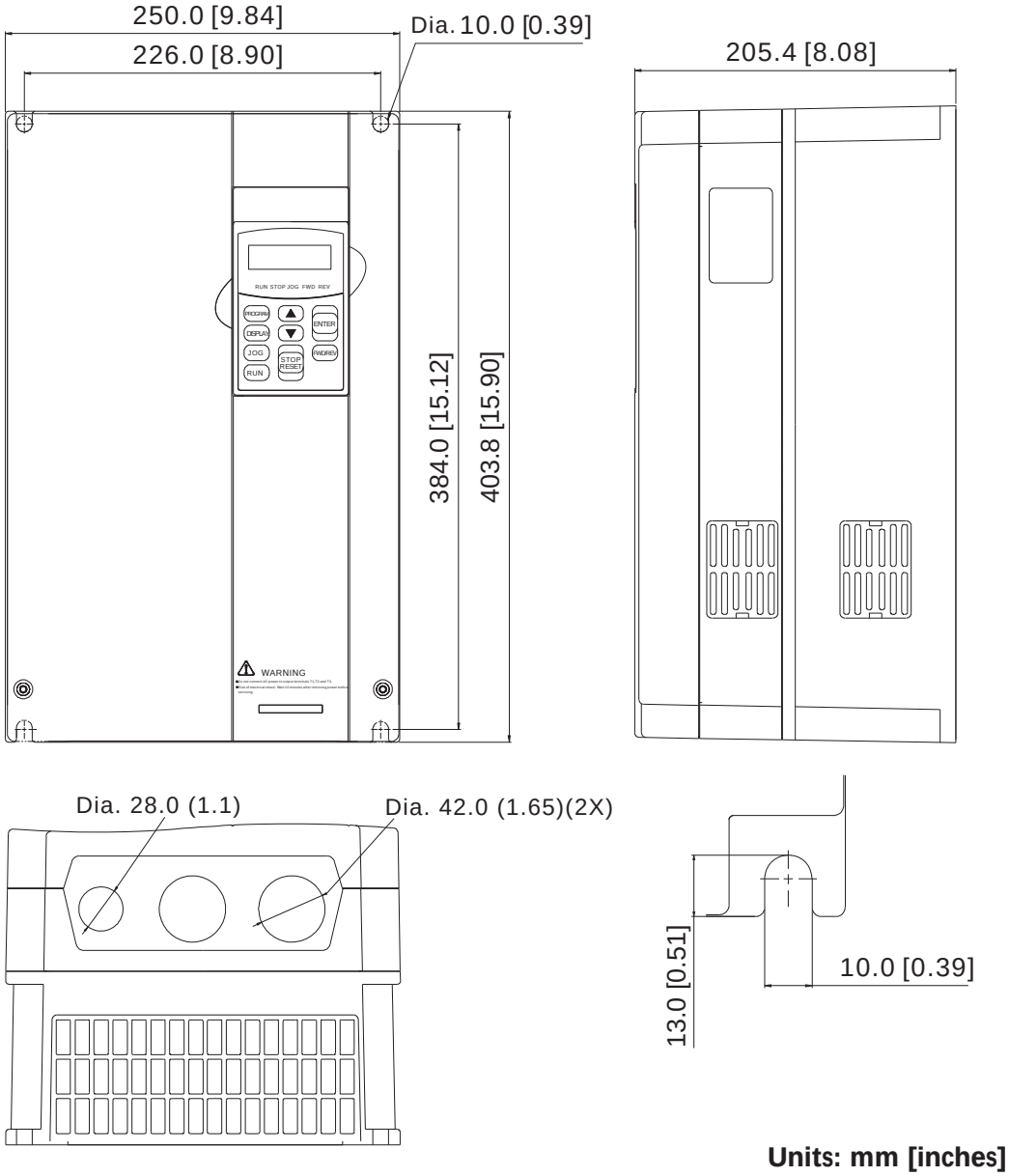


Units: mm [inches]

Dimensions (continued)

Frame D

Part numbers: GS3-2020, GS3-2025, GS3-2030
GS3-4020, GS3-4025, GS3-4030

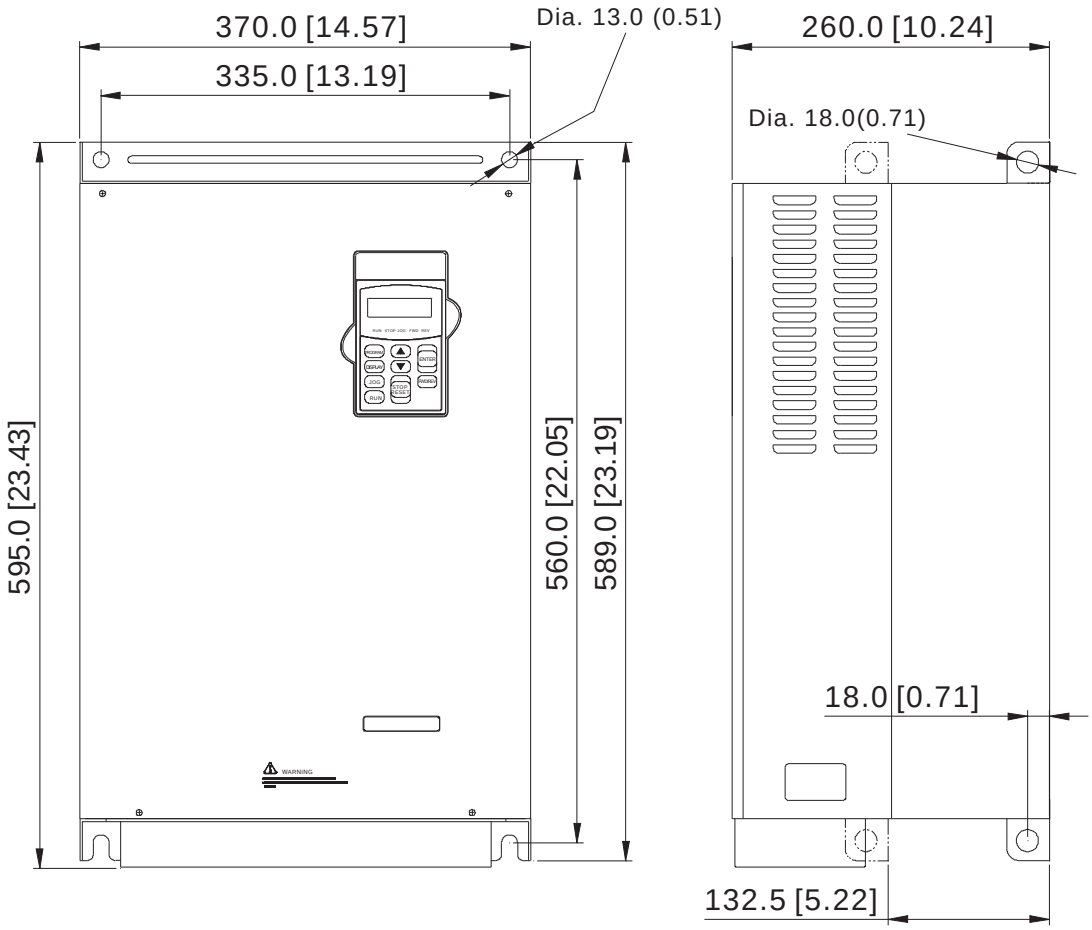


Units: mm [inches]

Dimensions (continued)

Frame E

Part Numbers: GS3-2040, GS3-2050
GS3-4040, GS3-4050, GS3-4060

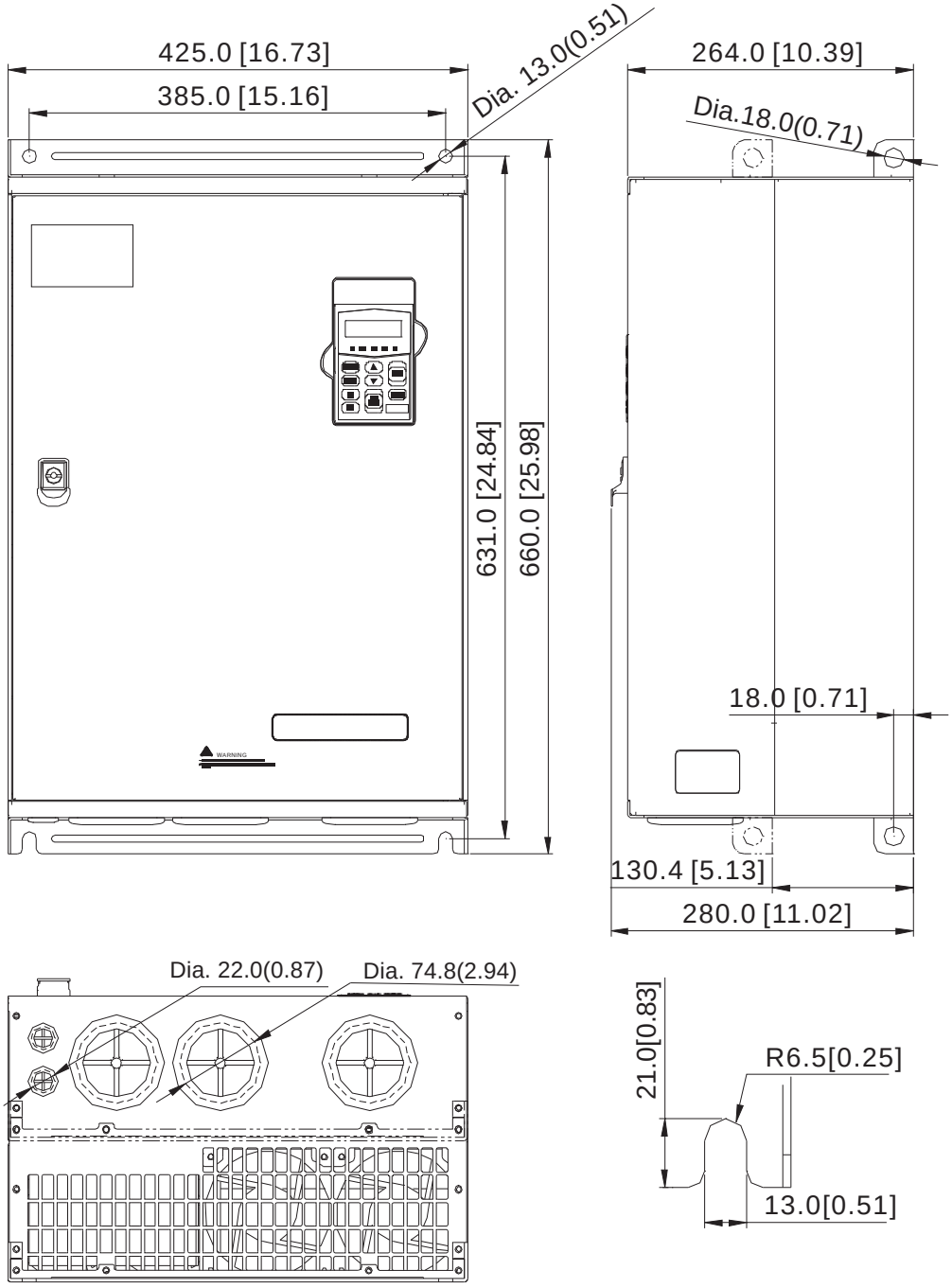


Units: mm [inches]

Dimensions (continued)

Frame F

Part Numbers: GS3-4075, GS3-4100



Units: mm [inches]

Circuit Connections

DANGER!

HAZARDOUS VOLTAGE! Before making any connection to the AC drive, disconnect all power to the AC drive, and wait five minutes for DC bus capacitors to discharge.

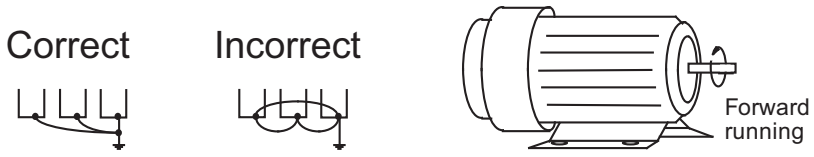
WARNING: Any electrical or mechanical modification to this equipment without prior written consent of AutomationDirect.com, Inc. will void all warranties, may result in a safety hazard, and may void the UL listing.

WARNING: Do not connect the AC input power to the T1, T2, and T3 output terminals. Doing this will damage the AC drive

WARNING: Tighten all screws to the proper torque rating. See "Main Circuit Wiring" later in this chapter.

Wiring Notes: PLEASE READ PRIOR TO INSTALLATION.

1. During installation, follow all local electrical, construction, and safety codes for the country in which the AC drive is to be installed.
2. Make sure the appropriate protective devices (circuit breaker or fuses) are connected between the power supply and AC drive.
3. Make sure that the leads are connected correctly and the AC drive is properly grounded. (Ground resistance should not exceed 0.1Ω.)
4. Use ground leads that comply with AWG/MCM standards and keep them as short as possible.
5. Do not use a power circuit contactor or disconnect switch for run/stop control of the AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.
6. Multiple *DURAPULSE* units can be installed in one location. All of the units should be grounded directly to a common ground terminal. The *DURAPULSE* ground terminals may also be connected in parallel, as shown in the figure below. **Make sure there are no ground loops.**



7. When the AC drive output terminals T1, T2, and T3 are connected to the motor terminals T1, T2, and T3, respectively, the motor will rotate counterclockwise (as viewed from the shaft end of the motor) when a forward operation command is received. To reverse the direction of motor rotation, switch the connections of any of the two motor leads.

8. Make sure that the power source is capable of supplying the correct voltage and required current to the AC drive.
9. Do not attach or remove wiring when power is applied to the AC drive.
10. Do not inspect components unless inside "POWER" lamp is turned off.
11. Do not monitor the signals on the circuit board while the AC drive is in operation.
12. GS3 series *DURAPULSE* drives **cannot be used with single-phase motors**.
13. Route the power and control wires separately, or at 90 degree angle to each other.
14. If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to the AC drive. EMI can also be reduced by lowering the Carrier Frequency.
15. If the AC drive is installed in a place where a load reactor is needed, install the filter close to the T1, T2, and T3 side of AC drive. Do not use a Capacitor, L-C Filter (Inductance-Capacitance), or R-C Filter (Resistance-Capacitance), unless approved by AutomationDirect.
16. When using a GFCI (Ground Fault Circuit Interrupt), select current sensor with sensitivity of 200mA, and not less than 0.1-second detection to avoid nuisance tripping.

Motor Operation Precautions

1. When using the AC drive to operate a standard 3-phase induction motor, notice that the energy loss is greater than for an inverter duty motor.
2. Avoid running a standard induction motor at low speed, which may cause the motor temperature to exceed the motor rating due to limited airflow produced by the motor's fan.
3. When the standard motor operates at low speed, the output load must be decreased.
4. If **100% output torque** is desired at low speed, it may be necessary to use a special **"inverter-duty" rated motor**.

Short Circuit Withstand (SCCR)

Models through 50 hp are suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes; 10,000A for models 60 hp through 100 hp. The maximum voltage is 240V for all 230V models, and 480V for all 460V models.

Applicable Codes

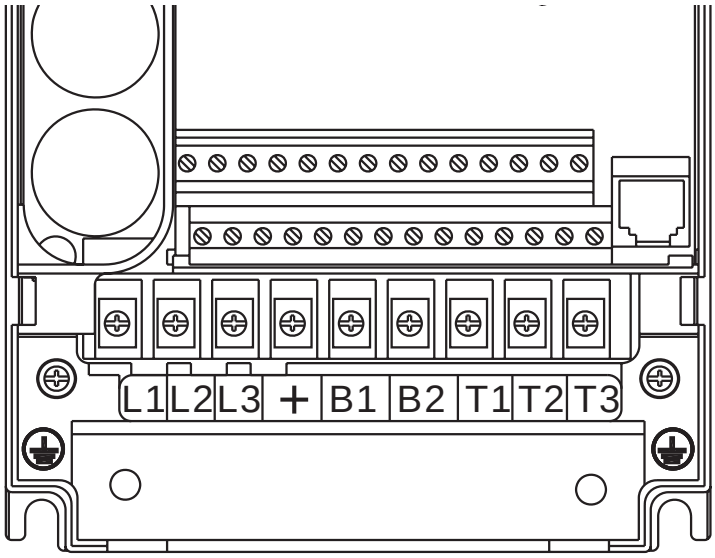
All *DURAPULSE* AC drives are Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL) listed, and therefore comply with the requirements of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

Installation intended to meet the UL and cUL requirements must follow the instructions provided in "Wiring Notes" as a minimum standard. Follow all local codes that exceed UL and cUL requirements. Refer to the technical data label affixed to the AC drive and the motor nameplate for electrical data.

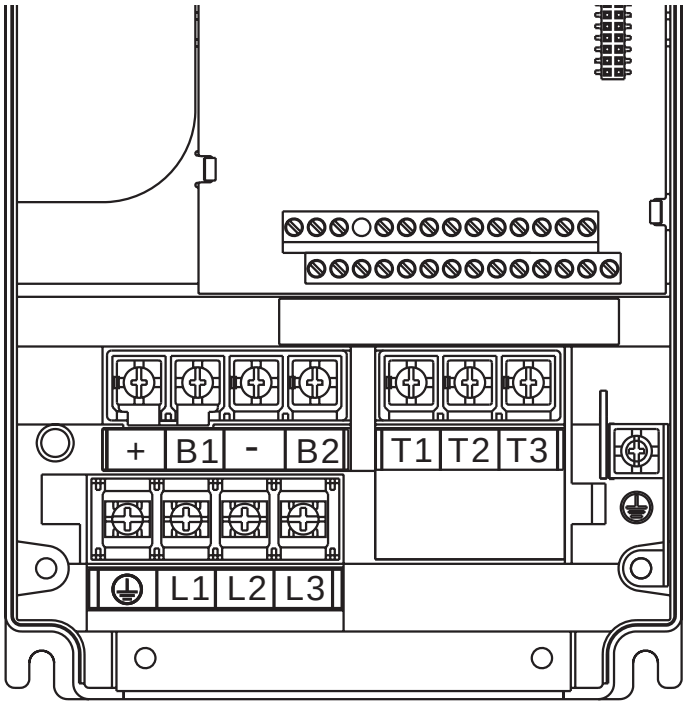
The "Circuit Protection Devices" section in APPENDIX A, lists the recommended fuse part number for each *DURAPULSE* part number. These fuses (or equivalent) must be used on all installations where compliance with U.L. standards is required.

Terminal Wiring Diagrams

GS3-21P0, GS3-22P0, GS3-41P0, GS3-42P0, GS3-43P0

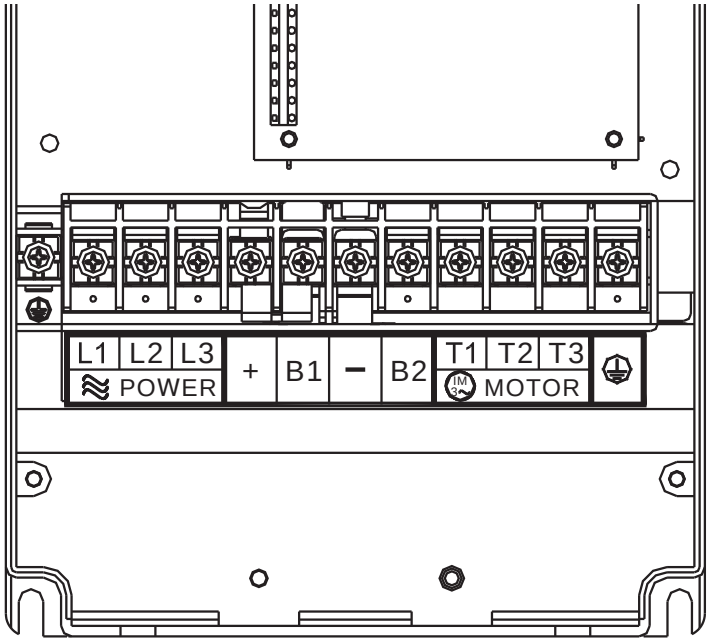


GS3-23P0, GS3-25P0, GS3-45P0

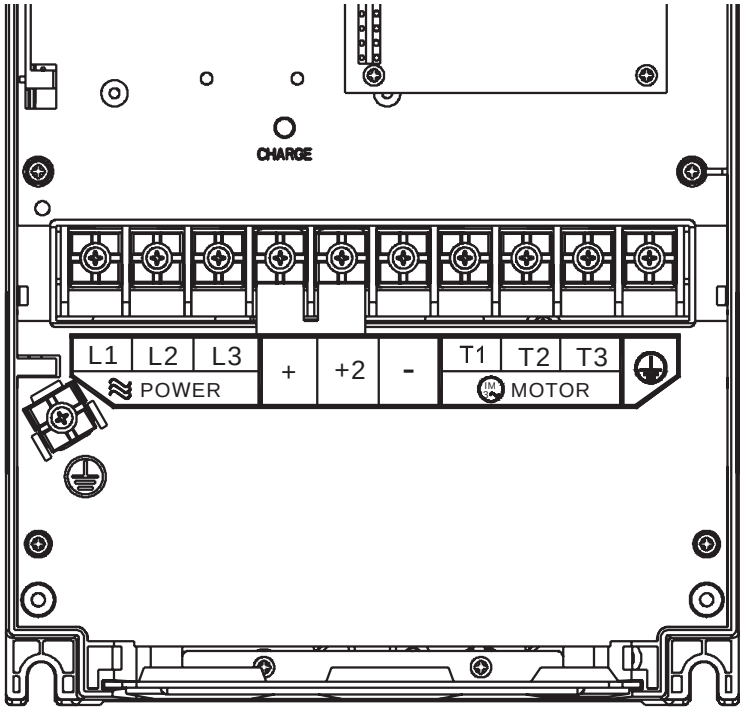


Terminal Wiring Diagrams (continued)

GS3-27P5, GS3-47P5, GS3-2010, GS3-4010, GS3-2015, GS3-4015

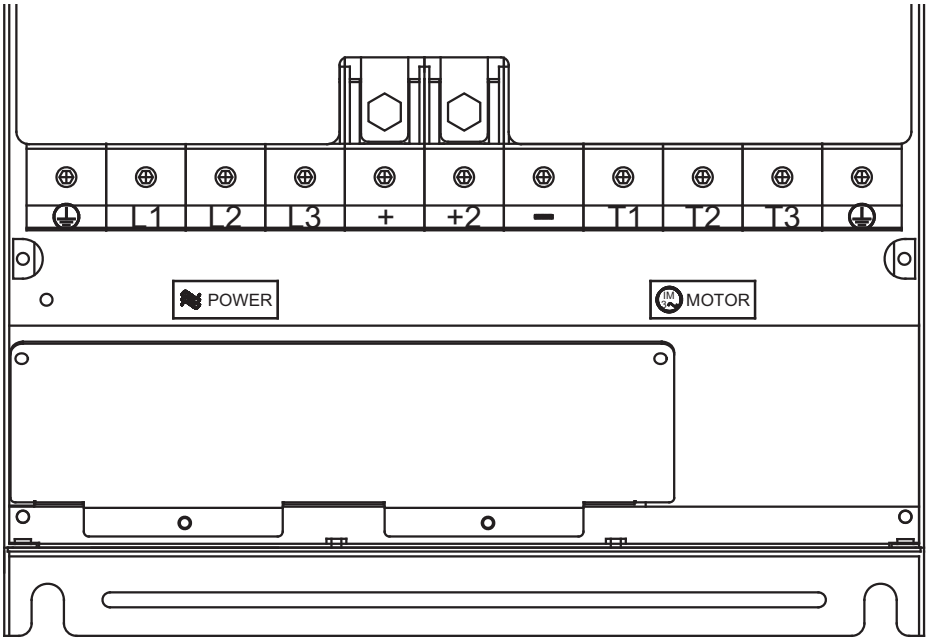


GS3-2020, GS3-4020, GS3-2025, GS3-4025, GS3-2030, GS3-4030

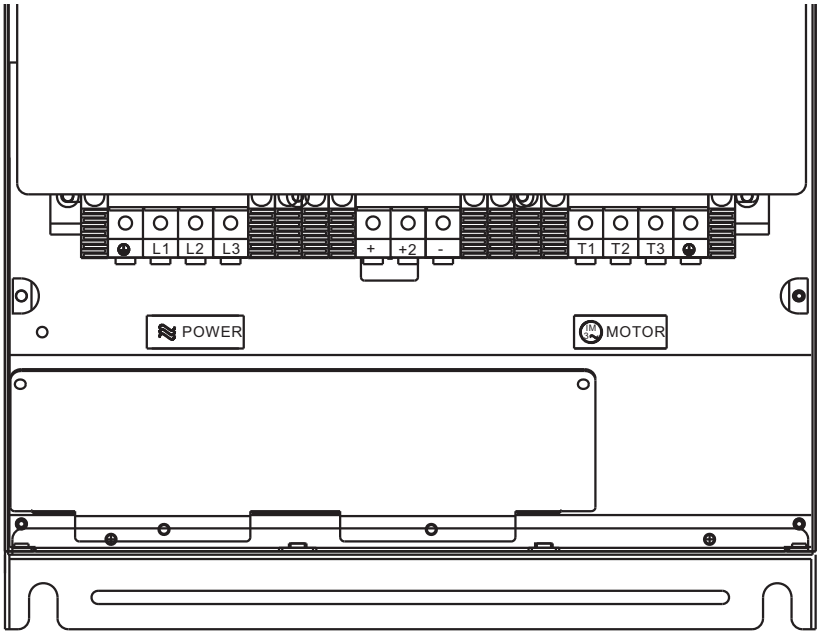


Terminal Wiring Diagrams (continued)

GS3-2040, GS3-2050

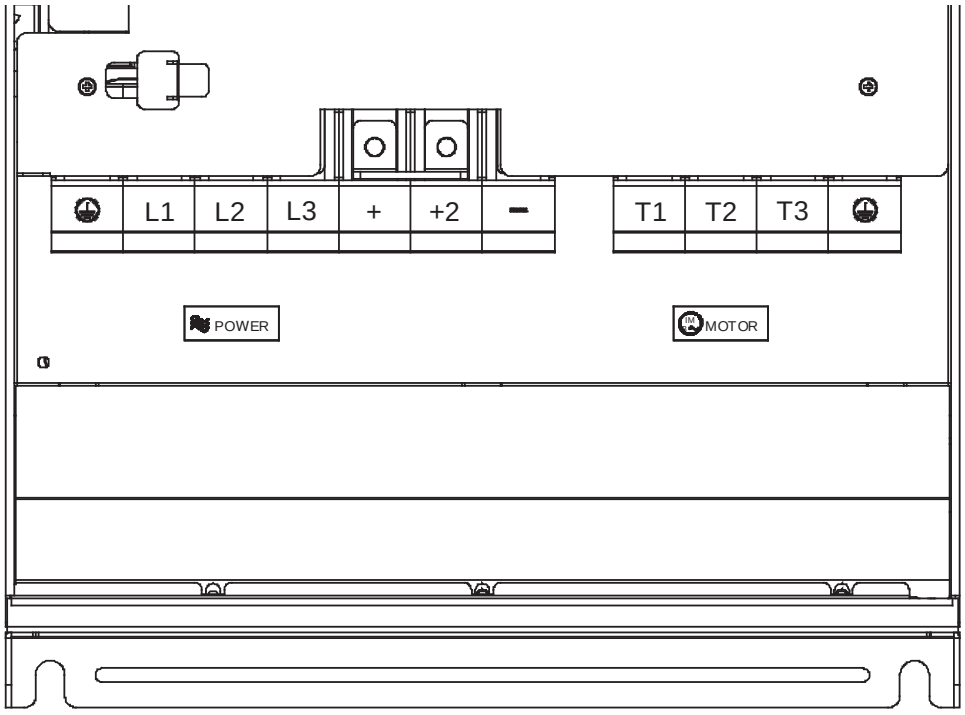


GS3-4040, GS3-4050,GS3-4060



Terminal Wiring Diagrams (continued)

GS3-4075, GS3-4100



Main Circuit Wiring

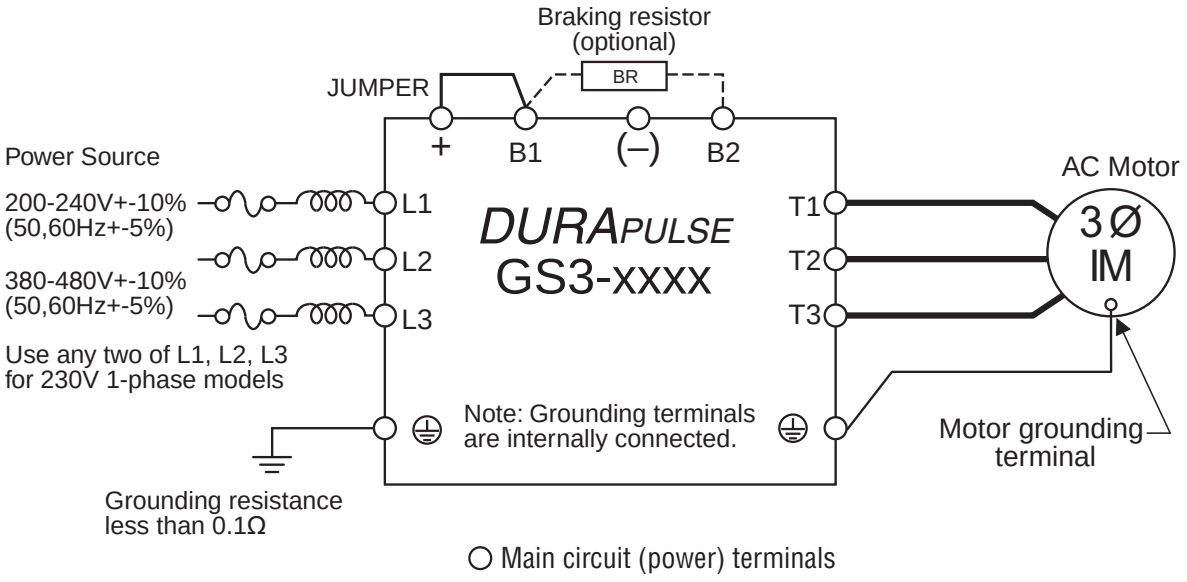
Main Circuit Terminals	
Terminal	Description
L1, L2, L3	Input Power
T1, T2, T3	AC Drive Output
B1, B2	Braking Resistor Connection (Under 20HP)
+2, – (negative)	External Dynamic Brake Unit (20HP & Over)
⏚	Ground

Main Circuit Wiring Specifications				
AC Drive Model	**Input Current (A)**	**Output Current (A)**	**Wire Range (AWG)**	**Terminal Tightening Torque (kgf-cm)**
GS3-21P0	5.7	5	10-18	18
GS3-22P0	7.6	7		
GS3-23P0	15.5	10		
GS3-25P0	20.6	17		
GS3-27P5	26	25	8-12	30
GS3-2010	34	33		
GS3-2015	50	49		40
GS3-2020	60	65	2-8	
GS3-2025	75	75		
GS3-2030	90	90		
GS3-2040	110	120	2/0-3/0	200
GS3-2050	142	145		
GS3-41P0	3.2	2.7	10-18	18
GS3-42P0	4.3	4.2		
GS3-43P0	5.9	5.5		
GS3-45P0	11.2	8.5		
GS3-47P5	14	13	8-12	30
GS3-4010	19	18		
GS3-4015	25	24		40
GS3-4020	32	32	2-8	
GS3-4025	39	38		
GS3-4030	49	45		
GS3-4040	60	60	2-4	57
GS3-4050	63	73		
GS3-4060	90	91		
GS3-4075	130	110	2/0-3/0	200
GS3-4100	160	150		

Power Wiring Diagrams

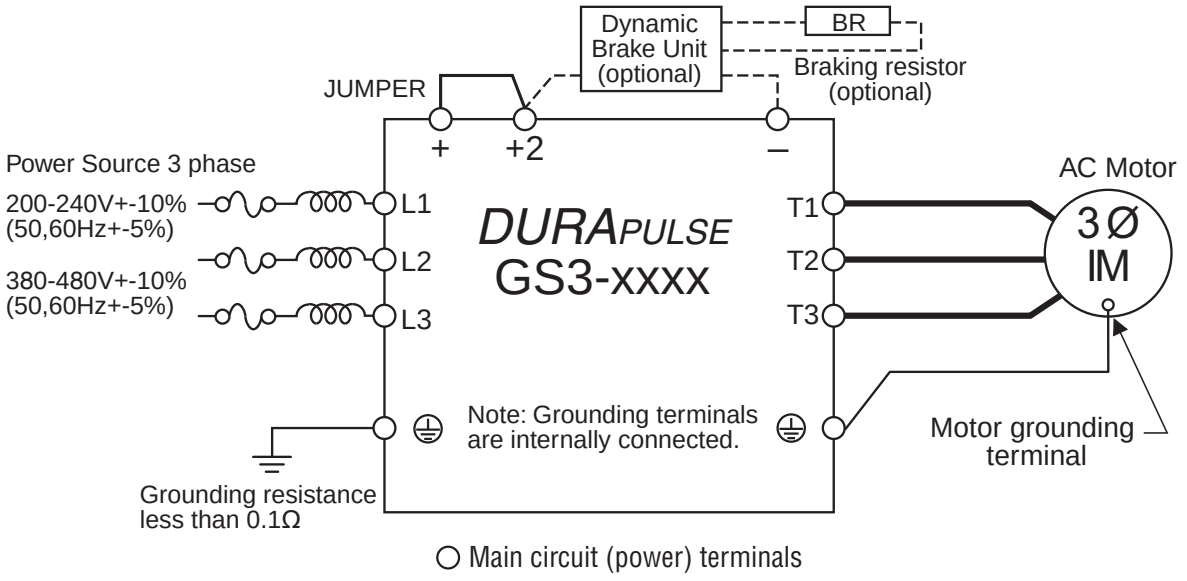
Drives under 20hp

Users must connect wiring according to the circuit diagram shown below.



Drives 20–30hp (230VAC) & 20–60hp (460VAC)

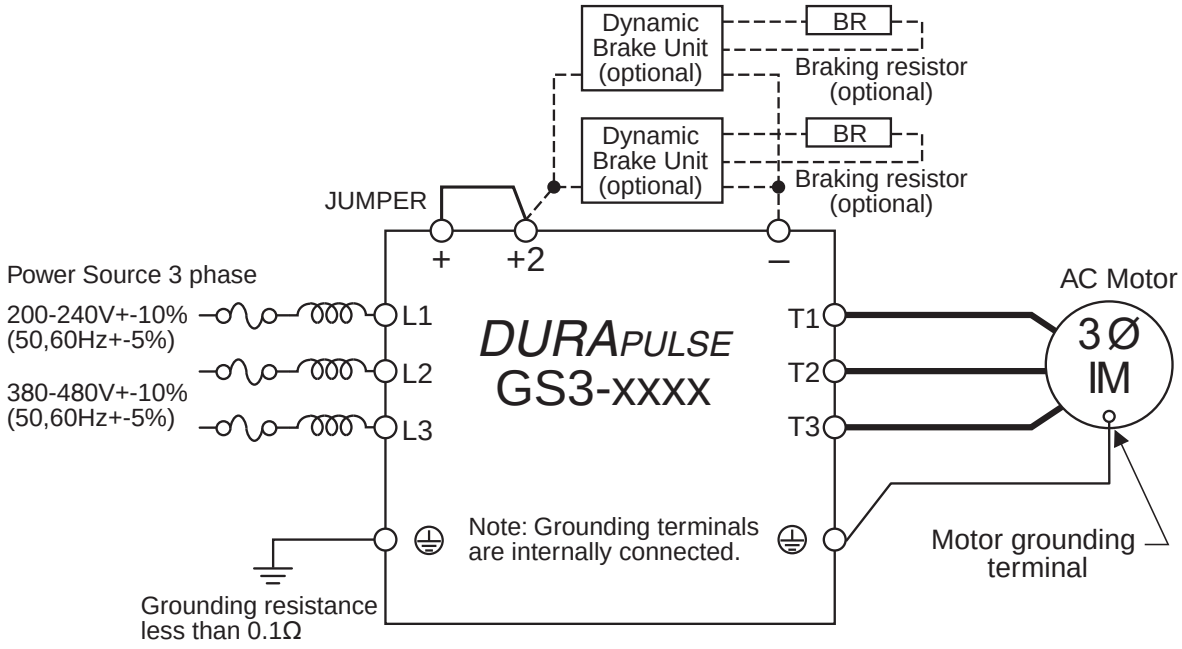
Users must connect wiring according to the circuit diagram shown below.



Power Wiring Diagrams (continued)

Drives 40–50hp (230VAC) & 75–100hp (460VAC)

Users must connect wiring according to the circuit diagram shown below.



Control Terminal Designations

Control Circuit Terminals		
Terminal Symbol	**Description**	**Remarks**
+24V	DC Voltage Source	(+24V, 20mA), used only for AC drive digital inputs wired for source mode operation
DI1	Digital Input 1	Input Voltage: Internally Supplied *(see WARNING below)* Sink Mode: Low active, Vin_L Min = 0V, Vin_L Max = 15V, Iin Min = 2.1mA, Iin Max = 7.0mA Source Mode: High active, Vin_H Min = 8.5V, Vin_H Max = 24V, Iin Min = 2.1mA, Iin Max = 7.0mA Input response: 12 - 15 msec Also see "Basic Wiring Diagram" on the next pages.
DI2	Digital Input 2	
DI3	Digital Input 3	
DI4	Digital Input 4	
DI5	Digital Input 5	
DI6	Digital Input 6	
DI7	Digital Input 7	
DI8	Digital Input 8	
DI9	Digital Input 9	
DI10	Digital Input 10	
DI11	Digital Input 11	
DCM	Digital Common	
+10V	Internal Power Supply	+10VDC (10mA maximum load)
AI1	Analog Input	0 to +10 V input only
AI2	Analog Input	0 to 20 mA / 4 to 20 mA input
AI3	Analog Input	-10 to +10 V input only
ACM	Analog Common	
R1O	Relay Output 1 Normally Open	Resistive Load: 240VAC – 5A (N.O) / 3A (N.C.) 24VDC – 5A (N.O.) / 3A (N.C.) Inductive Load: 240VAC – 1.5A (N.O) / 0.5A (N.C) 24VDC – 1.5A (N.O) / 0.5A (N.C)
R1C	Relay Output 1 Normally Closed	
R1	Relay Output 1 Common	
DO1	Photocoupled digital output	12-48 VDC, 50 mA
DO2	Photocoupled digital output	
DO3	Photocoupled digital output	
DOC	Digital Output Common	
FO	Digital Frequency Output	Maximum 50mA @ 48VDC, Scalable squarewave, 50% duty cycle output
AO	Analog Output	0 to +10V, 2mA Output
Control Terminal Wire Range: 24–12 AWG ***Control Terminal Tightening Torque: 5kgf·cm [4lbf·in]***		

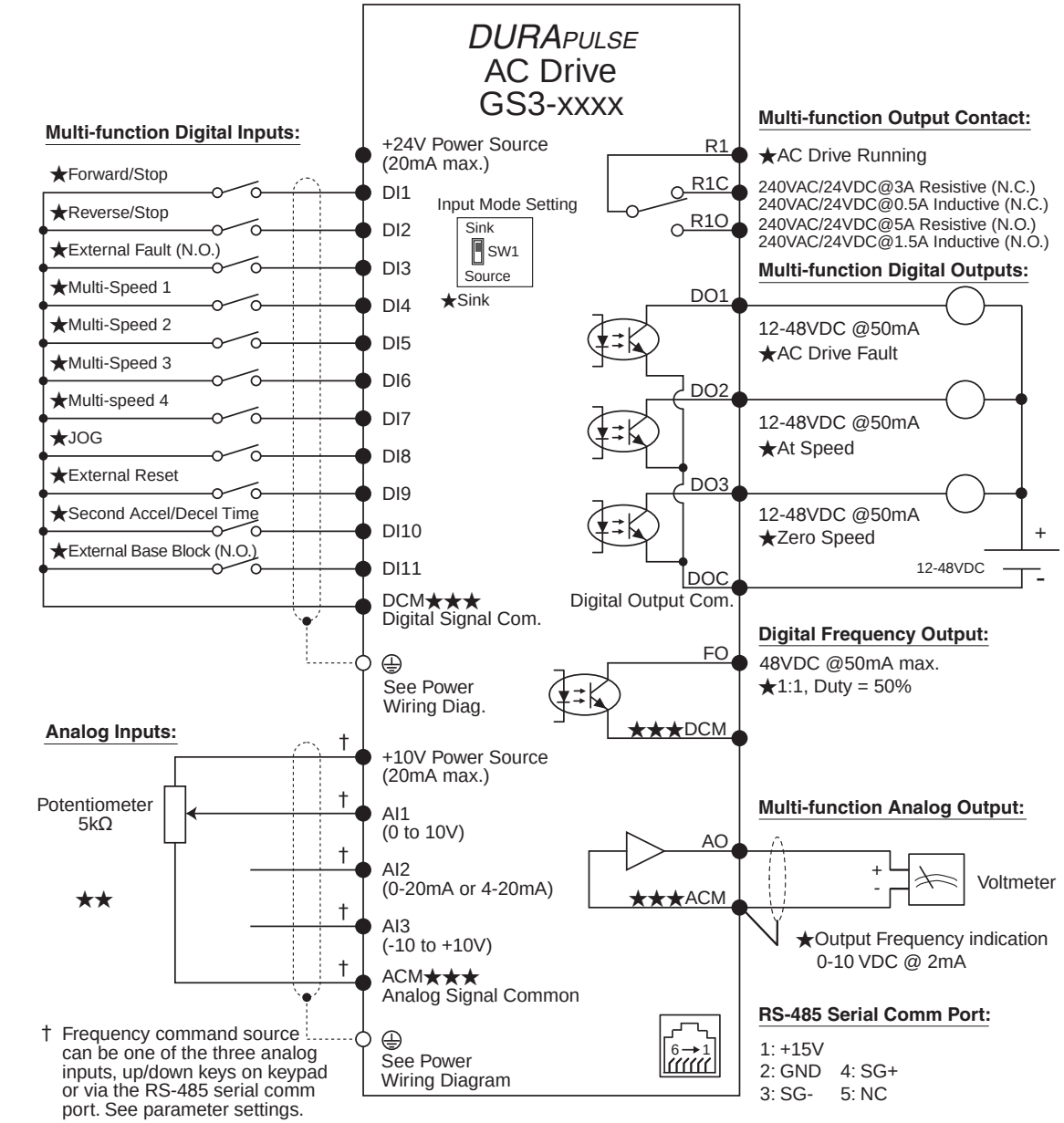
WARNING: Do NOT connect external voltage sources to the Digital Inputs. Permanent damage may result.

Use twisted-shielded, twisted-pair or shielded-lead wires for the control signal wiring. It is recommended to run all signal wiring in a separate steel conduit. The shield wire should only be connected at the AC drive. Do not connect shield wire on both ends.

Control Wiring Diagram – Sinking Inputs

Users must connect wiring according to the circuit diagram shown below.

WARNING: Do not plug a modem or telephone into the *DURAPULSE* RJ-12 Serial Comm Port, or permanent damage may result.



★ Factory default setting

★★ Factory default source of frequency command is via the keypad up/down keys

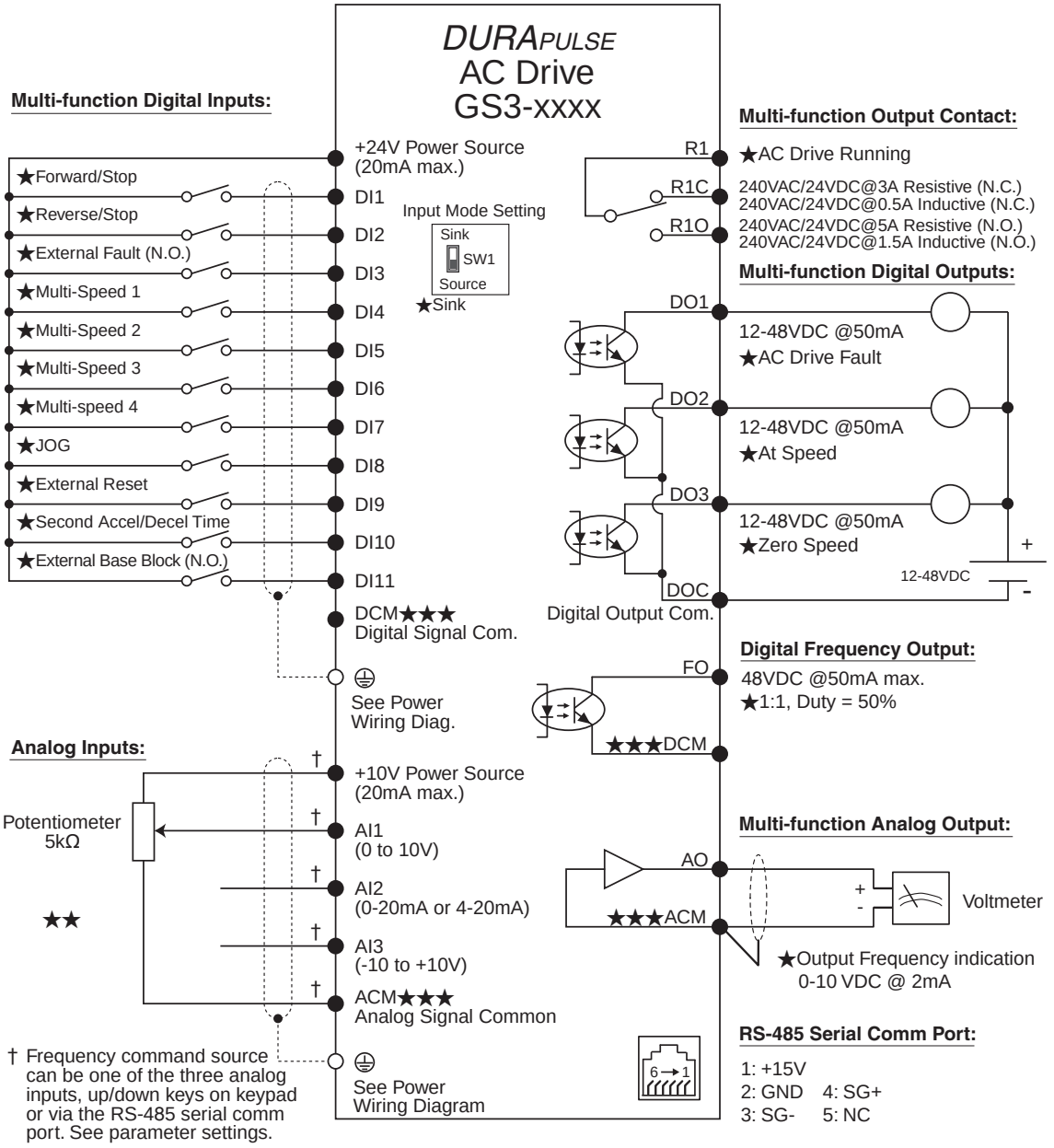
★★★ ACM and DCM are isolated from each other

○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

Control Wiring Diagram – Sourcing Inputs

Users must connect wiring according to the circuit diagram shown below.

WARNING: Do not plug a modem or telephone into the *DURAPULSE* RJ-12 Serial Comm Port, or permanent damage may result.



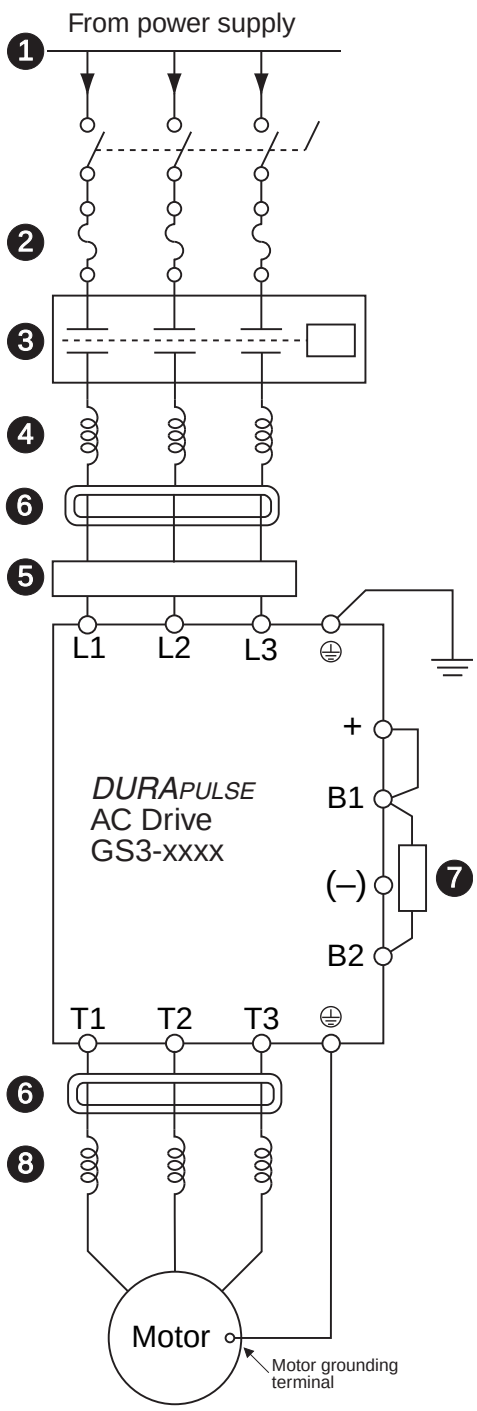
★ Factory default setting

★★ Factory default source of frequency command is via the keypad up/down keys

★★★ ACM and DCM are isolated from each other

○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

External Accessories



1 Power Supply
Please follow the specific power supply requirements shown in CHAPTER 1

2 Fuses
Input fuses protect the AC drive from excessive input current due to line surges, short circuits, and ground faults. They are recommended for all installations and may be required for UL-listed installations.

3 Contactor (Optional)
Do NOT use a power circuit contactor or disconnect switch for run/stop control of the AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.

4 AC Line Reactor (Optional)
Input line reactors protect the AC drive from transient overvoltage conditions typically caused by utility capacitor switching. Input line reactors also reduce harmonics associated with AC drives, and are recommended for all installations.

5 EMI filter (Optional)
Input EMI filters reduce electromagnetic interference or noise on the input side of the AC drive. They are required for CE compliance and recommended for installations prone to or sensitive to electromagnetic interference.

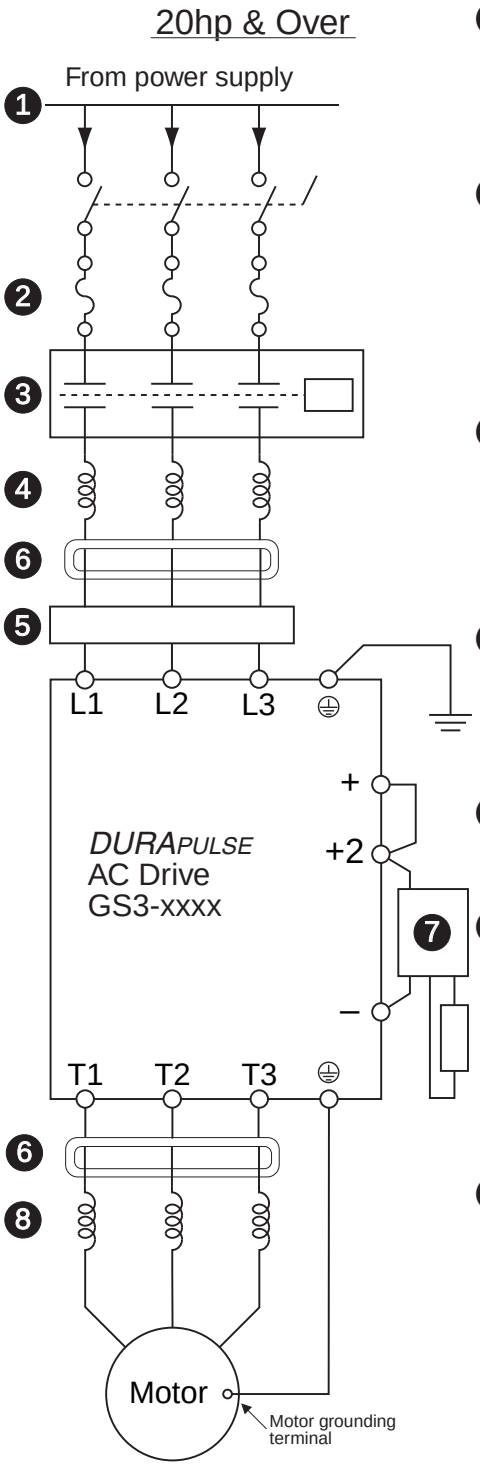
6 RF filter (Optional)
RF filters reduce the radio frequency interference or noise on the input or output side of the inverter.

7 Braking Resistor (Optional)
Dynamic braking allows the AC drive to produce additional braking (stopping) torque. AC drives can typically produce between 15% & 20% braking torque without the addition of any external components. Optional braking may be required for applications that have high inertia loads or require rapid deceleration.

8 AC Line Reactor (Optional)
Output line (load) reactors protect the motor insulation against AC drive short circuits and IGBT reflective wave damage, and also “smooth” the motor current waveform, allowing the motor to run cooler. They are recommended for operating “non-inverter-duty” motors, and when the length of wiring between the AC drive and motor exceeds 75ft.

Please refer to Appendix A for specifications on DURAPULSE AC Drive Accessories.

External Accessories (continued)



1 Power Supply
Please follow the specific power supply requirements shown in CHAPTER 1

2 Fuse
Input fuses protect the AC drive from excessive input current due to line surges, short circuits, and ground faults. They are recommended for all installations and may be required for UL-listed installations.

3 Contactor (Optional)
Do NOT use a power circuit contactor or disconnect switch for run/stop control of the AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.

4 AC Line Reactor (Optional)
Input line reactors protect the AC drive from transient overvoltage conditions typically caused by utility capacitor switching. Input line reactors also reduce harmonics associated with AC drives, and are recommended for all installations.

5 EMI filter (Optional)
Input EMI filters reduce electromagnetic interference or noise on the input side of the AC drive. They are required for CE compliance and recommended for installations prone to or sensitive to electromagnetic interference.

6 RF filter (Optional)
RF filters reduce the radio frequency interference or noise on the input or output side of the inverter.

7 Braking Unit and Braking Resistor (Optional)
Dynamic braking allows the AC drive to produce additional braking (stopping) torque. AC drives can typically produce between 15% & 20% braking torque without the addition of any external components. Optional braking may be required for applications that have high inertia loads or require rapid deceleration.

8 AC Line Reactor (Optional)
Output line (load) reactors protect the motor insulation against AC drive short circuits and IGBT reflective wave damage, and also “smooth” the motor current waveform, allowing the motor to run cooler. They are recommended for operating “non-inverter-duty” motors, and when the length of wiring between the AC drive and motor exceeds 75ft.

Please refer to Appendix A for specifications on DURAPULSE AC Drive Accessories.

CHAPTER 3

KEYPAD OPERATION AND QUICKSTART

Contents of this Chapter...

The *DURAPULSE* Digital Keypad 3–2
- LCD Display 3–2
- LED Indicators 3–2
- Function Keys 3–3
- Displaying the Status of the *DURAPULSE* AC Drive 3–4
- Programming the *DURAPULSE* AC Drive 3–5

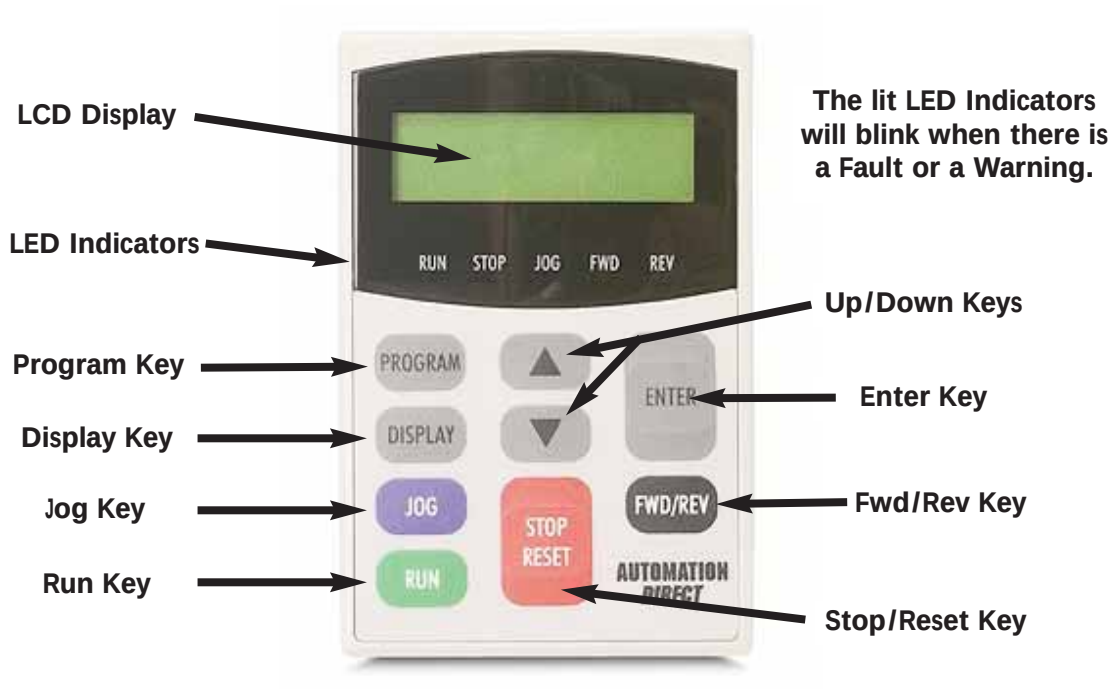
DURAPULSE Quickstart 3–6
- Example 1: Constant torque (e.g. conveyors, compressors, etc.) 3–6
- Example 2: Variable torque (e.g. fans, centrifugal pumps, etc.) 3–10

Auto-Tune Procedure 3–14

Copy Keypad Function 3–16
- Enable Copy Keypad Function 3–16
- Write Parameter Settings to Keypad 3–17
- Write Parameter Settings to Drive 3–18

The *DURAPULSE* Digital Keypad

The digital keypad includes a 2 line x 16 character LCD display, 5 status LED Indicators, and 9 function keys. The diagram below shows all of the features of the digital keypad and an overview of their functions.



LCD Display

The LCD Display shows the operation values and parameter settings of the AC drive.

LED Indicators

RUN The RUN LED indicates the AC drive is in Run Mode.

STOP The STOP LED indicates the AC drive is not in Run Mode.

FWD The FWD LED indicates the AC drive is running the motor in the forward direction.

REV The REV LED indicates the AC drive is running the motor in the reverse direction.

JOG The JOG LED indicates the AC drive is in the Jog Mode.

If the STOP key on the keypad is active and the keypad is removed, the drive will stop.

Function Keys

Program Key

Pressing the PROGRAM key will display the parameter groups. Use the UP/DOWN or PROGRAM keys to cycle through the parameter groups. The LCD display will show which parameter group is currently selected.

Display Key

Pressing the DISPLAY key on the keypad repeatedly will cycle through the status messages on the AC drive.

Fwd/Rev Key

Pressing the FWD/REV key changes the direction in which the motor operates.

Run

Pressing the RUN key starts the AC drive operation. This key has no function if the AC drive is controlled by the external control terminals.

Up/Down Keys

The UP/DOWN keys are used to scroll through the parameter groups, the various parameters in each group and also change the parameter settings in single-unit increments. To quickly run through the range of settings, press and hold the UP or DOWN key.

Enter Key

Press the ENTER key to view parameters and store parameter settings.

Stop/Reset Key

Used to stop AC drive operation. If the AC drive has stopped due to a fault, clear the fault first, then press this key to reset the AC drive.

Jog Key

Pressing the JOG key controls the jog function.



After a one (1) minute key inactivity, the keypad LCD display will automatically revert to the display mode and display the user defined display function selected in parameter P8.00.

Adjust Frequency Setpoint

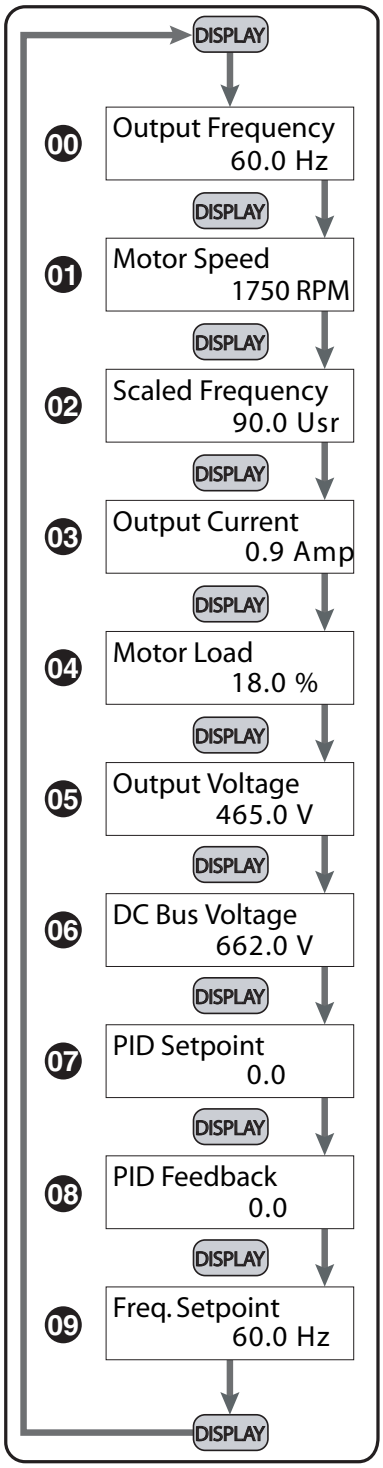
If the UP and DOWN keys are pressed when the LCD is in DISPLAY mode and the AC drive frequency is being controlled by the keypad (P4.00=1), then the keypad will display the frequency setpoint and have the ability to adjust the frequency setpoint with the UP/DOWN keys accordingly. The frequency setpoint will be stored even if the drive is powered off.

Adjust PID Setpoint

The ability to adjust the PID setpoint with the UP and DOWN keys will be true if parameter P7.00 is set to a value of 01, 02, 03, or 04, parameter P7.02 = 00 and the LCD display shows the PID setpoint.

Displaying the Status of the *DURAPULSE* AC Drive

Press the DISPLAY key on the keypad repeatedly to cycle through the status messages on the AC drive. The diagram below shows the order of the status messages as you cycle through them and shows the definition of the status messages. The status of the AC drive can be shown in RUN or STOP mode.



00 Actual Operating Frequency
Displays the actual operating frequency present at the T1, T2, and T3 terminals. *Example: 60.0Hz*

01 RPM
Displays the present *estimated* speed of the motor. *Example: 1750 RPM*

02 Scaled Frequency
Displays the result of output frequency x parameter P8.01. *Example: 60Hz x 1.5 = 90.0*

03 Amps
Displays the output current present at the T1, T2, and T3 terminals. *Example: 0.9A*

04 % Motor Load
Displays the amount of load on the AC drive.
Example: (Output Current ÷ Drive Rated Current) x 100

05 Output Voltage
Displays the output voltage present at the T1, T2, and T3 terminals. *Example: 465V*

06 DC Bus Voltage
Displays the DC Bus Voltage. *Example: 662 VDC*

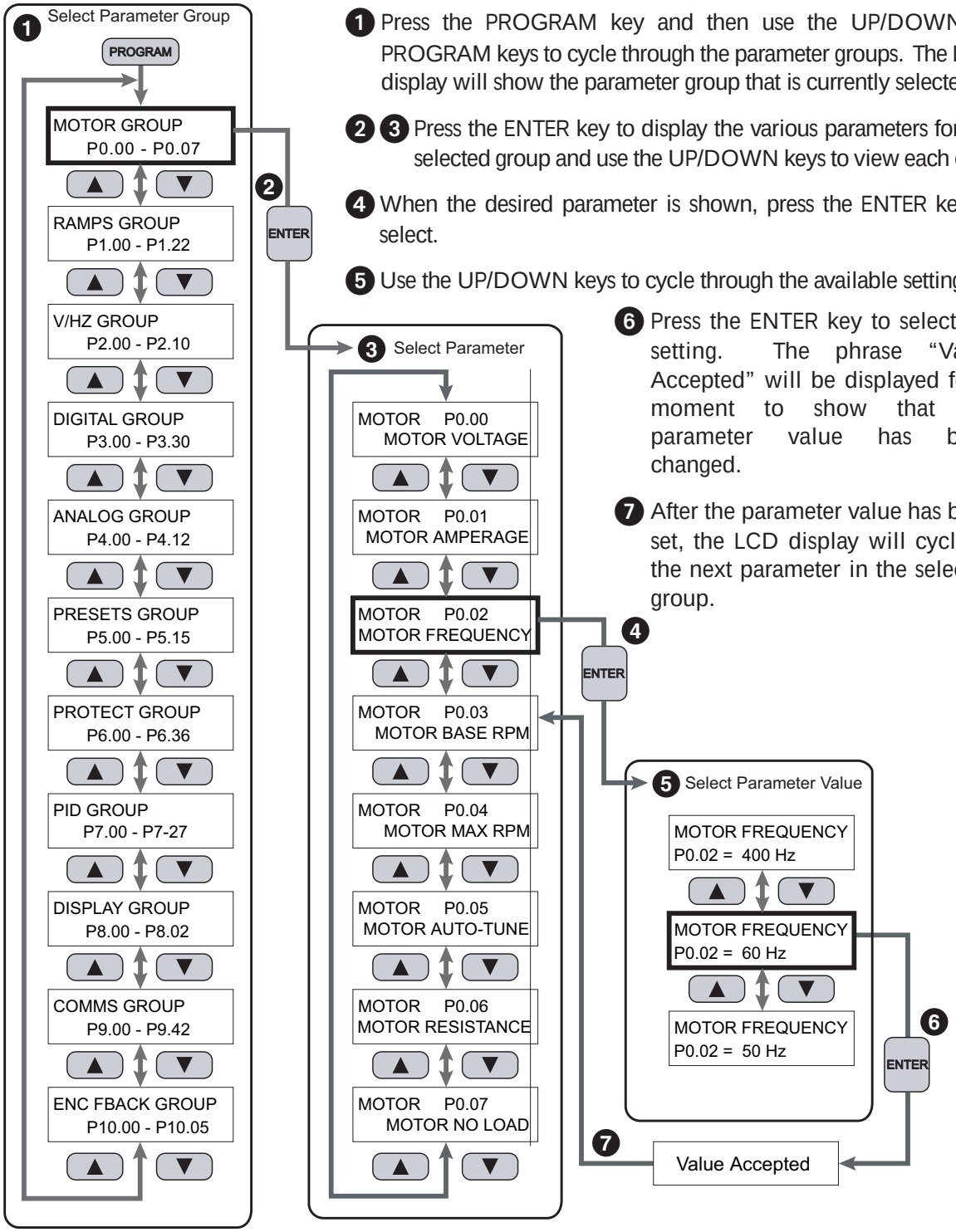
07 PID Setpoint
Displays the PID setpoint. *Note: It is possible to change the PID setpoint with the ▲ and ▼ keys when the PID setpoint value is displayed on the keypad. The PID function (P7.00) must be enabled, and the PID Setpoint source (P7.02) must be set to keypad (00).*

08 PID Feedback Signal (PV)
Displays the PID feed-back signal.

09 Frequency Setpoint
Displays the frequency setting of the AC drive.
Example: 60.0Hz

Programming the *DURAPULSE* AC Drive

The *DURAPULSE* AC Drive parameters are organized into eleven (11) different groups according to their functions, plus a special "Copy Keypad" function for storing up to four (4) different sets of program parameters into the keypad. The illustration below shows you how to navigate through the parameter groups and parameter settings. For a complete list of parameters, see CHAPTER 4.



1. Press the PROGRAM key and then use the UP/DOWN or PROGRAM keys to cycle through the parameter groups. The LCD display will show the parameter group that is currently selected.
2. 3. Press the ENTER key to display the various parameters for the selected group and use the UP/DOWN keys to view each one.
4. When the desired parameter is shown, press the ENTER key to select.
5. Use the UP/DOWN keys to cycle through the available settings.
6. Press the ENTER key to select the setting. The phrase "Value Accepted" will be displayed for a moment to show that the parameter value has been changed.
7. After the parameter value has been set, the LCD display will cycle to the next parameter in the selected group.

DURAPULSE Quickstart

The following examples will help you quickly set up your *DURAPULSE* AC Drive for two common applications. The first example applies to an application that requires constant torque, and the second example requires variable torque in its application.



For a complete list and description of the parameters for the DURAPULSE AC drives, see CHAPTER 4.

Example 1: Constant torque (e.g. conveyors, compressors, etc.)

In this example, the AC drive needs to operate a motor that is connected to a conveyor. In order to decide which parameters need modifications, we will make a list of the needs for the application.

Application Needs

- The AC drive must control a 460V, 1hp inverter duty motor. We will use a model GS3-41P0 AC drive for this application. An example of the motor nameplate is shown below.

INVERTER DUTY MOTOR							
HP	1	Volts	460	PHASE	3	TYPE	P
RPM	1725	AMPS	2.6	HZ	60	SF	1.15
DESIGN	B			AMB	40°C	INSUL CLASS	F
DUTY	CONT			ENCL	TEFC	CODE	K

- The maximum speed for the motor is 2000 rpm.
- The motor should accelerate to maximum speed in 5 seconds.
- The motor should decelerate from maximum speed in 5 seconds. (Applications with high starting torque reqirements and/or high inertia loads may require optional braking resistors.)
- The motor will require a high torque when starting.
- The operation of the motor (start, stop, etc.) will be controlled by remote control terminals. All keys on the *DURAPULSE* keypad should be disabled.
- The frequency of the AC drive will be determined by remote potentiometer that has a 0 to +10V signal.
- The display of the AC drive should default to the motor speed (rpm) when running.

Parameter Setup

In order to meet the needs of this application, the parameters should be set as follows:

P0.00 **Motor Nameplate Voltage** **Setting: 460**

Range: 230V series: 200/208/220/230/240 Default Setting: 240
460V series: 380/400/415/440/460/480 Default Setting: 480

This parameter setting is determined by the motor nameplate.

P0.01 **Motor Nameplate Amps** **Setting: 2.6**

Range: Drive Rated Amps x .1 to Drive Rated Amps x 1.0 Default Setting: Drive Rating (A)

This parameter setting is determined by the motor nameplate..

P0.02 **Motor Base Frequency** **Setting: 60**

Range: 50/60/400 Default Setting 60

This parameter setting is determined by the motor nameplate.

P0.03 **Motor Base RPM** **Setting: 1725**

Range: 375 to 24,000 RPM Default Setting: 1750

This parameter setting is determined by the motor nameplate.

P0.04 **Motor Maximum RPM** **Setting: 2000**

Range: P0.03 to 24,000 RPM Default Setting: P0.03

This parameter setting is determined by the needs of the application.



WARNING: The Motor Maximum RPM parameter (P0.04) should never exceed the maximum RPM rating for the motor that you are using. If this information is not readily available, consult your motor manufacturer.

P1.00 **Stop Methods** **Setting: 00**

Range: 00 Ramp to Stop
01 Coast to stop Default Setting: 00

The application requires that this parameter be set to Ramp to Stop because the motor needs to stop under power. (If the AC drive is set for Coast to Stop, the AC drive will ignore the Deceleration Time setting.)



WARNING: If the Stop Method for the *DURAPULSE* AC drive is set for Coast to Stop, the AC drive will ignore the (P1.02) setting for Deceleration Time.

P1.01 Acceleration Time — Setting: 5.0

Range: 0.1 to 600 sec — Default Setting: 10 sec

The motor should accelerate from 0 RPM to Maximum Motor RPM (P0.04) in 5 seconds.

P1.02 Deceleration Time — Setting: 5.0

Range: 0.1 to 600 sec — Default Setting: 30 sec

The motor should decelerate from 2000 rpm; Maximum Motor RPM (P0.04) to 0 RPM in 5 seconds.

P2.00 Volts/Hertz Settings — Setting: 01

Range: 00 - General Purpose — Default Setting: 0.0
01 - High Starting Torque
02 - Fans and Pumps
03 - Custom

The *DURAPULSE* AC drive has some predefined torque settings that meet the needs of most applications. A custom setting is available if needed. In this example, the application requires a high starting torque.

P3.00 Source of Operation Command — Setting: 02

Default Setting: 00

Settings	00	Operation Determined by Digital Keypad
	01	Operation determined by external control terminals. Keypad STOP is enabled.
	02	Operation determined by external control terminals. Keypad STOP is disabled.
	03	Operation determined by RS-485 interface. Keypad STOP is enabled.
	04	Operation determined by RS-485 interface. Keypad STOP is disabled.

The AC drive operation will be determined by external control terminals, and the keypad stop will be disabled.



If parameter P3.00 = 00, 01, or 03, enabling the keypad STOP key, the drive will stop if the keypad is removed from the drive.

P4.00 Source of Frequency Command Setting: 02

Default: 01

Settings:
- 01 Frequency determined by digital keypad up/down
- 02* Frequency determined by 0 to +10V input on AI1 terminal.
- 03 Frequency determined by 4 to 20 mA input on AI2 terminal.
- 04 Frequency determined by 0 to 20 mA input on AI2 terminal.
- 05 Frequency determined by RS-485 communication interface
- 06 Frequency determined by-10V~+10V input on AI3 terminal

** In order to set P4.00 = 02, you must first change the value of P4.13 to some value other than two (02) in order to avoid the "Error: Duplicate Function" error message. (P4.13 default value is 02)*

P6.00 Electronic Thermal Overload Relay Setting: 00

Default: 00

Settings:
- 00 Constant Torque (inverter/vector duty motor)
- 01 Variable Torque (fan-cooled standard motor)
- 02 Inactive

This function setting 00 is the standard overload protection curve used to protect inverter/vector duty motors.

P8.00 User Defined Display Function Setting: 01

Default Setting: 00

Settings:
- 00 Output Frequency (Hz)
- 01 Motor Speed (RPM)
- 02 Scaled Frequency
- 03 Output Current (A)
- 04 Motor Load (%)
- 05 Output Voltage(V)
- 06 DC Bus Voltage (V)
- 07 PID Setpoint
- 08 PID Feedback (PV)
- 09 Frequency Setpoint

The AC drive display will default to motor speed (rpm) when running.

Example 2: Variable torque (e.g. fans, centrifugal pumps, etc.)

In this example, the AC drive needs to operate a motor that is connected to a centrifugal pump. As in Example 1, we will make a list of the needs for the application in order to decide which parameters need modifications.

Application Needs

- The AC drive must control a 208V, 3hp fan-cooled standard duty motor. The AC drive model we will be using for this application is a GS3-23P0. An example of the motor nameplate is shown below.

STANDARD DUTY MOTOR							
HP	3	Volts	208	PHASE	3	TYPE	P
RPM	3525	AMPS	9.2	HZ	60	SF	1.15
DESIGN	B			AMB	40°C	INSUL CLASS	F
DUTY	CONT			ENCL	TEFC	CODE	K

- The maximum speed for the motor is 3600 rpm.
- The motor should accelerate to maximum speed in 20 seconds.
- The motor should coast to stop when operation is terminated.
- The motor will be turning a centrifugal pump.
- The operation of the motor (start, stop, etc.) will be controlled by the *DURAPULSE* digital keypad.
- The frequency of the AC drive will be determined by the *DURAPULSE* keypad potentiometer.
- The display of the AC drive should default to output current (A) when running.

Parameter Setup

In order to meet the needs of this application, the parameters should be set as follows:

P0.00 **Motor Nameplate Voltage** **Setting: 208**

Range: 230V series: 200/208/220/230/240 Default Setting: 240
460V series: 380/400/415/440/460/480 Default Setting: 480

This parameter setting is determined by the motor nameplate.

P0.01 **Motor Nameplate Amps** **Setting: 9.2**

Range: Drive Rated Amps x 0.1 to Drive Rated Amps x 1.0 Default Setting: Drive Rating (A)

This parameter setting is determined by the motor nameplate.

P0.02 **Motor Base Frequency** **Setting: 60**

Range: 50/60/400 Default Setting 60

This parameter setting is determined by the motor nameplate.

P0.03 **Motor Base RPM** **Setting: 3525**

Range: 375 to 24,000 RPM Default Setting: 1750

This parameter setting is determined by the motor nameplate.

P0.04 **Motor Maximum RPM** **Setting: 3600**

Range: P0.03 to 24,000 RPM Default Setting: P0.03

This parameter setting is determined by the needs of the application.



WARNING: The Motor Maximum RPM parameter (P0.04) should never exceed the maximum rpm rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

P1.00 **Stop Methods** **Setting: 01**

Range: 00 Ramp to Stop Default Setting: 00
01 Coast to stop

The application requires that this parameter be set to Coast to Stop.



WARNING: If the Stop Method for the *DURAPULSE* AC drive is set for Coast to Stop, the AC drive will ignore the Deceleration Time (P1.02) setting.

P1.01 **Acceleration Time** **Setting: 20.0**

Range: 0.1 to 600 sec Default Setting: 10 sec

The motor should accelerate from 0 RPM to Maximum Motor RPM (P0.04) in 20 seconds.

P2.00 Volts/Hertz Settings — Setting: 02

Range: 00 - General Purpose
01 - High Starting Torque
02 - Fans and Pumps
03 - Custom

Default Setting: 00

The *DURAPULSE* AC drive has some predefined torque settings that meet the needs of most applications. A custom setting is available if needed. In this example, the motor will be running a pump.



In some applications it is perfectly acceptable to leave this parameter set for "00" - General Purpose.

P3.00 Source of Operation Command — Setting: 00

Default Setting: 00

Settings	00	Operation Determined by Digital Keypad
	01	Operation determined by external control terminals. Keypad STOP is enabled.
	02	Operation determined by external control terminals. Keypad STOP is disabled.
	03	Operation determined by RS-485 interface. Keypad STOP is enabled.
	04	Operation determined by RS-485 interface. Keypad STOP is disabled.

The AC drive operation will be determined by the Digital Keypad.



If parameter P3.00 = 0, 1, or 3, enabling the keypad STOP key, the drive will stop if the keypad is removed from the drive.

P4.00 Source of Frequency Command — Setting: 00

Default: 01

Settings:
- 01 Frequency determined by digital keypad up/down
- 02* Frequency determined by 0 to +10V input on AI1 terminal.
- 03 Frequency determined by 4 to 20 mA input on AI2 terminal.
- 04 Frequency determined by 0 to 20 mA input on AI2 terminal.
- 05 Frequency determined by RS-485 communication interface.
- 06 Frequency determined by -10V ~ +10V input on AI3 terminal

** In order to set P4.00 = 02, you must first change the value of P4.13 to some value other than two (02) in order to avoid the "Error: Duplicate Function" error message. (P4.13 default value is 02)*

P6.00 Electronic Thermal Overload Relay — Setting: 01

Default Setting: 00

Settings:
- 00 Constant Torque (inverter/vector duty motor)
- 01 Variable Torque (fan-cooled standard motor)
- 02 Inactive

This function setting 01 is used to derate the AC drive output current overload protection to protect a fan-cooled standard motor running at low speeds.

P8.00 User Defined Display Function — Setting: 03

Default Setting: 00

Settings:
- 00 Output Frequency (Hz)
- 01 Motor Speed (RPM)
- 02 Scaled Frequency
- 03 Output Current (A)
- 04 Motor Load (%)
- 05 Output Voltage(V)
- 06 DC Bus Voltage (V)
- 07 PID Setpoint
- 08 PID Feedback (PV)
- 09 Frequency Setpoint

The AC drive display will default to indicate Output Current (A) when running.



For a complete list and description of the parameters for the DURAPULSE AC drives, see CHAPTER 4.

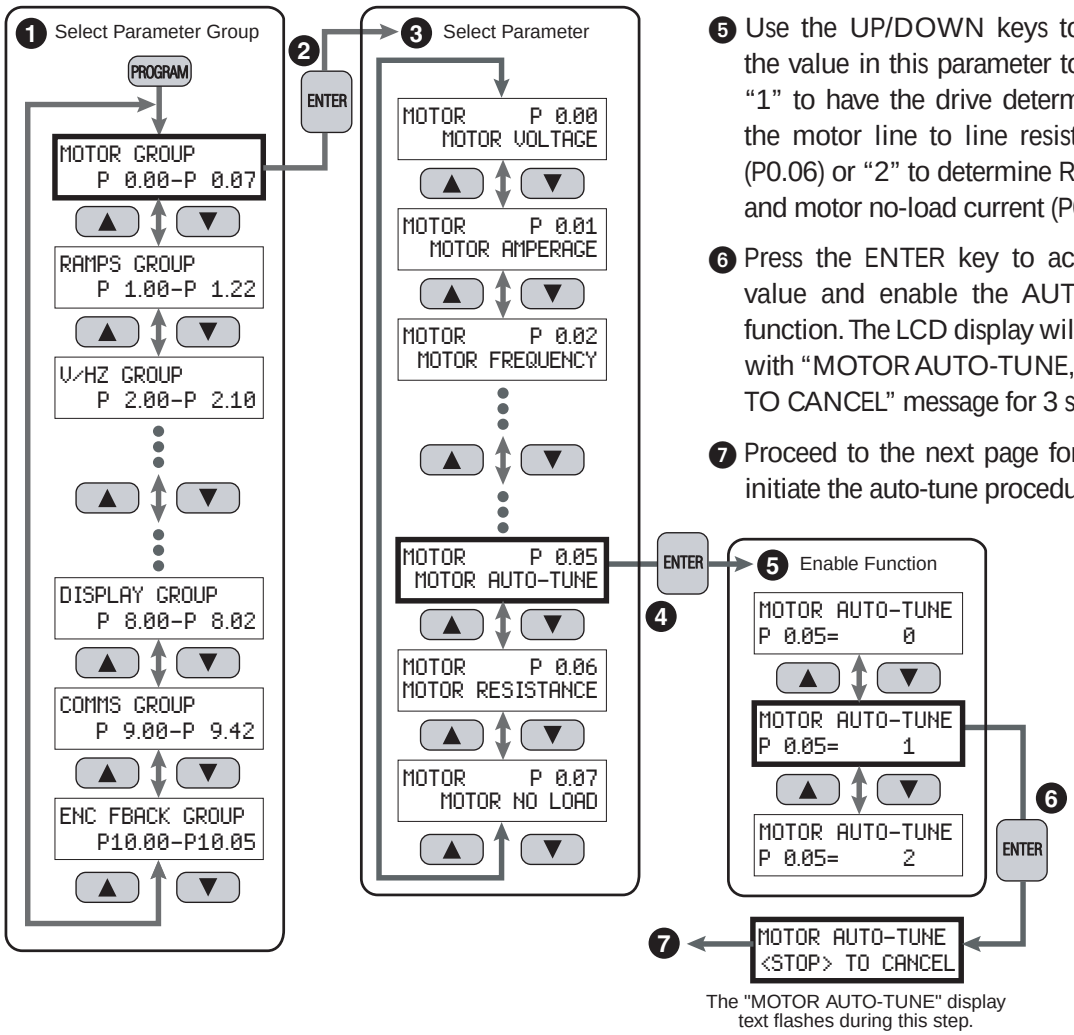
Auto-Tune Procedure

Auto-tuning is required only for Sensorless Vector Control Modes (P2.10 = 02, 03, 05).

WARNING: The motor will rotate when executing the auto-tuning procedure. It is also very important that no load be connected to the motor output shaft at the time the auto-tune procedure is performed.

The *DURAPULSE* AC drive is capable of performing an auto-tune procedure when a motor is connected to the AC drive. It is also very important for safety and functional reasons that no load be physically connected to the motor output shaft during auto-tuning. The auto-tune will begin when the RUN key is pressed on the AC drive keypad. To enable the Auto-Tune procedure, do the following:

1. Press the PROGRAM key repeatedly until the MOTOR GROUP, P0.00-P0-07, is displayed on the keypad LCD display.
2. Press the ENTER key to display the various parameters for this group.
3. Use the UP/DOWN keys to display parameter P0.05, MOTOR AUTO-TUNE.
4. Press the ENTER key to display the current value for this parameter.



The "MOTOR AUTO-TUNE" display text flashes during this step.

5. Use the UP/DOWN keys to change the value in this parameter to either a "1" to have the drive determine only the motor line to line resistance R1 (P0.06) or "2" to determine R1 (P0.06) and motor no-load current (P0.07).
6. Press the ENTER key to accept this value and enable the AUTO-TUNE function. The LCD display will indicate with "MOTOR AUTO-TUNE, <STOP> TO CANCEL" message for 3 seconds.
7. Proceed to the next page for steps to initiate the auto-tune procedure.



It is not necessary to set up the encoder and control mode before performing the auto-tuning function. (Auto-tuning is required only for the sensorless vector control modes.)



Do NOT set auto-tuning without a motor connected to the drive.
Do NOT set auto-tuning with any mechanical load connected to the motor output shaft.

Auto-Tune Instructions

If the drive is set to auto-tune with no motor connected, the drive will go into an infinite auto-tune loop without access to the parameter groups. To correct this situation, simply power down the unit, connect the motor, complete auto-tuning (even if incorrect), reset factory default (9.08 = 99), and then start over.

1. Make sure all wiring is correctly connected to the AC drive and motor.
2. Make sure there is no load connected to the motor's output shaft, including any belts or gear boxes.
3. Program parameters P0.00, P0.01, P0.02, P0.03 and P0.04 with the correct values for the motor being used.
4. After enabling the Auto-Tune parameter P0.05 as shown on the previous page for either a "1" to have the AC drive determine only the motor line to line resistance R1 (P0.06), or a "2" to determine R1 (P0.06) and the motor's no-load current (P0.07), the message MOTOR AUTO-TUNE (flashing), <STOP> TO CANCEL will appear on the keypad LCD display for a 3 second period. If the STOP key is pressed during this time, the Auto-Tune procedure will terminate, the value in parameter P0.05 will reset to "0" and the LCD display will return to the display mode.
5. After the confirmation message is shown, (the AC drive is ready to perform an Auto-Tune), the keypad LCD will display the message PRESS <RUN>, TO CONTINUE for 60 seconds. Once the RUN key is pressed, the display will show DETECTING MOTOR (flashing), <STOP> TO CANCEL. If the STOP key is pressed, the Auto-Tune procedure will terminate, the keypad LCD display will show either a "R1 Detect Error" or "No Load Error" warning message, and the value in parameter P0.05 will reset to "0". Use the STOP/RESET key to clear the warning message and return the drive to the display mode. Then repeat the procedure.
6. The Auto-Tune procedure will take approximately 15 seconds to execute, plus the acceleration and deceleration times in parameters P1.01 and P1.02. (The greater the horsepower of the AC drive and motor, the more acceleration and deceleration time will be required.)
7. Upon completion of the Auto-Tune procedure, the display will show the message TUNING COMPLETE, PRESS <ENTER>. At this time, the determined values for parameters P0.06 and P0.07 will be filled in automatically. Please check these parameters to make sure a value was determined. If no value was determined, then repeat the procedure.
8. If the STOP/RESET key on the keypad is pressed during auto-tuning, or if the RUN key is not pressed within 60 seconds once the message PRESS <RUN>, TO CONTINUE is displayed, the Auto-Tune procedure will terminate and the value in parameter P0.05 will reset to "0". The *DURAPULSE* AC drive will return to the normal display mode.

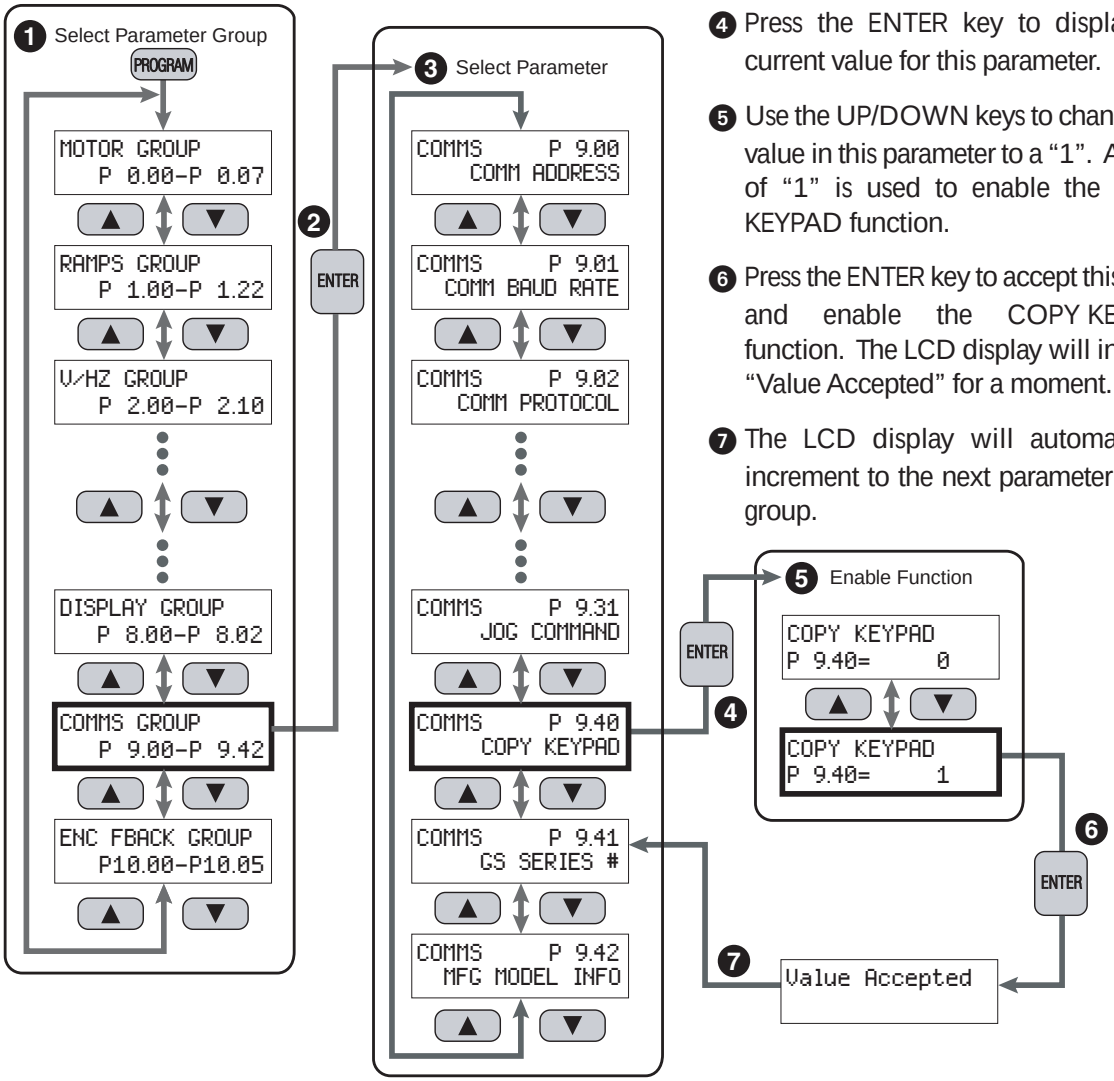
Copy Keypad Function

The COPY KEYPAD function has the ability to permanently store up to four (4) different program parameter settings within the keypad device. The stored parameter settings can be for any of the *DURAPULSE* AC Drives. This allows the parameter settings to be backed-up and readily available for either duplicating the same multiple AC drives or for maintenance use if a drive needs to be replaced.

It is recommended that once the application has been programmed, the parameter settings be backed-up in the keypad for future use and maintenance.

Enable Copy Keypad Function

1. Press the PROGRAM key repeatedly until the COMMS GROUP, P9.00 - P9.42, is displayed on the keypad LCD display.
2. Press the ENTER key to display the various parameters for this group.
3. Use the UP/DOWN keys to display parameter P9.40, the COPY KEYPAD function.

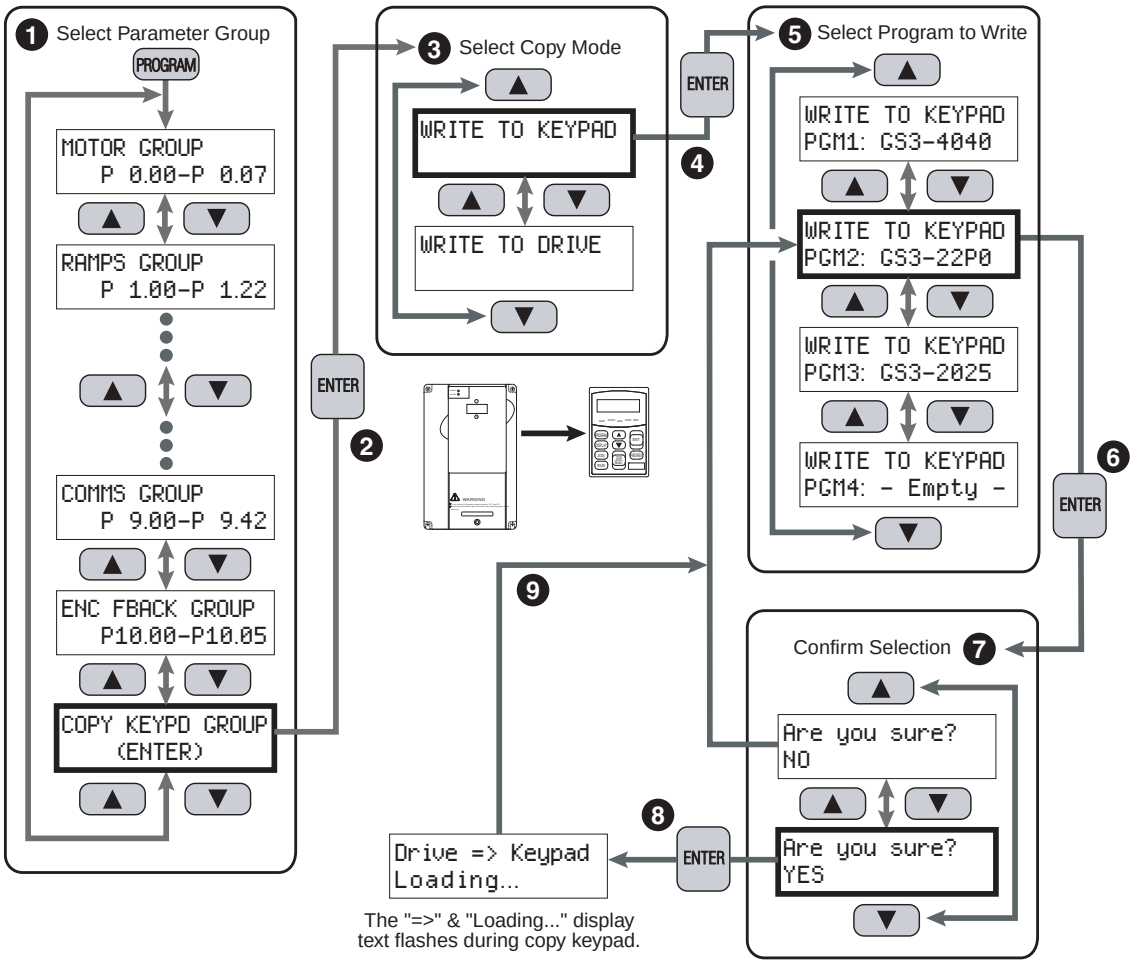


4. Press the ENTER key to display the current value for this parameter.
5. Use the UP/DOWN keys to change the value in this parameter to a "1". A value of "1" is used to enable the COPY KEYPAD function.
6. Press the ENTER key to accept this value and enable the COPY KEYPAD function. The LCD display will indicate "Value Accepted" for a moment.
7. The LCD display will automatically increment to the next parameter in the group.

Write Parameter Settings to Keypad

WARNING: Do not remove the Keypad during transfer of program parameter settings to or from the AC drive.

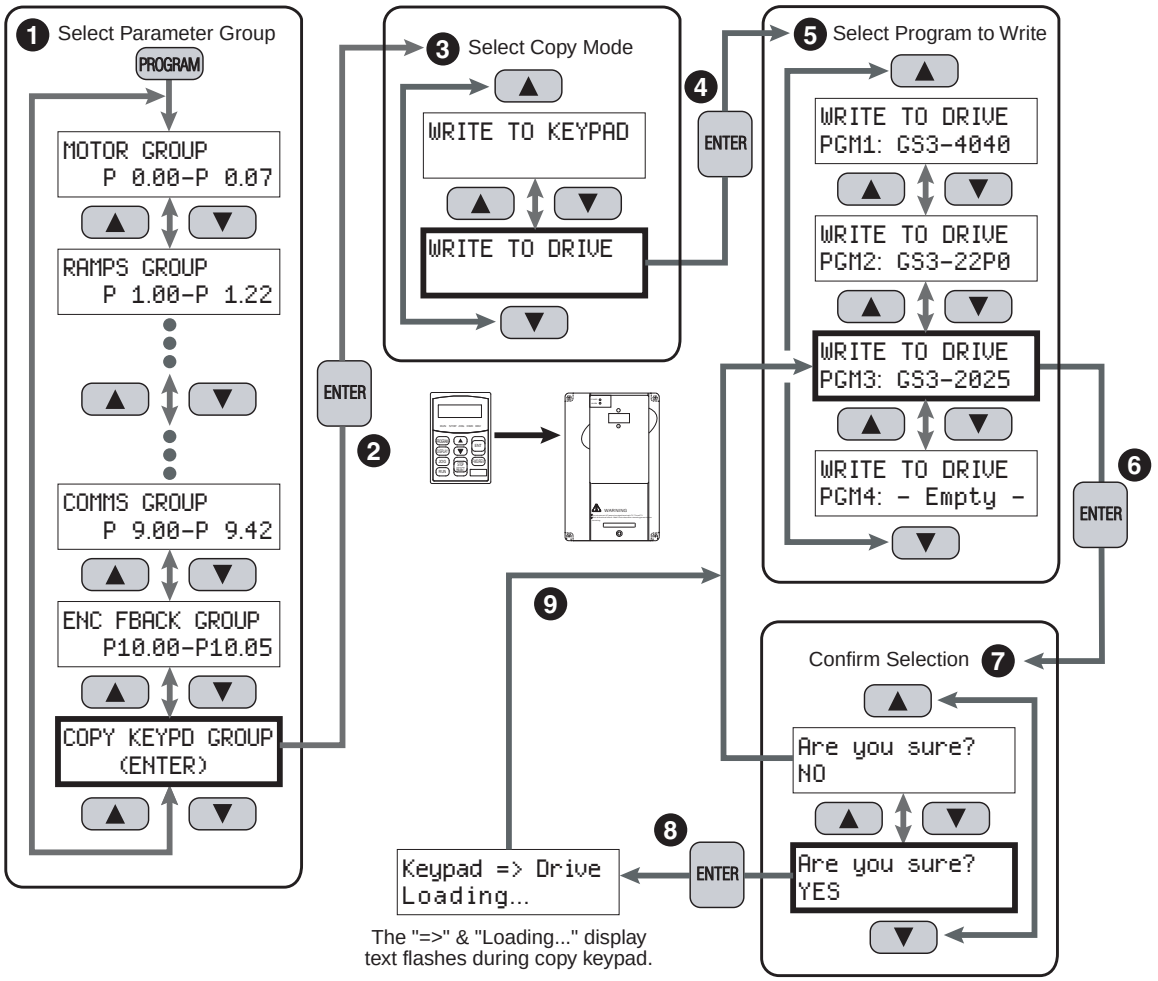
1. After P9.40 COPY KEYPAD is enabled, the LCD display will show an additional group called COPY KEYPD GROUP. Press the PROGRAM key and then the UP/DOWN or PROGRAM keys until this new group is displayed.
2. Press the ENTER key to display the copy mode selections.
3. Select the WRITE TO KEYPAD mode using the UP/DOWN keys.
4. Press the ENTER key to display the four (4) available program numbers to write from the AC drive to the keypad. The program name will automatically be named the part number of the AC drive, for example: GS3-22P0.
5. 6. Use the UP/DOWN keys to select the desired program number; PGM1 thru PGM4 and press the ENTER key.
7. 8. Use the UP/DOWN keys to select "Yes" to confirm and press the ENTER key.
9. The LCD display will show the message "Drive => Keypad, Loading..." while the parameters are being copied and return to the program selection when finished. (Does not restore P9.40 back to Disable Copy Keypad Function.)



Write Parameter Settings to Drive

WARNING: Do not remove the Keypad during transfer of program parameter settings to or from the AC drive.

1. After the COPY KEYPAD parameter is enabled, the LCD display will show an additional group called COPY KEYPD GROUP. Press the PROGRAM key and then the UP/DOWN or PROGRAM keys until this new group is displayed.
2. Press the ENTER key to display the copy mode selections.
3. Select the WRITE TO DRIVE mode using the UP/DOWN keys.
4. Press the ENTER key to display the four (4) available program numbers to write from the keypad to the AC drive. The program name must match the part number of the AC drive being programmed; for example: GS3-2025.
5. 6. Use the UP/DOWN keys to select the desired program number; PGM1 thru PGM4 and press the ENTER key.
7. 8. Use the UP/DOWN keys to select "Yes" to confirm and press the ENTER key.
9. The LCD display will show the message "Keypad => Drive, Loading..." while the parameters are being copied and return to the program selection when finished.





Use the PROGRAM key to back out of the various menu selections without saving changes.



The warning message RATING MISMATCH will be displayed on the LCD display if trying to do a WRITE TO DRIVE copy mode and selecting an existing program that does not match the drive being used.

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AC Drive Parameters



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DURAPULSE Parameter Summary

Parameters available only in later firmware versions of *DURAPULSE* AC drives



Some parameters and settings are available only in later firmware versions of *DURAPULSE* AC drives. Check parameter P9.39 to determine the firmware version of your *DURAPULSE* drive.

Parameters and settings available only with firmware v1.02 and higher:

- P6.30
- P9.39

Parameters and settings available only with firmware v1.04 and higher:

- P3.02~P3.10 settings 19, 20
- P3.11~P3.14 setting 16
- P3.31
- P4.13
- P4.14
- P4.15
- P4.16
- P4.17
- P4.18
- P7.27 settings 02, 03
- P7.28

Parameters and settings available only with firmware v1.05 and higher:

- P2.09
- P2.10 settings 04, 05
- P4.13 default = 06
- P6.37

Parameter Summary				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Motor Parameters				
P0.00	Motor Nameplate Voltage	230V class: 200/208/220/230/240 460V class: 380/400/415/440/460/480	240 480	
P0.01	Motor Nameplate Amps	Drive Rated Amps x 0.4 to 1.0	Drive Rated Amps x 1.0	
P0.02	Motor Base Frequency	50/60/400	60	
P0.03	Motor Base RPM	375 to 24,000 rpm	1750	
P0.04	Motor Maximum RPM (Max operation Freq., AI1 and AI2 100% value)	P0.03 to 24,000 rpm	P0.03	
P0.05	Motor Auto Tune	00 Disable 01 Enable P0.06 only 02 Enable P0.06 and P0.07	00	
P0.06	Motor Line to Line Resistance R1	00 to 65535 mΩ	00	
P0.07	Motor No-Load Current	Drive Rated Amps x 0.0 to 0.9 (Amps)	Drive Rated Amps x 0.4	

***** Some parameters and settings are available only in later firmware versions of *DURAPULSE* drives. Refer to the beginning of this "*DURAPULSE* Parameter Summary" section for more information.

Parameter Summary				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Ramp Parameters				
P1.00	Stop Methods	00: Ramp to Stop 01: Coast to Stop	00	
◆ **P1.01**	Acceleration Time 1	0.1 to 600.0s (must be > 1s to be effective)	10.0	
◆ **P1.02**	Deceleration Time 1	0.1 to 600.0s (must be > 1s to be effective)	30.0	
P1.03	Accel S-curve	0 to 7	00	
P1.04	Decel S-curve	0 to 7	00	
◆ **P1.05**	Acceleration Time 2	0.1 to 600.0s (must be > 1s to be effective)	10.0	
◆ **P1.06**	Deceleration Time 2	0.1 to 600.0s (must be > 1s to be effective)	30.0	
P1.07	Select method to use 2nd Accel/Decel	00: RMP2 from DI terminal 01: Transition Frequencies P1.08 & P1.09	00	
P1.08	Accel 1 to Accel 2 frequency transition	0.0 to 400.0 Hz	0.0	
P1.09	Decel 2 to Decel 1 frequency transition	0.0 to 400.0 Hz	0.0	
P1.10	Skip Frequency 1	0.0 to 400.0 Hz	0.0	
P1.11	Skip Frequency 2	0.0 to 400.0 Hz	0.0	
P1.12	Skip Frequency 3	0.0 to 400.0 Hz	0.0	
P1.13	Skip Frequency 4	0.0 to 400.0 Hz	0.0	
P1.14	Skip Frequency 5	0.0 to 400.0 Hz	0.0	
P1.17	Skip Frequency Band	0.0 to 20.0 Hz	0.0	
P1.18	DC Injection Current Level	00 to 100 %	00	
P1.20	DC Injection during Start-up	0.0 to 5.0 sec	0.0	
P1.21	DC Injection during Stopping	0.0 to 25.0 sec	0.0	
P1.22	Start-point for DC Injection	0.0 to 60.0 Hz	0.0	

***** Some parameters and settings are available only in later firmware versions of *DURAPULSE* drives. Refer to the beginning of this "*DURAPULSE* Parameter Summary" section for more information.

◆ Parameter can be set during RUN Mode.

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Volts/Hertz Parameters				
P2.00	Volts/Hertz Settings	00: General Purpose 01: High Starting Torque 02: Fans and Pumps 03: Custom	00	
◆ **P2.01**	Slip Compensation	0.0 to 10.0	0.0 (V/Hz mode) 1.0 (Vector mode)	
◆ **P2.02**	Auto-torque Boost	00 to 10	00	
◆ **P2.03**	Torque Compensation Time Constant	00 to 10 sec	0.05	
P2.04	Mid-point Frequency	0.1 to 400 Hz	0.5	
P2.05	Mid-point Voltage	230V class: 0.1 to 240V 460V class: 0.1 to 480V	5.0 10.0	
P2.06	Min. Output Frequency	0.1 to 20.0 Hz	0.5	
P2.07	Min. Output Voltage	230V class: 0.1 to 50V 460V class: 0.1 to 100V	5.0 10.0	
P2.08	PWM Carrier Frequency	01 to 15 kHz 01 to 15 kHz 01 to 09 kHz 01 to 06 kHz	1–5hp = 15 7.5–25hp = 9 30–60hp = 6 75–100hp = 6	
◆ **P2.09**	Slip Compensation Time Constant	0.05 to 10.00 sec	0.10	
P2.10	Control Mode	00: V/Hz without encoder feedback 01: V/Hz with encoder feedback 02: Sensorless Vector without encoder feedback 03: Sensorless Vector with encoder feedback 04: V/Hz with encoder feedback & high-speed regulation 05: Sensorless Vector with encoder feedback & high-speed regulation	00	
* Some parameters and settings are available only in later firmware versions of *DURAPULSE* drives. Refer to the beginning of this "*DURAPULSE* Parameter Summary" section for more information.				
◆ Parameter can be set during RUN Mode.				

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Digital Parameters				
P3.00	Source of Operation Command	00: Operation determined by digital keypad 01: Operation determined by external control terminals; keypad STOP is enabled 02: Operation determined by external control terminals; keypad STOP is disabled 03: Operation determined by RS-485 interface; keypad STOP is enabled 04: Operation determined by RS-485 interface; keypad STOP is disabled	00	
P3.01	Multi-function Input Terminals (DI1 - DI2)	00: DI1 - FWD / STOP, DI2 - REV / STOP 01: DI1 - RUN / STOP, DI2 - REV / FWD 02: DI1 - RUN momentary (N.O.) DI2 - REV / FWD DI3 - STOP momentary (N.C.)	00	
P3.02	Multi-function Input DI3	00: External Fault (N.O.) 01: External Fault (N.C.) 02: External Reset 03: Multi-Speed Bit 1 04: Multi-Speed Bit 2 05: Multi-Speed Bit 3 06: Multi-Speed Bit 4 07: Manual Keyboard Control 08: Reserved 09: Jog 10: External Base Block (N.O.) 11: External Base Block (N.C.) 12: Second Accel/Decel Time 13: Speed Hold 14: Increase Speed 15: Decrease Speed 16: Reset Speed to Zero 17: PID Disable (N.O.) 18: PID Disable (N.C.) 19: 1st/2nd Source Select (N.O.) 20: 1st/2nd Source Select (N.C.) 99: Input Disable	00	
P3.03	Multi-function Input DI4		03	
P3.04	Multi-function Input DI5		04	
P3.05	Multi-function Input DI6		05	
P3.06	Multi-function Input DI7		06	
P3.07	Multi-function Input DI8		09	
P3.08	Multi-function Input DI9		02	
P3.09	Multi-function Input DI10		12	
P3.10	Multi-function Input DI11		10	

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Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Digital Parameters (continued)				
P3.11	Multi-Function Output Terminal 1 (Relay Output)	00: AC Drive Running 01: AC Drive Fault 02: At Speed 03: Zero Speed 04: Above Desired Frequency (P3.16) 05: Below Desired Frequency (P3.16) 06: At Maximum Speed (P0.04) 07: Over Torque detected (P6.08) 08: Above Desired Current (P3.17) 09: Below Desired Current(P3.17) 10: PID Deviation Alarm 11: Heatsink Overheat Warning (OH1) 12: Soft Braking Signal 13: Above Desired Frequency 2 (P3.20) 14: Below Desired Frequency 2 (P3.20) 15: Encoder Loss 16: PID Feedback Loss Warning	00	
P3.12	Multi-Function Output Terminal 2 (DO1)		01	
P3.13	Multi-Function Output Terminal 3 (DO2)		02	
P3.14	Multi-Function Output Terminal 4 (DO3)		03	
◆ **P3.16**	Desired Frequency	0.0 to 400.0 Hz	0.0	
◆ **P3.17**	Desired Current	0.0 to <Drive Rated Amps>	0.0	
◆ **P3.18**	PID Deviation Level	1.0 to 50.0 %	10.0	
◆ **P3.19**	PID Deviation Time	0.1 to 300.0 sec	5.0	
◆ **P3.20**	Desired Frequency 2	0.0 to 400.0 Hz	0.0	
◆ **P3.30**	Frequency Output (FO) Scaling Factor	1 to 20	1	
P3.31	2nd Source of Operation Command	00: Operation determined by digital keypad 01: Operation determined by external control terminals; keypad STOP is enabled 02: Operation determined by external control terminals; keypad STOP is disabled 03: Operation determined by RS-485 interface; keypad STOP is enabled 04: Operation determined by RS-485 interface; keypad STOP is disabled	0	
* Some parameters and settings are available only in later firmware versions of *DURAPULSE* drives. Refer to the beginning of this "*DURAPULSE* Parameter Summary" section for more information.				
◆ Parameter can be set during RUN Mode.				

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Analog Parameters				
P4.00	Source of Frequency Command	01: Frequency determined by digital keypad up/down 02: Frequency determined by 0 to +10V input on AI1 terminal 03: Frequency determined by 4 to 20 mA input on AI2 terminal 04: Frequency determined by 0 to 20 mA input on AI2 terminal 05: Frequency determined by RS-485 communication interface 06: Frequency determined by -10V to +10V input on (AI3) terminal	01	
◆ **P4.01**	Analog Input Offset Polarity	00: No Offset 01: Positive Offset 02: Negative Offset	00	
◆ **P4.02**	Analog Input Offset	0.0 to 100.0%	0.0	
◆ **P4.03**	Analog Input Gain	0.0 to 300.0%	100.0	
P4.04	Analog Input Reverse Motion Enable	00: Forward Motion Only 01: Reverse Motion Enable	00	
P4.05	Loss of AI2 Signal (4-20 mA)	00: Decelerate to 0Hz 01: Stop immediately and display error code "External Fault" 02: Continue operation by the last frequency command	00	
◆ **P4.11**	Analog Output Signal	00: Frequency Hz 01: Current A 02: PV	00	
◆ **P4.12**	Analog Output Gain	00 to 200%	100	
P4.13	2nd Source of Frequency Command	same settings as for P4.00	06	
◆ **P4.14**	2nd Analog Input Offset Polarity	same settings as for P4.01	00	
◆ **P4.15**	2nd Analog Input Offset	0.0 to 100.0%	0.0 (float)	
◆ **P4.16**	2nd Analog Input Gain	0.0 to 300.0%	100.0 (float)	
◆ **P4.17**	Trim Frequency Reference	0.0 to 400.0 Hz	0.0 (float)	
◆ **P4.18**	Trim Mode Select	00: Disable Trim function 01: 1st source frequency + 2nd source freq 02: 1st source frequency - 2nd source freq 03: Speed Command + Trim Frequency Reference (P4.17) 04: Speed Command - Trim Frequency Reference (P4.17)	00	
* Some parameters and settings are available only in later firmware versions of *DURAPULSE* drives. Refer to the beginning of this "*DURAPULSE* Parameter Summary" section for more information.				
◆ Parameter can be set during RUN Mode.				

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Presets Parameters				
◆ **P5.00**	Jog Speed	0.0 to 400.0 Hz	6.0	
◆ **P5.01**	Multi-Speed 1	0.0 to 400.0 Hz	0.0	
◆ **P5.02**	Multi-Speed 2	0.0 to 400.0 Hz	0.0	
◆ **P5.03**	Multi-Speed 3	0.0 to 400.0 Hz	0.0	
◆ **P5.04**	Multi-Speed 4	0.0 to 400.0 Hz	0.0	
◆ **P5.05**	Multi-Speed 5	0.0 to 400.0 Hz	0.0	
◆ **P5.06**	Multi-Speed 6	0.0 to 400.0 Hz	0.0	
◆ **P5.07**	Multi-Speed 7	0.0 to 400.0 Hz	0.0	
◆ **P5.08**	Multi-Speed 8	0.0 to 400.0 Hz	0.0	
◆ **P5.09**	Multi-Speed 9	0.0 to 400.0 Hz	0.0	
◆ **P5.10**	Multi-Speed 10	0.0 to 400.0 Hz	0.0	
◆ **P5.11**	Multi-Speed 11	0.0 to 400.0 Hz	0.0	
◆ **P5.12**	Multi-Speed 12	0.0 to 400.0 Hz	0.0	
◆ **P5.13**	Multi-Speed 13	0.0 to 400.0 Hz	0.0	
◆ **P5.14**	Multi-Speed 14	0.0 to 400.0 Hz	0.0	
◆ **P5.15**	Multi-Speed 15	0.0 to 400.0 Hz	0.0	

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◆ Parameter can be set during RUN Mode.

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Protection Parameters				
P6.00	Electronic Thermal Overload Relay	00: Inverter/Vector Duty Motors 01: Fan Cooled Standard Motors 02: Inactive	00	
P6.01	Auto Restart after Fault	00 to 10	00	
P6.02	Momentary Power Loss	00: Stop operation after momentary power loss 01: Continue operation after momentary power loss, speed search from Speed Reference 02: Continue operation after momentary power loss, speed search from Minimum Speed	00	
P6.03	Reverse Operation Inhibit	00: Enable Reverse Operation 01: Disable Reverse Operation	00	
P6.04	Auto Voltage Regulation	00: AVR enabled 01: AVR disabled 02: AVR disabled during decel 03: AVR disabled during stop	00	
P6.05	Over-Voltage Stall Prevention	00: Enable Over-voltage Stall Prevention 01: Disable Over-voltage Stall Prevention	00	
P6.06	Auto Adjustable Accel/Decel	00: Linear Accel/Decel 01: Auto Accel, Linear Decel 02: Linear Accel, Auto Decel 03: Auto Accel/Decel 04: Auto Accel/Decel Stall Prevention (limited by P1.01, P1.02, P1.05 and P1.06)	00	
P6.07	Over-Torque Detection Mode	00: Disabled 01: Enabled during constant speed operation 02: Enabled during acceleration	00	
P6.08	Over-Torque Detection Level	30 to 200%	150	
P6.09	Over-Torque Detection Time	0.1 to 10.0	0.1	
P6.10	Over-Current Stall Prevention during Acceleration	20 to 200% 00: Disable	150	
P6.11	Over-Current Stall Prevention during Operation	20 to 200%	150	
P6.12	Maximum Allowable Power Loss Time	0.3 to 5.0 sec	2.0	
P6.13	Base-Block Time for Speed Search	0.3 to 5.0 sec	0.5	
P6.14	Maximum Speed Search Current Level	30 to 200%	150	

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Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Protection Parameters (continued)				
P6.15	Upper Bound of Output Frequency	0.1 to 400 Hz	400	
P6.16	Lower Bound of Output Frequency	0.0 to 400 Hz	0.0	
P6.17	Over-Voltage Stall Prevention Level	230V series - 330.0V to 450.0V 460V series - 600.0V to 900.0V	390.0 780.0	
P6.18	Braking Voltage Level	230V series - 370.0V to 450.0V 460V series - 740.0V to 900.0V	380.0 760.0	
P6.30	Line Start Lockout	00: Enable Line Start Lockout 01: Disable Line Start Lockout	00	
P6.31	Present Fault Record	00: No Fault occurred 01: Over-current (oc) 02: Over-voltage (ov) 03: Over-temperature 04: Overload (oL) 05: Thermal Overload (oL1) 06: Over-Torque (oL2) 07: External Fault (EF) 08: CPU failure 1 (CF1) 09: CPU failure 2 (CF2) 10: CPU failure 3 (CF3) 11: Hardware Protection Failure (HPF) 12: Over-current during accel (OCA) 13: Over-current during decel (OCd) 14: Over-current during steady state (OCn) 15:Ground fault or fuse failure (GFF) 17: Input power 3-phase loss 19: Auto Ramp Fault 20: Parameters Locked 21: PID Feedback loss (FbE) 22: Encoder Feedback Loss 23: Output Shorted (OCC) 24: Momentary Power Loss	00	
P6.32	Second Most Recent Fault Record		00	
P6.33	Third Most Recent Fault Record		00	
P6.34	Fourth Most Recent Fault Record		00	
P6.35	Fifth Most Recent Fault Record		00	
P6.36	Sixth Most Recent Fault Record		00	
◆ **P6.37**	Hunting Gain	0 to 1000	0	

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◆ Parameter can be set during RUN Mode.

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
PID Parameters				
P7.00	Input Terminal for PID Feedback	00: Inhibit PID operation 01: Forward-acting (heating loop) PID feedback, PV from AI1 (0 to + 10V) 02: Forward-acting (heating loop) PID feedback, PV from AI2 (4 to 20 mA) 03: Reverse-acting (cooling loop) PID feedback, PV from AI1 (0 to +10V) 04: Reverse-acting (cooling loop) PID feedback, PV from AI2 (4 to 20 mA)	00	
P7.01	PV 100% Value	0.0 to 999	100.0	
P7.02	PID Setpoint Source	00: Keypad 01: Serial Communications 02: AI1 (0 to +10V) 03: AI2 (4 to 20mA)	02	
◆ **P7.03**	PID Feedback Gain	00 to 300.0%	100	
◆ **P7.04**	PID Setpoint Offset Polarity	00: No Offset 01: Positive Offset 02: Negative Offset	00	
◆ **P7.05**	PID Setpoint Offset	0.0 to 100.0%	0.0	
◆ **P7.06**	PID Setpoint Gain	0.0 to 300.0%	100	
◆ **P7.10**	Keypad PID Setpoint	0.0 to 999	0.0	
◆ **P7.11**	PID Multi-setpoint 1	0.0 to 999	0.0	
◆ **P7.12**	PID Multi-setpoint 2	0.0 to 999	0.0	
◆ **P7.13**	PID Multi-setpoint 3	0.0 to 999	0.0	
◆ **P7.14**	PID Multi-setpoint 4	0.0 to 999	0.0	
◆ **P7.15**	PID Multi-setpoint 5	0.0 to 999	0.0	
◆ **P7.16**	PID Multi-setpoint 6	0.0 to 999	0.0	
◆ **P7.17**	PID Multi-setpoint 7	0.0 to 999	0.0	
◆ **P7.20**	Proportional Control	0.0 to 10.0	1.0	
◆ **P7.21**	Integral Control	0.00 to 100.0 sec	1.00	
◆ **P7.22**	Derivative Control	0.00 to 1.00 sec	0.00	
P7.23	Upper Bound for Integral Control	00 to 100%	100	
P7.24	Derivative Filter Time Constant	0.0 to 2.5 sec	0.0	
P7.25	PID Output Frequency Limit	00 to 110%	100	
P7.26	Feedback Signal Detection Time	0.0 to 3600 sec.	60	
P7.27	PID Feedback Loss	00: Warn and AC Drive Stop 01: Warn and continue operation 02: Warn and continue at last frequency 03: Warn and continue at Preset Speed (P7.28)	00	
◆ **P7.28**	PID Feedback Loss Preset Speed	0.0 to 400.0 Hz	0.0	

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◆ Parameter can be set during RUN Mode.

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Display Parameters				
◆ **P8.00**	User Defined Display Function	00: Output Frequency (Hz) 01: Motor Speed (rpm) 02: Scaled Frequency 03: Output Current (A) 04: Motor Load (%) 05: Output Voltage (V) 06: DC Bus Voltage (V) 07: PID Setpoint 08: PID Feedback (PV) 09: Frequency Setpoint	00	
◆ **P8.01**	Frequency Scale Factor	0.01 to 160.0	1.0	
◆ **P8.02**	Backlight Timer	00: Timer Enable (1 min light off) 01:Timer Disable	00	

Communications Parameters				
P9.00	Communication Address	01 to 254	01	
P9.01	Transmission Speed	00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud	01	
P9.02	Communication Protocol	00: MODBUS ASCII mode 7 data bits, no parity, 2 stop bits 01: MODBUS ASCII mode 7 data bits, even parity, 1 stop bit 02: MODBUS ASCII mode 7 data bits, odd parity, 1 stop bit 03: MODBUS RTU mode 8 data bits, no parity, 2 stop bits 04: MODBUS RTU mode 8 data bits, even parity, 1 stop bit 05: MODBUS RTU mode 8 data bits, odd parity, 1 stop bit	00	
P9.03	Transmission Fault Treatment	00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating	00	
P9.04	Time Out Detection	00: Disable 01: Enable	00	
P9.05	Time Out Duration	0.1 to 60.0 seconds	0.5	
◆ **P9.07**	Parameter Lock	00: All parameters can be set and read 01: All parameters are read-only	00	
P9.08	**Restore to Default**	**99: Restores all parameters to factory defaults**	00	

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◆ Parameter can be set during RUN Mode.

Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Communications Parameters (continued)				
◆ **P9.11**	Block Transfer Parameter 1	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.12**	Block Transfer Parameter 2	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.13**	Block Transfer Parameter 3	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.14**	Block Transfer Parameter 4	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.15**	Block Transfer Parameter 5	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.16**	Block Transfer Parameter 6	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.17**	Block Transfer Parameter 7	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.18**	Block Transfer Parameter 8	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.19**	Block Transfer Parameter 9	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.20**	Block Transfer Parameter 10	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.21**	Block Transfer Parameter 11	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.22**	Block Transfer Parameter 12	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.23**	Block Transfer Parameter 13	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.24**	Block Transfer Parameter 14	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.25**	Block Transfer Parameter 15	P0.00 to P8.02, P9.99	P9.99	
◆ **P9.26**	Serial Comm Speed Reference	0.0 to 400.0 Hz	60.0	
◆ **P9.27**	Serial Comm RUN Command	00: Stop 01: Run	00	
◆ **P9.28**	Serial Comm Direction Command	00: Forward 01: Reverse	00	
◆ **P9.29**	Serial Comm External Fault	00: No fault 01: External fault	00	
◆ **P9.30**	Serial Comm Fault Reset	00: No action 01: Fault Reset	00	
◆ **P9.31**	Serial Comm JOG Command	00: Stop 01: Jog	00	
P9.39	Firmware Version	#.##	#.##	
◆ **P9.40**	Parameter Copy	00: Disable Copy Keypad Function 01: Enable Copy Keypad Function	00	
P9.41	GS Series Number	01: GS1 02: GS2 03: GS3 04: GS4	##	
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◆ Parameter can be set during RUN Mode.				

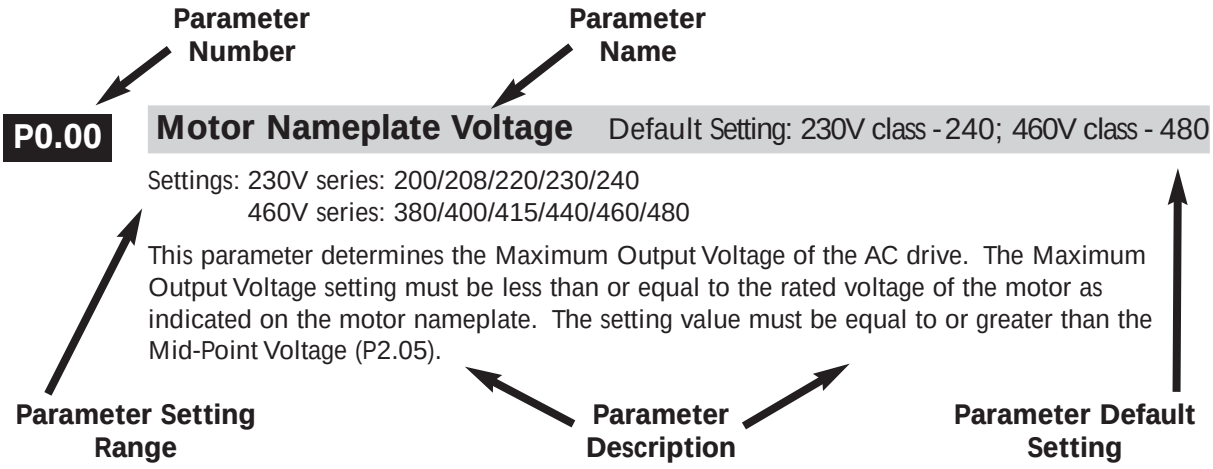
Parameter Summary (continued)				
Parameter *	**Description**	**Range***	**Default Setting**	**User Setting**
Communications Parameters (continued)				
P9.42	Manufacturer Model Information	00: GS3-21P0 (230V 3ph 1.0hp) 01: GS3-22P0 (230V 3ph 2.0hp) 02: GS3-23P0 (230V 3ph 3.0hp) 03: GS3-25P0 (230V 3ph 5.0hp) 04 :GS3-27P5 (230V 3ph 7.5hp) 05: GS3-2010 (230V 3ph 10hp) 06: GS3-2015 (230V 3ph 15hp) 07: GS3-2020 (230V 3ph 20hp) 08: GS3-2025 (230V 3ph 25hp) 09: GS3-2030 (230V 3ph 30hp) 10: GS3-2040 (230V 3ph 40hp) 11: GS3-2050 (230V 3ph 50hp) 12: GS3-41P0 (460V 3ph 1.0hp) 13: GS3-42P0 (460V 3ph 2.0hp) 14: GS3-43P0 (460V 3ph 3.0hp) 15: GS3-45P0 (460V 3ph 5.0hp) 16: GS3-47P5 (460V 3ph 7.5hp) 17: GS3-4010 (460V 3ph 10hp) 18: GS3-4015 (460V 3ph 15hp) 19: GS3-4020 (460V 3ph 20hp) 20: GS3-4025 (460V 3ph 25hp) 21: GS3-4030 (460V 3ph 30hp) 22: GS3-4040 (460V 3ph 40hp) 23: GS3-4050 (460V 3ph 50hp) 24: GS3-4060 (460V 3ph 60hp) 25: GS3-4075 (460V 3ph 75hp) 26: GS3-4100 (460V 3ph 100hp)	##	N/A

Encoder Feedback Parameters				
P10.00	Encoder Pulses per Revolution	01 to 20000	1024	
P10.01	Encoder Type Input	00: Disable 01: Single Phase 02: Quadrature, FWD - CCW 03: Quadrature, FWD - CW	00	
◆ **P10.02**	Proportional Control	0.0 to 10.0	1.0	
◆ **P10.03**	Integral Control	0.00 to 100.00 sec	1.00	
P10.04	Encoder Control Output Limit	0.0 to 20.0%	7.5	
P10.05	Encoder Loss Detection	00: Warn and continue operation 01: Warn and RAMP to stop 02: Warn and COAST to stop	00	

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◆ Parameter can be set during RUN Mode.

Detailed Parameter Listings



If the ◆ symbol is found next to the parameter name, the parameter can be edited when the AC drive is in RUN Mode.

Motor Parameters

P0.00 **Motor Nameplate Voltage** Default Setting: 230V class - 240 / 460V class - 480

Settings: 230V series: 200/208/220/230/240
460V series: 380/400/415/440/460/480

This parameter determines the Maximum Output Voltage of the AC drive. The Maximum Output Voltage setting must be less than or equal to the rated voltage of the motor as indicated on the motor nameplate. The setting value must be equal to or greater than the Mid-Point Voltage (P2.05).

P0.01 **Motor Nameplate Amps** Default Setting: Drive Rating (A)

Range: Drive Rated Amps x 0.4 to Drive Rated Amps x 1.0

This parameter sets the output current to the motor, and is used by the drive to set the motor overload protection. Set this parameter value to the full load current listed on the motor nameplate. (Also refer to P6.00 to set overload current type.)

P0.02 **Motor Base Frequency** Default Setting 60

Range: 50/60/400

This parameter should be set to the base frequency of the motor as indicated on the motor nameplate. Motor Base Frequency determines the volts per hertz ratio.

P0.03 Motor Base RPM

Default Setting: 1750

Range: 375 to 24,000 RPM

- This value should be set according to rated Base RPM of the motor as indicated on the motor nameplate.

P0.04 Motor Maximum RPM

Default Setting: P0.03

Range: P0.03 to 24,000 rpm

- This value should be set according to the desired maximum speed of the motor. This value should not exceed the motor's maximum rated speed.



Warning: The Motor Maximum RPM parameter (P0.04) should never exceed the maximum RPM rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

- This value cannot be set lower than Motor Base RPM (P0.03).

This parameter, along with P0.02 and P0.03, determines the Maximum Output Frequency of the AC Drive. The Maximum Output Frequency can be calculated as follows:

$$\textbf{Max. Output Frequency} = \left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right) \text{x Base Frequency (P 0.02)}$$

- If an output limit based on Maximum Output Frequency is desired, use the following equation to determine the corresponding value for Motor Maximum RPM:

$$\textbf{Motor Maximum RPM} = \left(\frac{\text{Max. Output Frequency}}{\text{Motor Base Frequency (P 0.02)}}\right) \text{x Motor Base RPM (P 0.03)}$$

P0.05 Motor Auto Tune

Default Setting: 00

Settings: 00 Disable
01 Enable P0.06 only (R1)
02 Enable P0.06 and P0.07 (R1 + No-load Test)

- Auto-tuning is required only for Sensorless Vector Control Modes (P2.10 = 02, 03, 05).

Do NOT set auto-tuning without a motor connected. Also, do NOT set auto-tuning with any mechanical load connected to the motor output shaft.

The unit will auto detect when you press the RUN key after this parameter is set to 01 or 02. When set to 01, the unit will auto detect only the motor R1 line to line resistance value (P0.06); manually enter the motor no-load current in P0.07. When set to 02, the values of both P0.06 and P0.07 will be filled in automatically.

Refer to the "Auto-Tune Procedure" subsection of chapter 3 for step-by-step auto-tuning instructions.

P0.06 Motor Line-to-Line Resistance R1

Default: 00

Range: 00 to 65535 milliohm

The motor auto detection feature will set this parameter. The user may also set this parameter without using P0.05. Some motor manufacturers list this value on the motor nameplate.

P0.07 Motor No-Load Current

Default: Drive Rated Amps x 0.4

Range: Drive Rated Amps x 0.0 to 0.9 (Amps)

The rated current of the AC drive is regarded as 100%. The setting of the motor no-load current will affect the slip compensation. The setting value must be less than the Motor Rated Current (P0.01).

Ramp Parameters

P1.00 Stop Methods

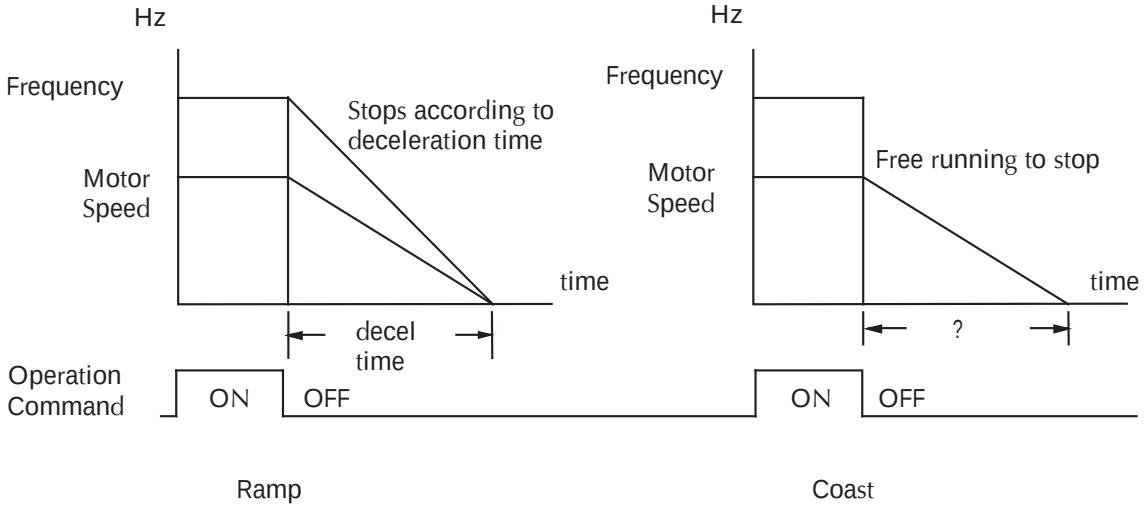
Default Setting: 00

Range: 00 Ramp to Stop
01 Coast to stop

This parameter determines how the motor is stopped when the AC drive receives a valid stop command.

- Ramp: The AC drive decelerates the motor to Minimum Output Frequency (P2.06) and then stops according to the deceleration time set in P1.02 or P1.06.
- Coast: The AC drive stops output instantly upon command, and the motor free runs until it comes to a complete stop.

The drive application or system requirements will determine which stop method is needed.



P1.01 ◆ Acceleration Time 1

Default Setting: 10 sec

Range: 0.1 to 600 sec

This parameter is used to determine the time required for the AC drive to ramp from 0 to its Maximum Motor RPM (P0.04). The rate is linear unless S-Curve is "Enabled" (P1.03 > 0).

P1.02 ◆ Deceleration Time 1

Default Setting: 30 sec

Range: 0.1 to 600 sec

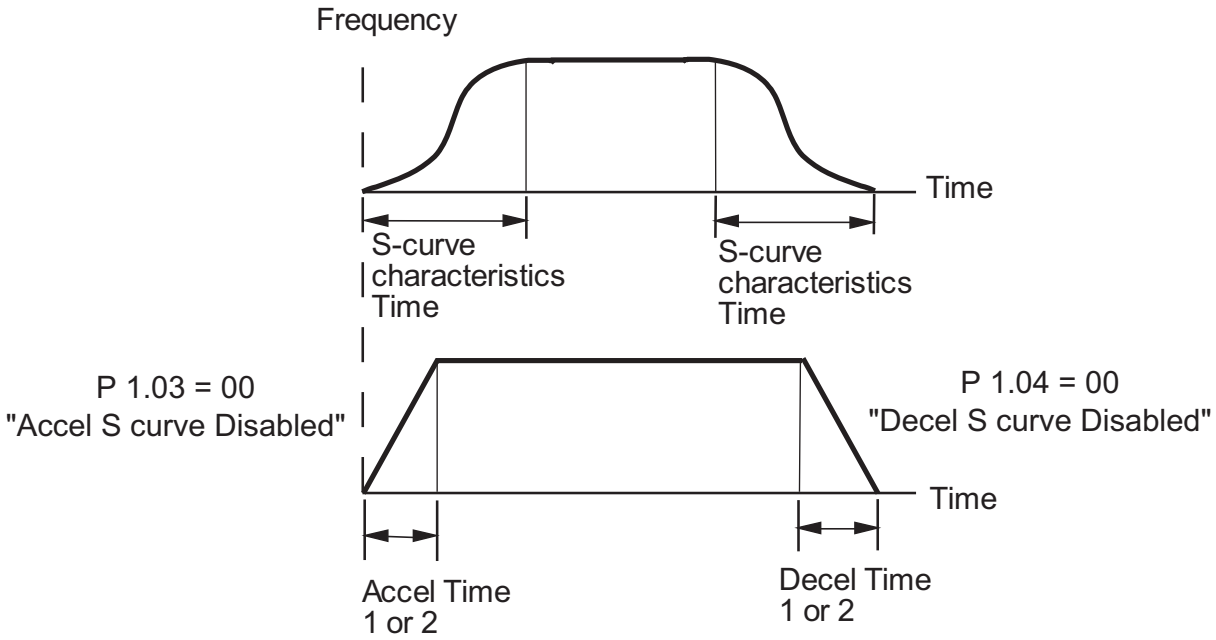
This parameter is used to determine the time required for the AC drive to decelerate from the Maximum Motor RPM (P0.04) down to 0Hz. The rate is linear unless S-Curve is "Enabled" (P1.04 > 0).

P1.03 Accel S-Curve

Default Setting: 00

Range: 00 to 07

This parameter is used whenever the motor and load need to be accelerated more smoothly. The Accel S-Curve may be set from 0 to 7 to select the desired acceleration S Curve.



S-curves can only be seen when the motor is loaded. Static testing will result in no noticeable change on tuning software (i.e. GSoft).

Accel / Decel times 1 and 2 are applied to S-curve calculations.

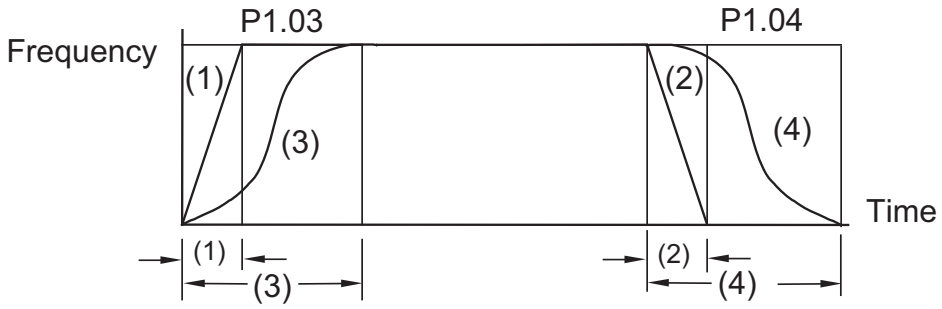
P1.04 Decel S-Curve

Default Setting: 00

Range: 00 to 07

This parameter is used whenever the motor and load need to be decelerated more smoothly. The Decel S-Curve may be set from 00 to 07 to select the desired deceleration S-Curve.

From the diagram shown below, the original setting accel/decel time will be for reference when the function of the S-curve is enabled. The actual accel/decel time will be determined based on the S-curve selected (1 to 7).



S curve is disabled in (1), (2)
P1.03 sets S curve for (3)
P1.04 sets S curve for (4)

P1.05 ◆ Acceleration Time 2

Default Setting: 10.0

Range: 0.1 to 600 sec

The Second Acceleration Time determines the time for the AC drive to accelerate from 0 RPM to Maximum Motor RPM (P0.04). Acceleration Time 2 (P1.05) can be selected using a multi-function input terminal or frequency transition (P1.07).

P1.06 ◆ Deceleration Time 2

Default Setting: 30 sec

Range: 0.1 to 600 sec

The Second Deceleration Time determines the time for the AC drive to decelerate from Maximum Motor RPM (P0.04) to 0 RPM. Deceleration Time 2 (P1.06) can be selected using a multi-function input terminal or frequency transition (P1.07).

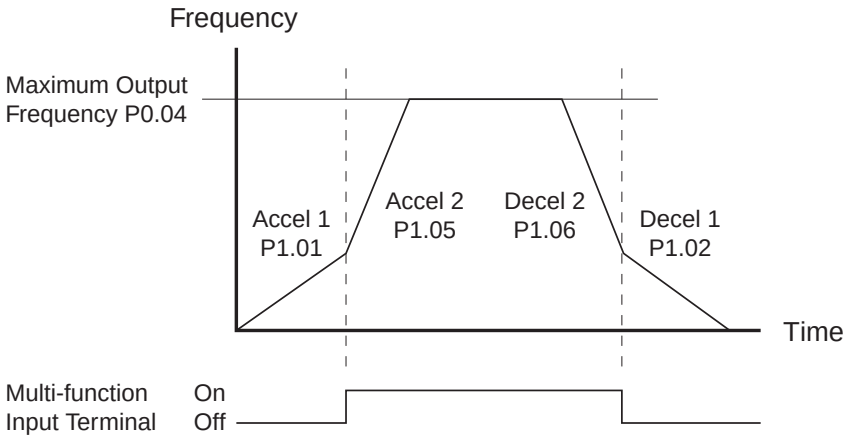
P1.07 Select Method for 2nd Accel/Decel

Default Setting: 00

Range: 00: Second Accel/Decel from terminal
01: Frequency Transitions P1.08 & P1.09

The second set of acceleration and deceleration times P1.05 and P1.06 can be selected either with a multi-function input terminal programmed to Second Accel/Decel, or by the values of the transition frequencies P1.08 and P1.09.

Second Accel/Decel Times selected with Multi-Function Input Terminal



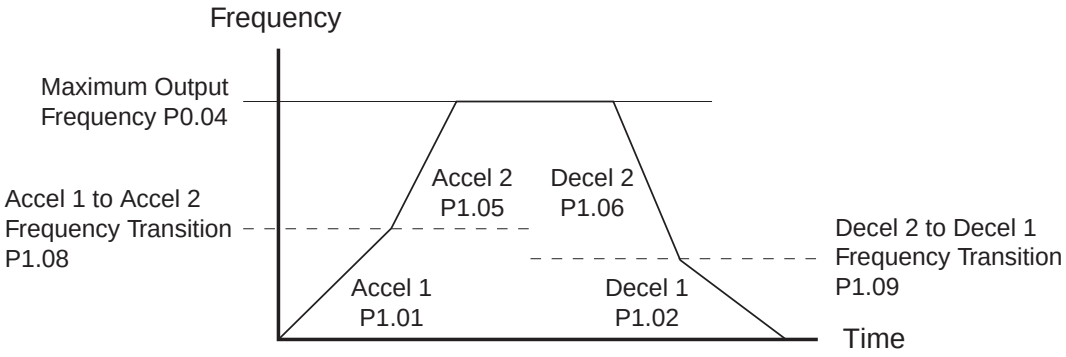
P1.08 Accel 1 to Accel 2 Frequency Transition

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

This parameter sets the frequency at which the AC drive changes acceleration rate from Acceleration Time 1 (P1.01) to Acceleration Time 2 (P1.05).

Second Accel/Decel Times selected with Frequency Transition



P1.09 Decel 2 to Decel 1 Frequency Transition

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

This parameter sets the frequency at which the AC drive changes deceleration rate from Deceleration Time 2 (P1.06) to Deceleration Time 1 (P1.02).

P1.10 **Skip Frequency 1** Default Setting: 0.0

Range: 0.0 to 400.0Hz

P1.11 **Skip Frequency 2** Default Setting: 0.0

Range: 0.0 to 400.0Hz

P1.12 **Skip Frequency 3** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

- P1.10, P1.11, and P1.12 determine the location of the frequency bands that will be skipped during AC drive operation.

P1.13 **Skip Frequency 4** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

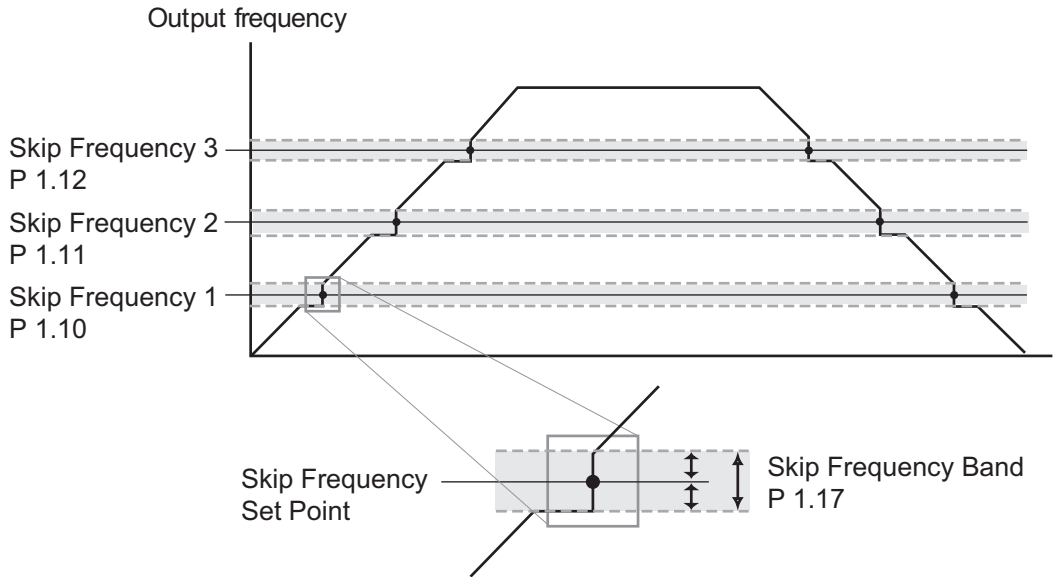
P1.14 **Skip Frequency 5** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

P1.17 **Skip Frequency Band** Default Setting: 0.0

Range: 0.0 to 20.0 Hz

This parameter determines the frequency band for a given Skip Frequency (P1.10, P1.11, or P1.12). Half of the Skip Frequency Band is above the Skip Frequency and the other half is below. Programming this parameter to 0.0 disables all skip frequencies.



P1.18 DC Injection Current Level

Default Setting: 00

Range: 00 to 100%

This parameter determines the amount of DC Braking Current applied to the motor during start-up and stopping. When setting DC Braking Current, please note that 100% is equal to the rated current of the drive. It is recommended to start with a low DC Braking Current Level and then increase until proper holding torque has been attained.

P1.20 DC Injection during Start-up

Default Setting: 0.0

Range: 0.0 to 5.0 sec

This parameter determines the duration of time that the DC Braking Current will be applied to the motor during the AC drive start-up. DC Braking will be applied for the time set in this parameter until the Minimum Frequency is reached during acceleration.

P1.21 DC Injection during Stopping

Default Setting: 0.0

Range: 0.0 to 25.0 sec

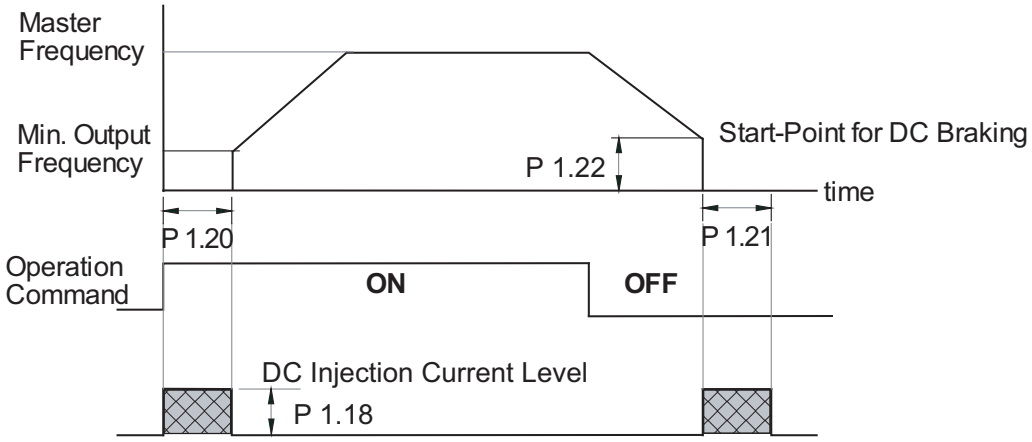
This parameter determines the duration of time that the DC braking voltage will be applied to the motor during stopping. If stopping with DC Braking is desired, then P1.00 must be set to Ramp to Stop (00).

P1.22 Start-point for DC Injection

Default Setting: 0.0

Range: 0.0 to 60.0 Hz

This parameter determines the frequency when DC Braking will begin during deceleration.



Volts/Hertz Parameters

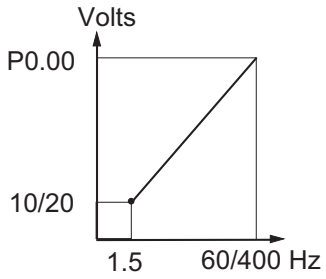
P2.00 **Volts/Hertz Settings** Default Setting: 0.0

Settings:

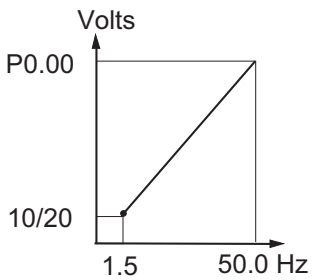
00	General Purpose (constant torque)
01	High Starting Torque
02	Fans and Pumps (variable torque)
03	Custom

P2.04 through P2.07 are only used when the Volts/Hertz parameter (P2.00) is set to 03.

00: General Purpose

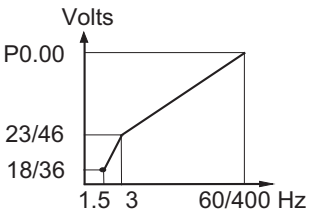


60/400Hz Base Frequency

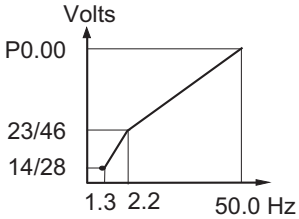


50Hz Base Frequency

01: High Starting Torque

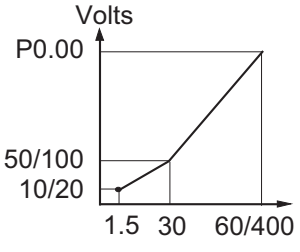


60/400Hz Base Frequency

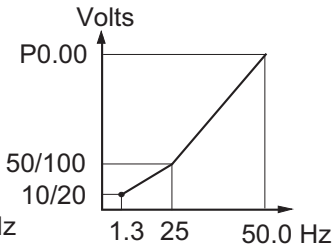


50Hz Base Frequency

02: Fans and Pumps

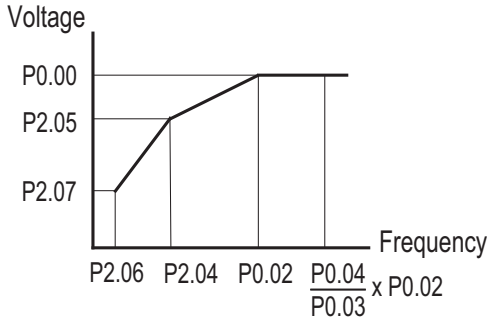


60/400Hz Base Frequency



50Hz Base Frequency

03: Custom



A custom curve can be applied for nonstandard motors.

Example:

These settings keep the V/Hz ratio at 380/300 for a motor rated 380V, 18000 rpm, 300 Hz:

P0.00 = 460V or 400V
P0.02 = 400 Hz
P2.00 = 03
P2.04 = 300 Hz
P2.05 = 380V
P2.06 = 1.5 Hz
P2.07 = 20V
P6.15 = 300 Hz

P2.01 ◆ Slip Compensation

Default Setting: V/Hz mode: 0.0 / Vector mode: 1.0

Range: 0.0 to 10.0

This parameter can be used to partially compensate for the slip inherent in asynchronous three phase AC induction motors. An increase in load on the motor will result in an increase in slip within the motor. When this parameter is set above zero, the drive automatically increases the output frequency as the load increases. The higher the parameter setting, the more aggressively the drive increases the output frequency. The drive compares the actual output current to the values of P0.01 (Motor Nameplate Amps) and P0.07 (Motor No-Load Current) in order to determine the required output frequency increase.

The proper setting for P2.01 is determined by trial and error. Correct settings of P0.01, P0.07, and P2.09 (if applicable) are important for proper operation of this slip compensation feature.

P2.02 ◆ Auto-torque Boost

Default Setting: 00

Range: 00 to 10

This parameter functions similarly to the High Starting Torque setting of the V/Hz Settings parameter (P2.00 = 01), except that this parameter (P2.02) uses less current. The High Starting Torque setting of P2.00 boosts starting torque by increasing current at every start beyond what is required to move the load. However, P2.02 Auto-torque Boost increases the current only as required to move the load. The proper setting for P2.02 is determined by trial and error.

- This parameter only applies in V/Hz mode.

P2.03 Torque Compensation Time Constant

Default Setting: 0.05

Range: 00 to 10 sec

This parameter is essentially a low-pass filter which affects how Auto-Torque Boost (P2.02) is applied. When this parameter is set to zero, Auto-Torque Boost is applied instantaneously. When this parameter is set greater than zero, Auto-Torque Boost is applied gradually over the time period set by this parameter.



P2.04 through P2.07 are used only when the Volts/Hertz parameter (P2.00) is set to 03. If trying to set when P2.00 is not 03, "ERR" will result.

P2.04 Mid-point Frequency

Default Setting: 1.5

Range: 0.1 to 400 Hz

This parameter sets the Mid-Point Frequency of V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point frequency can be determined.

This parameter must be greater than or equal to the Minimum Output Frequency (P2.06) and less than or equal to the Maximum Voltage Frequency (P0.02). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

P2.05 Mid-point Voltage

Default Setting: 230V class: 10.0 / 460V class: 20.0

Range: 230V class: 0.1 to 240V
460V class: 0.1 to 480V

This parameter sets the Mid-Point Voltage of any V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point Frequency can be determined.

This parameter must be greater than or equal to the Minimum Output Voltage (P2.07) and less than or equal to the Maximum Output Voltage (P0.00). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

P2.06 Minimum Output Frequency

Default Setting: 1.5

Range: 0.1 to 20.0 Hz

This parameter sets the Minimum Output Frequency of the AC drive.

This parameter must be less than or equal to the Mid-Point Frequency (P2.04). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

P2.07 Minimum Output Voltage

Default Setting: 230V class: 10.0 / 460V class: 20.0

Range: 230V class: 0.1 to 50V
460V class: 0.1 to 100V

This parameter sets the Minimum Output Voltage of the AC drive.

This parameter must be equal to or less than Mid-Point Voltage (P2.05). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

P2.08 PWM Carrier Frequency

Default Settings: 15/09/06/06

Range: 1 to 5 hp; 01 to 15 kHz — Default Setting: 15
7.5 to 25 hp; 01 to 15 kHz — 09
30 to 60 hp; 01 to 09 kHz — 06
75 to 100 hp, 01 to 06 kHz — 06

This parameter sets the carrier frequency of PWM (Pulse-Width Modulated) output.

- In the table below, we see that the carrier frequency of PWM output has a significant influence on the electromagnetic noise, leakage current and heat dissipation of the AC drive, and the acoustic noise to the motor.

Carrier Frequency	Acoustic Noise	Electromagnetic Noise, Leakage Current	Heat Dissipation
1kHz	significant	minimal	minimal
15kHz	minimal	moderate	moderate

P2.09 Slip Compensation Time Constant

Default Setting: 0.10

Range: 0.05 to 10.00 sec

This parameter is usually applied to heavy-load applications in which the motor speed is changed frequently. It acts as a damper for P2.01, Slip Compensation, which changes the output frequency to compensate for motor slip due to heavy loads. Frequent speed changes can cause system vibration, and P2.09 can be adjusted while monitoring drive/motor operation to reduce that vibration.

Increasing P2.09 slows the Slip Compensation response (loosens speed regulation).

Decreasing P2.09 speeds the Slip Compensation response (tightens speed regulation).

- This parameter is enabled only in the “high-speed regulation” control modes; (P2.10 = 04 or 05).
- This parameter is available only with AC drive firmware v1.05 or higher. Refer to P9.39 to determine the drive’s firmware version.

P2.10 Control Mode

Default: 00

Range: 00: V/Hz without encoder feedback
01: V/Hz with encoder feedback
02: Sensorless Vector without encoder feedback
03: Sensorless Vector with encoder feedback
04: V/Hz with encoder feedback and high-speed regulation
05: Sensorless Vector with encoder feedback and high-speed regulation

This parameter determines the control method of the AC drive.

The V/Hz modes (00, 01, & 04) are the basic control modes.

The Sensorless Vector modes (02, 03, & 05) allow improved torque performance at very low speeds and improved speed regulation. These modes require Auto-Tuning per P0.05 in order to match the characteristics of the particular motor being used.

The encoder feedback settings (01, 03, 04, & 05) require the installation of an optional GS3-FB feedback card in order for the drive to read the encoder signal from the motor. (Refer to Appendix A of this manual for more information regarding the GS3-FB.)

The high-speed regulation settings (04 & 05) enable two other parameters which can be used to reduce system vibration:
Slip Compensation Time Constant (P2.09) and Hunting Gain (P6.37).

Digital Parameters

P3.00 Source of Operation Command — Default Setting: 00

Settings:

00	Operation Determined by Digital Keypad
01	Operation determined by external control terminals. Keypad STOP is enabled.
02	Operation determined by external control terminals. Keypad STOP is disabled.
03	Operation determined by communication interface. Keypad STOP is enabled.
04	Operation determined by communication interface. Keypad STOP is disabled.

This parameter sets the input source for the AC drive operation commands. Refer to P3.01 to P3.10 for more details.

P3.01 Multi-Function Input Terminals (DI1-DI2) — Default Setting: 00

Settings:

00	DI1 - FWD/STOP DI2 - REV/STOP
01	DI1 - RUN/STOP DI2 - REV/FWD
02	DI1 - RUN (used with momentary N.O. contact) DI2 - REV/FWD DI3 - STOP (used with momentary N.C. contact)

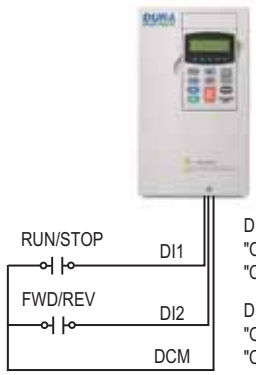
Multi-function Input Terminals DI1 and DI2 do not have separate parameter designations. DI1 and DI2 must be used in conjunction with each other to operate two and three wire control.

P3.01: Setting 00

DI1	DI2	Result
OFF	OFF	STOP
ON	OFF	FWD
OFF	ON	REV
ON	ON	STOP



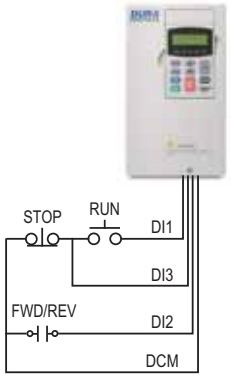
P3.01: Setting 01



DI1- RUN/STOP select
"Open" : Stop
"Close" : Run

DI2- FWD/REV select
"Open" : FWD
"Close" : REV

P3.01: Setting 02



DI1- RUN command
Latching input (N.O.)
Runs from momentary contact closure

DI2- FWD/REV select
"Open" : FWD
"Close" : REV

DI3- STOP command
Latching input (N.C.)
Stops from momentary contact opening

P3.02	**Multi-Function Input (DI3)**	Default Setting: 00
P3.03	**Multi-Function Input (DI4)**	Default Setting: 03
P3.04	**Multi-Function Input (DI5)**	Default Setting: 04
P3.05	**Multi-Function Input (DI6)**	Default Setting: 05
P3.06	**Multi-Function Input (DI7)**	Default Setting: 06
P3.07	**Multi-Function Input (DI8)**	Default Setting: 09
P3.08	**Multi-Function Input (DI9)**	Default Setting: 02
P3.09	**Multi-Function Input (DI10)**	Default Setting: 12
P3.10	**Multi-Function Input (DI11)**	Default Setting: 10

Settings for P3.02 to P3.10:

00	**External Fault (N.O.)
01	**External Fault (N.C.)
02	External Reset
03	Multi-Speed Bit 1 / PID Setpoint Bit 1
04	Multi-Speed Bit 2 / PID Setpoint Bit 2
05	Multi-Speed Bit 3 / PID Setpoint Bit 3
06	Multi-Speed Bit 4
07	Manual Keypad Control
08	Reserved
09	Jog
10	External Base Block (N.O.)
11	External Base Block (N.C.)
12	Second Accel/Decel Time
13	Speed Hold (P4.00 must be set to 01.)
14	***Increase Speed (P4.00 must be set to 01.)
15	***Decrease Speed (P4.00 must be set to 01.)
16	Reset Speed to Zero (P4.00 must be set to 01.)
17	PID Disable (N.O.)
18	PID Disable (N.C.)
*19	1st/2nd Source Select (N.O.)
*20	1st/2nd Source Select (N.C.)
99	Input Disable

** Parameter setting available only with firmware v1.04 or higher (refer to P9.39)*

*** Use either setting 00 or 01, but not both. Use interposing relays if more contacts are needed.*

**** Accel / Decel times must be more than one second in order for Increase (14) and Decrease (15) Speed settings to work efficiently.*

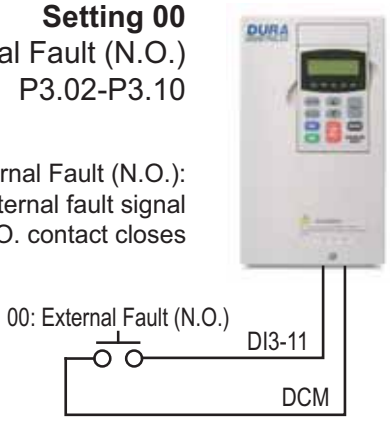
Setting Explanations for Parameters P3.02 through P3.10

Settings 00 and 01: External Fault (N.O. & N.C.)

When an External Fault input signal is received, the AC drive output will turn off, the drive will display the words "External Fault" on the LED Display, and the motor will Coast to Stop. To resume normal operation, the external fault must be cleared, and the drive must be reset. (The drive can be reset from the STOP/RESET key on the keypad, or from a contact wired to a digital input set for function 02, External Reset.)

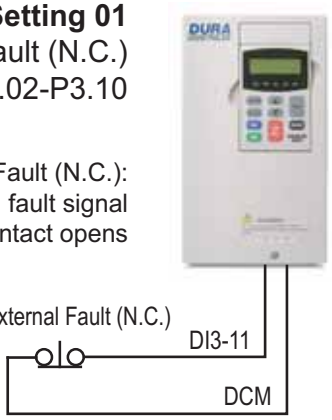
Setting 00
External Fault (N.O.)
P3.02-P3.10

External Fault (N.O.):
Drive receives external fault signal
when N.O. contact closes



Setting 01
External Fault (N.C.)
P3.02-P3.10

External Fault (N.C.):
Drive receives external fault signal
when N.C. contact opens



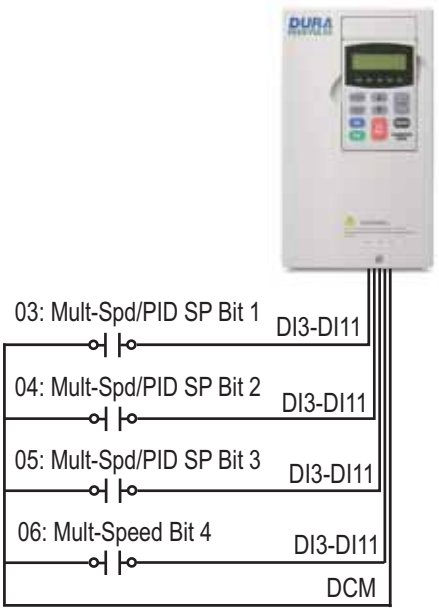
- Use either setting 00 or 01, but not both. Use interposing relays if more contacts are needed.

Setting 02: External Reset

An External Reset has the same function as the STOP/RESET key on the digital keypad. Use an External Reset to reset the drive after a fault.

Settings 03, 04, and 05: PID Setpoint Bits 1, 2, 3
Settings 03, 04, 05 and 06: Multi-Speed Bits 1, 2, 3 and 4

The four Multi-Speed Bits are used to select the multi-speed settings defined by parameters P5.01 to P5.15. The first three of these bits can also be used to select a PID setpoint, if PID is enabled (P7.00 ≠ 0.)



Multi-Speed / PID SP				Speed Selection	PID SP Selection
Bit 4	Bit 3	Bit 2	Bit 1		
OFF	OFF	OFF	OFF	P4.00	P7.02
OFF	OFF	OFF	ON	P5.01: Spd 1	P7.11: SP 1
OFF	OFF	ON	OFF	P5.02: Spd 2	P7.12: SP 2
OFF	OFF	ON	ON	P5.03: Spd 3	P7.13: SP 3
OFF	ON	OFF	OFF	P5.04: Spd 4	P7.14: SP 4
OFF	ON	OFF	ON	P5.05: Spd 5	P7.15: SP 5
OFF	ON	ON	OFF	P5.06: Spd 6	P7.16: SP 6
OFF	ON	ON	ON	P5.07: Spd 7	P7.17: SP 7
ON	OFF	OFF	OFF	P5.08: Spd 8	-
ON	OFF	OFF	ON	P5.09: Spd 9	-
ON	OFF	ON	OFF	P5.10: Spd 10	-
ON	OFF	ON	ON	P5.11: Spd 11	-
ON	ON	OFF	OFF	P5.12: Spd 12	-
ON	ON	OFF	ON	P5.13: Spd 13	-
ON	ON	ON	OFF	P5.14: Spd 14	-
ON	ON	ON	ON	P5.15: Spd 15	-

In order to use the Multi-Speed settings, P5.01 - P5.15 must be set.
In order to use the Multi-PID SPs, P7.11 - P7.17 must be set, and P7.00 ≠ 0.

When all Multi-Speed inputs are off, the AC drive reverts back to the Command Frequency (P4.00). When all PID Multi-Setpoint inputs are off, the AC drive reverts back to the PID Setpoint Source (P7.02).

Setting 07

This setting is used to temporarily switch to the keypad RUN and STOP buttons as the source of the operation command for run and stop functions. It does NOT change the source of the frequency command for the speed reference. Useful for troubleshooting.

Setting 09: Jog Command

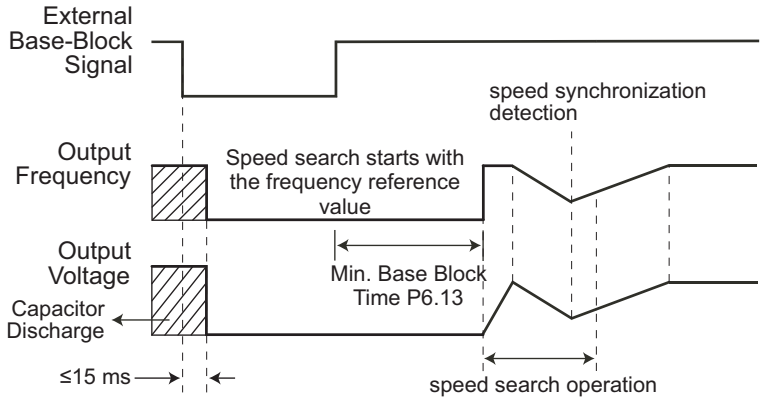
This setting configures a Multi-function Input Terminal to run the motor at a preset speed only while the Jog Input is activated. Set the Jog Speed in P5.00. The Jog function can be used in combination with a FWD/REV signal (P3.01 = 01 or 02) to Jog in forward or reverse directions.

The drive must be stopped to initiate this command. The Jog Command cannot be used simultaneously with an active FWD/STOP, REV/STOP, or RUN/STOP command.

Settings 10 and 11: External Base Block (N.O.) and External Base Block (N.C.)

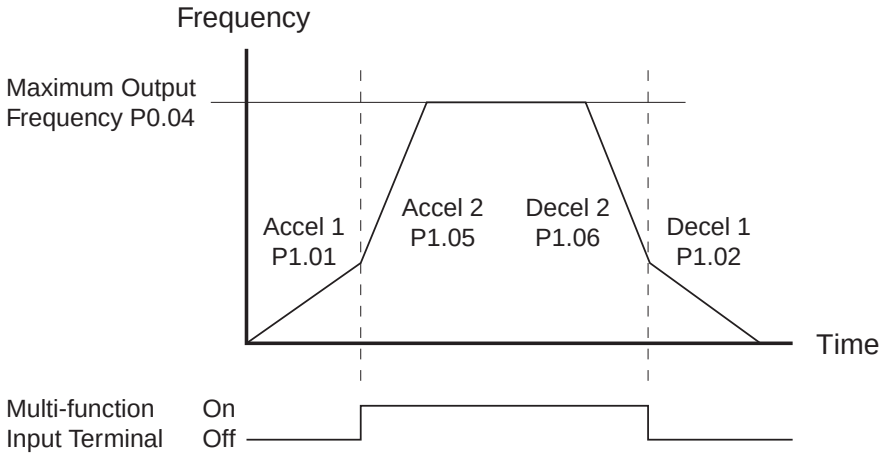
Value 10 is for a normally open (N.O) input, and value 11 is for a normally closed (N.C.) input.

When an External Base Block is activated, the LCD display reads "EXT.BASE-BLOCK," the AC drive stops all output, and the motor will free run. When the External Base Block is deactivated, the AC drive will start the speed search function and synchronize with the motor speed. The AC drive will then accelerate to the Master Frequency.



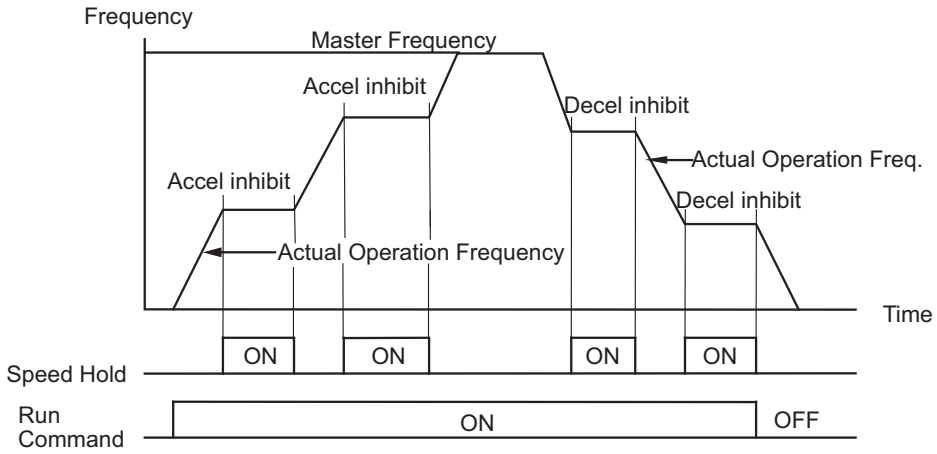
Setting 12: Second Accel/Decel Time

Multi-function Input Terminals DI3~DI11 can be set to select between Accel/Decel times 1 and 2. Parameters P1.01 and P1.02 set Accel 1 and Decel 1 times. Parameters P1.05 and P1.06 set Accel 2 and Decel 2 times.



Setting 13: Speed Hold

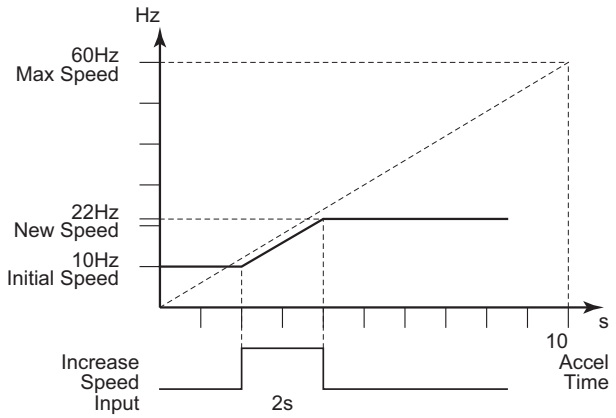
When the Speed Hold command is received, the drive acceleration or deceleration is stopped and the drive maintains a constant speed.



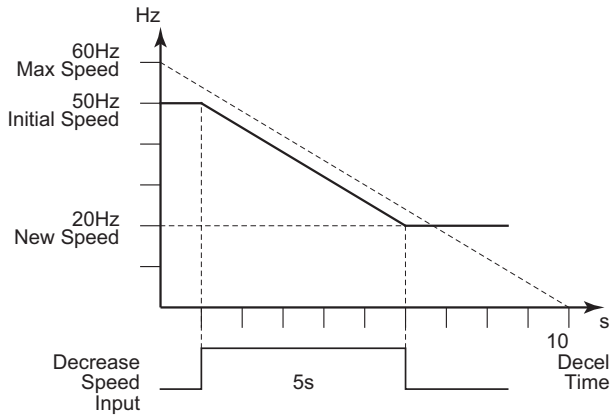
Settings 14 and 15: Increase and Decrease Speed (Electronic Motor Operated Potentiometer)

Settings 14 and 15 allow the Multi-function terminals to be used to increase or decrease speed. As long as the DI terminal is activated, the speed reference will continuously increase or decrease using the acceleration and deceleration ramp settings.

- Increase Speed rate of change = P0.04(Hz) / P1.01(s)
- Decrease Speed rate of change = P0.04(Hz) / P1.02(s)
- Example:
  For P0.04 = 60Hz; P1.01 = P1.02 = 10s; rate of change = 60Hz/10s = 6Hz/s



Speed Increase = (2s)(6Hz/s) = 12Hz
New Speed = 10Hz + 12Hz = 22Hz



Speed Decrease = (5s)(6Hz/s) = 30Hz
New Speed = 50Hz - 30Hz = 20Hz

- *In order to use these settings, P4.00 must be set to 01.*
- *Accel / Decel times must be more than one second to work efficiently.*

Setting 16: Reset Speed to Zero

This setting allows a Multi-function input terminal to reset the drive output frequency to zero.

Settings 17 and 18: PID Disable (N.O) and (N.C.)

Settings 17 and 18 set the Multi-function terminals to disable PID operation.

Settings 19* and 20*: 1st/2nd Source Select (N.O.) and (N.C.)

The AC drive runs from the (1st) Source of Operation Command (P3.00) and the (1st) Source of Frequency Command (P4.00) if the 1st/2nd Source Select signal is inactive.

The AC drive runs from the 2nd Source of Operation Command (P3.31) and the 2nd Source of Frequency Command (P4.13) if the 1st/2nd Source Select signal is active.

- Among other uses, these two settings allow the drive operation to be switched back and forth between local and remote control.

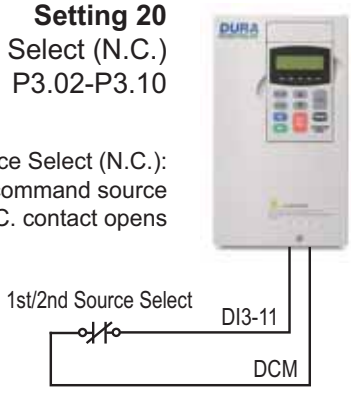
Setting 19
1st/2nd Source Select (N.O.)
P3.02-P3.10

1st/2nd Source Select (N.O.):
Drive selects the 2nd command source when N.O. contact closes



Setting 20
1st/2nd Source Select (N.C.)
P3.02-P3.10

1st/2nd Source Select (N.C.):
Drive selects the 2nd command source when N.C. contact opens



** Parameter settings 19 and 20 are available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.*

Setting 99: Multi-Function Input Disable

Setting a Multi-Function Input to 99 will disable that input. The purpose of this function is to provide isolation for unused Multi-Function Input Terminals. Any unused terminals should be programmed to 99 to make sure they have no effect on drive operation.

Any unused terminals should be programmed to 99 to make sure they have no effect on drive operation.

P3.11 **Multi-Function Output Terminal 1 (Relay Output)** Default Setting: 00

P3.12 **Multi-Function Output Terminal 2 (DO1)** Default Setting: 01

P3.13 **Multi-Function Output Terminal 3 (DO2)** Default Setting: 02

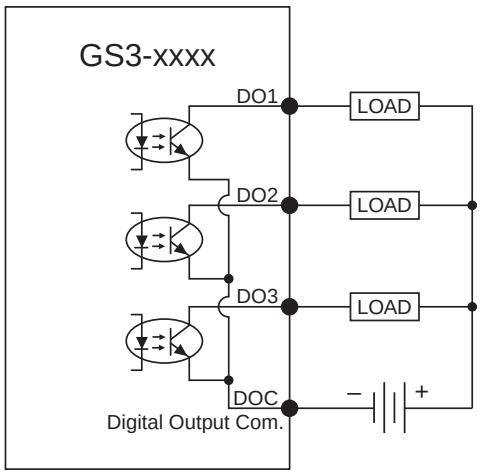
P3.14 **Multi-Function Output Terminal 4 (DO3)** Default Setting: 03

Settings for P3.11 - P3.14:

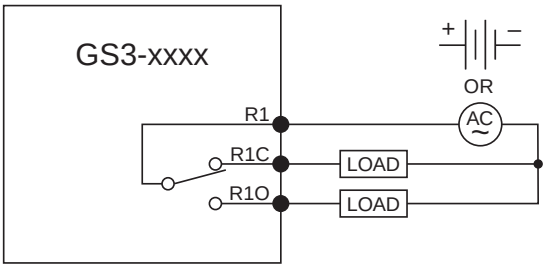
00	AC Drive Running
01	AC Drive Fault
02	At Speed
03	Zero Speed
04	Above Desired Frequency (P3.16)
05	Below Desired Frequency (P3.16)
06	At Maximum Speed (P0.02)
07	Over Torque Detected
08	Above Desired Current (P3.17)
09	Below Desired Current (P3.17)
10	PID Deviation Alarm (P3.18 and P3.19)
11	Heatsink Overheat Warning (OH)
12	Soft Braking Signal
13	Above Desired Frequency 2 (P3.20)
14	Below Desired Frequency 2 (P3.20)
15	Encoder Loss
*16	PID Feedback Loss Warning

** - Parameter setting available only with firmware v1.04 or higher (refer to P9.39)*

Wiring Diagram for
DO1, DO2, DO3, DOC
(Digital Outputs)



Wiring Diagram for
R1, R1C, R1O
(Relay Output)



Setting Explanations for Parameters P3.11 through P3.14

Setting 00: AC Drive Running — The terminal will be activated when there is an output from the drive.

Setting 01: AC Drive Fault — The terminal will be activated when one of the faults listed under parameters P6.31 through P6.36 occurs.

Setting 02: At Speed — The terminal will be activated when the AC drive attains the Command Frequency (P4.00).

Setting 03: Zero Speed — The output will be activated when Command Frequency (P4.00) is lower than the Minimum Output Frequency (P2.06).

Setting 04: Above Desired Frequency — The output will be activated when the AC drive is above the Desired Frequency (P3.16).

Setting 05: Below Desired Frequency — The output will be activated when the AC drive is below the Desired Frequency (P3.16).

Setting 06: At Maximum Speed — The output will be activated when the AC drive reaches Motor Maximum RPM (P0.04).

Setting 07: Over Torque Detected — The output will be activated when the AC drive reaches the Over-torque Detection Level (P6.08) and exceeds this level for a time greater than the Over-torque Detection Time (P6.09).

Setting 08: Above Desired Current — The output will be activated when the AC drive is above the Desired Current (P3.17).

Setting 09: Below Desired Current — The output will be activated when the AC drive is below the Desired Current (P3.17).

Setting 10: PID Deviation Alarm — The output will be activated when the AC drive exceeds the PID Deviation Level (P3.18) for longer than the PID Deviation Time (P3.19).

Setting 11: Heatsink Overheat Warning (OH) — The output will be activated when the heatsink overheats.The function will be activated as follows: Temperature range: 1 ~ 15HP, >90°C (194°F) ON; <90°C (194°F) OFF. Above 15HP: >80°C (176°F) ON; <80°C (176°F) OFF

Setting 12: Soft Braking Signal — If DC Bus voltage is greater than the braking voltage level set in parameter P6.18 (Braking Voltage level), then any output configured for function 12 will change state.

Setting 13: Above Desired Frequency 2 — The output will be activated when the AC drive is above the Desired Frequency.(P3.20)

Setting 14: Below Desired Frequency — The output will be activated when the AC drive is below the Desired Frequency. (P3.20)

Setting 15: Encoder Loss — The output will be activated when the AC drive experiences loss of the encoder signal.

Setting *16: PID Feedback Loss Warning — The output will be activated when the AC drive experiences loss of a 4 to 20 mA PID Feedback signal.

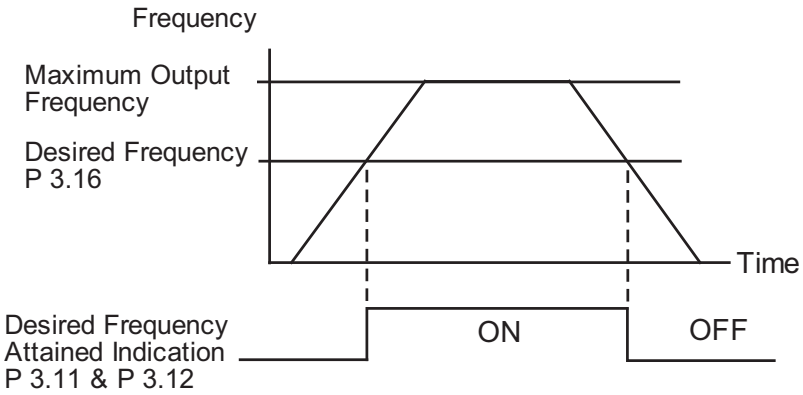
** - Parameter setting available only with firmware v1.04 or higher (refer to P9.39)*

P3.16 ◆ Desired Frequency

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

- If a Multi-function output terminal is set to function as Desired Frequency Attained (P3.11 or P3.12 = 04 or 05), then the output will be activated when the programmed frequency is attained.



P3.17 ◆ Desired Current

Default Setting: 0.0

Range: 0.0 to <Drive Rated Amps>

P3.18 ◆ PID Deviation Level

Default Setting: 10.0

Range: 1.0 to 50.0%

If a Multi-function Output terminal is set to PID Deviation Alarm (RO, DO1-DO3 setting = 10), then the output will be activated when the amount of deviation between the SP (set point) and PV (process variable) in the PID loop constantly exceeds the threshold set by this parameter for the period of time set by P3.19. This is defined in percentage of PV Value (see P7.01).

- This parameter is used in conjunction with P3.19, PID Deviation Time.

P3.19 ◆ PID Deviation Time

Default Setting: 5.0

Range: 0.1 to 300.0 sec

If a Multi-function Output terminal is set to PID Deviation Alarm (RO, DO1-DO3 setting = 10), then the output will be activated when the amount of deviation between the SP (set point) and PV (process variable) in the PID loop constantly exceeds the threshold set by P3.18 for the period of time set by this parameter.

- This parameter is used in conjunction with P3.18, PID Deviation Level.

P3.20 ◆ Desired Frequency 2

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

P3.30 ◆ Frequency Output (FO) Scaling Factor

Default Setting: 1

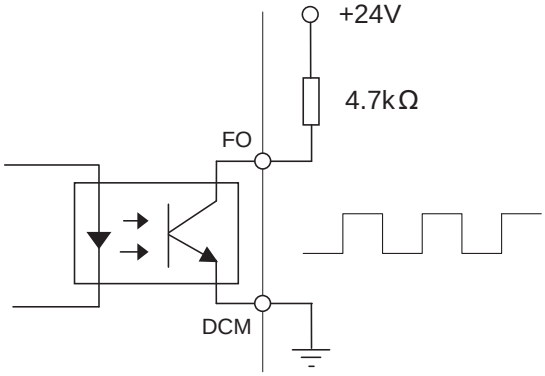
Range: 1 to 20

This parameter determines the scaling factor that is used to scale the frequency at the Digital Frequency Output terminals (FO-DCM). The number of output pulses per second is equal to the AC drive output frequency multiplied by P3.30. (Pulse per second = actual output frequency x P3.30).

Example 1: When drive frequency is 60.0 Hz and P3.30 = 10;
60.0 Hz x 10 = 600.0 Hz;
Frequency of FO's outputted square wave is 600.0 Hz

Example 2: When drive output frequency = 400.0 Hz and P3.30 = 20
400.0Hz x 20 = 8kHz;
FO's output frequency is 8kHz.

FO is an open collector circuit. Square wave is generated, for example, by sending +24V through a 4.7 kΩ resistor as shown in the diagram below.



P3.31 2nd Source of Operation Command

Default Setting: 00

Settings:

00	Operation Determined by Digital Keypad
01	Operation determined by external control terminals. Keypad STOP is enabled.
02	Operation determined by external control terminals. Keypad STOP is disabled.
03	Operation determined by RS-485 communication interface. Keypad STOP is enabled.
04	Operation determined by RS-485 communication interface. Keypad STOP is disabled.

This parameter sets the second input source for the AC drive operation command.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

Analog Parameters

P4.00 Source of Frequency Command

Default Setting: 01

Settings:

01	Frequency determined by digital keypad up/down.
02*	Frequency determined by 0 to +10V input (including remote potentiometer) on AI1 terminal.
03	Frequency determined by 4 to 20 mA input on AI2 terminal.
04	Frequency determined by 0 to 20 mA input on AI2 terminal.
05	Frequency determined by RS-485 communication interface.
06	Frequency determined by -10V to +10V input on AI3 terminal.

This parameter sets the input source for the AC drive frequency command.

** In order to set P4.00 = 02, you must first change the value of P4.13 to some value other than two (02) in order to avoid the "Error: Duplicate Function" error message. (P4.13 default value is 02)*

P4.01 ◆ Analog Input Offset Polarity

Default Setting: 00

Settings:

00	Offset disabled
01	Positive Offset
02	Negative Offset

This parameter sets the analog input bias frequency to be positive or negative.

- The Analog Input Offset calculation will also define the Analog Input Offset Polarity. Refer to the note following P4.02.
- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

P4.02 ◆ Analog Input Offset

Default Setting: 0.0

Range: 0.0 to 100%

This parameter provides a frequency offset for an analog input.

- Use the equation below to determine the Analog Input Offset. For this equation, you will need to know the necessary Minimum Frequency References and Maximum Output Frequency needed for your application.

$$\textbf{Analog Offset \%} = \left(\frac{\text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100$$



The result of the Analog Input Offset calculation will also define the Analog Input Offset Polarity (P4.01). A positive answer means you should have a positive offset. A negative answer means you should have a negative offset.

- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

P4.03 ◆ Analog Input Gain

Default Setting: 100.0

Range: 0.0 to 300.0%

This parameter sets the ratio of analog input vs frequency output.

- Use the equation below to calculate the Analog Input Gain. For this equation, you will need to know the minimum and maximum set-point frequencies needed for your application.

$$\text{Analog Gain \%} = \left(\frac{\text{Max. Frequency Reference} - \text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100$$

- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

P4.04 Analog Input Reverse Motion Enable

Default Setting: 00

Range: 00 Forward Motion Only
01 Reverse Motion Enable

- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

P4.05 Loss of AI2 Signal (4-20mA)

Default Setting: 00

Range: 00 - Decelerate to 0Hz
01 - Stop immediately and display “EF”.
02 - Continue operation by the last frequency command

This parameter determines the operation of the drive when the ACI frequency command is lost.

P4.11 ◆ Analog Output Signal

Default Setting: 00

Range: 00 - Frequency Hz
01 - Current A
02 - PV

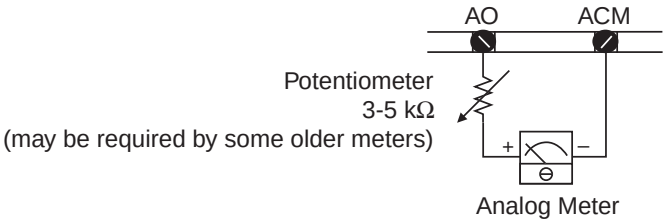
This parameter configures the 0-10V AO output to indicate either output Frequency, output Current, or the PID Process Variable.

P4.12 ◆ Analog Output Gain

Default Setting: 100

Range: 00 to 200%

This parameter sets the voltage range of the analog output signal on output terminal AO.



- When P4.11 is set to 00, the analog output voltage is directly proportional to the output frequency of the AC drive. With the factory setting of 100%, the Maximum Output Frequency of the AC drive corresponds to +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by P4.12)
- When P4.11 is set to 01, the analog output voltage is directly proportional to the output current of the AC drive. With the factory setting of 100%, the 2.5 times rated current of the AC drive corresponds to +10 VDC analog voltage output. (The actual voltage is about +10 VDC, and can be adjusted by P4.12).

Note: Any type of voltmeter can be used. If the meter reads full scale at a voltage less than 10 volts, then P4.12 should be set by the following formula:

P4.12 = (meter full scale voltage ÷ 10) × 100%

For Example: When using the meter with full scale of 5 Volts, adjust P4.12 to 50%.

P4.13 2nd Source of Frequency Command

Default Setting: 06

Settings:

01*	Frequency determined by digital keypad up/down.
02	Frequency determined by 0 to +10V input on AI1 terminal.
03	Frequency determined by 4 to 20 mA input on AI2 terminal.
04	Frequency determined by 0 to 20 mA input on AI2 terminal.
05	Frequency determined by RS-485 communication interface.
06	Frequency determined by -10V ~ +10V input on AI3 terminal.

This parameter sets the second input source for the AC drive frequency command.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- This parameter is available only with AC drive firmware v1.04 or higher.
  Default setting = 02 for firmware v1.04.
  Default setting = 06 for firmware v1.05 and higher.
  Refer to P9.39 to determine the drive's firmware version.

** In order to set P4.13 = 01, you must first change the value of P4.00 to some value other than one (01) in order to avoid the "Error: Duplicate Function" error message. (P4.00 default value is 01)*

P4.14 ◆ 2nd Analog Input Offset Polarity

Default Setting: 00

Settings:

00	Offset disabled
01	Positive Offset
02	Negative Offset

This parameter sets the analog input 2nd bias frequency to be positive or negative.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- The 2nd Analog Input Offset calculation will also define the 2nd Analog Input Offset Polarity. Refer to the note following P4.15.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version

P4.15 ◆ 2nd Analog Input Offset

Default Setting: 0.0

Range: 0.0 to 100%

This parameter provides a frequency offset for a second analog input.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- Use the equation below to determine the Analog Input Offset. For this equation, you will need to know the necessary Minimum Frequency References and Maximum Output Frequency needed for your application.

$$\textbf{Analog Offset \%} = \left(\frac{\text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100$$

The result of the 2nd Analog Input Offset calculation will also define the Analog 2nd Input Offset Polarity (P4.14). A positive answer means you should have a positive offset. A negative answer means you should have a negative offset.

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

P4.16 ◆ 2nd Analog Input Gain

Default Setting: 100.0

Range: 0.0 to 300.0%

This parameter sets the ratio of the second analog input vs frequency output.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- Use the equation below to calculate the Analog Input Gain. For this equation, you will need to know the minimum and maximum set-point frequencies needed for your application.

$$\text{Analog Gain \%} = \left(\frac{\text{Max. Frequency Reference} - \text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100$$

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

P4.17 ◆ Trim Reference Frequency

Default Setting: 00

Range: 0.0 to 400.0 Hz

This parameter determines a set frequency to add to or subtract from the selected Frequency Command (P4.00 or P4.13) to produce a modified actual frequency command. The setting of P4.18 determines whether P4.17 adds to or subtracts from the Frequency Command.

- This parameter is active only if P4.18 is set to 03 or 04.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

Effects of P4.17 on Actual Frequency Command		
Source of Frequency Command	**Trim Mode Select P4.18 Setting**	**Actual Frequency Command**
P4.00	03	P4.00 + P4.17
	04	P4.00 - P4.17
P4.13	03	P4.13 + P4.17
	04	P4.13 - P4.17

P4.18 ◆ Trim Mode Select

Default Setting: 00

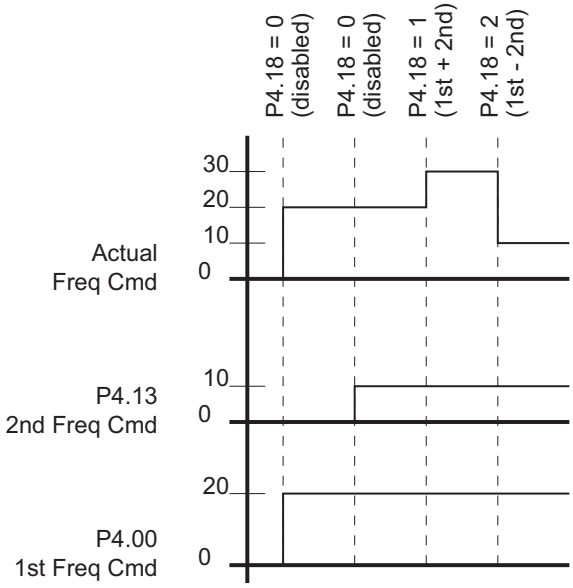
Settings:

00	Disable Trim Function
01	1st Frequency Command (P4.00) + 2nd Frequency Command (P4.13)
02	1st Frequency Command (P4.00) - 2nd Frequency Command (P4.13)
03	Frequency Command (P4.00 or P4.13) + Trim Ref Frequency (P4.17)
04	Frequency Command (P4.00 or P4.13) - Trim Ref Frequency (P4.17)

This parameter determines how the Frequency Command is modified by the Trim Frequency to produce the modified actual frequency command.

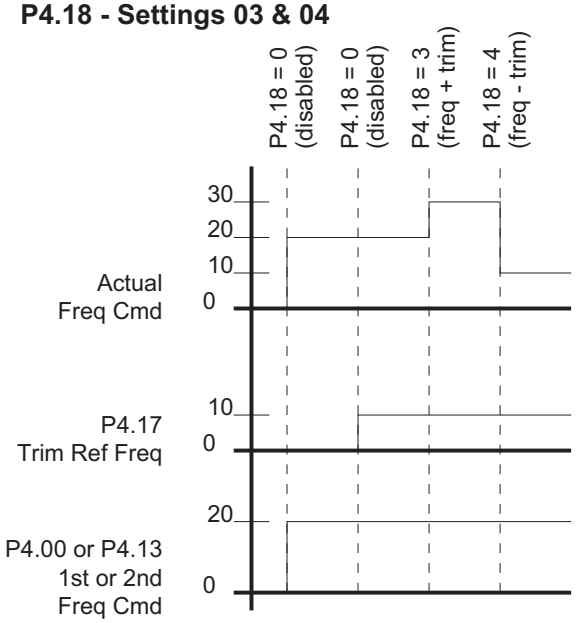
- For parameter settings 03 and 04, the Trim Frequency modifies whichever primary Frequency Command is selected as active by the digital input controlled by P3.02~P3.10 settings 19 or 20.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

P4.18 - Settings 01 & 02



NOTE: P4.00 & P4.13 values shown also include any effects of P4.01~P4.04 and P4.14~P4.16. These seven additional parameters affect frequency commands only from the analog inputs. They do not affect keypad or RS-485 frequency commands.

P4.18 - Settings 03 & 04



NOTE: P4.00 & P4.13 values shown also include any effects of P4.01~P4.04 and P4.14~P4.16. These seven additional parameters affect frequency commands only from the analog inputs. They do not affect keypad or RS-485 frequency commands.

Analog Input Parameter Examples

Refer to the following equations and examples for changing the ratio of the analog input signal relative to the output frequency of the drive.

Use the equations below when calculating the values for the Maximum Output Frequency, Analog Input Offset, Analog Input Gain, and the Mid-point Frequency.

A) **Maximum Output Frequency** =
(P0.04 Maximum Speed / P0.03 Base Speed) x P0.02 Base Frequency



The Maximum Output Frequency is not a parameter setting, but is needed in order to calculate the Analog Gain. The default Maximum Output Frequency for the DURAPULSE drive is 60Hz. If parameters P0.02, P0.03, or P0.04 are changed, then the Maximum Output Frequency will change.

B) **Analog Offset %** =
(Minimum Frequency Reference / Maximum Output Frequency) x 100

C) **Analog Gain %** =
((Max Freq Reference - Min Freq Reference) / Max Output Frequency) x 100

D) **Mid-point Frequency** =
((Max Freq Reference - Min Freq Reference) / 2) + Min Freq Reference



The Mid-point Frequency calculation shows the frequency reference of the drive when the potentiometer or other analog input device is at its mid-point.

Example 1: Standard Operation

This example illustrates the default operation of the drive. The example is given to further illustrate the use of the analog calculations. The full range of the analog input signal corresponds to the full forward frequency range of the AC drive.

- Minimum Frequency Reference = 0Hz
- Maximum Frequency Reference = 60 Hz

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (0Hz / 60 Hz) x 100 = **0%**

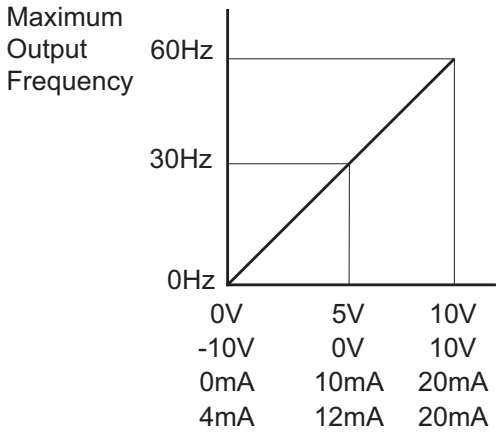
C) **Analog Gain %** = ((60 Hz – 0Hz) / 60 Hz) x 100 = **100%**

D) **Mid-point Frequency** = ((60 Hz – 0Hz) / 2) + 0Hz = **30 Hz**

Parameter Settings

P4.01: 00 (default) – Offset disabled
P4.02: 00 (default) – 0% Analog Input Offset
P4.03: 100 (default) – 100% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results



Example 2: Standard Operation with Increased Maximum Output Frequency

This example illustrates how to run the motor faster than its base speed. For this purpose, the only required parameter change is P0.04, Motor Maximum RPM. (Motors produce reduced output torque when running above their base speed.)

WARNING: The Motor Maximum RPM parameter (P0.04) should never exceed the maximum speed rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

The analog input adjustment parameters P4.01 through P4.04 can remain defaulted, as determined by the analog input calculations shown below. The increased Maximum Output Frequency can be obtained regardless of whether the Source of Frequency Command is an analog input or one of the other sources, such as the keypad, RS-485 communication interface, jog, or multi-speed settings.

- Minimum Frequency Reference = 0Hz
- Maximum Frequency Reference = 70 Hz
- Motor Maximum RPM = 2042 rpm

Calculations

A) **Max Output Frequency** = (2042 rpm / 1750 rpm) x 60 Hz = **70 Hz**

B) **Analog Offset %** = (0Hz / 70 Hz) x 100 = **0%**

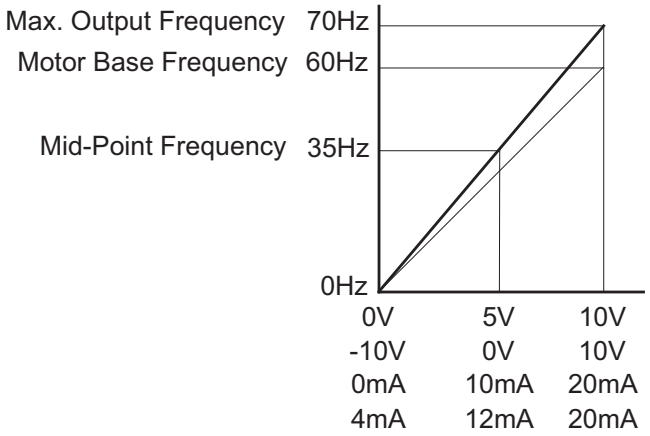
C) **Analog Gain %** = ((70 Hz – 0Hz) / 70 Hz) x 100 = **100%**

D) **Mid-point Frequency** = ((70 Hz – 0Hz) / 2) + 0Hz = **35 Hz**

Parameter Settings

P0.04: 2042 – Motor Maximum RPM
P4.01: 00 (default) – Offset disabled
P4.02: 00 (default) – 0% Analog Input Offset
P4.03: 100 (default) – 100% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results



Example 3: Positive Offset

In this example, the Analog Input will have a positive offset while still using the full scale of the potentiometer or other analog signal device. When the analog signal is at its lowest value (0V, 0mA, or 4mA), the set-point frequency will be at 10Hz. When analog signal is at its maximum value (10V or 20mA), the set-point frequency will be 60 Hz.

- Minimum Frequency Reference = 10 Hz
- Maximum Frequency Reference = 60 Hz

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (10 Hz / 60 Hz) x 100 = **16.7%**

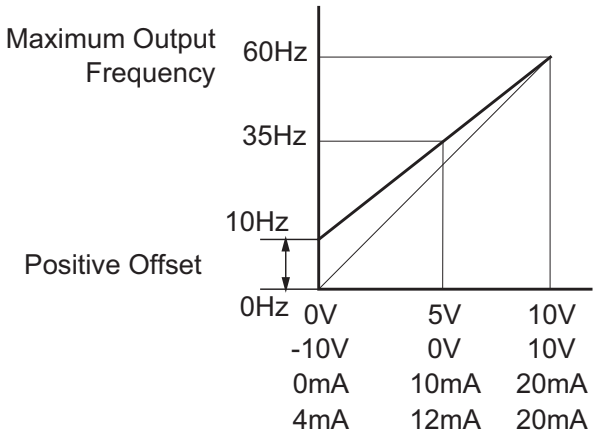
C) **Analog Gain %** = ((60 Hz – 10 Hz) / 60 Hz) x 100 = **83.3%**

D) **Mid-point Frequency** = ((60 Hz – 10 Hz) / 2) + 10 Hz = **35 Hz**

Parameter Settings

P4.01: 01 – Positive Input Offset Polarity
P4.02: 16.7 – 16.7% Analog Input Offset
P4.03: 83.3 – 83.3% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results



Example 4: Forward and Reverse Operation

In this example, the potentiometer (or other analog signal device) is programmed to run a motor full-speed in both forward and reverse directions. The frequency reference will be 0Hz when the potentiometer is positioned at mid-point of its scale. Parameter P4.04 must be set to enable reverse motion.

When calculating the values for the Analog Input using reverse motion, the reverse frequency reference should be shown using a negative (-) number. Pay special attention to signs (+/-) for values representing reverse motion.

- Minimum Frequency Reference = -60 Hz (reverse)
- Maximum Frequency Reference = 60 Hz

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (-60 Hz / 60 Hz) x 100 = **-100%**

The negative (-) value for the Analog Offset % shows that a negative offset is needed for P4.01.

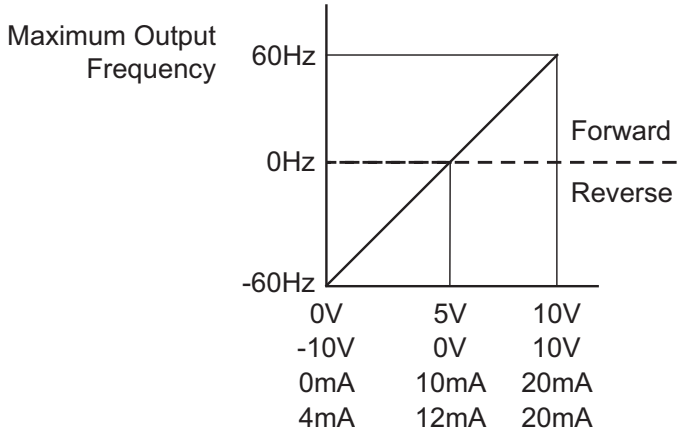
C) **Analog Gain %** = ((60 Hz – (-60 Hz)) / 60 Hz) x 100 = **200%**

D) **Mid-point Frequency** = ((60 Hz – (-60 Hz)) / 2) + (-60 Hz) = **0Hz**

Parameter Settings

P4.01: 02 – Negative Input Offset Polarity
P4.02: 100 – 100% Analog Input Offset
P4.03: 200 – 200% Analog Input Gain
P4.04: 01 – Reverse Motion Enable

Results



Example 5: Forward Run/Reverse Jog

This example shows an application in which the drive runs full-speed forward and jogs in reverse. The full scale of the potentiometer (or other analog signal device) will be used.

When calculating the values for the Analog Input using reverse motion, the reverse frequency reference should be shown using a negative (-) number. Pay special attention to signs (+/-) for values representing reverse motion.

- Minimum Frequency Reference = -15 Hz (reverse)
- Maximum Frequency Reference = 60 Hz

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (-15 Hz / 60 Hz) x 100 = **-25%**

The negative (-) value for the Analog Offset % shows that a negative offset is needed for P4.01.

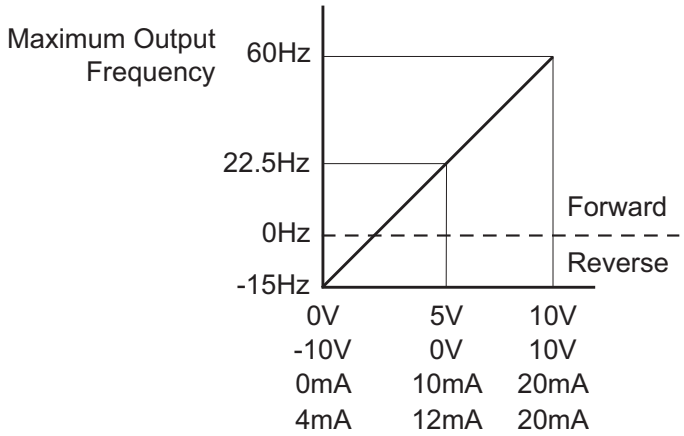
C) **Analog Gain %** = ((60 Hz – 15 Hz) / 60 Hz) x 100 = **125%**

D) **Mid-point Frequency** = ((60 Hz – (-15 Hz)) / 2) + (-15 Hz) = **22.5 Hz**

Parameter Settings

P4.01: 02 – Negative Input Offset Polarity
P4.02: 25 – 25% Analog Input Offset
P4.03: 125 – 125% Analog Input Gain
P4.04: 01 – Reverse Motion Enable

Results



Example 6: Reduced Analog Gain

This example shows how to limit the Maximum Frequency Reference by reducing the Analog Input Gain. When the Analog Input is at its maximum value (10V or 20mA), the set-point frequency will be 50Hz. However, this reduced maximum frequency applies only to an Analog Input Source of Frequncy Command. The Maximum Output Frequency can still can still go to 60 Hz if controlled from the Keypad, RS-485 interface, Jog Command, or Multi-Speed settings.

- Minimum Frequency Reference = 0Hz
- Maximum Frequency Reference = 50 Hz

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (0Hz / 50 Hz) x 100 = **0%**

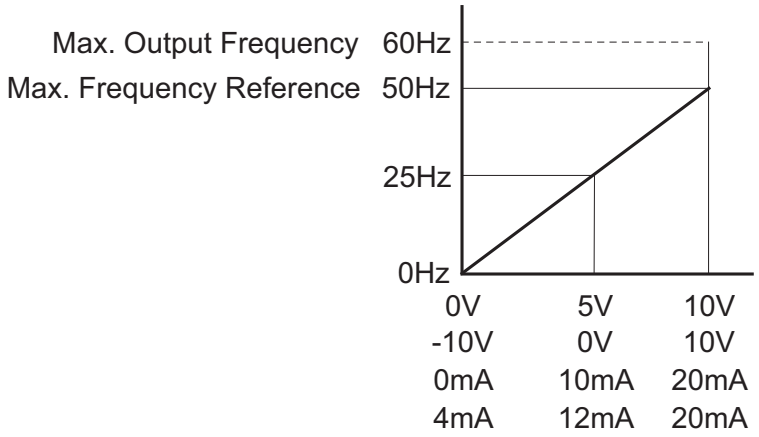
C) **Analog Gain %** = ((50 Hz – 0Hz) / 60 Hz) x 100 = **83.3%**

D) **Mid-point Frequency** = ((50 Hz – 0Hz) / 2) + 0Hz = **25 Hz**

Parameter Settings

P4.01: 00 (default) – Offset disabled
P4.02: 00 (default) – 0% Analog Input Offset
P4.03: 71.4 – 71.4% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results



Example 7: Positive Offset with Reduced Analog Gain

This example illustrates how to provide a positive offset of the Analog Input, while using the full scale of the potentiometer or other analog device. At the same time, the Maximum Frequency Reference is limited by reducing the Analog Input Gain.

When the analog signal is at its lowest value, the set-point frequency will be at 11.5Hz. When the analog signal is at its maximum value, the set-point frequency will be 39.6Hz.

- Minimum Frequency Reference = 11.5 Hz
- Maximum Frequency Reference = 39.6 Hz

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (11.5 Hz / 60 Hz) x 100 = **19.2%**

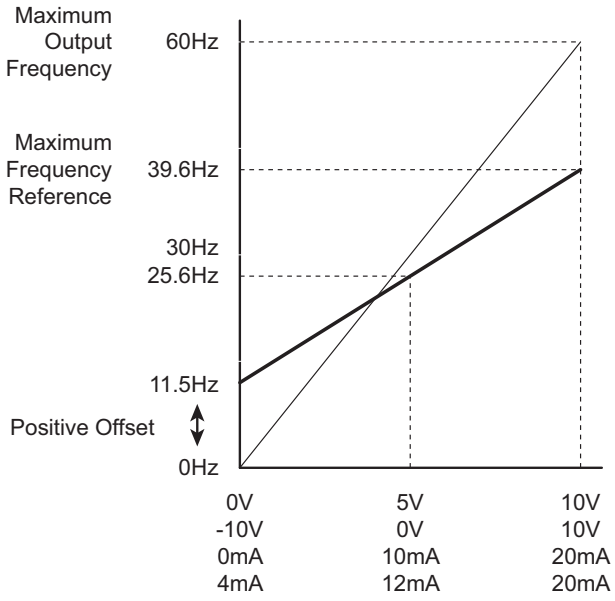
C) **Analog Gain %** = ((39.6 – 11.5) / 60) x 100 = **46.8%**

D) **Mid-point Frequency** = ((39.6 – 11.5) / 2) + 11.5 = **25.6 Hz**

Parameter Settings

P4.01: 01 – Positive Analog Input Offset Polarity
P4.02: 19.2 – 19.2% Analog Input Offset
P4.03: 46.8 – 46.8% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results



Example 8: Trim Mode

This example illustrates using the drive in Trim Mode with a Trim Reference Frequency

- Minimum Frequency Reference = 0Hz
- Maximum Frequency Reference = 45 Hz
- Output Frequency = Frequency Command - Trim Reference Frequency

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = **60 Hz**

B) **Analog Offset %** = (0Hz / 60 Hz) x 100 = **0%**

C) **Analog Gain %** = ((60 Hz – 0Hz) / 60 Hz) x 100 = **100%**

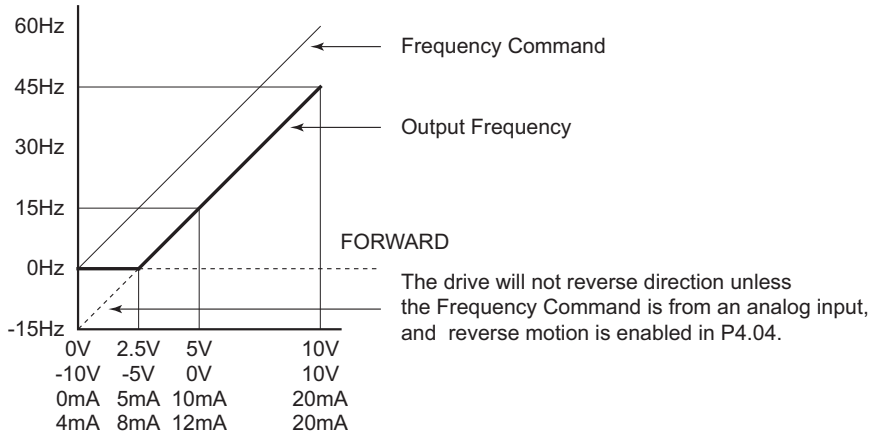
D) **Mid-point Frequency** = ((60 Hz – 0Hz) / 2) + 0Hz = **30 Hz**

- **Actual Output Frequency$_{P4.18=04}$ = Freq Command – Trim Ref Freq**

Parameter Settings

P4.01: 00 (default) – Offset disabled
P4.02: 00 (default) – 0% Analog Input Offset
P4.03: 100 (default) – 100% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only
P4.17: 15 – Trim Reference Frequency = 15 Hz
P4.18: 04 – Output Frequency = Frequency Command - Trim Reference Frequency

Results



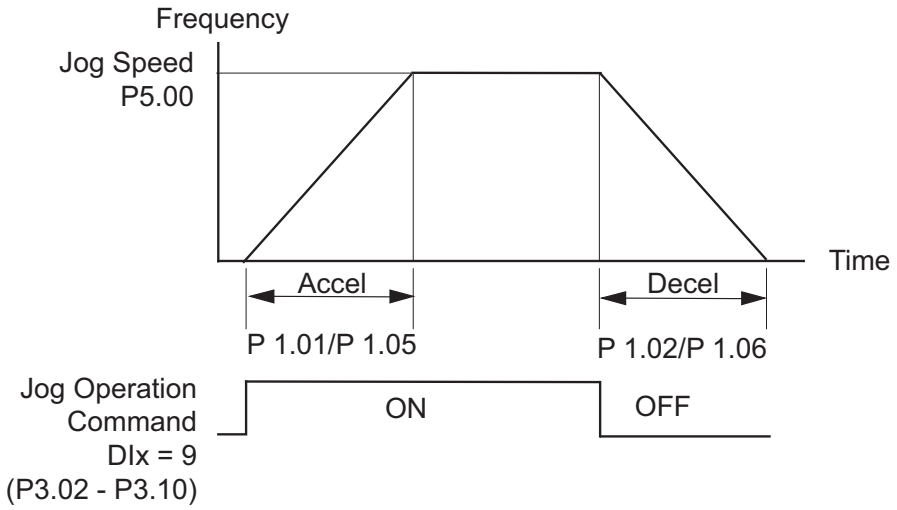
Presets Parameters

P5.00 ◆ **Jog Speed** Default Setting: 6.0

Range: 0.0 to 400.0 Hz

This parameter sets the speed for the Jog Command.

- The Jog Command is selected by a Multi-Function Input Terminal (P3.02 to P3.10) set to the Jog Command function (09).
- Acceleration and deceleration times apply to the Jog Speed



The Jog function can be used in conjunction with the direction signal (FWD/REV; P3.01 = 01 or 02) to Jog in forward and reverse directions.

The drive must be stopped to initiate this command. The Jog command cannot be used simultaneously with an active FWD/STOP, REV/STOP, or RUN/STOP command.

P5.01	◆ **Multi-Speed 1**	Default Setting: 0.0
P5.02	◆ **Multi-Speed 2**	Default Setting: 0.0
P5.03	◆ **Multi-Speed 3**	Default Setting: 0.0
P5.04	◆ **Multi-Speed 4**	Default Setting: 0.0
P5.05	◆ **Multi-Speed 5**	Default Setting: 0.0
P5.06	◆ **Multi-Speed 6**	Default Setting: 0.0
P5.07	◆ **Multi-Speed 7**	Default Setting: 0.0
P5.08	◆ **Multi-Speed 8**	Default Setting: 0.0
P5.09	◆ **Multi-Speed 9**	Default Setting: 0.0
P5.10	◆ **Multi-Speed 10**	Default Setting: 0.0
P5.11	◆ **Multi-Speed 11**	Default Setting: 0.0
P5.12	◆ **Multi-Speed 12**	Default Setting: 0.0
P5.13	◆ **Multi-Speed 13**	Default Setting: 0.0
P5.14	◆ **Multi-Speed 14**	Default Setting: 0.0
P5.15	◆ **Multi-Speed 15**	Default Setting: 0.0

Range for P5.01~P5.15: 0.0 to 400.0 Hz

The Multi-Function Input Terminals (refer to P3.02 to P3.10) are used to select one of the AC drive preset Multi-speeds. The speeds (frequencies) are determined by the settings of P5.01 to P5.15.



When all multi-speed inputs are off, the AC drive reverts back to the Command Frequency (P4.00).

Multi-Speed Bits				Speed Selection
Bit 4	Bit 3	Bit 2	Bit 1	
OFF	OFF	OFF	OFF	P4.00: Source of Frequency
OFF	OFF	OFF	ON	P5.01: Multi-Speed 1
OFF	OFF	ON	OFF	P5.02: Multi-Speed 2
OFF	OFF	ON	ON	P5.03: Multi-Speed 3
OFF	ON	OFF	OFF	P5.04: Multi-Speed 4
OFF	ON	OFF	ON	P5.05: Multi-Speed 5
OFF	ON	ON	OFF	P5.06: Multi-Speed 6
OFF	ON	ON	ON	P5.07: Multi-Speed 7

Multi-Speed Bits				Speed Selection
Bit 4	Bit 3	Bit 2	Bit 1	
ON	OFF	OFF	OFF	P5.08: Multi-Speed 8
ON	OFF	OFF	ON	P5.09: Multi-Speed 9
ON	OFF	ON	OFF	P5.10: Multi-Speed 10
ON	OFF	ON	ON	P5.11: Multi-Speed 11
ON	ON	OFF	OFF	P5.12: Multi-Speed 12
ON	ON	OFF	ON	P5.13: Multi-Speed 13
ON	ON	ON	OFF	P5.14: Multi-Speed 14
ON	ON	ON	ON	P5.15: Multi-Speed 15

Protection Parameters

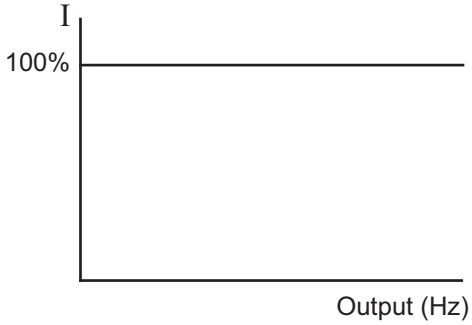
P6.00 Electronic Thermal Overload Relay

Default Setting: 00

Settings:

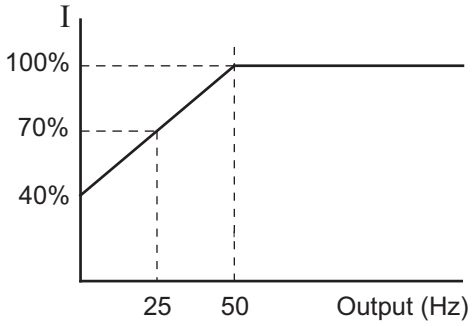
00 Constant Torque (Recommended **for inverter/vector duty motors**)

Use this setting when using the drives with motors designed specifically for AC drive outputs and for running at low speeds with high currents. Motor currents will be 100% throughout the speed range, and can be up to 150% for one minute.



01 Variable Torque (Recommended **for fan-cooled standard motors**)

Use this setting when using the drives with motors which are NOT designed specifically for AC drive outputs. Motors with shaft mounted fans offer poor cooling at low speeds, therefore the output can be derated at lower output frequencies. This derated current is for protecting the motor at lower speeds.



The output current is derated as follows:

- I_{output} (%) = [f_{output} (Hz) x 1.2 %/Hz] + 40%

Example:
If the rated motor current is 10A, and the output frequency is 25Hz, the derating will be 70%, and the overload will be 10.5A (150%) for one minute.

- I_{output} (%) = [(25Hz) (1.2 %/Hz)] + 40% = 70%
- 10A x 70% = 7A
- 7A x 150% = 10.5A

02 Inactive

This parameter determines the drive's motor overload protection characteristic. The Variable Torque setting (01) allows less motor current at lower speeds than does the Constant Torque setting (00).

P6.01 Auto Restart after Fault

Default Setting: 00

Range: 00 to 10

After fault occurs (allowable faults: over-current OC, over-voltage OV), the AC drive can be reset/restarted automatically up to 10 times. Setting this parameter to 0 will disable the reset/restart operation after any fault has occurred. When enabled, the AC drive will restart with speed search, which starts at the previous Frequency. To set the fault recovery time after a fault, please see (P6.13) base-block time for speed search.

P6.02 Momentary Power Loss

Default Setting: 00

Settings:

00	Stop operation after momentary power loss.
01	Continue operation after momentary power loss; speed search from Speed Reference.
02	Continue operation after momentary power loss; speed search from Minimum Speed.



This parameter will only work if the Source of Operation (P3.00) is set to something other than 00 (Operation determined by digital keypad).

P6.03 Reverse Operation Inhibit

Default Setting: 00

Settings:

00	Enable Reverse Operation
01	Disable Reverse Operation

This parameter determines whether the AC Motor Drive can operate in the reverse direction.

P6.04 Auto Voltage Regulation

Default Setting: 00

Settings:

00	AVR enabled
01	AVR disabled
02	AVR disabled during decel
03	AVR disabled during stop

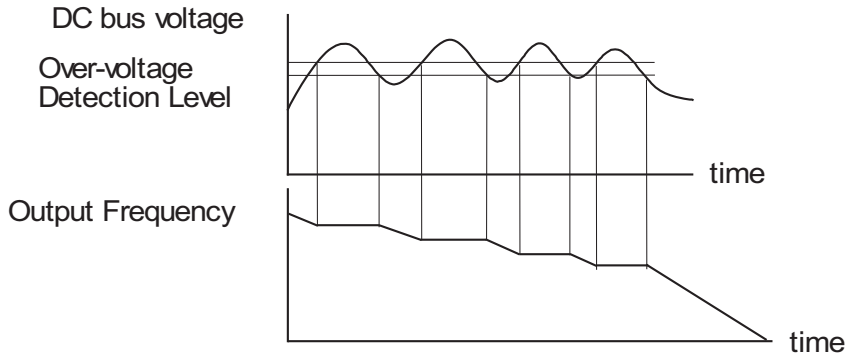
- AVR function automatically regulates the AC drive output voltage to the Maximum Output Voltage (P0.00). For instance, if P0.00 is set at 200 VAC and the input voltage is at 200V to 264VAC, then the Maximum Output Voltage will automatically be regulated to 200 VAC.
- Without AVR function, the Maximum Output Voltage may vary between 180V to 264VAC, due to the input voltage varying between 180V to 264 VAC.
- Selecting program value 2 enables the AVR function and also disables the AVR function during deceleration. This offers a quicker deceleration.

P6.05 Over-Voltage Stall Prevention

Default Setting: 00

Range: 00 Enable Over-voltage Stall Prevention
01 Disable Over-voltage Stall Prevention

During deceleration, the AC drive DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the AC drive will stop decelerating, and maintain a constant output frequency. The drive will resume deceleration when the voltage drops below the factory-preset value.



With moderate inertial loads, over-voltage during deceleration will not occur. For applications with high inertia loads, the AC drive will automatically extend the deceleration time. If deceleration time is critical for the application, a dynamic braking resistor should be used. ***Set this parameter to 01 (disable) when using a dynamic braking resistor.***

P6.06 Auto Adjustable Accel/Decel

Default Setting: 00

Settings:

00	Linear Accel/Decel
01	Auto Accel, Linear Decel
02	Linear Accel, Auto Decel
03	Auto Accel/Decel
04	Auto Accel/Decel Stall Prevention

If the auto accel/decel is selected, the AC drive will accel/decel in the fastest and smoothest means possible by automatically adjusting the time of accel/decel.

This parameter provides five modes to choose:

- 00 Linear Acceleration and deceleration (operation by P1.01, P1.02 or P1.05, P1.06 acceleration/deceleration time).
- 01 Automatic acceleration, linear deceleration (Operation by automatic acceleration time, P1.02 or P1.06 deceleration time).
- 02 Linear acceleration and automatic deceleration (Operation by automatic acceleration time, P1.01 or P1.05 acceleration time).
- 03 Automatic acceleration, deceleration (Operation by AC drive auto adjustable control).
- 04 Auto acceleration, deceleration. The auto accel/decel will not be quicker than the settings for acceleration (P1.01 or P1.05) or deceleration (P1.02 or P1.06). The operation is specific to preventing a stall.

P6.07 Over-Torque Detection Mode

Default Setting: 00

Settings:

00	Disabled
01	Enabled during constant speed operation
02	Enabled during acceleration

P6.08 Over-Torque Detection Level

Default Setting: 150

Range: 30 to 200%

- A setting of 100% is proportional to the Rated Output Current of the drive.
- This parameter sets the Over-Torque Detection level in 1% increments. (The AC drive rated current is equal to 100%.)

P6.09 Over-Torque Detection Time

Default Setting: 0.1

Range: 0.1 to 10.0

This parameter sets the Over-Torque Detection Time in units of 0.1 seconds.

P6.10 **Over-current Stall Prevention during Acceleration** Default Setting: 150

Range: 20 to 200%

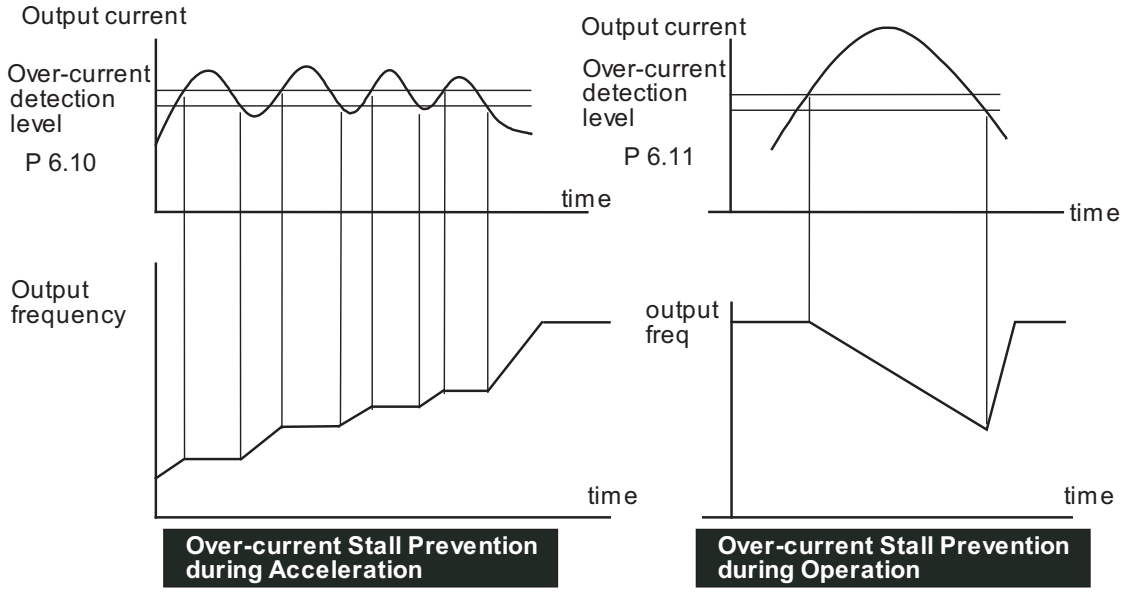
A setting of 100% is equal to the Rated Output Current of the drive.

Under certain conditions, the AC drive output current may increase abruptly, and exceed the value specified by P6.10 This is commonly caused by rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and maintain a constant output frequency. The AC drive will only resume acceleration when the current drops below the maximum value.

P6.11 **Over-current Stall Prevention during Operation** Default Setting: 150

Range: 20 to 200%

During steady-state operation with motor load rapidly increasing, the AC drive output current may exceed the limit specified in P6.11. When this occurs, the output frequency will decrease to maintain a constant motor speed. The drive will accelerate to the steady-state output frequency only when the output current drops below the level specified by P6.11.



Over-current Stall Prevention during Acceleration

Over-current Stall Prevention during Operation

P6.12 Maximum Allowable Power Loss Time

Default Setting: 2.0

Range: 0.3 to 5.0 sec

During a power loss, if the power loss time is less than the time defined by this parameter, the AC drive will resume operation. If the Maximum Allowable Power Loss Time is exceeded, the AC drive output is turned off.

P6.13 Base-Block Time for Speed Search

Default Setting: 0.5

Range: 0.3 to 5.0 sec

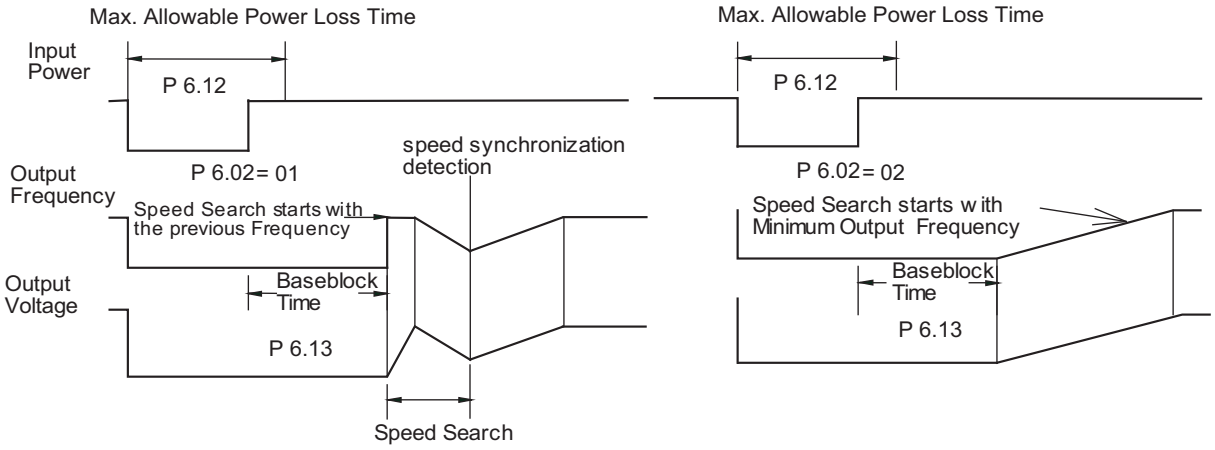
- When a momentary power loss is detected, the AC drive turns off for a specified time interval determined by P6.13 before resuming operation. This time interval is called Base-Block. This parameter should be set to a value where the residual output voltage due to regeneration is nearly zero, before the drive resumes operation.
- This parameter also determines the searching time when performing external Base-Block and Fault Reset (P6.01).

P6.14 Maximum Speed Search Current Level

Default Setting: 150

Range: 30 to 200%

Following a power failure, the AC drive will start its speed search operation only if the output current is greater than the value determined by P6.14. When the output current is less than that of P6.14, the AC drive output frequency is at a "speed synchronization point". The drive will start to accelerate or decelerate back to the operating frequency at which it was running prior to the power failure.



P6.15 Upper Bound of Output Frequency

Default Setting: 400

Range: 0.1 to 400 Hz

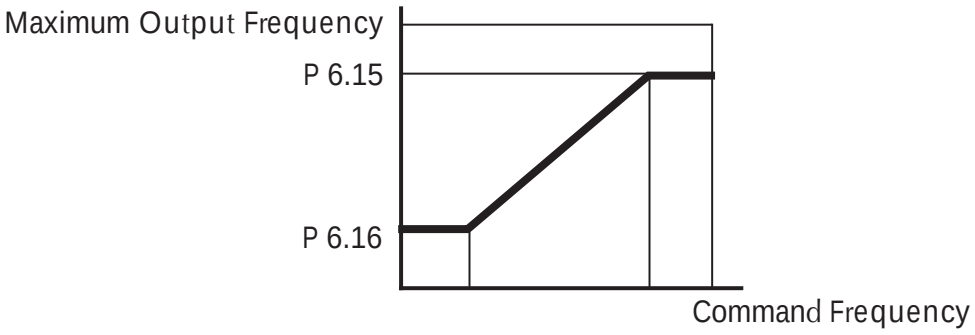
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.
- This parameter must be equal to or greater than the Lower Bound of Output Frequency (P6.16).
- If the Upper Bound of Output Frequency is 50Hz and the Maximum Output Frequency is 60 Hz, then any Command Frequency above 50 Hz will generate a 50 Hz output from the drive.
- The Output Frequency is also limited by the Motor Maximum RPM (P0.04).

P6.16 Lower Bound of Output Frequency

Default Setting: 0.0

Range: 0.0 to 400 Hz

- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.
- This parameter must be equal to or less than the Upper Bound of Output Frequency (P6.15).
- If the Lower Bound of Output Frequency is 10 Hz, and the Minimum Output Frequency (P2.06) is set at 1.0 Hz, then any Command Frequency between 1-10 Hz will generate a 10 Hz output from the drive.
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.



If the reference frequency is less than 0.5 Hz, then this parameter setting is disabled.

P6.17 Over-Voltage Stall Prevention Level

Default: 230V series = 390.0V
Default: 460V series = 780.0V

Range: 230V Series - 330.0V to 450.0V
460V Series - 600.0V to 900.0V

When drive is running, if the DC bus voltage exceeds Over-Voltage Stall level (P6.17), the AC drive will start over-voltage stall prevention.

P6.18 Braking Voltage Level

Default: 230V series = 380.0V
Default: 460V series = 760.0V

Range: 230V Series - 370.0V to 450.0V
460V Series - 740.0V to 900.0V

This parameter establishes the Dynamic Braking Voltage level threshold based on the DC Bus voltage. With the drive running and with DC Bus voltage above the braking level threshold, the braking transistor internal to the drive is gated ON, connecting the external braking resistor across the DC Bus to dissipate the excess voltage as heat.

P6.30 Line Start Lockout

Default Setting: 00

Settings:

00	Enable Line Start Lockout
01	Disable Line Start Lockout

When this parameter is enabled, the AC Drive will not start the motor when powered up with a RUN command already applied. The drive must see the RUN command change from STOP to RUN before it will start.

When this parameter is disabled, the AC Drive will start the motor when powered up with a RUN command already applied.

- This parameter is available only with AC drive firmware v1.02 or higher. Refer to P9.39 to determine the drive's firmware version.

P6.31	**Present Fault Record**	Default Setting: 00
P6.32	**Second Most Recent Fault Record**	Default Setting: 00
P6.33	**Third Most Recent Fault Record**	Default Setting: 00
P6.34	**Fourth Most Recent Fault Record**	Default Setting: 00
P6.35	**Fifth Most Recent Fault Record**	Default Setting: 00
P6.36	**Sixth Most Recent Fault Record**	Default Setting: 00

Settings for P6.31 - P6.36:

00	No Fault occurred
01	Over-current (oc)
02	Over-voltage (ov)
03	Over-temperature (oH)
04	Overload (oL)
05	Thermal Overload (oL1)
06	Over-Torque (oL2)
07	External Fault (EF)
08	CPU failure 1 (CF1)
09	CPU failure 2 (CF2)
10	CPU failure 3 (CF3)
11	Hardware Protection Failure (HPF)
12	Over-current during accel (OCA)
13	Over-current during decel (OCd)
14	Over-current during steady state (OCn)
15	Ground fault or fuse failure (GFF)
17	Input Power 3 phase loss
19	Auto Ramp Fault
20	Parameters Locked
21	PID Feedback Loss
22	Encoder Feedback Loss
23	Output Shorted(OCC)
24	Momentary Power Loss

P6.37	**Hunting Gain**	Default Setting: 0

Range: 0 to 1000

This parameter can help control frequency oscillation of motors (if needed). If system vibration is encountered due to drive frequency hunting, reduce the vibration by adjusting this parameter while monitoring drive/motor operation.

- This parameter is enabled only in the “high-speed regulation” control modes; (P2.10 = 04 or 05).
- This parameter is available only with AC drive firmware v1.05 or higher. Refer to P9.39 to determine the drive’s firmware version.

PID Parameters

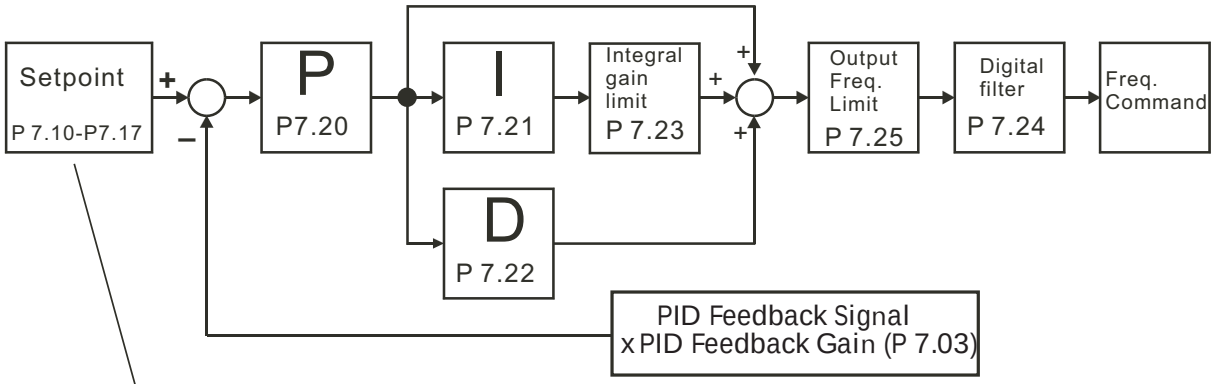
P7.00 Input Terminal for PID Feedback

Default Setting: 00

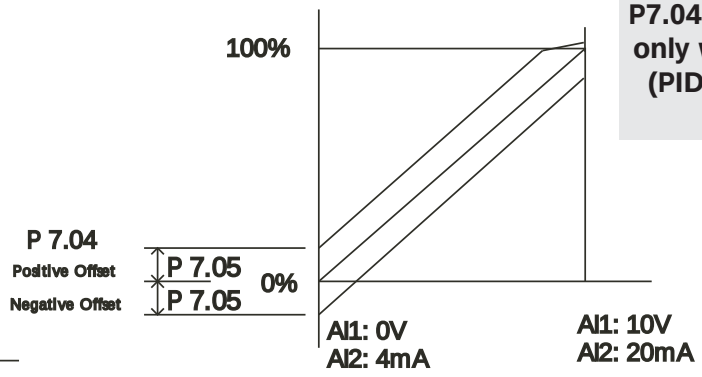
Settings:

00	Inhibit PID operation.
01	Forward-acting (heating loop) PID feedback, PV from AI1 (0 to +10V)
02	Forward-acting (heating loop) PID feedback, PV from AI2 (4 to 20 mA)
03	Reverse-acting (cooling loop) PID feedback, PV from AI1 (0 to +10V)
04	Reverse-acting (cooling loop) PID feedback, PV from AI2 (4 to 20 mA)

Basic PID Loop Diagram:



PID Setpoint x PID Setpoint Gain (P 7.06) + PID Setpoint Offset (P 7.05)



P7.04 thru P7.06 are used only when P7.02 = 2 or 3 (PID Setpoint Source is AI1 or AI2).

P7.01 **PV 100% Value** Default Setting: 100.0

Range: 0.0 to 999

This parameter should be set to the value corresponding to the 100% value of the process variable (PV). The setting for P7.01 cannot be less than any setting for P7.10 to P7.17.



The setting for PV 100% value (P7.01) cannot be set less than any value set for P7.10 to P7.17. If you are unable to reduce P7.01 to the desired value, check parameters P7.10 to P7.17, and reduce these values accordingly.

P7.02 **PID Setpoint Source** Default Setting: 02

Settings:

00	Keypad
01	Serial Communications*
02	AI1 (0 to 10V)
03	AI2 (4 to 20mA)

The user may change the display to PID setpoint by changing P8.00 to 07 on the keypad.



** Serial communication PID setpoint uses P7.10 memory address:*
Hexadecimal - 070A, MODBUS Decimal - 41803, Octal - V3412.

P7.03 ◆ **PID Feedback Gain** Default: 100

Range: 00 to 300.0%

P7.04 ◆ **PID Setpoint Offset Polarity** Default: 00

Settings:

00	No Offset
01	Positive Offset
02	Negative Offset

This parameter functions similarly to P4.01, Analog Input Offset Polarity.

- This parameter only affects analog inputs AI1 and AI2. It does not affect AI3.

P7.05 ◆ **PID Setpoint Offset** Default: 0.0

Range: 0.0 to 100.0%

This parameter functions similarly to P4.02, Analog Input Offset.

- This parameter only affects analog inputs AI1 and AI2. It does not affect AI3.

P7.06 ◆ **PID Setpoint Gain** Default: 100

Range: 0.0 to 300.0%

This parameter functions similarly to P4.03, Analog Input Gain.

- This parameter only affects analog inputs AI1 and AI2. It does not affect AI3.

P7.10 ◆ **Keypad PID Setpoint** Default Setting: 0.0

Range: 0.0 to 999

This parameter is used for serial communication PID setpoints.



Serial communication PID setpoint uses P7.10 memory address: Hexadecimal - 070A, MODBUS Decimal - 41803, Octal - V3412.



The setting for P7.10 cannot exceed the setting for P7.01.

P7.11 ◆ **PID Multi-setpoint 1** Default Setting: 0.0

P7.12 ◆ **PID Multi-setpoint 2** Default Setting: 0.0

P7.13 ◆ **PID Multi-setpoint 3** Default Setting: 0.0

P7.14 ◆ **PID Multi-setpoint 4** Default Setting: 0.0

P7.15 ◆ **PID Multi-setpoint 5** Default Setting: 0.0

P7.16 ◆ **PID Multi-setpoint 6** Default Setting: 0.0

P7.17 ◆ **PID Multi-setpoint 7** Default Setting: 0.0

Range for P7.11-P7.17: 0.0 to 999 Default Setting: 0.0

The Multi-Function Input Terminals DI3 to DI11 (P3.02 to P3.10) are used to select one of the PID Multi-Setpoints. The SPs are determined by P7.11 to P7.17.



1) *In order to use the Multi-PID SPs, P7.11 - P7.17 must be set, and P7.00 ≠ 0.*
2) *The settings for P7.11 through P7.17 cannot exceed the setting for P7.01.*
3) *When all PID Multi-Setpoint inputs are off, the AC drive reverts to the PID Setpoint Source (P7.02).*

Multi-PID SP Bits			PID SP Selection
Bit 3	Bit 2	Bit 1	
OFF	OFF	OFF	P7.02
OFF	OFF	ON	P7.11: SP 1
OFF	ON	OFF	P7.12: SP 2
OFF	ON	ON	P7.13: SP 3
ON	OFF	OFF	P7.14: SP 4
ON	OFF	ON	P7.15: SP 5
ON	ON	OFF	P7.16: SP 6
ON	ON	ON	P7.17: SP 7

P7.20 ◆ Proportional Control (P)

Default Setting: 1.0

Range: 0.0 to 10.0

The first parameter of PID control is Proportional Control (P). For a given process, if the Proportional Value is set too low, the control action will be too sluggish. If the Proportional value is set too high, the control action will be unstable (erratic).

Set the Integral Control (I) and Derivative Control (D) to zero (0). Begin tuning the process with a low Proportional Value, and increase the Proportional value until the system goes unstable (erratic). When instability is reached, reduce the Proportional Value slightly until the system becomes stable (smaller values reduce system Gain). Stability can be tested by moving between two wide-spread setpoint values.

With 10% deviation and P=1, then PX 10% = Control Output. For example, if the speed of a motor is dragged down 10% due to a load increase, a corrective speed signal increase of 10% is generated. In a perfect world, this increase in speed command should bring the motor speed back to normal.

P7.21 ◆ Integral Control (I)

Default Setting: 1.00

Range: 0.00 to 100.0 sec (0.00 disable)

Using only the Proportional Control, the corrective action may not increase fast enough or the setpoint may never be reached because of system losses. The Integral Control is used to generate additional corrective action.

When tuning, begin with a large Integral value and reduce the value until the system goes unstable (erratic). When instability is reached, increase the Integral value slightly until the system becomes stable and the desired setpoint value is reached.

P7.22 ◆ Derivative Control (D)

Default Setting: 0.00

Range: 0.00 to 1.00 sec

If the control output is too sluggish after the Proportional Control (P) and Integral Control (I) values are set, Derivative Control (D) may be required. Begin with a high Derivative value and reduce the value to the point of system instability. Then increase the Derivative value until the control output regains stability. Stability can be tested by moving between two wide-spread setpoint values.

P7.23 Upper Bound for Integral Control

Default Setting: 100

Range: 00 to 100%

- This parameter defines an upper boundary or limit for the integral gain (I) and therefore limits the Master Frequency. Use the formula below to calculate the Integral upper limit.
- The formula is: Integral upper limit = (Maximum Output Frequency) x P7.23. This parameter can limit the Maximum Output Frequency.

$$\textbf{Max. Output Frequency} = \left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right) \text{x Base Frequency (P 0.02)}$$

P7.24 Derivative Filter Time Constant

Default Setting: 0.0

Range: 0.0 to 2.5 sec

To avoid amplification of measured noise in the controller output, a derivative digital filter is inserted. This filter helps smooth oscillations. Larger values for P7.24 provide more smoothing.

P7.25 PID Output Frequency Limit

Default Setting: 100

Range: 00 to 110%

This parameter defines the percentage of output frequency limit during the PID control. The formula is Output Frequency Limit = (Maximum Output Frequency) x P7.25. This parameter will limit the Maximum Output Frequency.

$$\textbf{Max. Output Frequency} = \left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right) \text{x Base Frequency (P 0.02)}$$

P7.26 Feedback Signal Loss Detection Time

Default Setting: 60

Range: 0.0 to 3600 sec

This parameter defines how long the PID Feedback signal is lost before an error is generated. Setting this parameter to 0.0 disables the PID Feedback loss timer. When the feedback signal is lost, the PID Feedback loss timer starts timing. When the timer value is greater than the setting value of P7.26, the PID Feedback Loss warning will activate as set in P7.27. The display shows "PID FBACK LOSS", meaning a feedback abnormality is detected. When the signal is corrected, the warning message "PID FBACK LOSS" will automatically be corrected if a PV signal is still present. If no signal is present, then the screen must be manually reset.

P7.27 PID Feedback Loss Operation

Default Setting: 00

Settings:

00	Warn and AC Drive Stop
01	Warn and Continue Operation
*02	Warn and Continue at Last Frequency
*03	Warn and Continue Preset Speed set in P7.28

* - Parameter setting available only with firmware v1.04 or higher (refer to P9.39)

This parameter sets the operation of the drive when there is a loss of the PID feedback signal.

P7.28 PID Feedback Loss Preset Speed

Default Setting: 0.0

Range: 0 to 400.0 Hz

This parameter sets the speed of operation of the drive when there is a loss of the PID feedback signal, and P7.27 is set to 03.

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

Display Parameters

P8.00 ◆ User Defined Display Function

Default Setting: 00

Settings:

00	Output Frequency (Hz)
01	Motor Speed (rpm)
02	Scaled Frequency
03	Output Current (A)
04	Motor Load (%)
05	Output Voltage (V)
06	DC Bus Voltage (V)
07	PID Setpoint
08	PID Feedback (PV)
09	Frequency Setpoint

P8.01 ◆ Frequency Scale Factor

Default Setting: 1.0

Range: 0.01 to 160.0

This parameter can be used to multiply the display unit by a scaling factor so that the display will represent some other user desired unit. For example, the user may want to scale the drive display to represent ft/min for a motor that is driving a conveyor.

The coefficient K determines the multiplying factor for the user-defined unit.

- The display value is calculated as follows:

  Display value = output frequency x K

- The display window is only capable of showing four digits, but P8.01 can be used to create larger numbers. The display window uses decimal points to signify numbers up to five digits as explained below:

DISPLAY	***NUMBER REPRESENTED***
9999	The absence of a decimal point indicates a four digit integer.
999.9	A single decimal point between the middle and the right-most numbers is a true decimal point; it separates ones and tenths as in “300.5 (three hundred and one-half).
9999.	A single decimal point after the right-most number is not a true decimal point; instead it indicates that a zero follows the right-most numbers. For example, the number 12340 would be displayed as “1234.”.

P8.02 ◆ Backlight Timer

Default Setting: 00

Settings:

00	Timer Enable (1 min light off)
01	Timer Disable

This parameter is used to enable or disable the backlight timer.

Communications Parameters

P9.00 Communication Address

Default Setting: 01

Range: 01 to 254

If the AC drive is controlled by serial communication, the communication address must be set via this parameter.



P9.01 Transmission Speed

Default Setting: 01

Settings:

00	4800 baud data transmission speed
01	9600 baud data transmission speed
02	19200 baud data transmission speed
03	38400 baud data transmission speed

This parameter is used to set the transmission speed between the computer and AC drive. Users can set parameters and control the operation of the AC drive via the RS-485 serial interface of a personal computer.

P9.02 Communication Protocol

Default Setting: 00

Settings:

00	MODBUS ASCII mode	<7 data bits, no parity, 2 stop bits>
01	MODBUS ASCII mode	<7 data bits, even parity, 1 stop bit>
02	MODBUS ASCII mode	<7 data bits, odd parity, 1 stop bit>
03	MODBUS RTU mode	<8 data bits, no parity, 2 stop bits>
04	MODBUS RTU mode	<8 data bits, even parity, 1 stop bit>
05	MODBUS RTU mode	<8 data bits, odd parity, 1 stop bit>

Each *DURAPULSE* AC drive has a pre-assigned communication address specified by P9.00. The master computer or PLC then controls each AC drive according to its communication address. *DURAPULSE* drives can be set up to communicate on Modbus networks using one of the following modes: ASCII (American Standard Code for Information Interchange), or RTU (Remote Terminal Unit). Users can select the desired mode along with the serial port communications protocol using the settings above.

P9.03 Transmission Fault Treatment

Default Setting: 00

Settings:

00	Display fault and continue operating
01	Display fault and RAMP to stop
02	Display fault and COAST to stop
03	No fault displayed and continue operating

This parameter is used to detect an error and take appropriate action.

P9.04 Time Out Detection

Default Setting: 00

Settings:

00	Disable
01	Enable

When this parameter is set to 01, the communications Time Out Detection is Enabled. If a delay in communications for more than the Time Out Duration (P9.05) is detected, the action selected by the Transmission Fault Treatment (P9.03) will be used.

P9.05 Time Out Duration

Default Setting: 0.5

Range: 0.1 to 60.0 seconds

P9.07 ◆ Parameter Lock

Default Setting: 00

Settings:

00	All parameters can be set and read
01	All parameters are read-only

P9.08 Restore to Default

Default Setting: 00

Settings: 0 or 99

•• Setting 99 restores all parameters to factory defaults. ••

P9.11	◆ **Block Transfer Parameter 1**	Default Setting: P9.99
P9.12	◆ **Block Transfer Parameter 2**	Default Setting: P9.99
P9.13	◆ **Block Transfer Parameter 3**	Default Setting: P9.99
P9.14	◆ **Block Transfer Parameter 4**	Default Setting: P9.99
P9.15	◆ **Block Transfer Parameter 5**	Default Setting: P9.99
P9.16	◆ **Block Transfer Parameter 6**	Default Setting: P9.99
P9.17	◆ **Block Transfer Parameter 7**	Default Setting: P9.99
P9.18	◆ **Block Transfer Parameter 8**	Default Setting: P9.99
P9.19	◆ **Block Transfer Parameter 9**	Default Setting: P9.99
P9.20	◆ **Block Transfer Parameter 10**	Default Setting: P9.99
P9.21	◆ **Block Transfer Parameter 11**	Default Setting: P9.99
P9.22	◆ **Block Transfer Parameter 12**	Default Setting: P9.99
P9.23	◆ **Block Transfer Parameter 13**	Default Setting: P9.99
P9.24	◆ **Block Transfer Parameter 14**	Default Setting: P9.99
P9.25	◆ **Block Transfer Parameter 15**	Default Setting: P9.99

Range for Block Transfer Parameters (P9.11-P9.25): P0.00 to P8.02, P9.99

The sequential block transfer parameters (P9.11 through P9.25) allow you to "group" various miscellaneous non-sequential parameters, so that only one PLC programming write instruction is required to update those parameters, instead of three separate write instructions.

- Example:
  Writing directly to three non-sequential parameters P1.00, P1.02, and P1.04 requires three separate write instructions from the PLC. However, those drive parameters can be updated with only one PLC write instruction to the sequential transfer blocks P9.11 through P9.13; if P9.11 is set to P1.00, P9.12 is set to P1.02, and P9.13 is set to P1.04.
- Setting P9.99 (default) disables the Block Transfer Parameter.

P9.26 ◆ **Serial Comm Speed Reference** Default Setting: 60.0

Range: 0.0 to 400.0 Hz [16-bit binary (HEX) format]

This parameter is used to set the Frequency Command when the AC drive is controlled by communication interface.

In order for this parameter to function, the Source of Frequency Command (P4.00) must be set to 05.

P9.27 ◆ **Serial Comm RUN Command** Default Setting: 00

Settings:

00	Stop
01	Run

- Do not write both RUN (P9.27) & JOG (P9.31) Commands in the same write instruction. Use separate write instructions from the master computer or PLC.

In order for this parameter to function, the Source of Operation Command (P3.00) must be set to 03 or 04.

P9.28 ◆ **Serial Comm Direction Command** Default Setting: 00

Settings:

00	Forward
01	Reverse

P9.29 ◆ **Serial Comm External Fault** Default Setting: 00

Settings:

00	No action
01	External fault

P9.30 ◆ **Serial Comm Fault Reset** Default Setting: 00

Settings:

00	No action
01	Fault Reset

P9.31 ◆ **Serial Comm JOG Command** Default Setting: 00

Settings:

00	Stop
01	Jog

- Do not write both RUN (P9.27) & JOG (P9.31) Commands in the same write instruction. Use separate write instructions from the master computer or PLC.

P9.39 **Firmware Version** Default Setting: ##

Settings: Factory Set, Read Only

- This parameter is available only with AC drive firmware v1.02 or higher.

P9.40 ◆ Parameter Copy

Default Setting: 00

Settings:

00	DISABLE Copy Keypad Function
01	ENABLE Copy Keypad Function

This parameter is used to upload or download information to the drive.

P9.41 GS Series Number

Default Setting: ##

Settings

01	GS1
02	GS3
03	GS3
04	GS4

P9.42 Manufacturer Model Information

Default Setting: ##

Settings

00	GS3-21P0 (230V / 3ph / 1.0 hp)
01	GS3-22P0 (230V / 3ph / 2.0 hp)
02	GS3-23P0 (230V / 3ph / 3.0 hp)
03	GS3-25P0 (230V / 3ph / 5.0 hp)
04	GS3-27P5 (230V / 3ph / 7.5 hp)
05	GS3-2010 (230V / 3ph / 10 hp)
06	GS3-2015 (230V / 3ph / 15 hp)
07	GS3-2020 (230V / 3ph / 20 hp)
08	GS3-2025 (230V / 3ph / 25 hp)
09	GS3-2030 (230V / 3ph / 30 hp)
10	GS3-2040 (230V / 3ph / 40 hp)
11	GS3-2050 (230V / 3ph / 50 hp)
12	GS3-41P0 (460V / 3ph / 1.0 hp)
13	GS3-42P0 (460V / 3ph / 2.0 hp)
14	GS3-43P0 (460V / 3ph / 3.0 hp)
15	GS3-45P0 (460V / 3ph / 5.0 hp)
16	GS3-47P5 (460V / 3ph / 7.5 hp)
17	GS3-4010 (460V / 3ph / 10 hp)
18	GS3-4015 (460V / 3ph / 15 hp)
19	GS3-4020 (460V / 3ph / 20 hp)
20	GS3-4025 (460V / 3ph / 25 hp)
21	GS3-4030 (460V / 3ph / 30 hp)
22	GS3-4040 (460V / 3ph / 40 hp)
23	GS3-4050 (460V / 3ph / 50 hp)
24	GS3-4060 (460V / 3ph / 60 hp)
25	GS3-4075 (460V / 3ph / 75 hp)
26	GS3-4100 (460V / 3ph / 100 hp)

Encoder Feedback Parameters

P10.00 Encoder Pulses Per Revolution — Default 1024

Range: 01 to 20000

An encoder is used as a transducer to feed back the motor speed, and this parameter defines the number of pulses for each cycle of the PI control.

P10.01 Encoder Type Input — Default: 00

Range:

00	Disable
01	Single Phase
02	Quadrature, FWD - CCW
03	Quadrature, FWD - CW

This parameter is used to specify encoder signal type. Settings 02 and 03 are used to distinguish motor rotation in relation to the quadrature type encoder signal. Error message "ENC SIGNAL ERROR" will come up if motor rotation does not match quadrature settings.



The diagram on the following page shows the output control relationship of P10.02, P10.03 and P10.04.

P10.02 ◆ Proportional Control — Default: 1.0

Range: 0.0 to 10.0

This parameter specifies proportional control and associated gain (I) used for vector control with encoder feedback (P2.10 = 03). As part of the drive's control algorithm, the most recent feedback signal is multiplied on each scan by the scaling factor set by this parameter.

P10.03 ◆ Integral Control — Default: 1.00

Range: 0.00 to 100.00 sec

This parameter specifies integral control and associated gain (I) used for vector control with encoder feedback (P2.10 = 03). The drive calculates a running integral, or summation, of the feedback signal over the time period set by this parameter. This summation, rather than the most recent feedback signal, is used in the control algorithm. Integral control "smoothes" the effect of radical changes in the feedback signal.

P10.04 Encoder Control Output Limit

Default: 7.5

Range: 0.0 to 20.0%

This parameter limits the amount of correction by the encoder proportional and integral controls (P10.02 & P10.03) on the output frequency when controlling speed. It can limit the maximum output frequency, and is defined in percent of maximum output frequency.

P10.05 Encoder Loss Detection

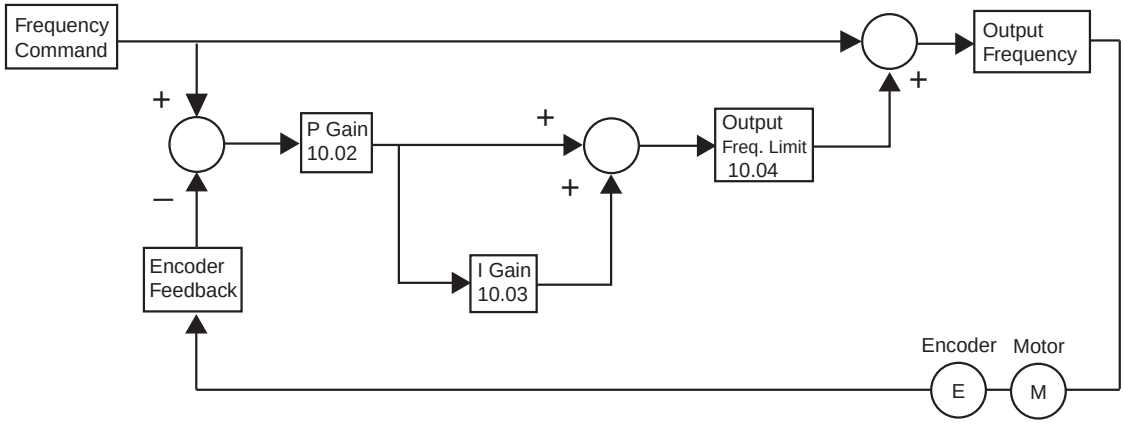
Default: 00

Settings:

00	Warn and continue operation
01	Warn and RAMP to stop
02	Warn and COAST to stop

This parameter governs the response of the drive to the feedback signals, such as the analog or encoder pulse signals, when they are performing abnormally.

Closed Loop Tuning Diagram (P10.02, P10.03, P10.04)



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DURAPULSE MODBUS COMMUNICATIONS



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Communications Parameters Summary

A summary of the *DURAPULSE* Communications Parameters is listed below. For a complete listing of the *DURAPULSE* Parameters, refer to CHAPTER 4.

Communications Parameters Summary			
Parameter	**Description**	**Range**	**Default**
P9.00	Communication Address	01 to 254	01
P9.01	Transmission Speed	00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud	01
P9.02	Communication Protocol	00: MODBUS ASCII mode 7 data bits, no parity, 2 stop bits 01: MODBUS ASCII mode 7 data bits, even parity, 1 stop bit 02: MODBUS ASCII mode 7 data bits, odd parity, 1 stop bit 03: MODBUS RTU mode 8 data bits, no parity, 2 stop bits 04: MODBUS RTU mode 8 data bits, even parity, 1 stop bit 05: MODBUS RTU mode 8 data bits, odd parity, 1 stop bit	00
P9.03	Transmission Fault Treatment	00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating	00
P9.04	Time Out Detection	00: Disable 01: Enable	00
P9.05	Time Out Duration	0.1 to 60.0 seconds	0.5
◆ **P9.07**	Parameter Lock	00: All parameters can be read and set 01: All parameters are read-only	00
P9.08	**Restore to Default**	**99: Restores all parameters to factory defaults**	00
◆ **P9.11**	Block Transfer Parameter 1	P0.00 to P8.02, P9.99	P9.99
◆ **P9.12**	Block Transfer Parameter 2	P0.00 to P8.02, P9.99	P9.99
◆ **P9.13**	Block Transfer Parameter 3	P0.00 to P8.02, P9.99	P9.99
◆ **P9.14**	Block Transfer Parameter 4	P0.00 to P8.02, P9.99	P9.99
◆ **P9.15**	Block Transfer Parameter 5	P0.00 to P8.02, P9.99	P9.99
◆ **P9.16**	Block Transfer Parameter 6	P0.00 to P8.02, P9.99	P9.99
◆ **P9.17**	Block Transfer Parameter 7	P0.00 to P8.02, P9.99	P9.99
◆ **P9.18**	Block Transfer Parameter 8	P0.00 to P8.02, P9.99	P9.99
◆ **P9.19**	Block Transfer Parameter 9	P0.00 to P8.02, P9.99	P9.99
◆ **P9.20**	Block Transfer Parameter 10	P0.00 to P8.02, P9.99	P9.99
◆ **P9.21**	Block Transfer Parameter 11	P0.00 to P8.02, P9.99	P9.99
◆ **P9.22**	Block Transfer Parameter 12	P0.00 to P8.02, P9.99	P9.99
◆ **P9.23**	Block Transfer Parameter 13	P0.00 to P8.02, P9.99	P9.99
◆ ***Parameter can be set during RUN Mode.***			

Communications Parameters Summary (continued)			
Parameter	**Description**	**Range**	**Default**
◆ **P9.24**	Block Transfer Parameter 14	P0.00 to P8.02, P9.99	P9.99
◆ **P9.25**	Block Transfer Parameter 15	P0.00 to P8.02, P9.99	P9.99
◆ **P9.26**	Serial Comm (RS485) Speed Reference	0.0 to 400.0 Hz	60.0
◆ **P9.27**	Serial Comm RUN Command	00: Stop 01: Run	00
◆ **P9.28**	Serial Comm Direction Command	00: Forward 01: Reverse	00
◆ **P9.29**	Serial Comm External Fault	00: No fault 01: External fault	00
◆ **P9.30**	Serial Comm Fault Reset	00: No action 01: Fault Reset	00
◆ **P9.31**	Serial Comm JOG Command	00: Stop 01: Jog	00
P9.39**	Firmware Version	#.##	#.##
◆ **P9.40**	Parameter Copy	00: Disable Copy Keypad Function 01: Enable Copy Keypad Function	00
P9.41	GS Series Number	01: GS1 02: GS2 03: GS3 04: GS4	##
P 9.42	Manufacturer Model Information	00: GS3-21P0 (230V 3ph 1.0hp) 01: GS3-22P0 (230V 3ph 2.0hp) 02: GS3-23P0 (230V 3ph 3.0hp) 03: GS3-25P0 (230V 3ph 5.0hp) 04: GS3-27P5 (230V 3ph 7.5hp) 05: GS3-2010 (230V 3ph 10hp) 06: GS3-2015 (230V 3ph 15hp) 07: GS3-2020 (230V 3ph 20hp) 08: GS3-2025 (230V 3ph 25hp 09: GS3-2030 (230V 3ph 30hp) 10: GS3-2040 (230V 3ph 40hp) 11: GS3-2050 (230V 3ph 50hp) 12: GS3-41P0 (460V 3ph 1.0hp) 13: GS3-42P0 (460V 3ph 2.0hp) 14: GS3-43P0 (460V 3ph 3.0hp) 15: GS3-45P0 (460V 3ph 5.0hp) 16: GS3-47P5 (460V 3ph 7.5hp) 17: GS3-4010 (460V 3ph 10hp) 18: GS3-4015 (460V 3ph 15hp) 19: GS3-4020 (460V 3ph 20hp) 20: GS3-4025 (460V 3ph 25hp) 21: GS3-4030 (460V 3ph 30hp) 22: GS3-4040 (460V 3ph 40hp) 23: GS3-4050 (460V 3ph 50hp) 24: GS3-4060 (460V 3ph 60hp) 25: GS3-4075 (460V 3ph 75hp) 26: GS3-4100 (460V 3ph 100hp)	##
***** Some parameters are available only in later firmware versions of DURAPULSE drives. Refer to "DURAPULSE Parameter Summary" in Chapter 4 (AC Drive Parameters) for more information.***			
◆ ***Parameter can be set during RUN Mode.***			

DURAPULSE Parameter Memory Addresses



The octal address also can be used in the WX / RX instruction of the DL-250-1, DL-450, and DL05.

Parameter Memory Addresses				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
Motor Parameters				
P0.00	Motor Nameplate Voltage	0000	40001	0
P0.01	Motor Nameplate Amps	0001	40002	1
P0.02	Motor Base Frequency	0002	40003	2
P0.03	Motor Base RPM	0003	40004	3
P0.04	Motor Maximum RPM	0004	40005	4
P0.05	Motor Auto Tune	0005	40006	5
P0.06	Motor Line to Line Resistance R1	0006	40007	6
P0.07	Motor No-Load Current	0007	40008	7
Ramp Parameters				
P1.00	Stop Methods	0100	40257	400
◆ **P1.01**	Acceleration Time 1	0101	40258	401
◆ **P1.02**	Deceleration Time 1	0102	40259	402
P1.03	Accel S-curve	0103	40260	403
P1.04	Decel S-curve	0104	40261	404
◆ **P1.05**	Acceleration Time 2	0105	40262	405
◆ **P1.06**	Deceleration Time 2	0106	40263	406
P1.07	Select method to use - 2nd Accel/Decel	0107	40264	407
P1.08	Accel 1 to Accel 2 frequency transition	0108	40265	410
P1.09	Decel 2 to Decel 1 frequency transition	0109	40266	411
P1.10	Skip Frequency 1	010A	40267	412
P1.11	Skip Frequency 2	010B	40268	413
P1.12	Skip Frequency 3	010C	40269	414
P1.13	Skip Frequency 4	010D	40270	415
P1.14	Skip Frequency 5	010E	40271	416
P1.17	Skip Frequency Band	0111	40274	421
P1.18	DC Injection Current Level	0112	40275	422
P1.20	DC Injection during Start-up	0114	40277	424
P1.21	DC Injection during Stopping	0115	40278	425
P1.22	Start-point for DC Injection	0116	40279	426

**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***

◆ ***Parameter can be set during RUN Mode.***

Parameter Memory Addresses (continued)				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
Volts/Hertz Parameters				
P2.00	Volts/Hertz Settings	0200	40513	1000
◆ **P2.01**	Slip Compensation	0201	40514	1001
◆ **P2.02**	Auto-torque Boost	0202	40515	1002
◆ **P2.03**	Torque Compensation Time Constant	0203	40516	1003
P2.04	Mid-point Frequency	0204	40517	1004
P2.05	Mid-point Voltage	0205	40518	1005
P2.06	Min. Output Frequency	0206	40519	1006
P2.07	Min. Output Voltage	0207	40520	1007
P2.08	PWM Carrier Frequency	0208	40521	1010
◆ **P2.09****	Slip Compensation Time Constant	0209	40522	1011
P2.10	Control Mode	020A	40523	1012
Digital Parameters				
P3.00	Source of Operation Command	0300	40769	1400
P3.01	Multi-function Input Terminals (DI1 - DI2)	0301	40770	1401
P3.02	Multi-function Input Terminal 3 (DI3)	0302	40771	1402
P3.03	Multi-function Input Terminal 4 (DI4)	0303	40772	1403
P3.04	Multi-function Input Terminal 5 (DI5)	0304	40773	1404
P3.05	Multi-function Input Terminal 6 (DI6)	0305	40774	1405
P3.06	Multi-function Input Terminal 7 (DI7)	0306	40775	1406
P3.07	Multi-function Input Terminal 8 (DI8)	0307	40776	1407
P3.08	Multi-function Input Terminal 9 (DI9)	0308	40777	1410
P3.09	Multi-function Input Terminal 10 (DI10)	0309	40778	1411
P3.10	Multi-function Input Terminal 11 (DI11)	030A	40779	1412
P3.11	Multi-Function Output Terminal 1 (Relay Output)	030B	40780	1413
P3.12	Multi-Function Output Terminal 2 (DO1)	030C	40781	1414
P3.13	Multi-Function Output Terminal 3 (DO2)	030D	40782	1415
P3.14	Multi-Function Output Terminal 4 (DO3)	030E	40783	1416
◆ **P3.16**	Desired Frequency	0310	40785	1420
◆ **P3.17**	Desired Current	0311	40786	1421
◆ **P3.18**	PID Deviation Level	0312	40787	1422
◆ **P3.19**	PID Deviation Time	0313	40788	1423
◆ **P3.20**	Desired Frequency 2	0314	40789	1424
◆ **P3.30**	Frequency Output (FO) Scaling Factor	031E	40799	1436
P3.31**	2nd Source of Operation Command	031F	40800	1437

**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***

***** Some parameters are available only in later firmware versions of DURAPULSE drives. Refer to P9.39 and "DURAPULSE Parameter Summary" in Chapter 4 for more information.***

◆ ***Parameter can be set during RUN Mode.***

Parameter Memory Addresses (continued)				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
Analog Parameters				
P4.00	Source of Frequency Command	0400	41025	2000
◆ **P4.01**	Analog Input Offset Polarity	0401	41026	2001
◆ **P4.02**	Analog Input Offset	0402	41027	2002
◆ **P4.03**	Analog Input Gain	0403	41028	2003
P4.04	Analog Input Reverse Motion Enable	0404	41029	2004
P4.05	Loss of AI2 Signal (4-20 mA)	0405	41030	2005
◆ **P4.11**	Analog Output Signal	040B	41036	2013
◆ **P4.12**	Analog Output Gain	040C	41037	2014
P4.13**	2nd Source of Frequency Command	040D	41038	2015
◆ **P4.14****	2nd Frequency Command Offset Polarity	040E	41039	2016
◆ **P4.15****	2nd Frequency Command Offset	040F	41040	2017
◆ **P4.16****	2nd Frequency Command Gain	0410	41041	2020
◆ **P4.17****	Trim Frequency Reference	0411	41042	2021
◆ **P4.18****	Trim Mode Select	0412	41043	2022

Presets Parameters				
◆ **P5.00**	Jog	0500	41281	2400
◆ **P5.01**	Multi-Speed 1	0501	41282	2401
◆ **P5.02**	Multi-Speed 2	0502	41283	2402
◆ **P5.03**	Multi-Speed 3	0503	41284	2403
◆ **P5.04**	Multi-Speed 4	0504	41285	2404
◆ **P5.05**	Multi-Speed 5	0505	41286	2405
◆ **P5.06**	Multi-Speed 6	0506	41287	2406
◆ **P5.07**	Multi-Speed 7	0507	41288	2407
◆ **P5.08**	Multi-Speed 8	0508	41289	2410
◆ **P5.09**	Multi-Speed 9	0509	41290	2411
◆ **P5.10**	Multi-Speed 10	050A	41291	2412
◆ **P5.11**	Multi-Speed 11	050B	41292	2413
◆ **P5.12**	Multi-Speed 12	050C	41293	2414
◆ **P5.13**	Multi-Speed 13	050D	41294	2415
◆ **P5.14**	Multi-Speed 14	050E	41295	2416
◆ **P5.15**	Multi-Speed 15	050F	41296	2417

**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***

***** Some parameters are available only in later firmware versions of DURAPULSE drives. Refer to P9.39 and "DURAPULSE Parameter Summary" in Chapter 4 for more information.***

◆ ***Parameter can be set during RUN Mode.***

Parameter Memory Addresses (continued)				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
Protection Parameters				
P6.00	Electronic Thermal Overload Relay	0600	41537	3000
P6.01	Auto Restart after Fault	0601	41538	3001
P6.02	Momentary Power Loss	0602	41539	3002
P6.03	Reverse Operation Inhibit	0603	41540	3003
P6.04	Auto Voltage Regulation	0604	41541	3004
P6.05	Over-Voltage Stall Protection	0605	41542	3005
P6.06	Auto Adjustable Accel/Decel	0606	41543	3006
P6.07	Over-Torque Detection Mode	0607	41544	3007
P6.08	Over-Torque Detection Level	0608	41545	3010
P6.09	Over-Torque Detection Time	0609	41546	3011
P6.10	Over-Current Stall Prevention during Acceleration	060A	41547	3012
P6.11	Over-Current Stall Prevention during Operation	060B	41548	3013
P6.12	Maximum Allowable Power Loss Time	060C	41549	3014
P6.13	Base-Block Time for Speed Search	060D	41550	3015
P6.14	Maximum Speed Search Current Level	060E	41551	3016
P6.15	Upper Bound of Output Frequency	060F	41552	3017
P6.16	Lower Bound of Output Frequency	0610	41553	3020
P6.17	Over-Voltage Stall Prevention Level	0611	41554	3021
P6.18	Braking Voltage Level	0612	41555	3022
P6.30**	Line Start Lockout	061E	41567	3036
P6.31	Present Fault Record	061F	41568	3037
P6.32	Second Most Recent Fault Record	0620	41569	3040
P6.33	Third Most Recent Fault Record	0621	41570	3041
P6.34	Fourth Most Recent Fault Record	0622	41571	3042
P6.35	Fifth Most Recent Fault Record	0623	41572	3043
P6.36	Sixth Most Recent Fault Record	0624	41573	3044
◆ **P6.37****	Hunting Gain	0625	41574	3045

**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***

***** Some parameters are available only in later firmware versions of DURAPULSE drives. Refer to P9.39 and "DURAPULSE Parameter Summary" in Chapter 4 for more information.***

◆ ***Parameter can be set during RUN Mode.***

Parameter Memory Addresses (continued)				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
PID Parameters				
P7.00	Input Terminal for PID Feedback	0700	41793	3400
P7.01	PV 100% Value	0701	41794	3401
P7.02	PID Setpoint Source	0702	41795	3402
◆ **P7.03**	PID Feedback Gain	0703	41796	3403
◆ **P7.04**	PID Setpoint Offset Polarity	0704	41797	3404
◆ **P7.05**	PID Setpoint Offset	0705	41798	3405
◆ **P7.06**	PID Setpoint Gain	0706	41799	3406
◆ **P7.10**	Keypad & Serial PID Setpoint	070A	41803	3412
◆ **P7.11**	PID Multi-setpoint 1	070B	41804	3413
◆ **P7.12**	PID Multi-setpoint 2	070C	41805	3414
◆ **P7.13**	PID Multi-setpoint 3	070D	41806	3415
◆ **P7.14**	PID Multi-setpoint 4	070E	41807	3416
◆ **P7.15**	PID Multi-setpoint 5	070F	41808	3417
◆ **P7.16**	PID Multi-setpoint 6	0710	41809	3420
◆ **P7.17**	PID Multi-setpoint 7	0711	41810	3421
◆ **P7.20**	Proportional Control	0714	41813	3424
◆ **P7.21**	Integral Control	0715	41814	3425
◆ **P7.22**	Derivative Control	0716	41815	3426
P7.23	Upper Bound for Integral Control	0717	41816	3427
P7.24	Derivative Filter Time Constant	0718	41817	3430
P7.25	PID Output Frequency Limit	0719	41818	3431
P7.26	Feedback Signal Detection Time	071A	41819	3432
P7.27	PID Feedback Loss	071B	41820	3433
◆ **P7.28****	PID Feedback Loss Preset Speed	071C	41821	3434

Display Parameters				
◆ **P8.00**	User Defined Display Function	0800	42049	4000
◆ **P8.01**	Frequency Scale Factor	0801	42050	4001
◆ **P8.02**	Backlight Timer	0802	42051	4002

**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***

***** Some parameters are available only in later firmware versions of DURAPULSE drives. Refer to P9.39 and "DURAPULSE Parameter Summary" in Chapter 4 for more information.***

◆ ***Parameter can be set during RUN Mode.***

Parameter Memory Addresses (continued)				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
Communications Parameters				
P9.00	Communication Address	0900	42305	4400
P9.01	Transmission Speed	0901	42306	4401
P9.02	Communication Protocol	0902	42307	4402
P9.03	Transmission Fault Treatment	0903	42308	4403
P9.04	Time Out Detection	0904	42309	4404
P9.05	Time Out Duration	0905	42310	4405
◆ **P9.07**	Parameter Lock	0907	42312	4407
P9.08	**Restore to Default**	0908	42313	4410
◆ **P9.11**	Block Transfer Parameter 1	090B	42316	4413
◆ **P9.12**	Block Transfer Parameter 2	090C	42317	4414
◆ **P9.13**	Block Transfer Parameter 3	090D	42318	4415
◆ **P9.14**	Block Transfer Parameter 4	090E	42319	4416
◆ **P9.15**	Block Transfer Parameter 5	090F	42320	4417
◆ **P9.16**	Block Transfer Parameter 6	0910	42321	4420
◆ **P9.17**	Block Transfer Parameter 7	0911	42322	4421
◆ **P9.18**	Block Transfer Parameter 8	0912	42323	4422
◆ **P9.19**	Block Transfer Parameter 9	0913	42324	4423
◆ **P9.20**	Block Transfer Parameter 10	0914	42325	4424
◆ **P9.21**	Block Transfer Parameter 11	0915	42326	4425
◆ **P9.22**	Block Transfer Parameter 12	0916	42327	4426
◆ **P9.23**	Block Transfer Parameter 13	0917	42328	4427
◆ **P9.24**	Block Transfer Parameter 14	0918	42329	4430
◆ **P9.25**	Block Transfer Parameter 15	0919	42330	4431
◆ **P9.26**	Serial Comm (RS-485) Speed Reference	091A	42331	4432
◆ **P9.27**	Serial Comm RUN Command	091B	42332	4433
◆ **P9.28**	Serial Comm Direction Command	091C	42333	4434
◆ **P9.29**	Serial Comm External Fault	091D	42334	4435
◆ **P9.30**	Serial Comm Fault Reset	091E	42335	4436
◆ **P9.31**	Serial Comm JOG Command	091F	42336	4437
P9.39**	Firmware Version	0927	42344	4447
◆ **P9.40**	Parameter Copy	0928	42345	4450
P9.41	GS Series Number	0929	42346	4451
P9.42	Manufacturer Model Information	092A	42347	4452

**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***

***** Some parameters are available only in later firmware versions of DURAPULSE drives. Refer to P9.39 and "DURAPULSE Parameter Summary" in Chapter 4 for more information.***

◆ ***Parameter can be set during RUN Mode..***

Parameter Memory Addresses (continued)				
Parameter	**Description**	**Hexadecimal**	**Modbus Decimal ***	**Octal**
Encoder Feedback Parameters				
P10.00	Encoder Pulse per Revolution	0A00	42561	5000
P10.01	Encoder type Input	0A01	42562	5001
◆ **P10.02**	Proportional Control	0A02	42563	5002
◆ **P10.03**	Integral Control	0A03	42564	5003
P10.04	Speed Control Output Speed Limit	0A04	42565	5004
P10.05	Encoder Loss Detection	0A05	42566	5005
**** For Modbus Decimal addresses used with CLICK PLCs, insert another zero as the next-to-most-significant digit, e.g., 402333 instead of 42333.***				
◆ ***Parameter can be set during RUN Mode.***				

DURAPULSE Status Addresses

The *DURAPULSE* Series AC drive has status memory addresses that are used to monitor the AC drive. The status addresses and value definitions are listed below.

Status Addresses (Read Only)

DURAPULSE Status Addresses			
Description	**Hexadecimal**	**Modbus Decimal**	**Octal**
Status Monitor 1	2100	48449	20400
Status Monitor 2	2101	48450	20401
Frequency Command F	2102	48451	20402
Output Frequency H	2103	48452	20403
Output Current A	2104	48453	20404
DC Bus Voltage d	2105	48454	20405
Output Voltage U	2106	48455	20406
Motor RPM	2107	48456	20407
Scale Frequency (Low Word)	2108	48457	20410
Scale Frequency (High Word)	2109	48458	20411
Power Factor Angle	210A	48459	20412
% Load	210B	48460	20413
PID Setpoint	210C	48461	20414
PID Feedback Signal (PV)	210D	48462	20415
Firmware Version	2110	48465	20420

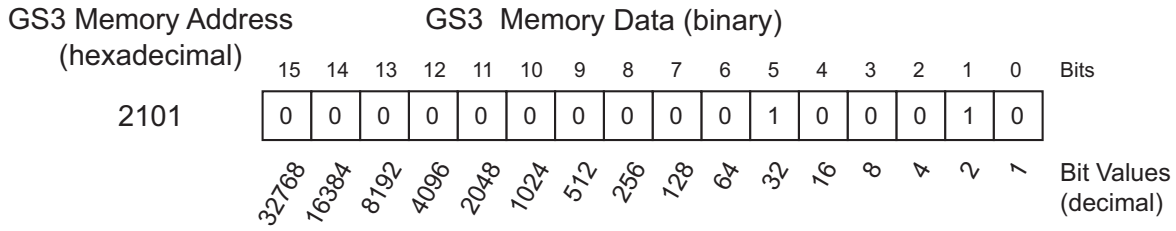
Status Monitor 1 h2100

Error Codes:

00: No fault occurred
01: Over-current(oc)
02: Over-voltage(ov)
03: Overheat (oH)
04: Overload (oL)
05: Thermal Overload 1 (oL1)
06: Over-torque (oL2)
07: External Fault (EF)
08: CPU Failure 1 (cF1)
09: CPU Failure 2 (cF2)
10: CPU Failure 3 (cF3)
11: Hardware Protection Failure (HPF)
12: Over-current during accel (ocA)
13: Over-current during decel (ocd)
14: Over-current during steady state (ocn)
15: Ground Fault or Fuse Failure (GFF)
16: Low Voltage (Lv)
17: Input Power 3-phase Loss (PHL)
18: External Base-Block (bb)
19: Auto Adjust accel/decel Failure (cFA)
20: Software Protection Code (codE)
21: PID Feedback Loss (FbE)
22: Encoder Feedback Loss (ENCODER LOSS)
23: Output Shorted (occ)
24: Momentary Power Loss (MOM POWER LOSS)

Some error codes will not display under status address if only a warning message. The drive must have a hard trip. To manually check this, set "External Fault" to Terminal Control, and trip. This will simulate the result of a hard trip.

Status Monitor 2 h2101



Status Monitor 2 - Memory Address h2101		
Address Bit(s)	**Bit(s) Value Binary (Decimal)**	**AC Drive Status**
0 and 1	00 (0)	Drive operation stopped (STOP)
	01 (1)	Run to Stop transition
	10 (2)	Standby
	11 (3)	Drive operation running (RUN)
2	1 (4)	JOG active
3 and 4	00 (0)	Rotational direction forward (FWD)
	01 (8)	REV to FWD transition
	10 (16)	FWD to REV transition
	11 (24)	Rotational direction reverse (REV)
5 ~ 7	N/A	Reserved
8	1 (32)	Source of frequency determined by serial comm interface (P4.00 = 5)
9	1 (64)	Source of frequency determined by AI terminal (P4.00 = 2, 3, 4 or 6)
10	1 (128)	Source of operation determined by serial comm interface (P3.00 = 3 or 4)
11	1 (256)	Parameters have been locked (P9.07 = 1)
12	N/A	Copy command eable

Frequency Command F (XXX.X) h2102

Status location for the frequency setting of the AC drive.

Output Frequency H (XXX.X) h2103

Status location for the actual operating frequency present at the T1, T2, and T3 terminal.

Output Current A h2104

Status location for the output current present at the T1, T2, and T3 terminals.

DC-BUS Voltage d (XXX.X) h2105

Status location for the DC Bus Voltage.

Output Voltage U (XXX.X) h2106

Status location for the output voltage present at the T1, T2, and T3 terminals.

Motor RPM h2107

Status location for the present estimated speed of the motor.

Scale Frequency (Low word) h2108

Status location for result of output frequency x P 8.01 (low word).

Scale Frequency (High word) h2109

Status location for result of output frequency x P 8.01 (high word).

Power Factor Angle h210A

Status location for the power factor angle.

% Load h210B

Status location for the amount of load on the AC drive. (Output Current ÷ Drive Rated Current) x 100.

PID Setpoint h210C

Status location for the PID setpoint.

PID Feedback Signal (Process Variable) h210D

Status location for PID process variable feedback signal.

Firmware Version h2110

Status location for the firmware version of the AC drive.

Communicating with AutomationDirect PLCs

The following steps explain how to connect and communicate with the *DURAPULSE* AC drives using AutomationDirect PLCs.

DURAPULSE drives have a provision for shutting down control or power to the inverter in the event of a communications time out. This feature can be set up through parameters P9.03, P9.04, and P9.05.

Step 1: Choose the Appropriate CPU

The *DURAPULSE* AC drives will communicate with the following AutomationDirect PLCs using Modbus communications.

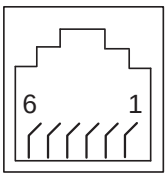
- Modbus control is easier to accomplish from a ***Direct***LOGIC PLC with an RS-485 port and MRX/MWX, or from a CLICK PLC using Send/Receive instructions.

Choose Your CPU	
Primary Choices	CLICK Analog CPU with Send/Receive instructions & RS-485 comm port D2-260 or DL06 with MRX / MWX instructions & RS-485 comm port
Secondary Choices	CLICK Basic CPU with Send/Receive instructions & RS-232 comm port DL05, D2-250(-1), or D4-450 with RX / WX instructions & RS-232 comm port

Step 2: Make the Connections

DURAPULSE RS-485 Serial Comm Port

GS3 Serial Comm Port
RS-485 Interface
RJ12 (6P6C)



1: +15V
2: GND
3: SG–
4: SG+
5: nc
6: reserved

The *DURAPULSE* Comm Port requires an RS-485 input.
RS-232 signals can be converted to RS-485 by using a separate converter.

PLC Connections for RS-485 Modbus RTU Control of *DURAPULSE* Drive					
Drive	**PLC ***	**PLC Port ***	**Communication**	**Direct Cable**	**Length**
DURAPULSE (GS3)	CLICK	3	RS-485	ZL-RJ12-CBL-2P ***	2m [6.6 ft] ***
	DL05	2 **	RS-232 – RS-485 **	N/A **	
	DL06 D0-DCM	2	RS-485	**GS-485HD15-CBL-2 *** **	2m [6.6 ft] ***
	D2-DCM D2-250(-1)	2 **	RS-232 – RS-485 **	N/A **	
	D2-260	2	RS-485	**GS-485HD15-CBL-2 *** **	2m [6.6 ft] ***
	D4-450	3 **	RS-232 – RS-485 **	N/A **	

**** If a PLC type or port is not listed in this chart, it cannot function as a Modbus RTU master.***
***** Requires RS-232–RS-485 converter & generic cabling options described later in this chapter.***
****** Termination resistors not required due to short cable length.***

RS-485 Connections For Multiple Drives

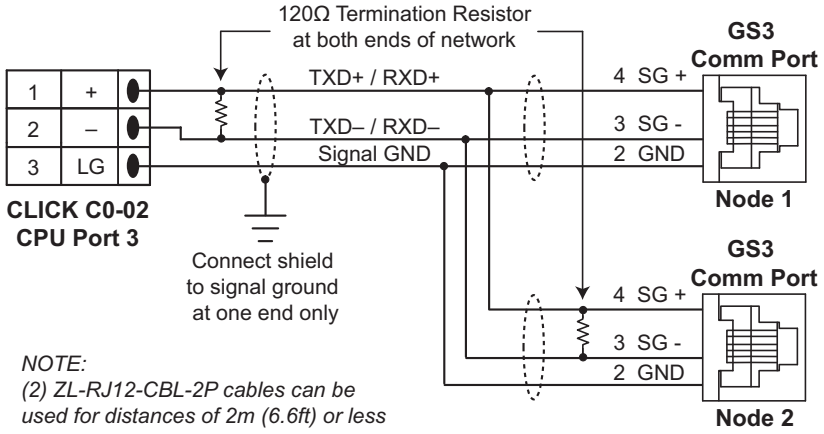
*ZIP*Link™ RS-485 communication boards (**ZL-CDM-RJ12X4** or **ZL-CDM-RJ12X10**) provide an easy means to break out the RS-485 signal to several drives at one location, which creates a star configuration. However, the transmission errors are negligible, so this configuration is acceptable for proper operation of the VFDs.

RS-485 Direct Connections

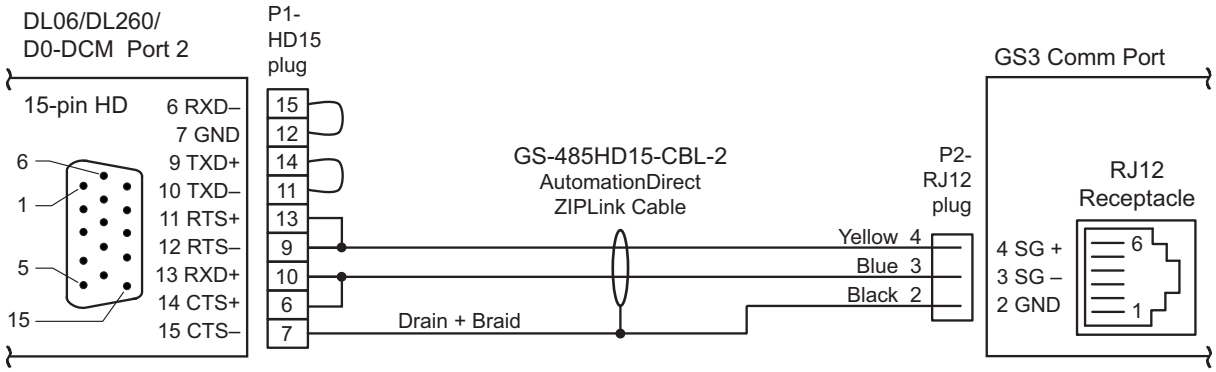
Termination Resistors are required on both ends of RS-485 networks; especially on long runs.
Select resistors that match the impedance rating of the cable (between 100 and 500Ω).

Recommended RS-485 cable: Belden 9842 or equivalent.

CLICK C0-02: RS-485 Connection Wiring

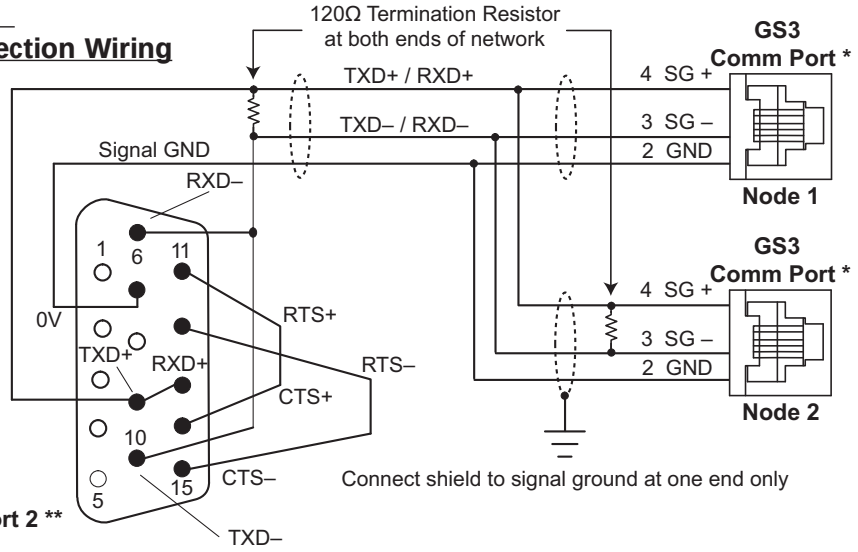


D0-DCM/DL06/DL260: RS-485 Connection Wiring
– for single drive at distance of 2 meters (6.6 ft) or less



RS-485 Direct Connections (continued)

D0-DCM/DL06/DL260: RS-485 Connection Wiring



* Consider using ZIPLink RJ12 Feedthrough Modules ZL-RTB-RJ12 for easy wiring termination.
** Consider using ZIPLink 15-pin high-density Comm Port Adapter, ZL-CMA15 or ZL-CMA15L, for easy wiring termination.

For Single Cable Runs of 2m (6.6 ft) or less to only one AC Drive: Use pre-terminated cable GS-485HD15-CBL-2 for easy wiring.

Cable D0-DSCBL (12ft; 3.7m) is available for connecting the DL05 to the FA-ISOCON. For a single run to only one AC Drive, cable GS-ISOCON-CBL-2 (2m; 6.6ft) is available for directly connecting the FA-ISOCON to the DURAPULSE Com Port.

RS-232C to RS-485 Conversion

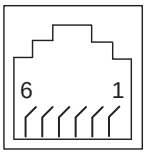
An RS-485 network cable can span up to 1000 meters (4000 feet). However, many AutomationDirect PLCs have only RS-232C communication ports, and require an FA-ISOCON (RS-232C to RS-422/485 network adapter) in order to make an RS-485 connection.

If an FA-ISOCON module is used, set the module dipswitches as required. Refer to the FA-ISOCON manual for more detailed information.

FA-ISOCON Switch Settings:

S21~S23	OFF, ON, ON (19200 baud)
S24~S27	OFF (Automatic Network Transmit Enable)
Terminate	ON (end of run term resistors)
Bias (2)	ON (end of run bias resistors)
1/2 DPX (2)	ON (RS-485 TXD/RXD jumpers)

FA-ISOCON RJ-12 Serial Comm Port A RS-232 Input Port



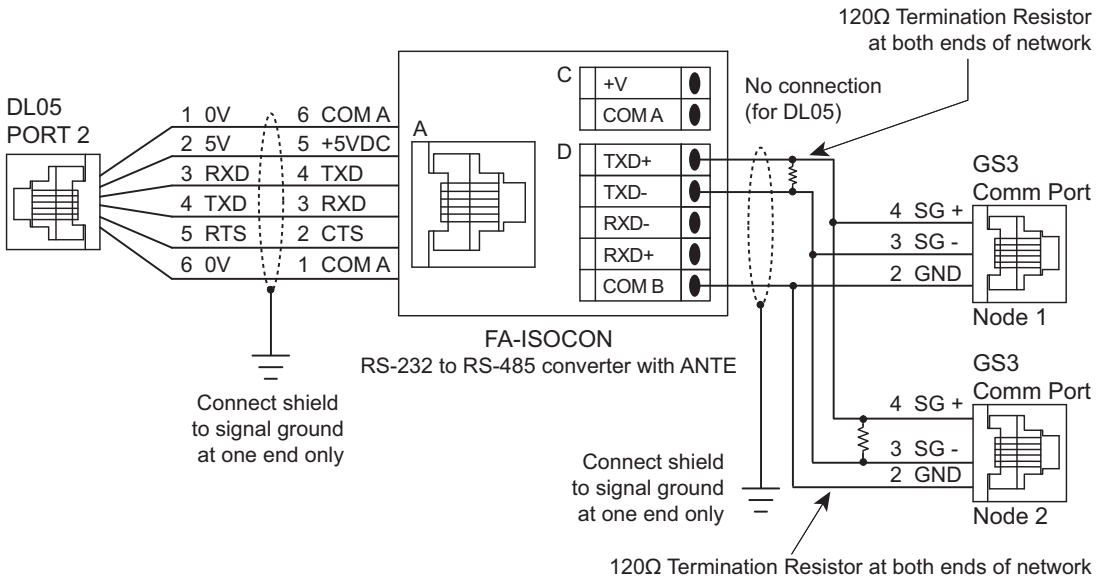
1: Signal Ground
2: CTS (input)
3: RXD (input)
4: TXD (output)
5: +5VDC in
6: Signal Ground

Recommended cable for RS-232: Belden 8102 or equivalent.
Recommended cable for RS-485: Belden 9842 or equivalent.
Various pre-terminated cables for specific wiring connections are available from AutomationDirect, as listed in applicable individual wiring sections of this chapter.

RS-232C to RS-485 Conversion (continued)

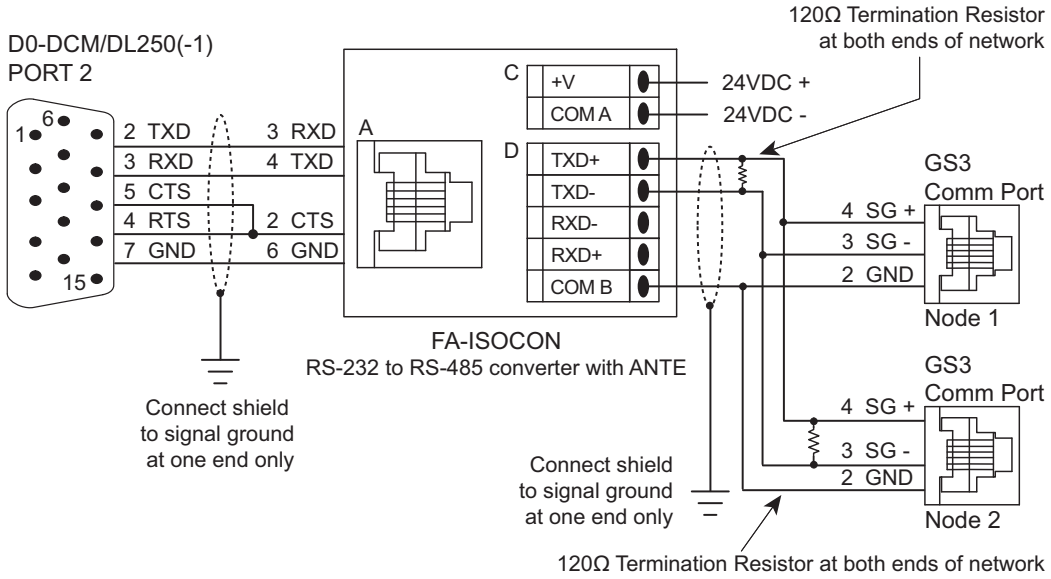
Use the following wiring diagrams to connect ***Direct***LOGIC RS-232C PLCs to a *DURAPULSE* Series AC drive with an FA-ISOCON network adapter module:

DL05: RS-232C to RS-485 Connection Wiring



Cable D0-DSCBL (12ft; 3.7m) is available for connecting the DL05 to the FA-ISOCON. For a single run to only one AC Drive, cable GS-ISOCON-CBL-2 (2m; 6.6ft) is available for directly connecting the FA-ISOCON to the GS3 Com Port.

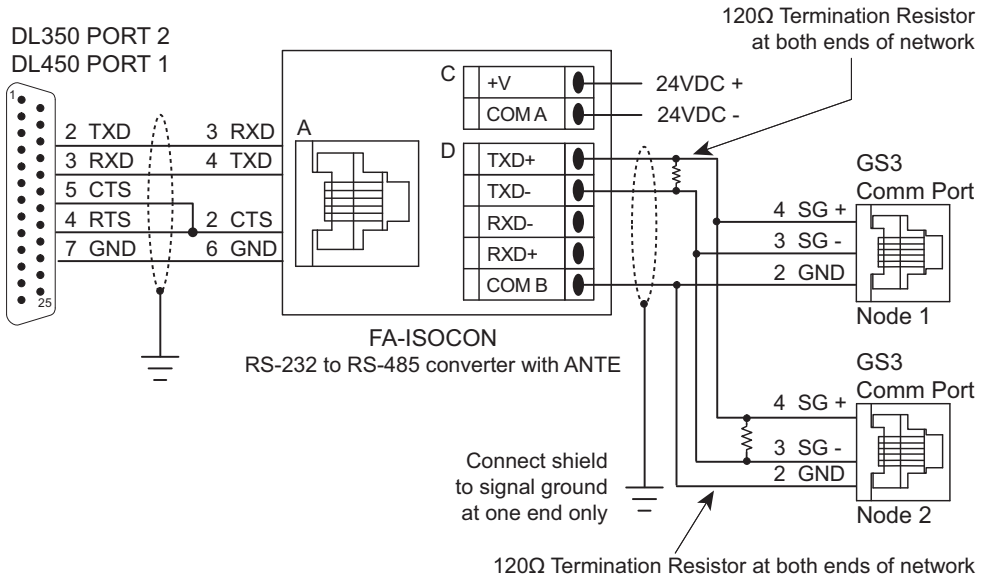
D0-DCM/DL250(-1): RS-232C to RS-485 Connection Wiring



A cable that will connect the D0-DCM or DL250(-1) to the FA-ISOCON can be constructed using the FA-15HD adapter and the D0-CBL cable. A cable can also be constructed using the FA-15HD adapter and RJ12-6P6C cable from the FA-CABKIT.

RS-232C to RS-485 Conversion (continued)

DL350/DL450: RS-232C to RS-485 Connection Wiring



A cable that will connect the DL450 to the FA-ISOCON can be constructed using the DB25-pin-male-to-RJ12 adapter and the RJ12-6P6C cable from the FA-CABKIT.

Ethernet Connection using GS-EDRV(100)

The GS-EDRV(100) provides a high-performance Ethernet link between a control system and a *DURAPULSE AC* DRIVE. It mounts on DIN rail and connects a drive to an Ethernet hub/switch or PC. The GS-EDRV(100) processes signals to and from the drive. It formats the signals to conform with the Ethernet standard to the H2-ERM(100) or H4-ERM(100), KEPdirect EBC I/O server, or independent controller with a MODBUS TCP/IP driver. This Ethernet interface allows for great connectivity to many control system architectures. An additional feature is the built-in web browser which allows users to configure and control the drive from any web browser via the IP address of the GS-EDRV(100) card.

Step 3: Set AC Drive Parameters

The following parameters need to be set as shown in order to communicate properly.

P3.00:	03 or 04	Operation Determined by RS-485 interface. Keypad STOP is enabled (03) or disabled (04).
P4.00:	05	Frequency determined by RS-485 communication interface.
P9.00:	xx	Communication address 1-254 (unique for each device, see P9.00).
P9.01:	01	9600 baud data transmission speed (higher baud rate setting may be required with FA-ISOCON network adapter; set adapter DIP switches accordingly).
P9.02:	05	MODBUS RTU mode <8 data bits, odd parity, 1 stop bit>.



*This list of parameter settings is the minimum required to communicate with a **Direct**LOGIC PLC. There may be other parameters that need to be set to meet the needs of your particular application.*

Step 4: Configure the PLC CPU

The PLC CPUs must be configured to communicate with the *DURAPULSE* AC drives. This configuration includes setting up the communication port and adding instructions to your logic program.

The set up for all of the AutomationDirect PLC CPUs is very similar, although there are some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your specific PLC CPU if more details are needed.



For instructions on Modbus Configuration for your specific PLC CPU, refer to the appropriate PLC User Manual.

Configure the CLICK PLC

Configure the CLICK CPU communication port before writing communication instructions into your logic program.

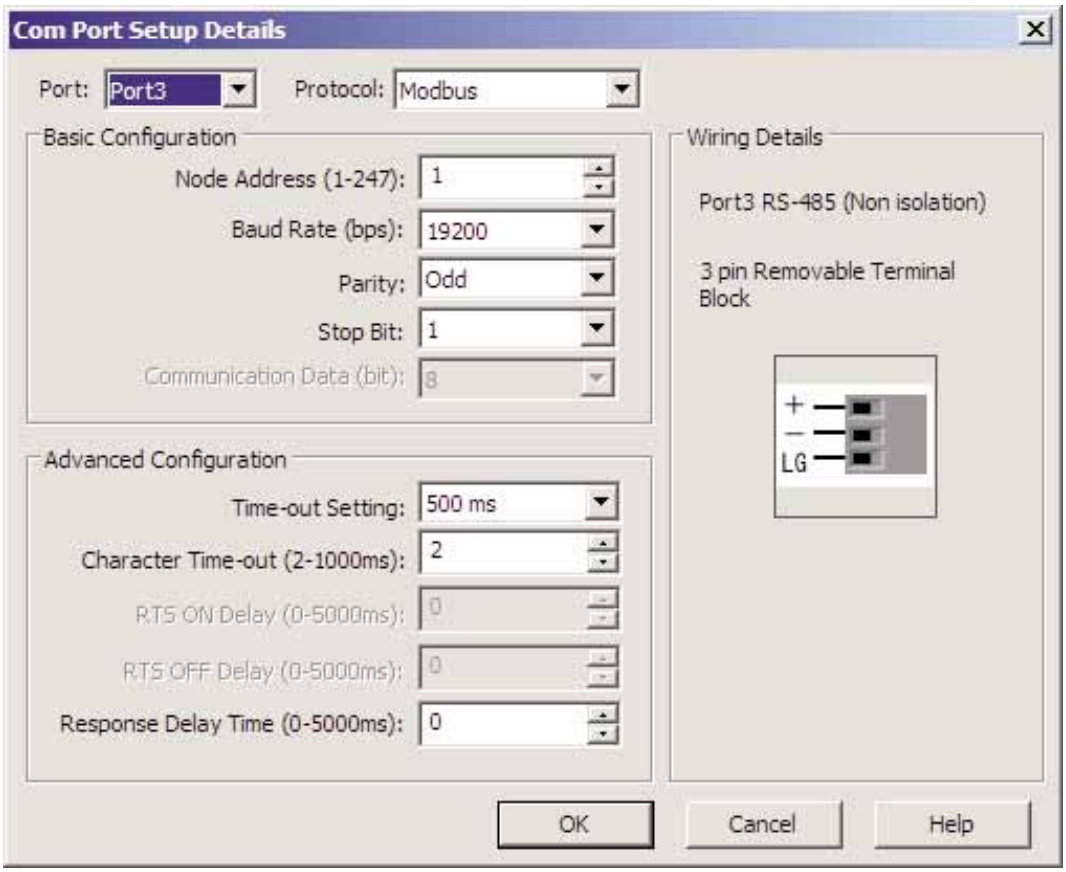


For more detailed instructions on Modbus Configuration for your CLICK, refer to the CLICK PLC Hardware User Manual, C0-USER-M, or to the CLICK software help file.

CLICK Port 3 MODBUS Configuration for RS-485

The following configuration example is specific for CLICK PLC CPUs.

- Configure the communication port before writing communication instructions into the logic program.
- In CLICK programming software, open the "**Comm Port Setup Details**" dialog box by choosing the Setup menu, then Comm Port Setup, then Port 2 Setup.
- From the "Port:" list box, choose "**Port 3**".
- For the "Protocol:" list box, select "**Modbus**".
- Set the "Node Address" to "**1**" to make the CLICK PLC a MODBUS master.
- Set the "Baud Rate" to "**19200**"
- Set the "Parity" to "**Odd**".
- Set the "Stop Bit" to "**1**".
- Set the "Time-out Setting" to "**500ms**".
- Set the "Response Delay Time" to "**0ms**".



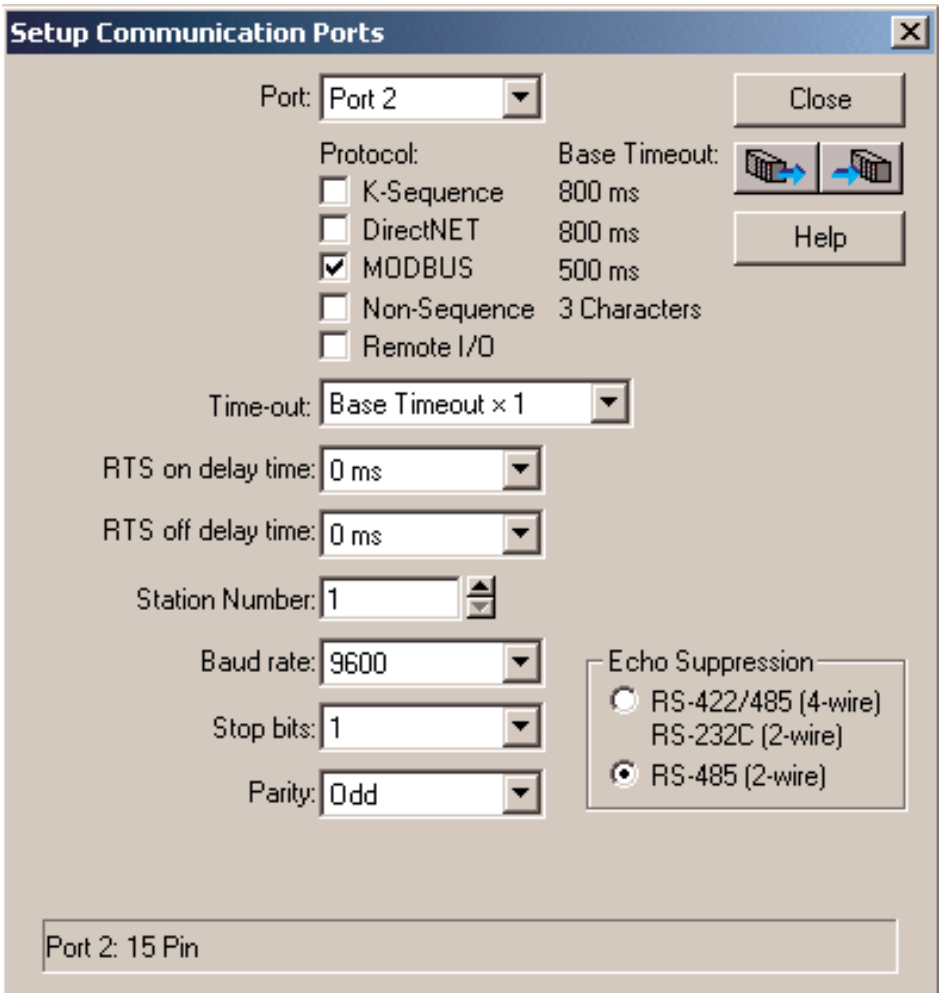
The communication port settings are saved in the project file. The project must be transferred to the CLICK PLC in order for any port setting changes to take effect.

Configure the *Direct*LOGIC CPUs

*Direct*LOGIC MODBUS Port Configuration for D2-260 and DL06

The following configuration example is specific to the D2-260 and DL06. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

- In ***Direct***SOFT, choose the PLC menu, then Setup, then "**Secondary Comm Port**".
- From the Port number list box at the top, choose "**Port 2**".
- For the Protocol, select "**MODBUS**".
- Response Delay Time should be "**0ms**". Both RTS on and off delay times must be set to 0ms .
- The Station Number should be set to "**1**" to make the D2-260 or DL06 CPU a MODBUS master.
- The Baud Rate should be set at "**9600**" (or higher, if using an FA-ISOCON network adapter module).
- In the Stop Bits list box, Choose "**1**".
- In the Parity list box, choose "**Odd**".



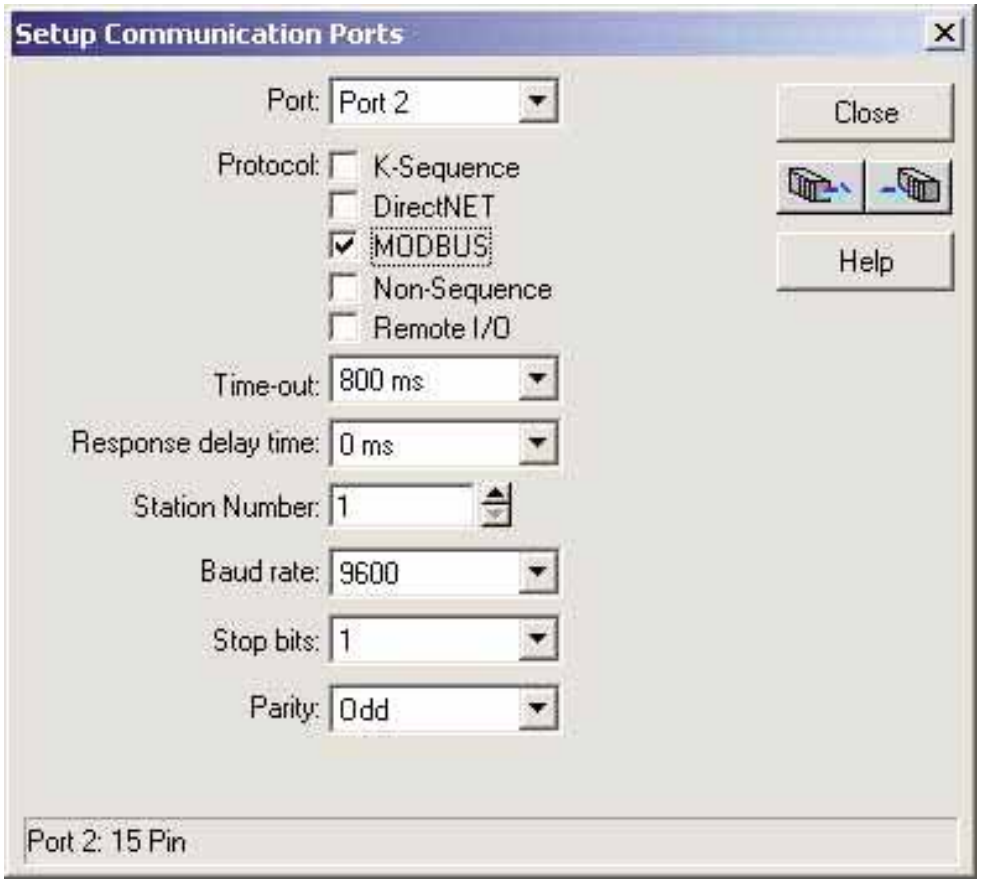
Configure the *Direct*LOGIC CPUs (continued)

***Direct*LOGIC MODBUS Port Configuration for DL05, D2-250(-1), or D4-450**

The following configuration example is specific to the D2-250(-1) and DL05. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***Logic CPU.

- In ***Direct***SOFT, choose the PLC menu, then Setup, then "**Secondary Comm Port**".
- From the Port list box, choose "**Port 2**".
- For the Protocol, select "**MODBUS**".
- In the Timeout list box, select "**800 ms**".
- Response Delay Time should be "**0ms**".
- The Station Number should be set to "**1**" to make the D2-250(-1) or DL05 CPU a MODBUS Master.
- The Baud Rate should be set at "**9600**" (or higher, if using an FA-ISOCON network adapter module).
- In the Stop Bits list box, choose "**1**".
- In the Parity list box, choose "**Odd**".

The DL250 network instructions used in Master mode will access only slaves 1 to 90. Each slave must have a unique number.



CLICK Modbus Ladder Programming

The set up for all of the CLICK CPUs is very similar. However, there may be some subtle differences between CPUs, or for the requirements of your particular program. Refer to the CLICK programming software internal help file for more information regarding CLICK programming.

The following ladder program shows some examples of how to control the *DURAPULSE* AC drive through Modbus RTU. The drive should be set up and tested for communications before it is connected to a load.

WARNING: A drive should never be connected to a load until any applicable communication programs have been proven.

WARNING: Write programs in such a way that the program does not erroneously overwrite a remote Stop command with a Run command, such as when P3.00 is set to 03. This example program prevents such an accidental overwrite.

These programs are for illustrational purposes only, and are not intended for a true application.

Separate Run Command Write Instruction

Why do we write the Run Command with a separate write instruction? If we write the Run Command to the drive along with the Speed Reference, Direction, External Fault, and Fault Reset Commands, we can keep the parameter addresses in sequence, and we can update all five of the commands with one write instruction. This method is valid **only** if we disable the drive's keypad STOP button (P3.00 = 04).

Typically, the keypad STOP button will be enabled (P3.00 = 03), and we need to prevent a change in one of the other commands from overriding a keypad Stop Command by causing a previous Run Command to be rewritten to the drive. By using a separate Run Command write instruction, only a deliberate Run Command change by the program will run the drive again after a stop.

Block Transfer Parameters for Modbus Programs

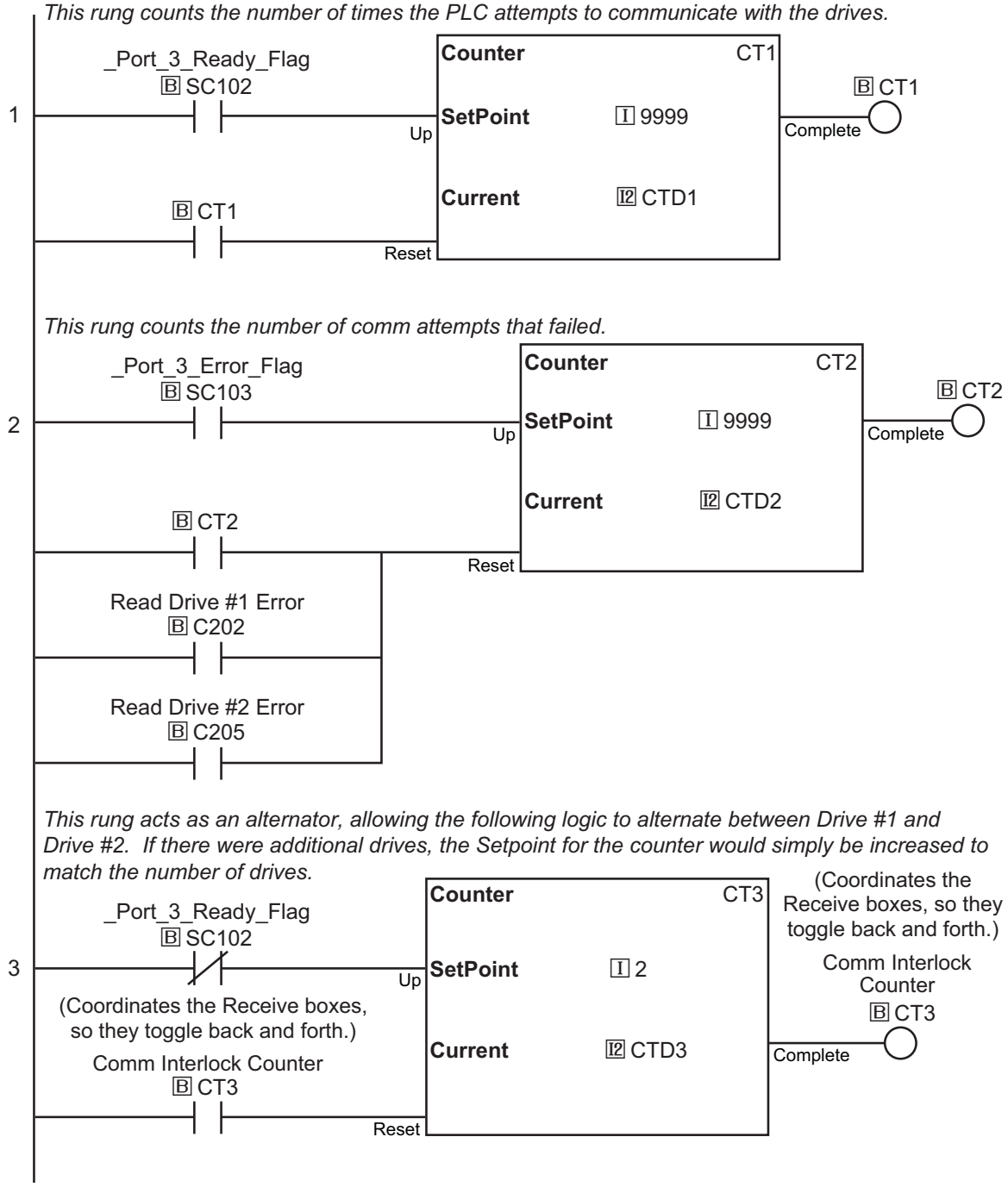
For writing to any of the parameters from P0.00 to P8.02, a group of 15 block transfer parameters (P9.11 to P9.25) is available in the *DURAPULSE* AC drive. This sequential block of parameters can be used to "group" various miscellaneous non-sequential parameters, so that you can update the parameters in one programming write block instead of having to use multiple write commands.

For example, it would typically take three different write commands to change the three non-sequential parameters Accel Time 1 (P1.01), Accel S-curve (P1.03), and Multi-speed 1 (P5.01).

However, you could make the same three changes using one write command by setting P9.11 to P1.01, P9.12 to P1.03, and P9.13 to P5.01, so that the parameters become sequential.

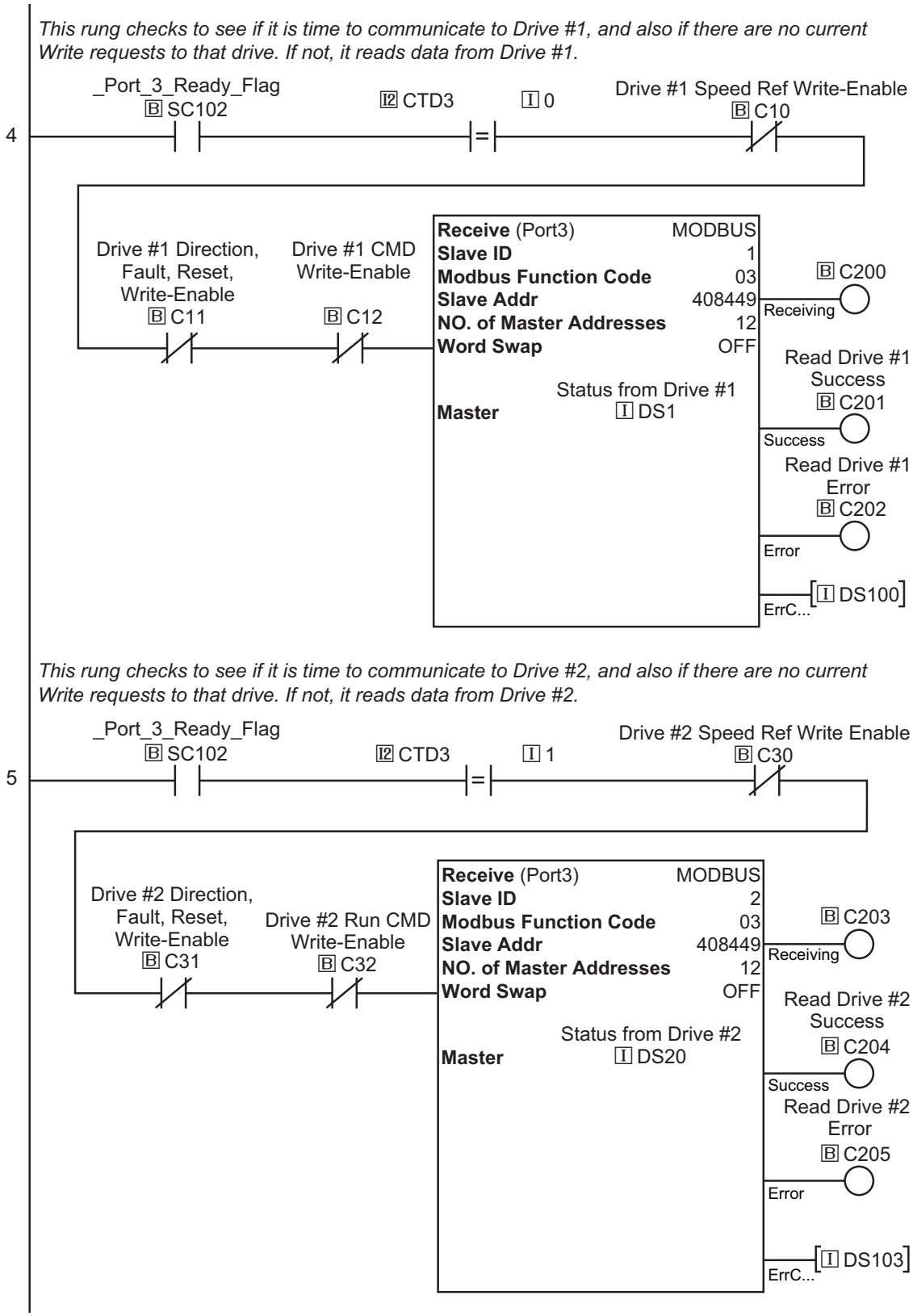
CLICK Communication Program – (for CLICK PLCs)

This program is for illustrational purposes only, and is not intended for a true application.



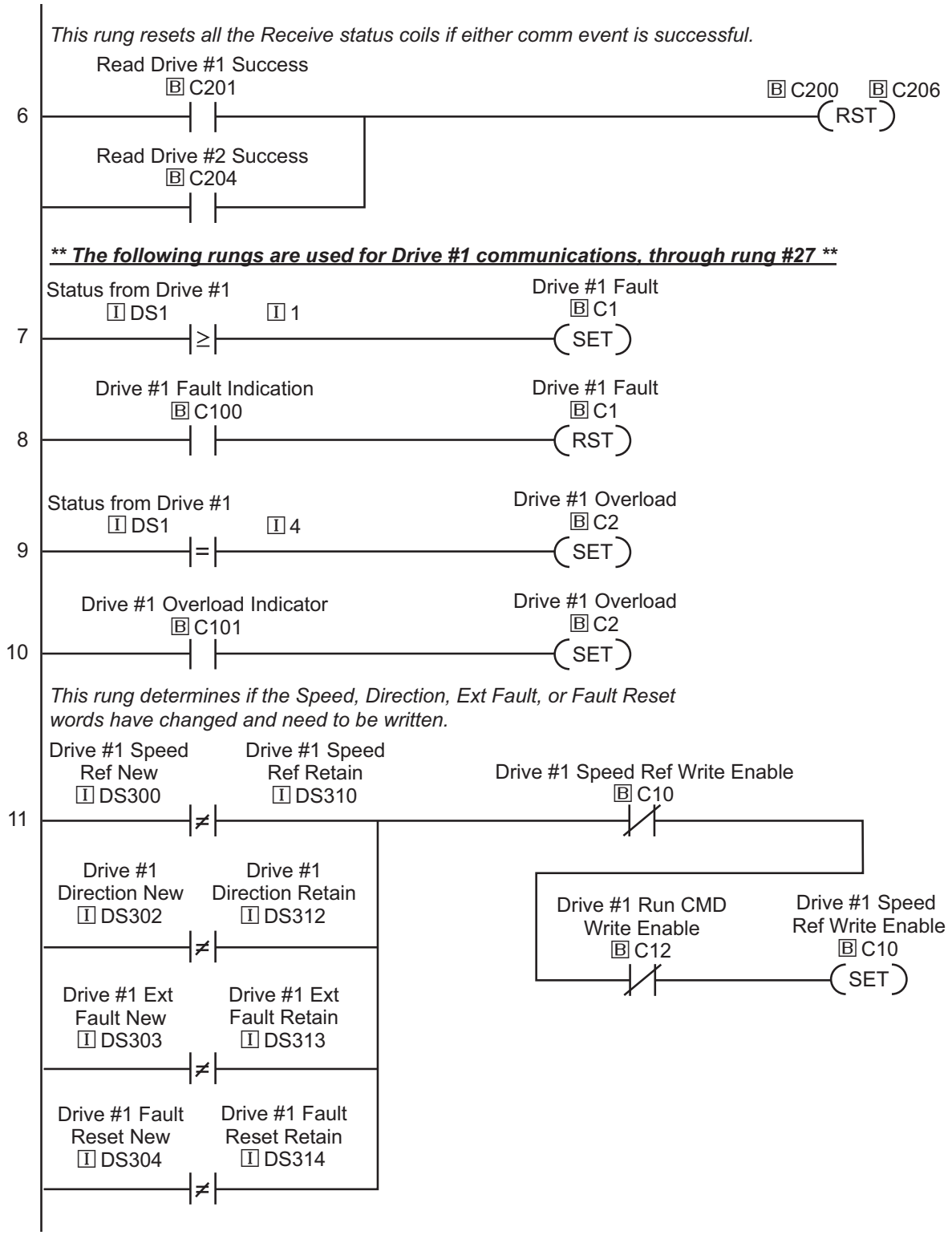
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CLICK Communication Program (continued)



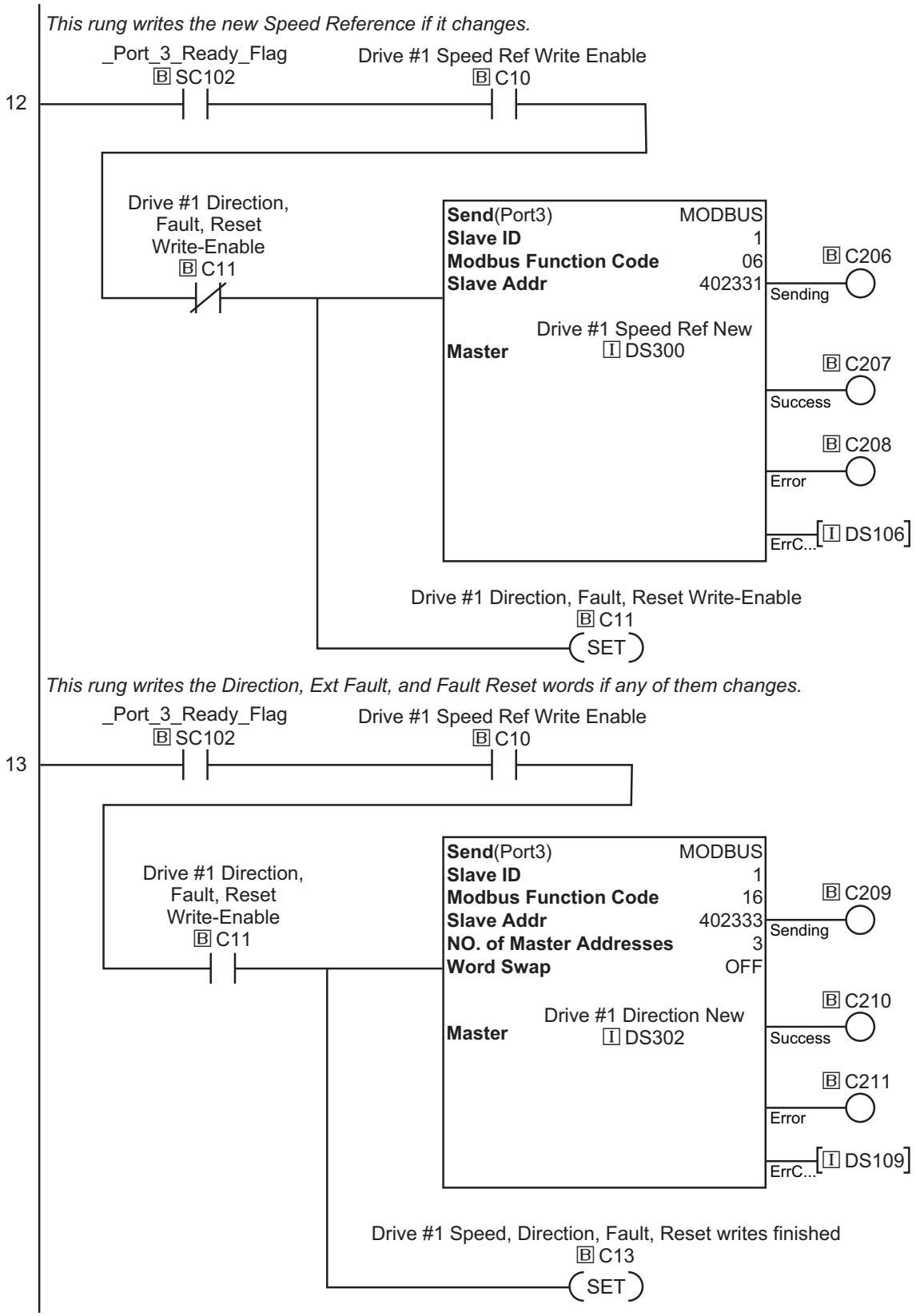
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CLICK Communication Program (continued)



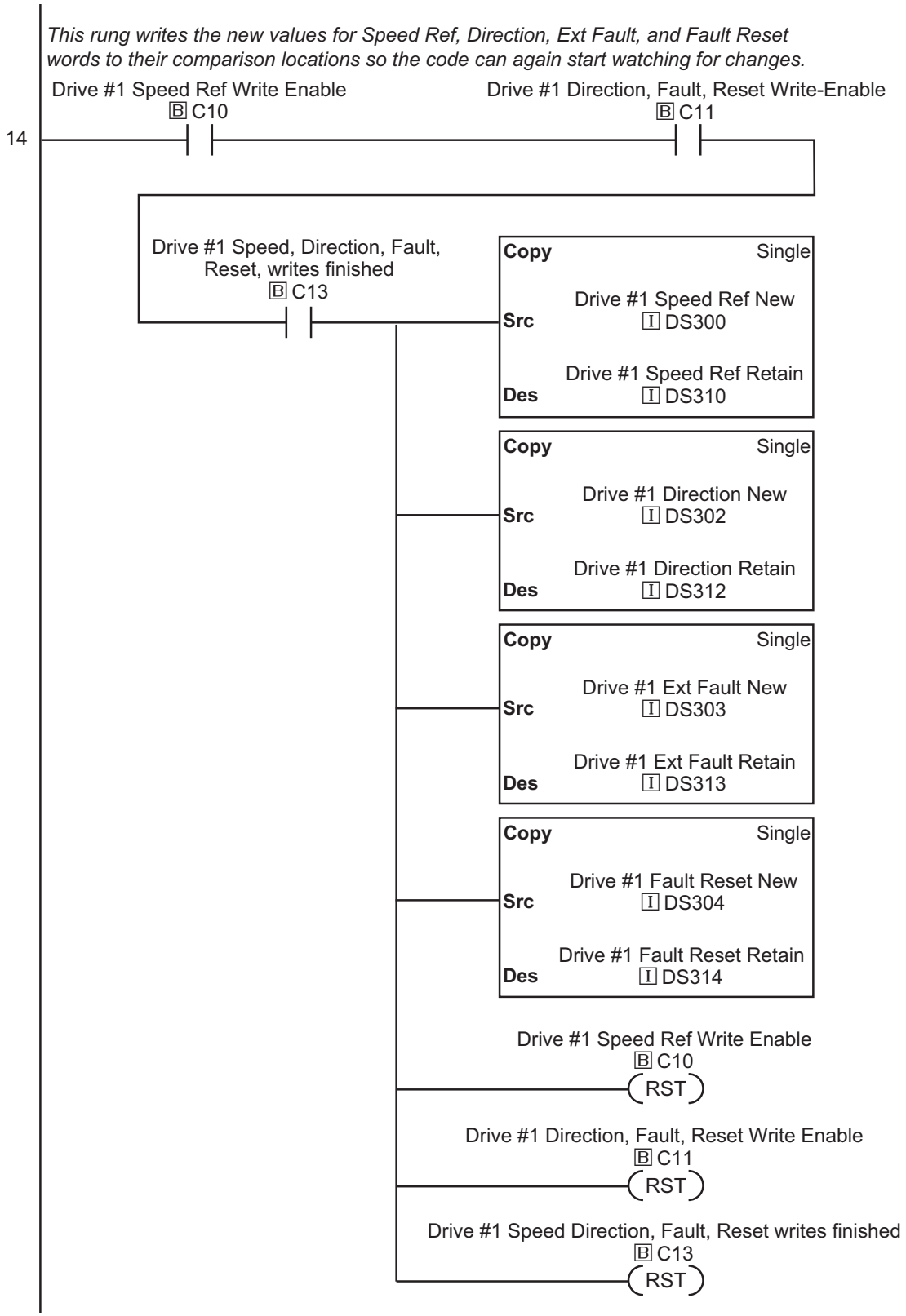
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CLICK Communication Program (continued)



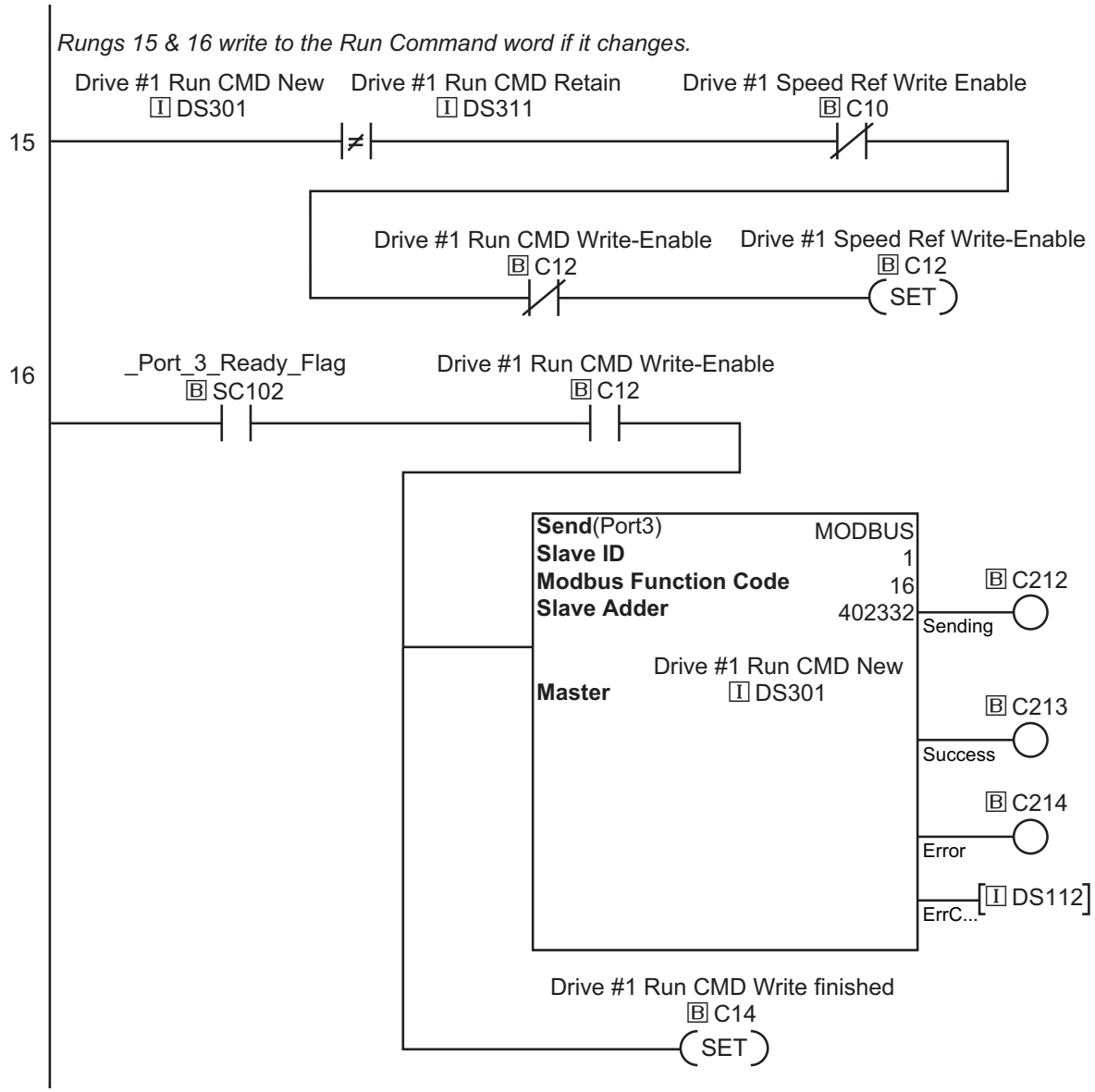
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CLICK Communication Program (continued)



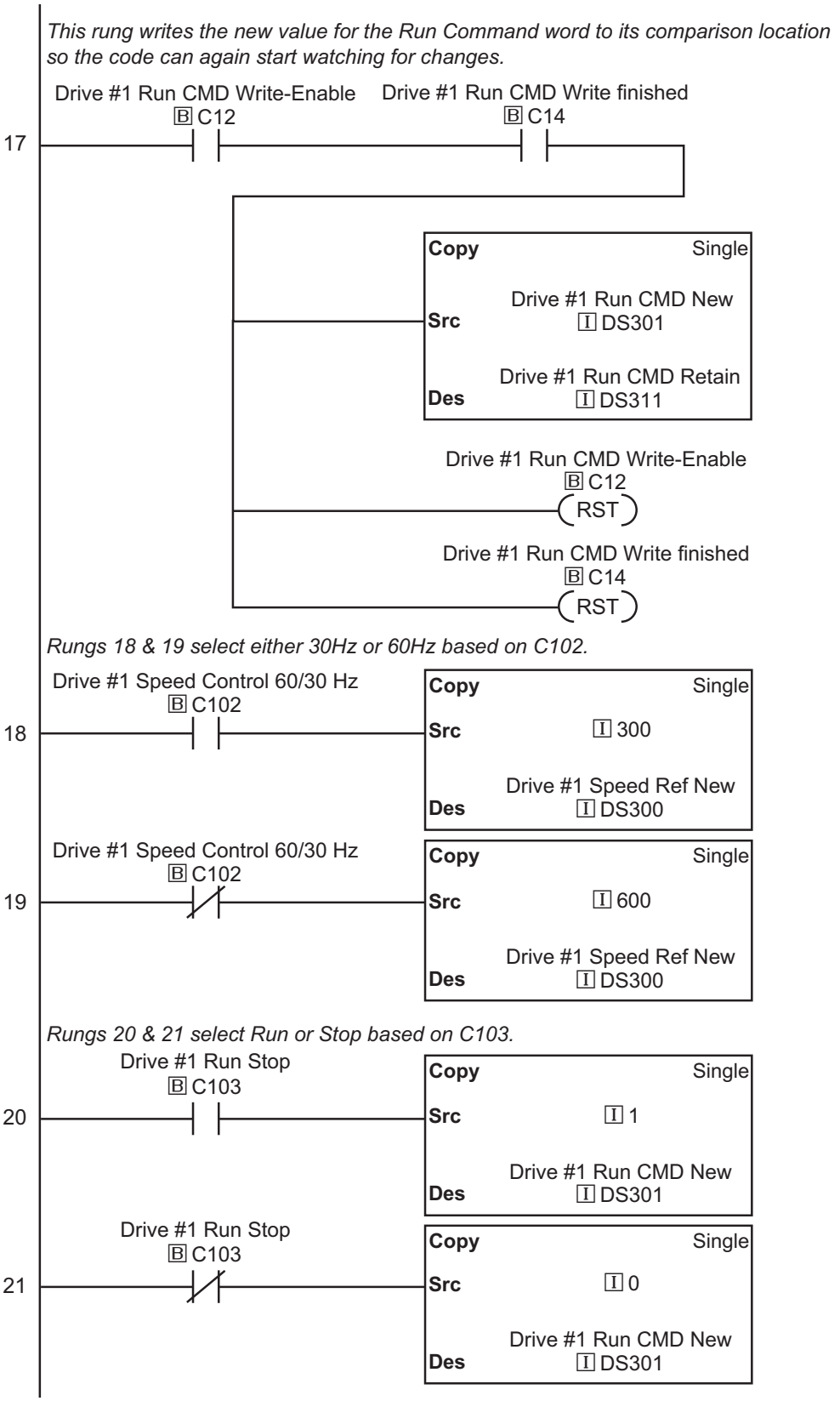
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CLICK Communication Program (continued)



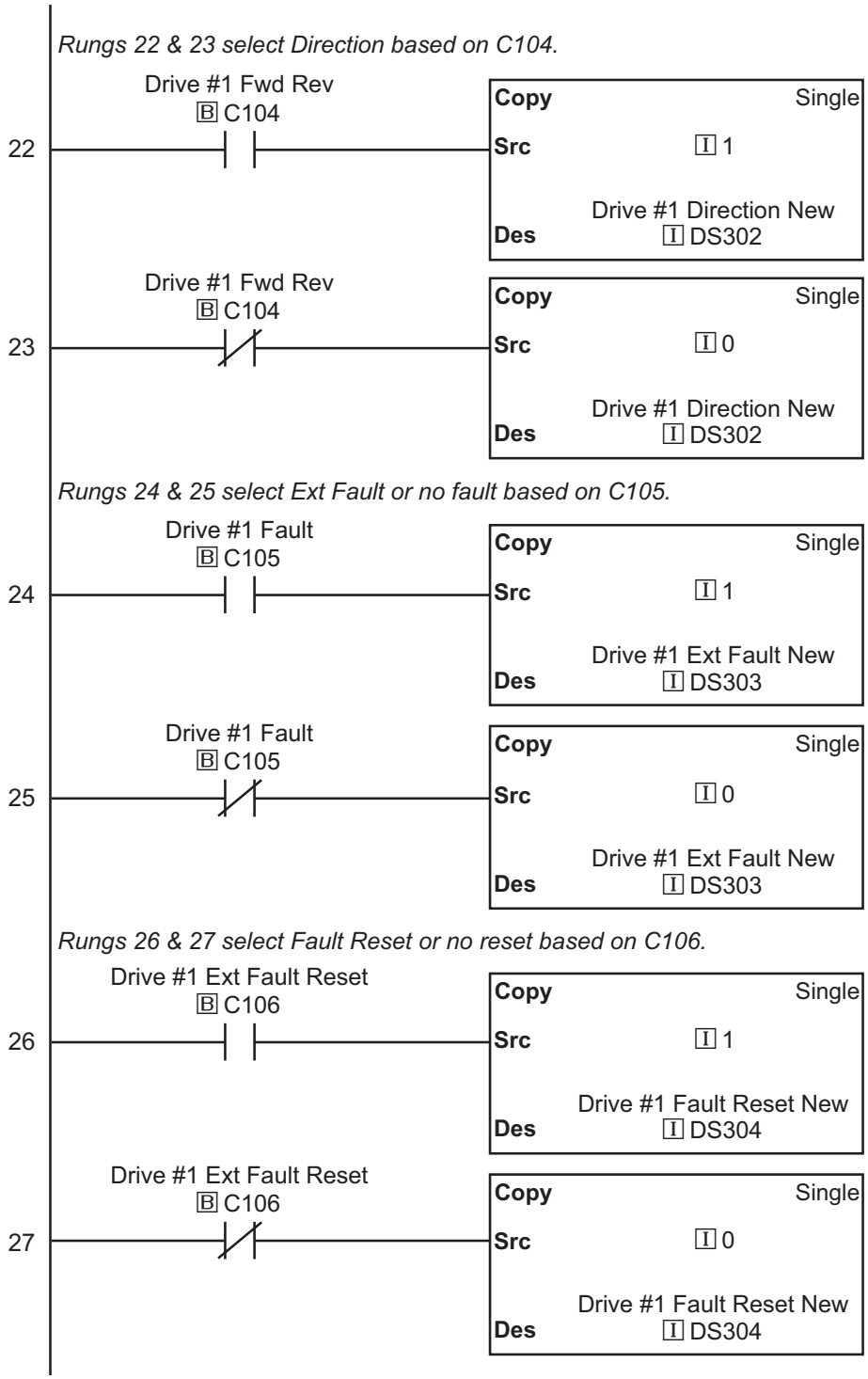
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CLICK Communication Program (continued)



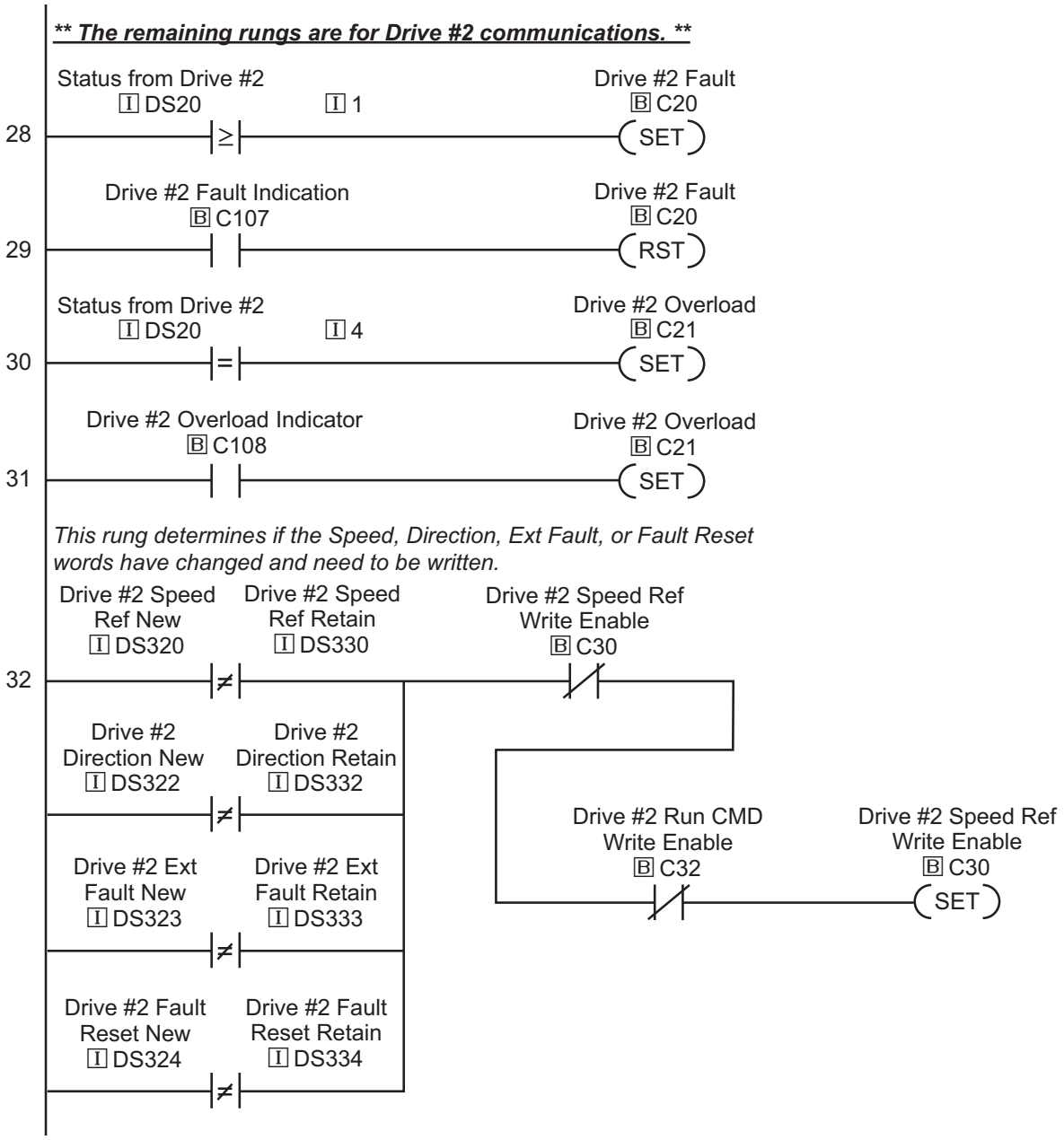
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CLICK Communication Program (continued)



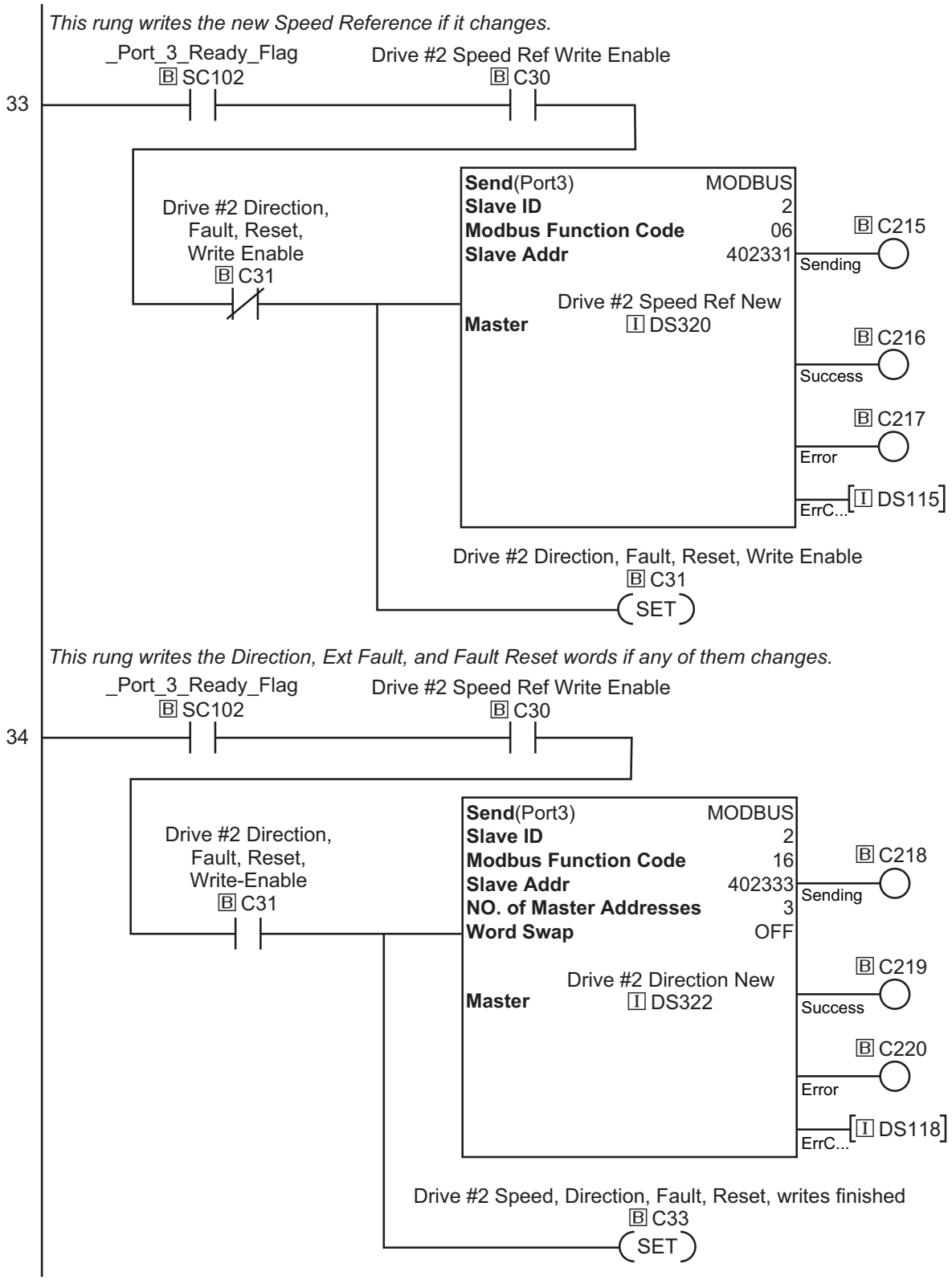
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CLICK Communication Program (continued)



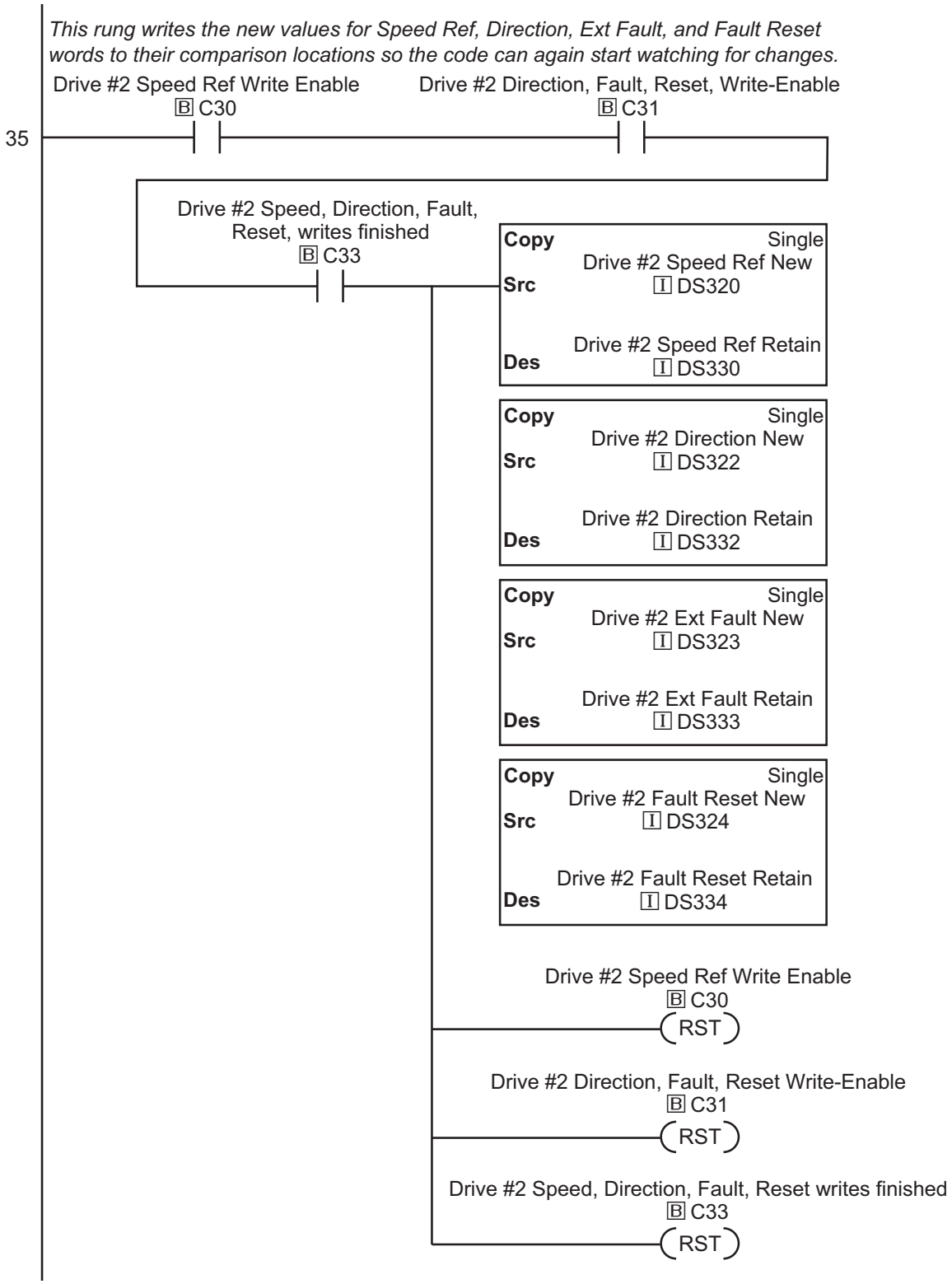
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CLICK Communication Program (continued)



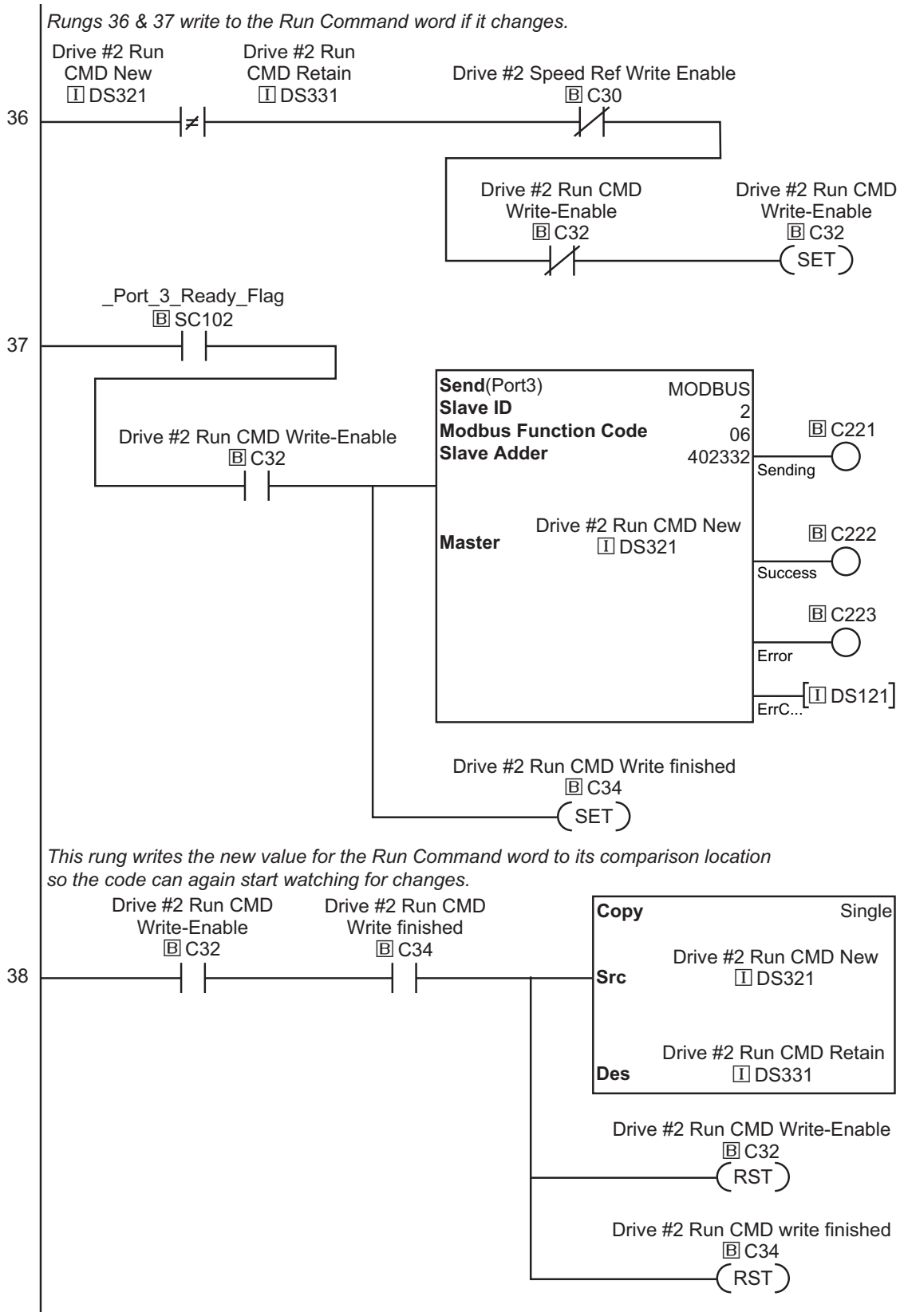
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CLICK Communication Program (continued)



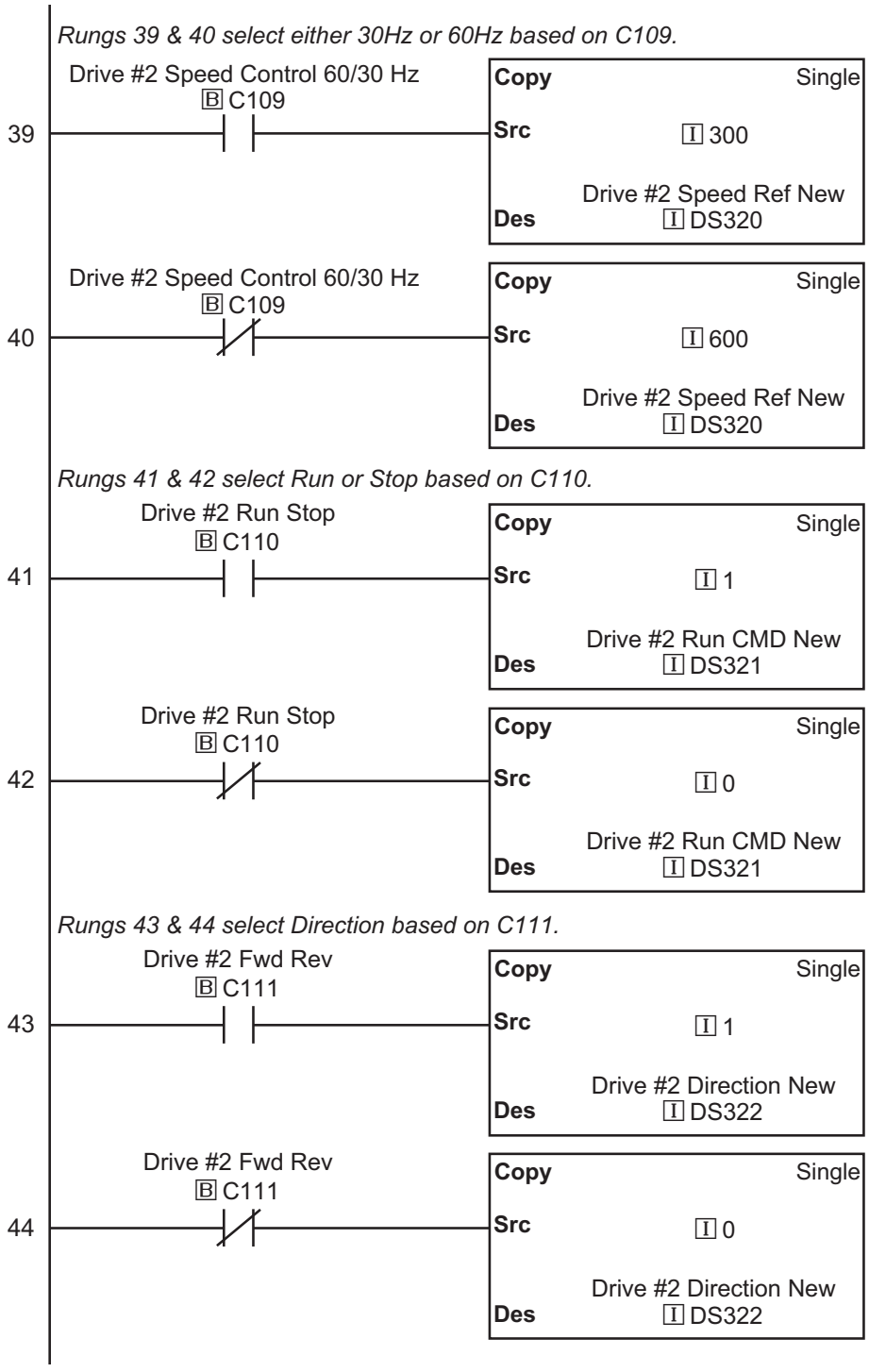
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CLICK Communication Program (continued)



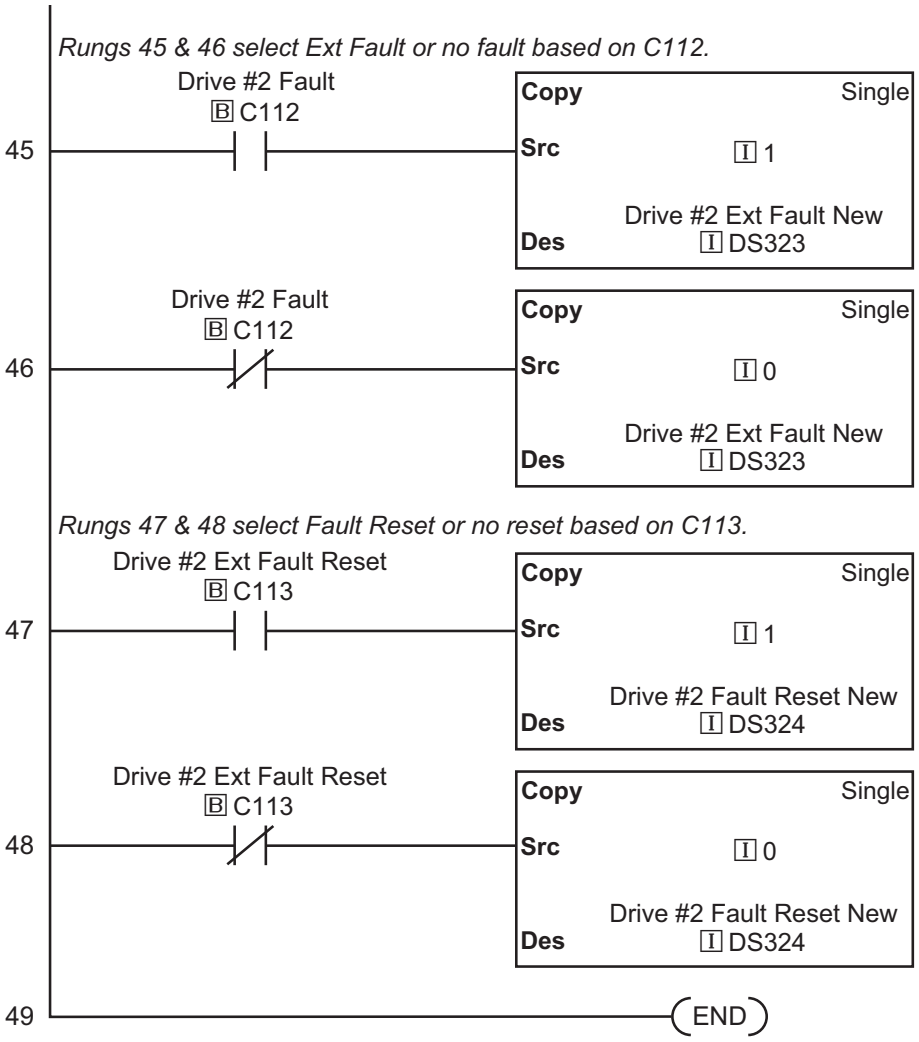
(Continued next page)

CLICK Communication Program (continued)



(Continued next page)

CLICK Communication Program (continued)



*Direct*LOGIC Modbus Ladder Programming

The set up for all of the ***Direct***Logic CPUs is very similar. However, there may be some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***Logic CPU.

The following ladder program shows some examples of how to control the *DURAPULSE* AC drive through Modbus RTU. The drive should be setup and tested for communications before it is connected to a load.



WARNING: A drive should never be connected to a load until any applicable communication programs have been proven.



WARNING: Write programs in such a way that the program does not erroneously overwrite a remote Stop command with a Run command, such as when P3.00 is set to 03. This example program prevents such an accidental overwrite.



These programs are for illustrational purposes only, and are not intended for a true application.

Separate Run Command Write Instruction

Why do we write the Run Command with a separate write instruction? If we write the Run Command to the drive along with the Speed Reference, Direction, External Fault, and Fault Reset Commands, we can keep the parameter addresses in sequence, and we can update all five of the commands with one write instruction. This method is valid **only** if we disable the drive's keypad STOP button (P3.00 = 04).

Typically, the keypad STOP button will be enabled (P3.00 = 03), and we need to prevent a change in one of the other commands from overriding a keypad Stop Command by causing a previous Run Command to be rewritten to the drive. By using a separate Run Command write instruction, only a deliberate Run Command change by the program will run the drive again after a stop.

Block Transfer Parameters for Modbus Programs

For writing to any of the parameters from P0.00 to P8.02, a group of 15 block transfer parameters (P9.11 to P9.25) is available in the *DURAPULSE* AC drive. This sequential block of parameters can be used to "group" various miscellaneous non-sequential parameters, so that you can update the parameters in one programming write block instead of having to use multiple write commands.

For example, it would typically take three different write commands to change the three non-sequential parameters Accel Time 1 (P1.01), Accel S-curve (P1.03), and Multi-speed 1 (P5.01).

However, you could make the same three changes using one write command by setting P9.11 to P1.01, P9.12 to P1.03, and P9.13 to P5.01, so that the parameters become sequential.

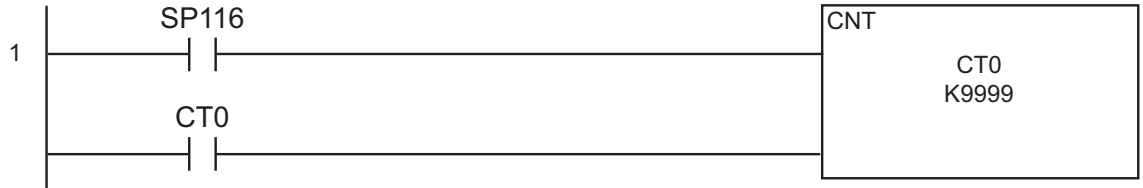
*Direct*LOGIC Basic Communication Program – start with this code

We recommend starting with the following program code, and using it to test communication to each of your drives before adding more advanced code for your application.

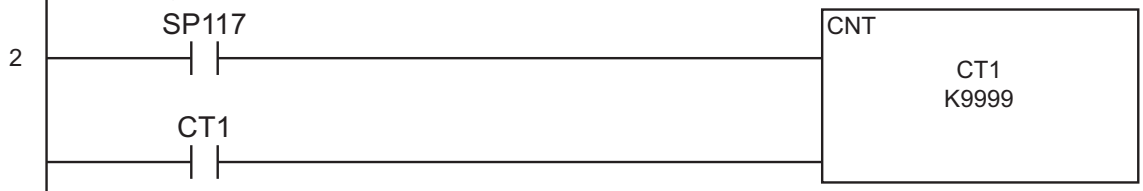
To target different drives, change the value Kf201 to Kf202 for slave 2, Kf203 for slave 3, etc.

This program is for illustrational purposes only, and is not intended for a true application.

This rung counts the number of times the PLC attempts to communicate to the drive.



This rung counts the number of times an attempted communication to the drive fails.



This rung reads the 'Status Addresses' information from the drive.
Use this code to test communication to each of your drives before writing more advanced code that polls multiple drives. To target different drives, change the value 'Kf201' to 'Kf202' for slave 2, 'Kf203' for slave 3, etc.



*SP116 is a special relay in the **Direct**LOGIC CPUs that monitors the PLC's communications. SP116 is on when Port 2 is communicating with another device.*

*SP117 is a special relay in the **Direct**LOGIC CPUs that monitors the PLC's communications. SP117 is on when Port 2 has encountered a communication error.*

Programming Differences for *Direct*LOGIC PLCs

Different types of *Direct*LOGIC PLCs can be programmed differently, depending upon the types of network read and write instructions they can perform. There are two different types of these instructions, and this User Manual shows programming examples of both types.

RX/WX Instructions for DL05, D2-250(-1), D4-450

PLCs with DL05, D2-250, D2-250-1, and D4-450 CPUs can read from and write to networks using RX (Read from Network) and WX (Write to Network) programming instructions.

MRX/MWX Instructions for DL06, D2-260

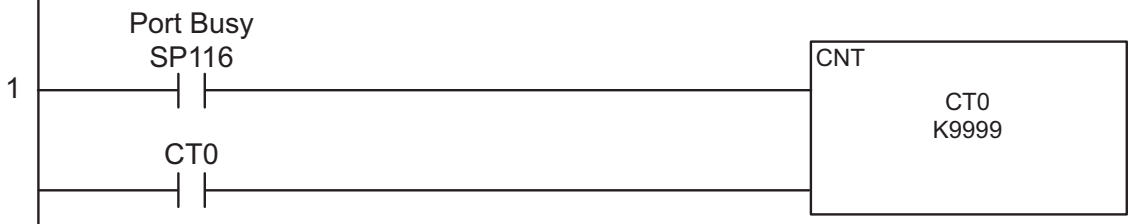
In addition to the RX and WX instructions listed above, PLCs with DL06 and D2-260 CPUs can also read from and write to networks using MRX (Modbus Read from Network) and MWX (Modbus Write to Network) programming instructions.

The MRX and MWX instructions are simpler and easier to use than are the RX and WX instructions. Therefore, we recommend that you use DL06 or D2-260 with MRX and MWX instructions if you have a choice.

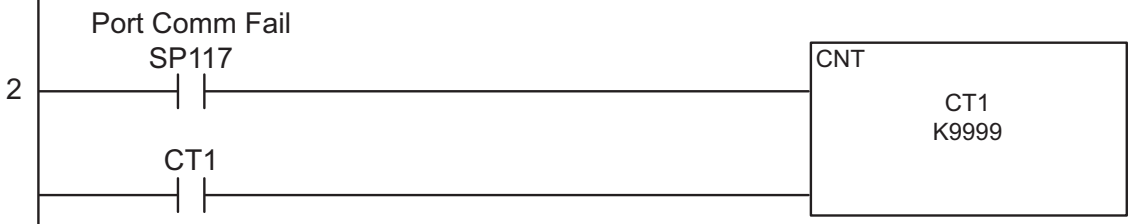
DL MRX/MWX Communication Program – for DL06 & D2-260 PLCs

This program is for illustrational purposes only, and is not intended for a true application.

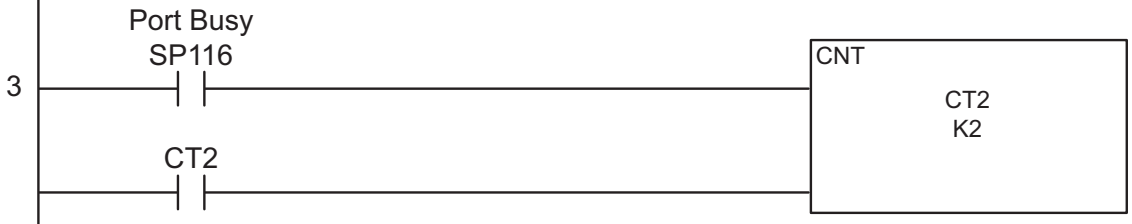
This rung counts the number of times the PLC attempts to communicate to the drive.



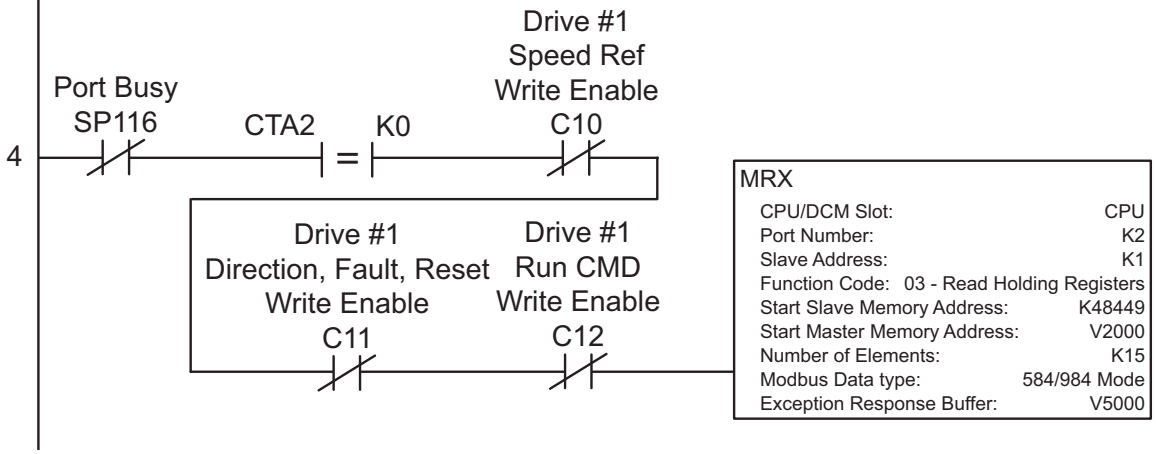
This rung counts the number of times an attempted communication to the drive fails.



This rung acts as an alternator, allowing the following logic to alternate between communicating to slave 1 or slave 2. If there were additional slaves, the 'K' number for the counter would simply be increased to match the number of slaves in the system.



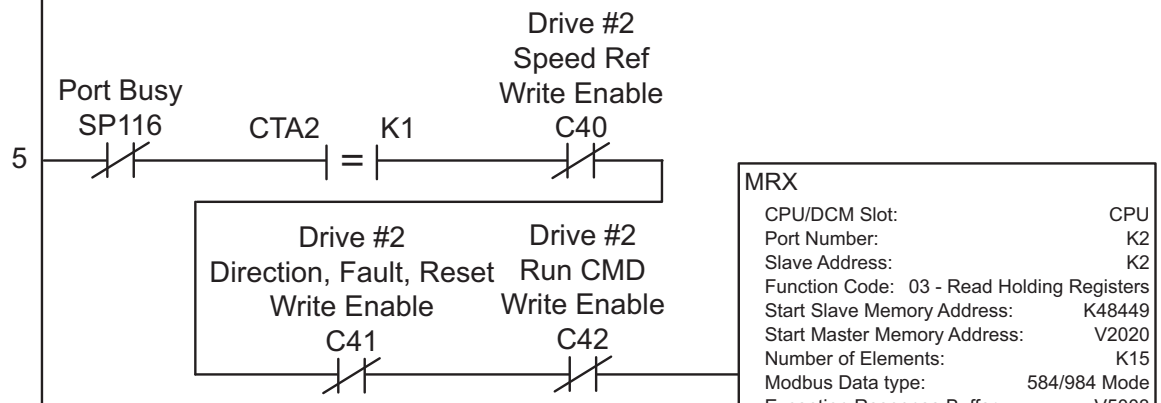
This rung checks to see if it is time to communicate to slave 1, and also if there are no current write requests to that drive. If not, it reads data from slave 1.



(Continued next page)

DL MRX/MWX Communication Program (continued)

This rung checks to see if it is time to communicate to slave 2, and also if there are no current write requests to that drive. If not, it reads data from slave 2.



****** The following 21 rungs (6–26) are for slave 1 communications control. ******

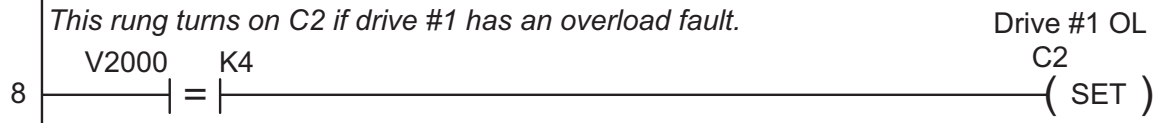
This rung turns on C1 if there is a fault in drive #1.



This rung allows a switch on input X1 to reset the C bit used to indicate a drive #1 fault.



This rung turns on C2 if drive #1 has an overload fault.

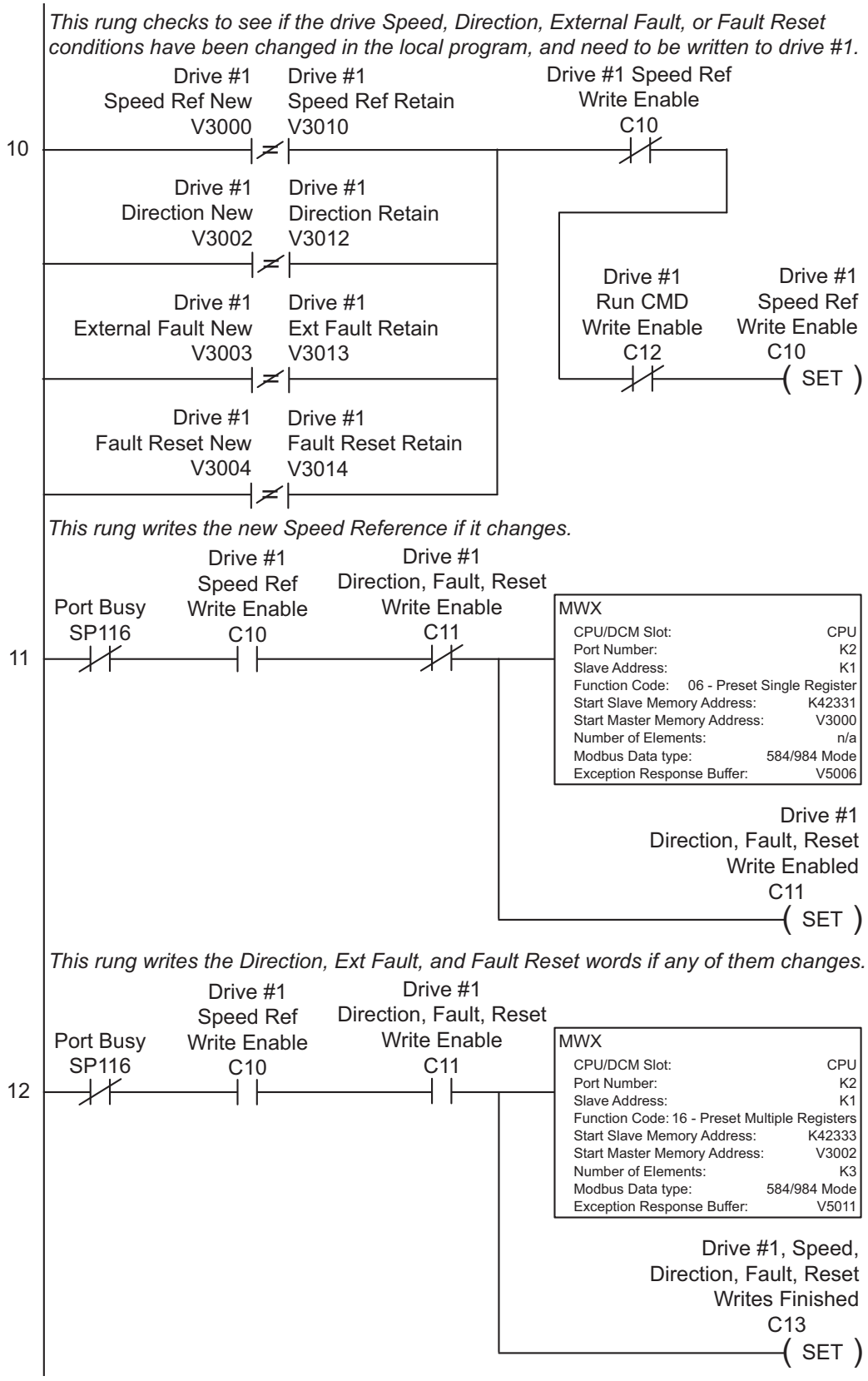


This rung allows a switch on input X2 to reset the overload fault bit C2.



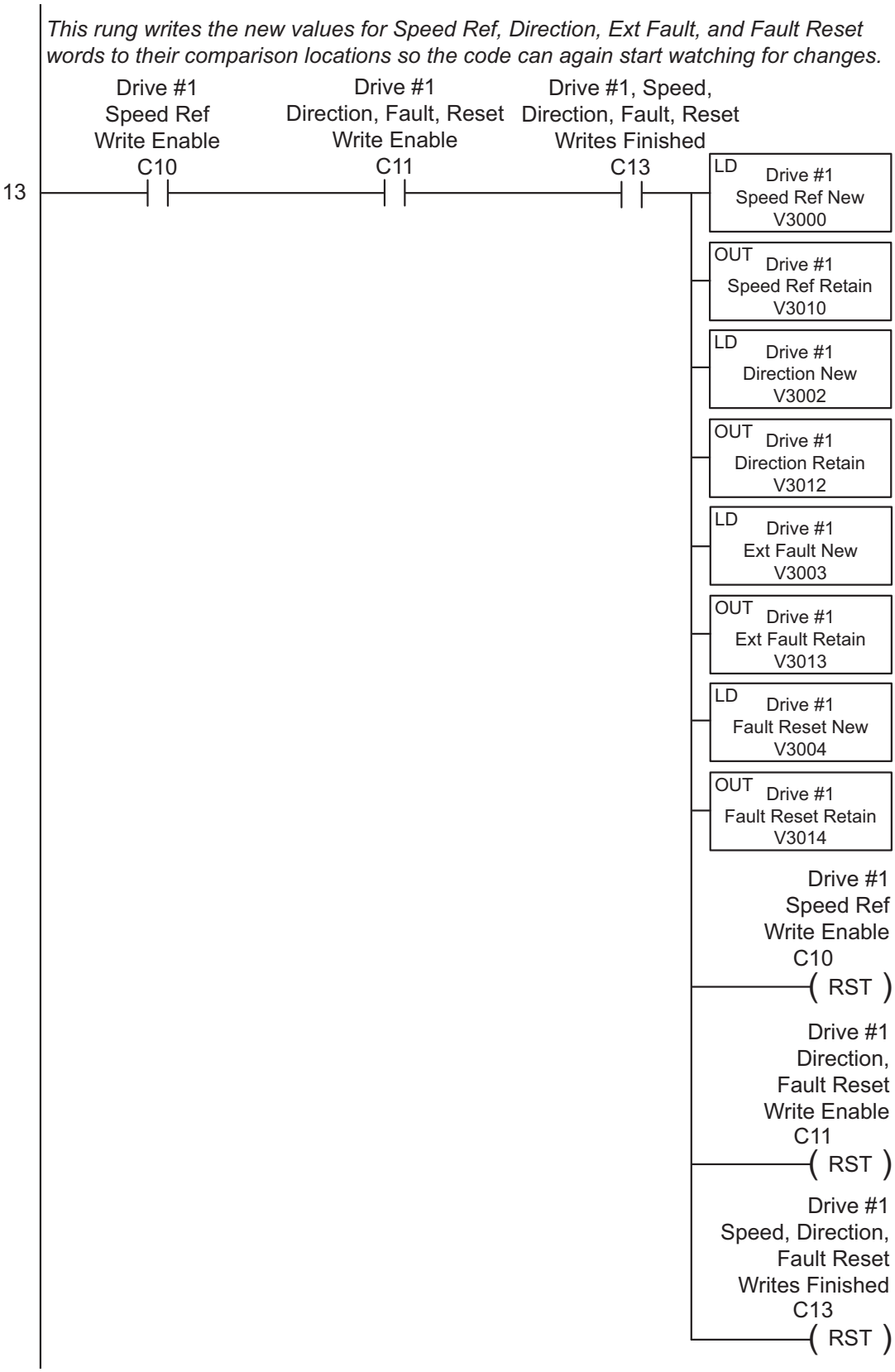
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DL MRX/MWX Communication Program (continued)



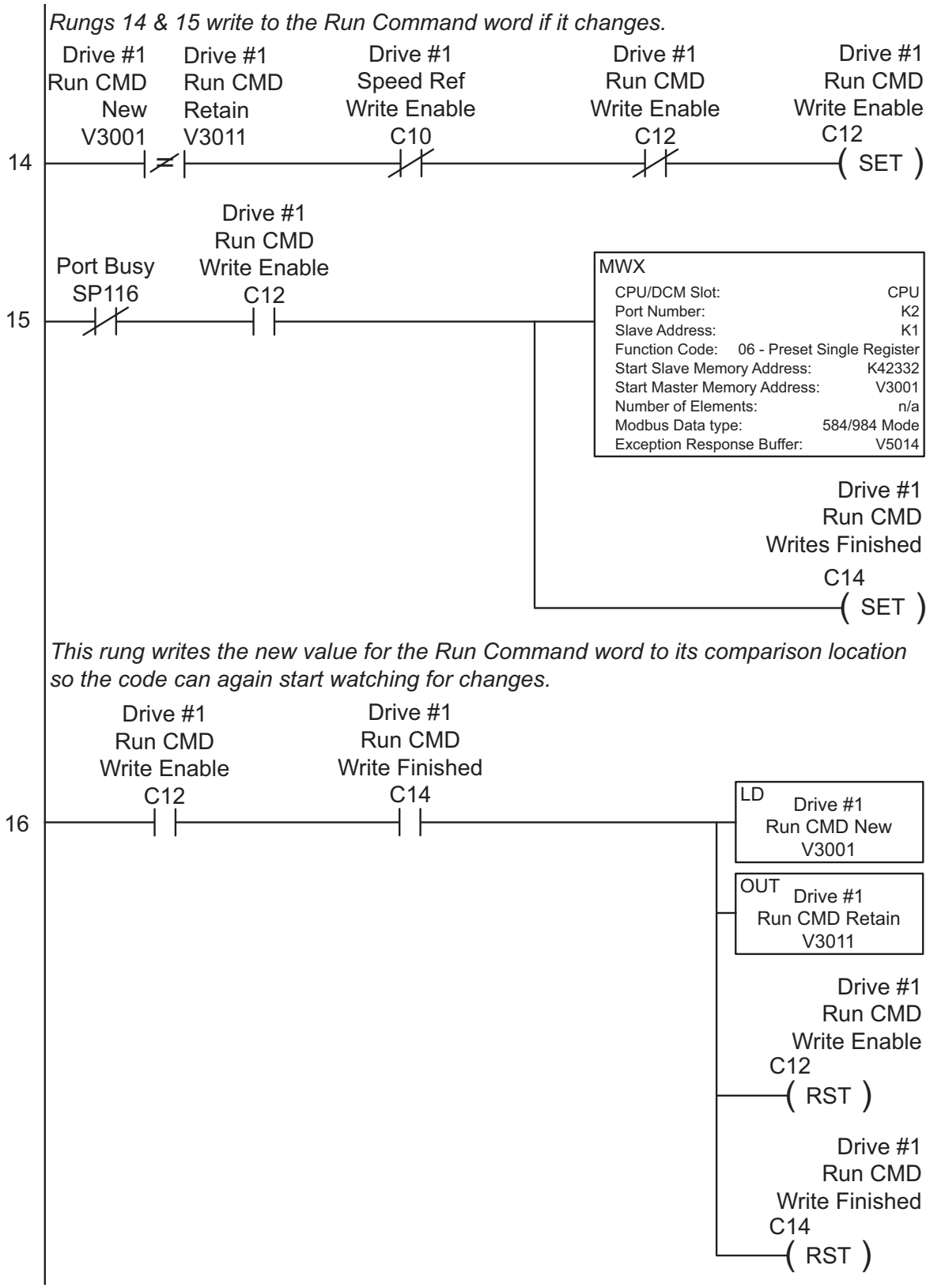
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DL MRX/MWX Communication Program (continued)



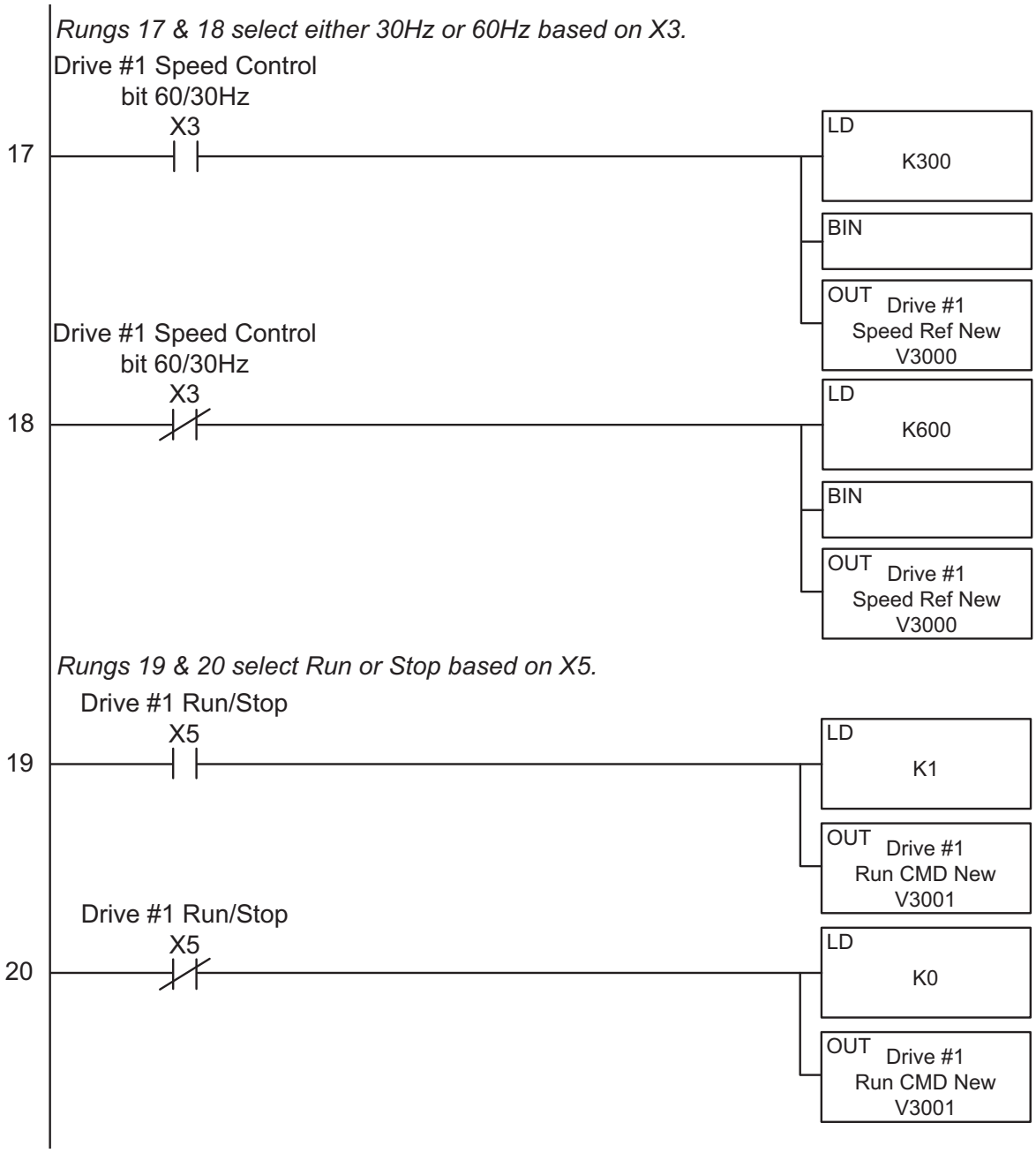
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DL MRX/MWX Communication Program (continued)



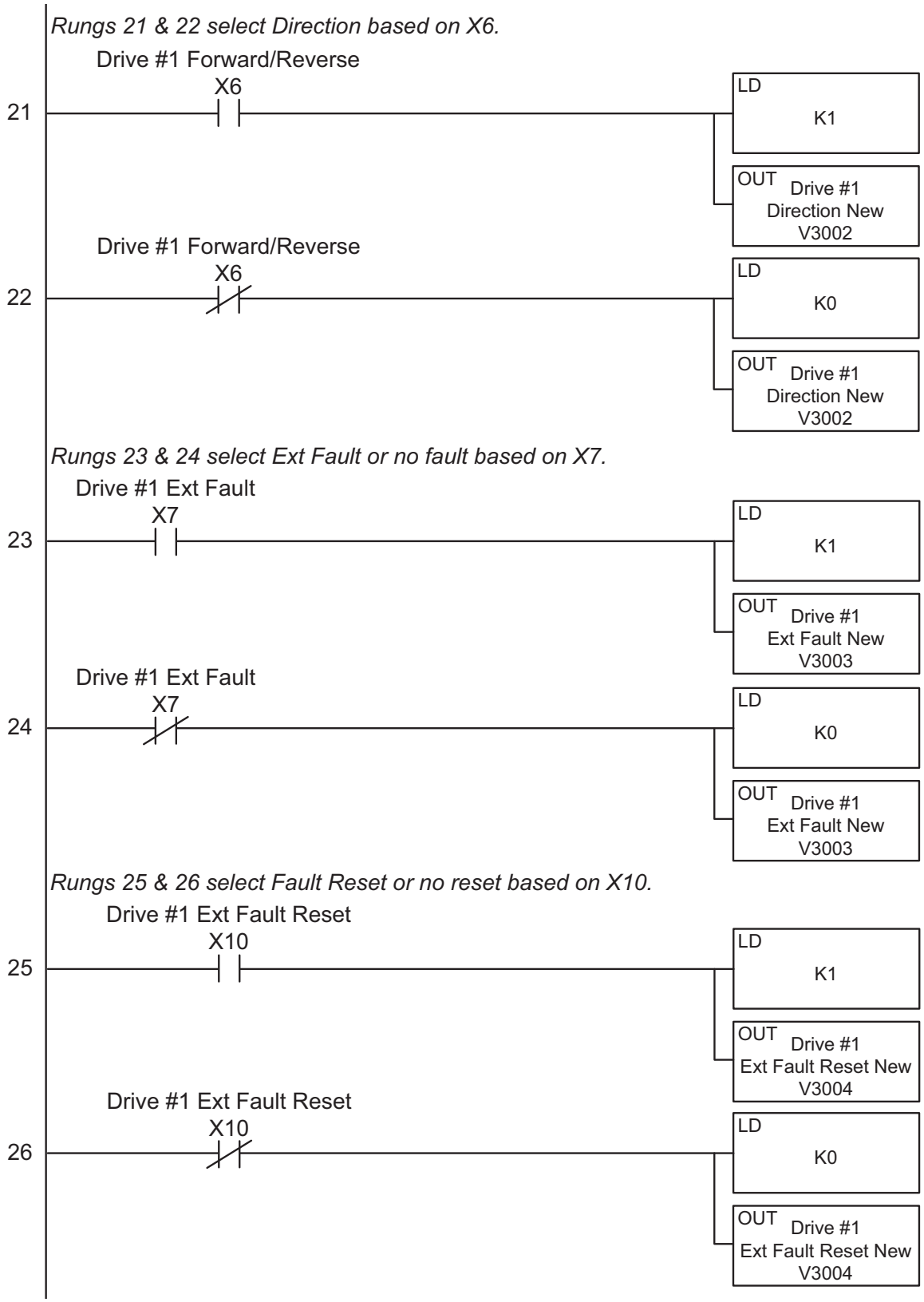
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DL MRX/MWX Communication Program (continued)



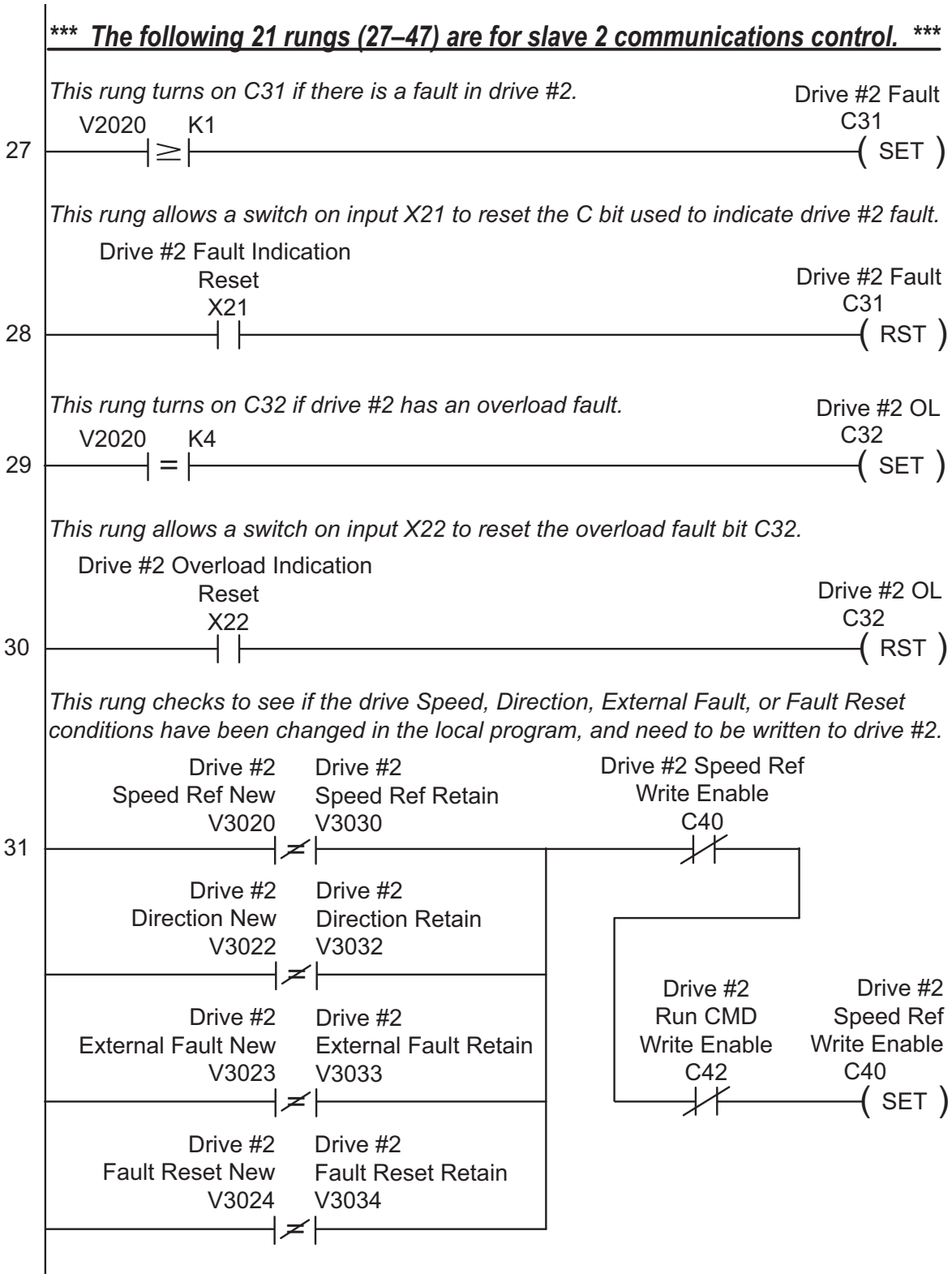
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DL MRX/MWX Communication Program (continued)



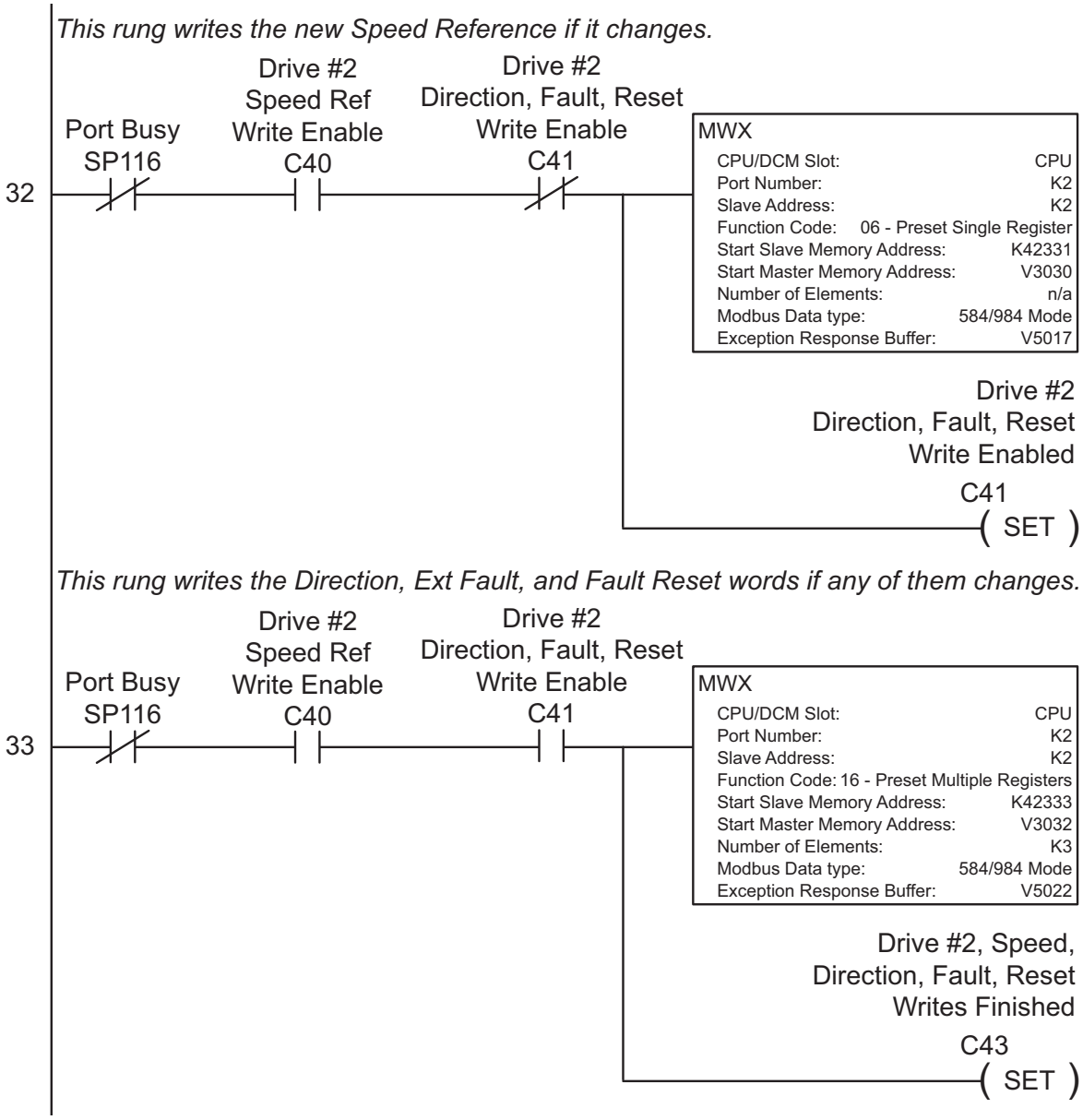
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DL MRX/MWX Communication Program (continued)



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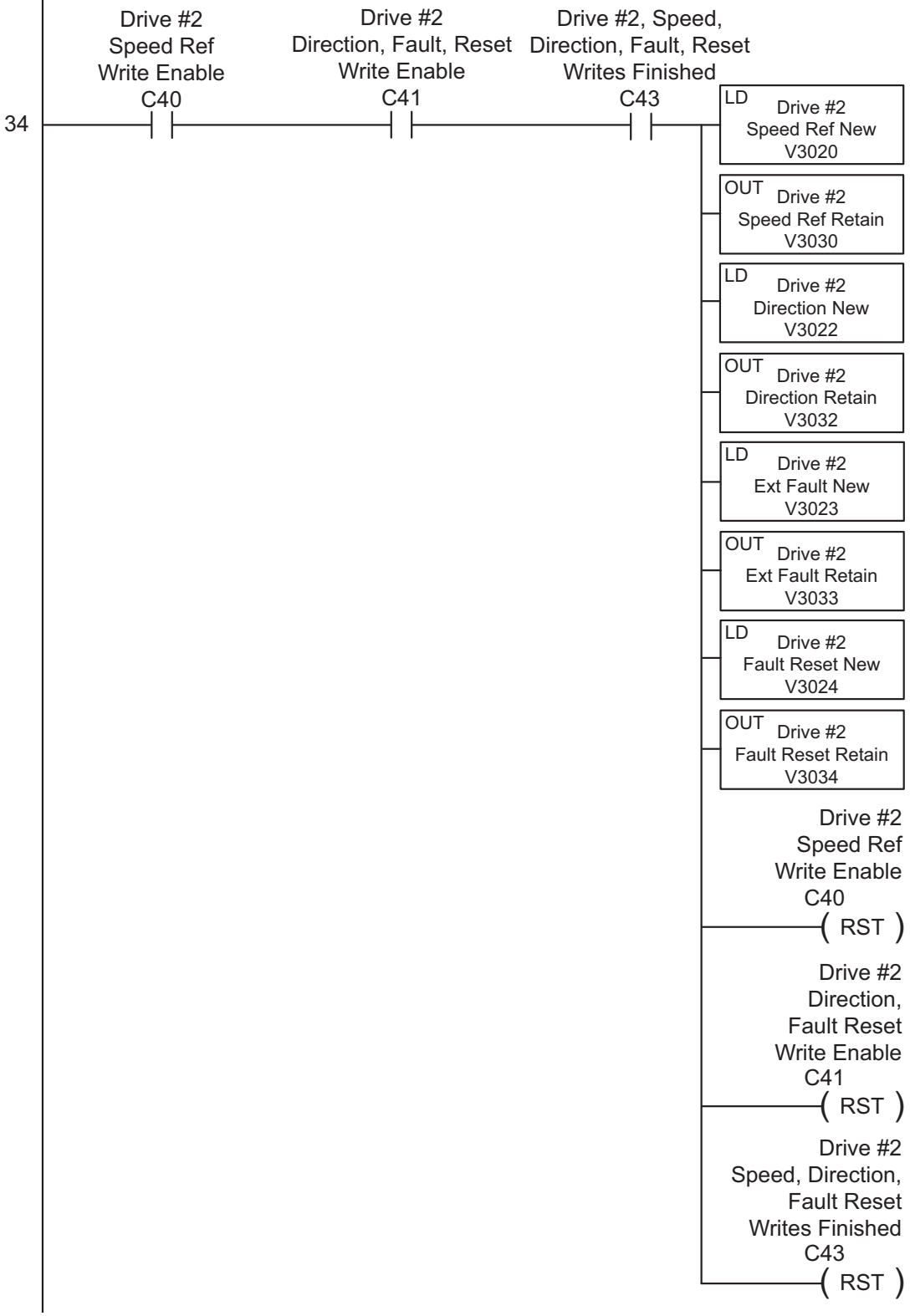
DL MRX/MWX Communication Program (continued)



(Continued next page)

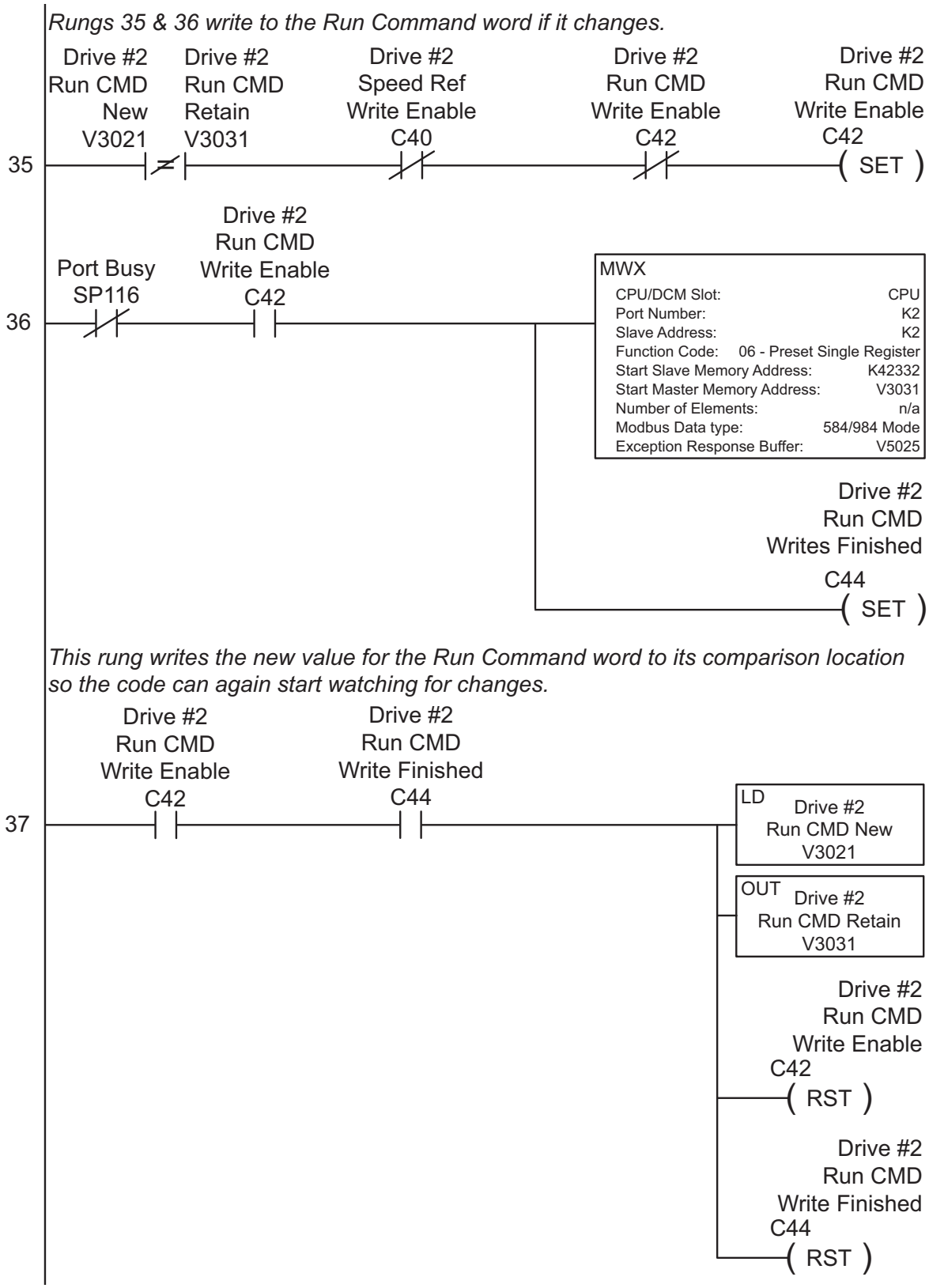
DL MRX/MWX Communication Program (continued)

This rung writes the new values for Speed Ref, Direction, Ext Fault, and Fault Reset words to their comparison locations so the code can again start watching for changes.



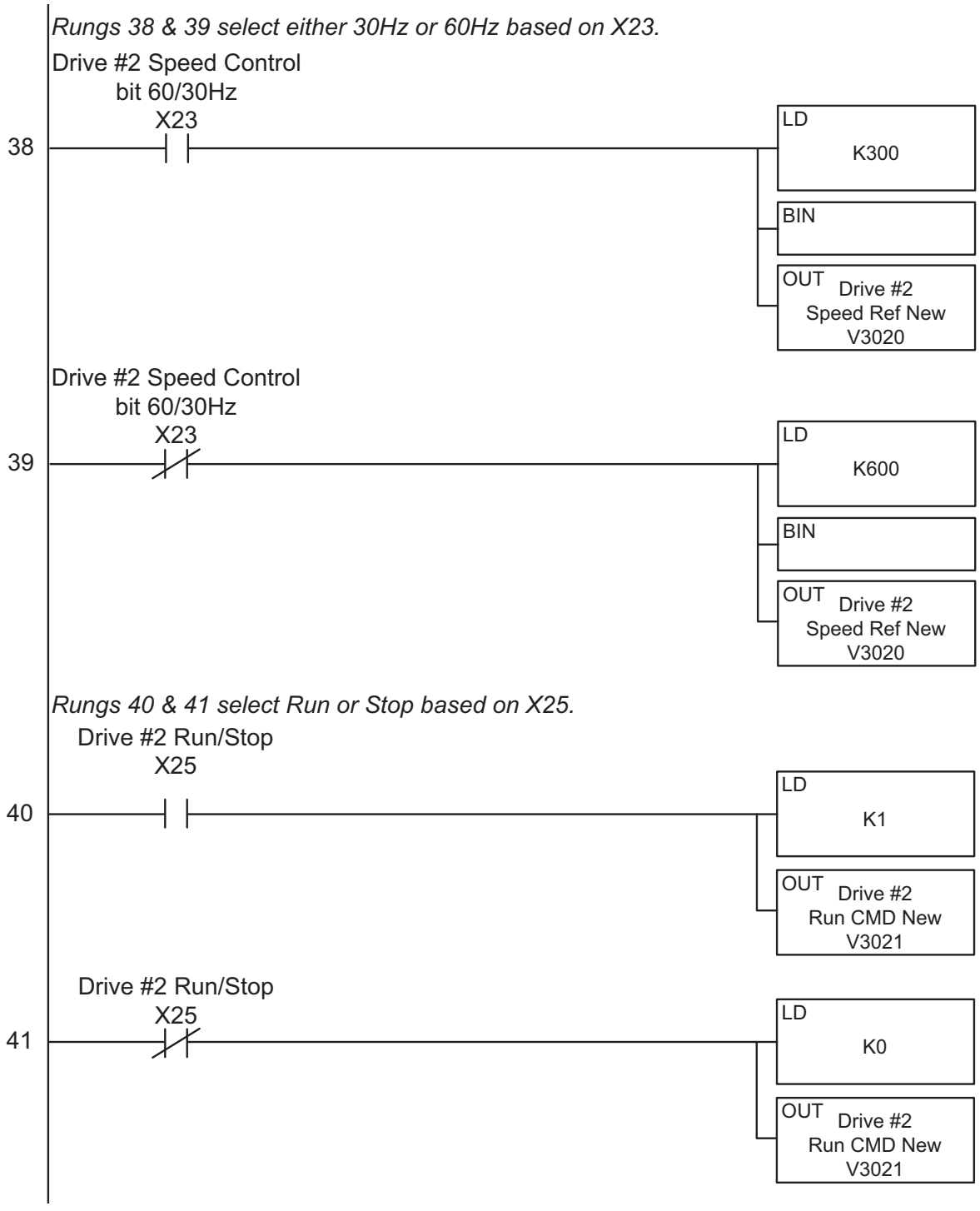
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DL MRX/MWX Communication Program (continued)



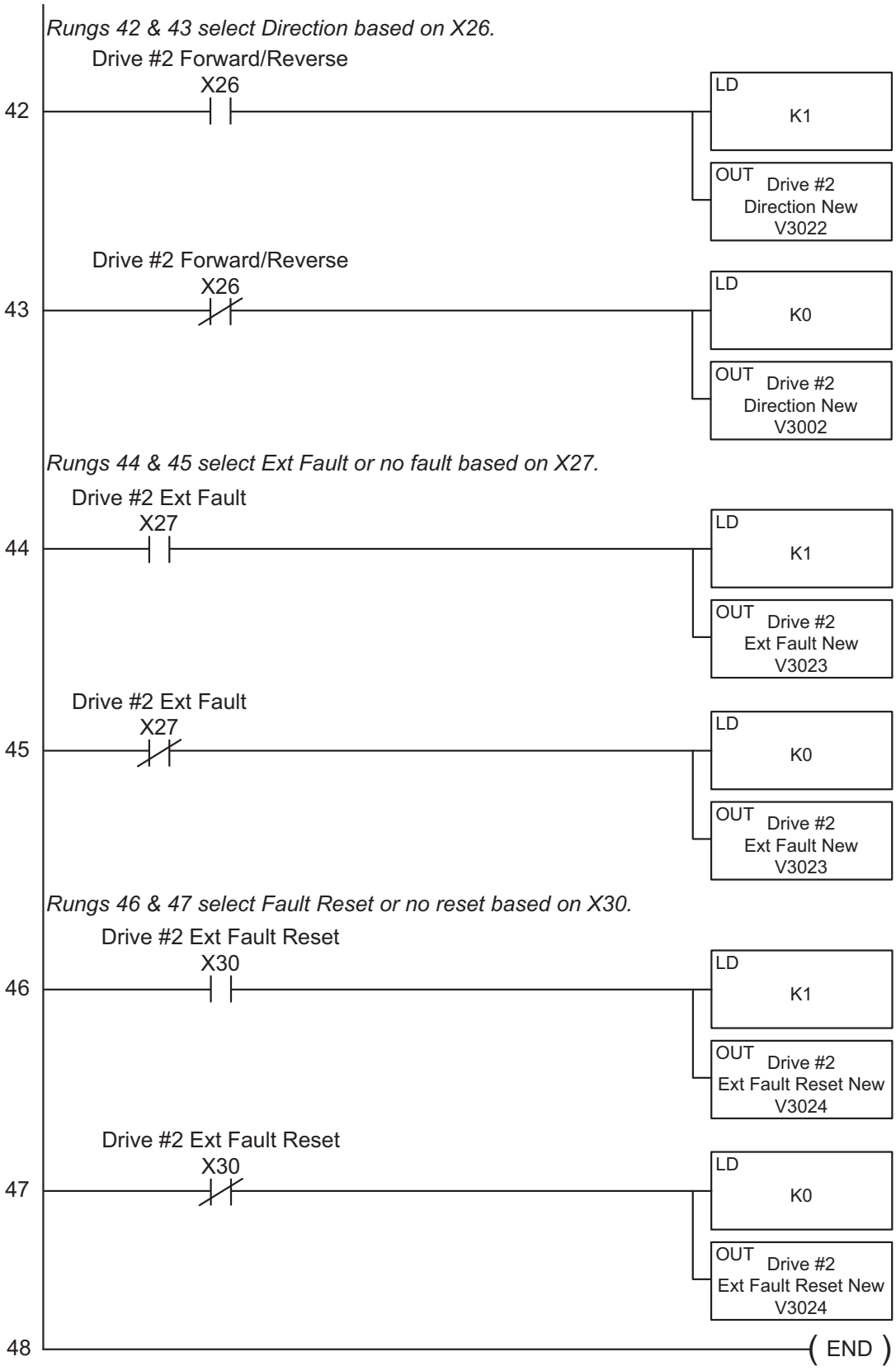
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DL MRX/MWX Communication Program (continued)



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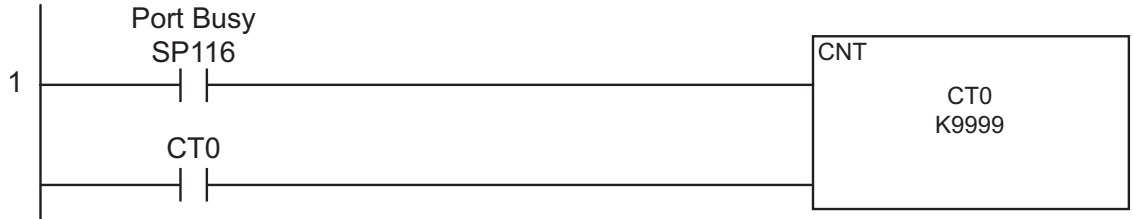
DL MRX/MWX Communication Program (continued)



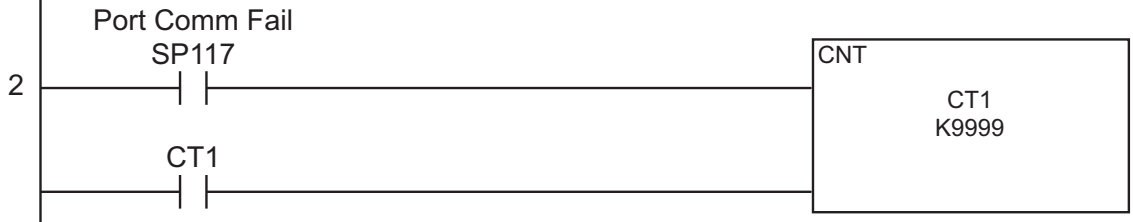
DL RX/WX Communication Program – for DL05, D2-250(-1), D4-450

This program is for illustrational purposes only, and is not intended for a true application.

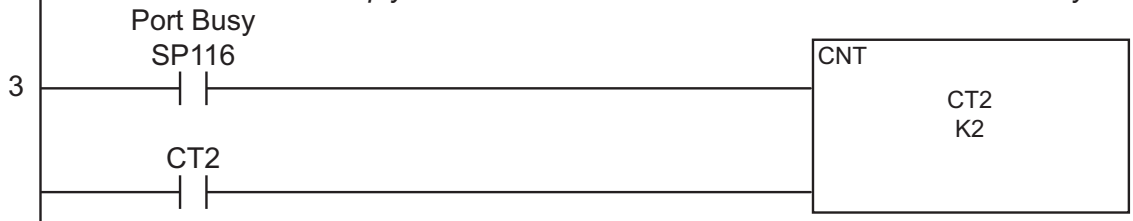
This rung counts the number of times the PLC attempts to communicate to the drive.



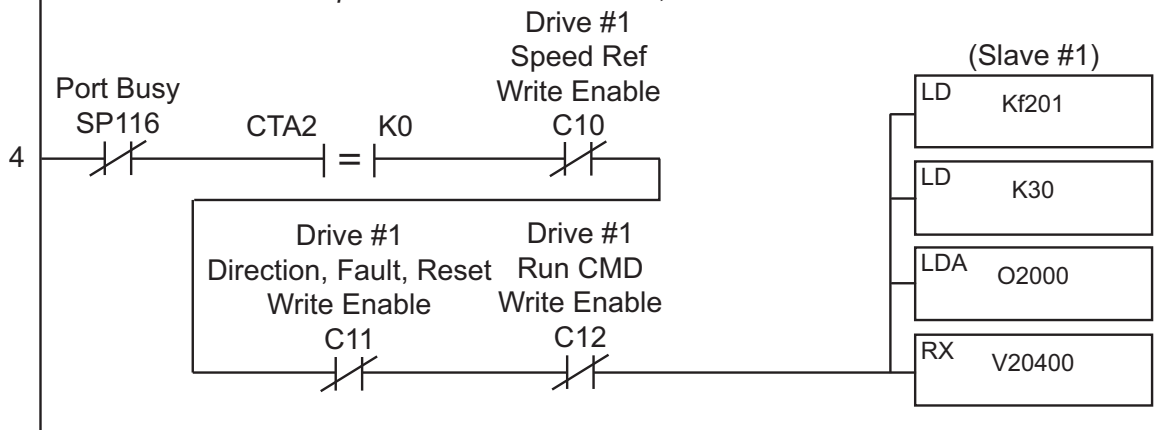
This rung counts the number of times an attempted communication to the drive fails.



This rung acts as an alternator, allowing the following logic to alternate between communicating to slave 1 or slave 2. If there were additional slaves, the 'K' number for the counter would simply be increased to match the number of slaves in the system.

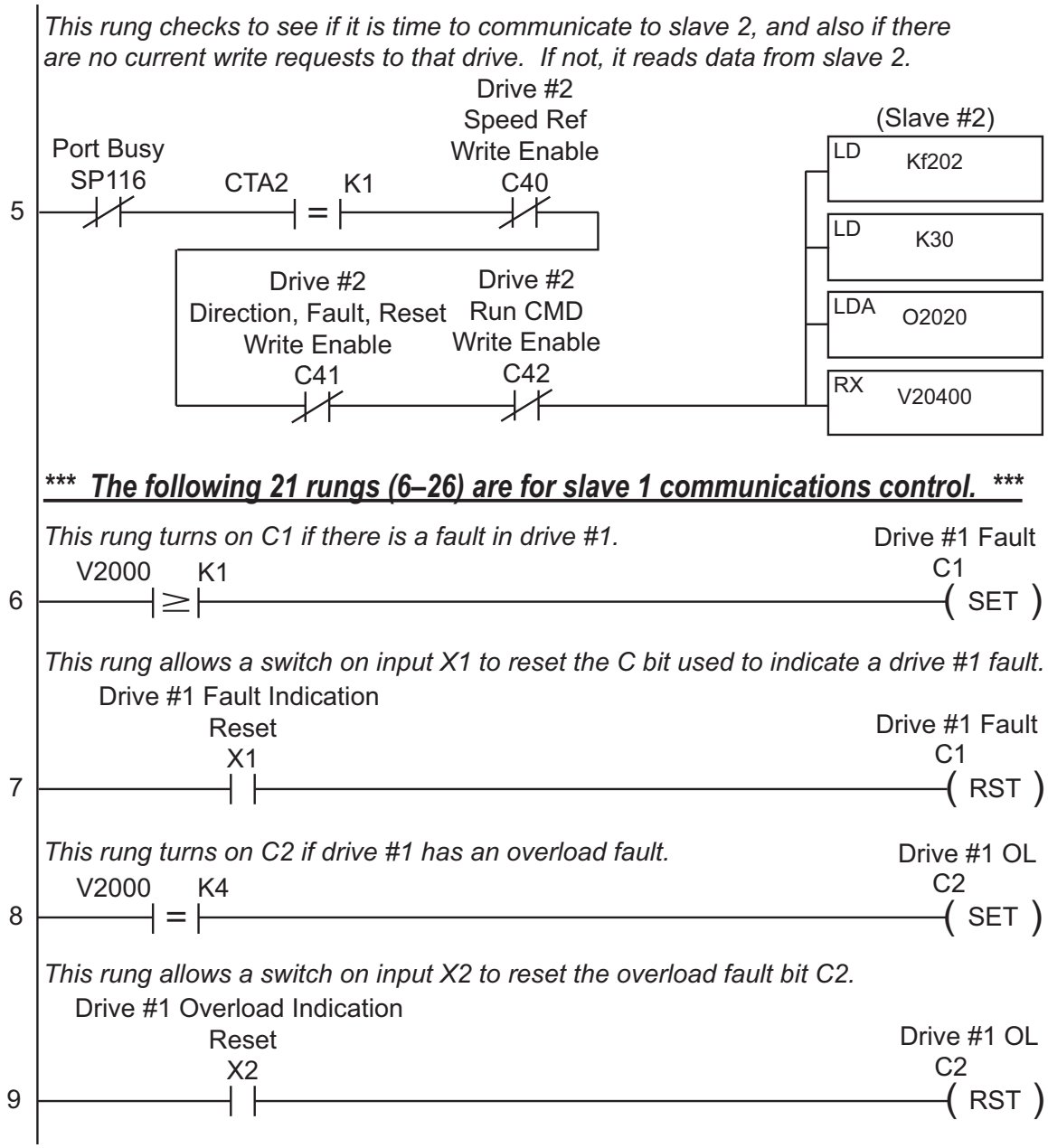


This rung checks to see if it is time to communicate to slave 1, and also if there are no current write requests to that drive. If not, it reads data from slave 1.



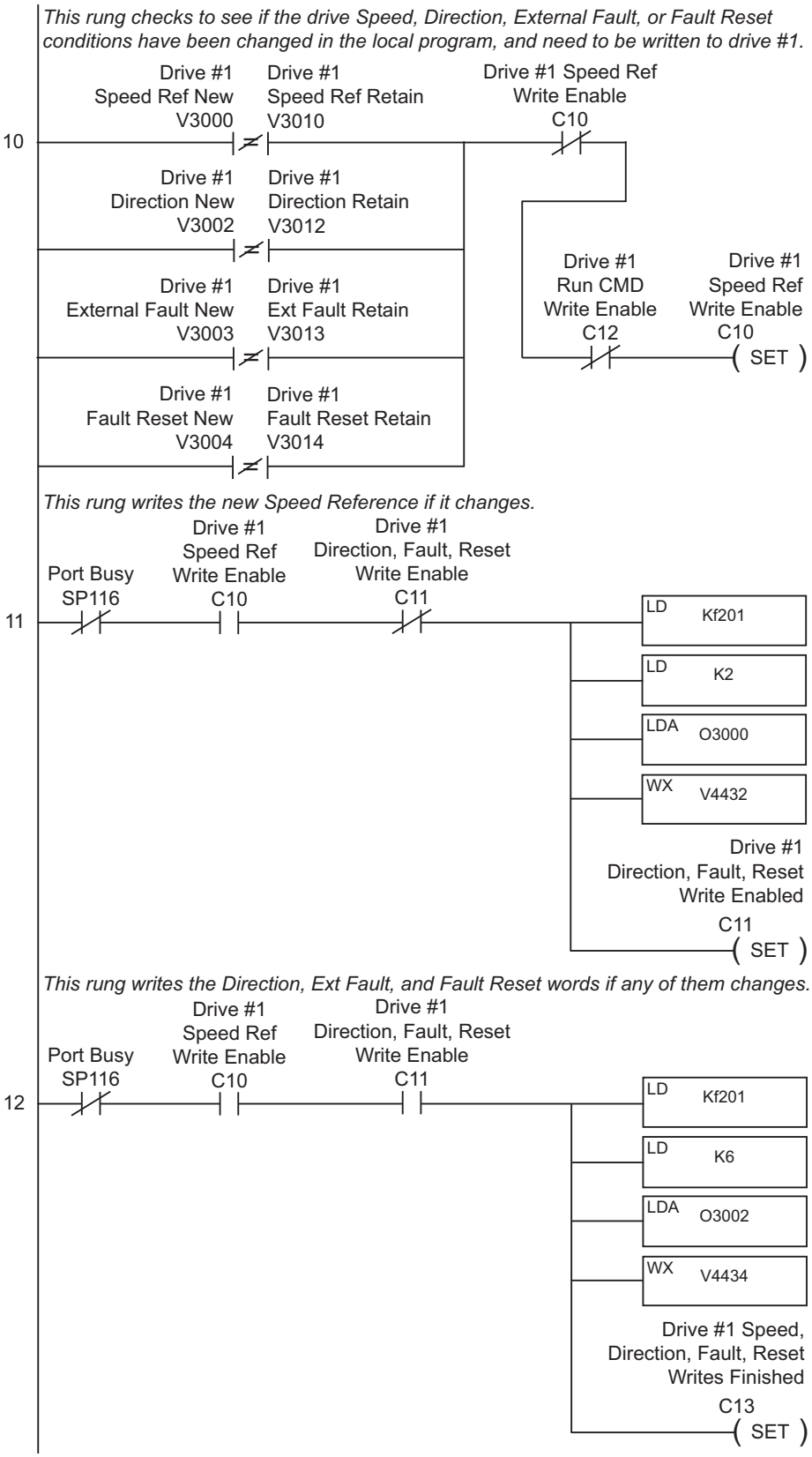
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DL RX/WX Communication Program (continued)



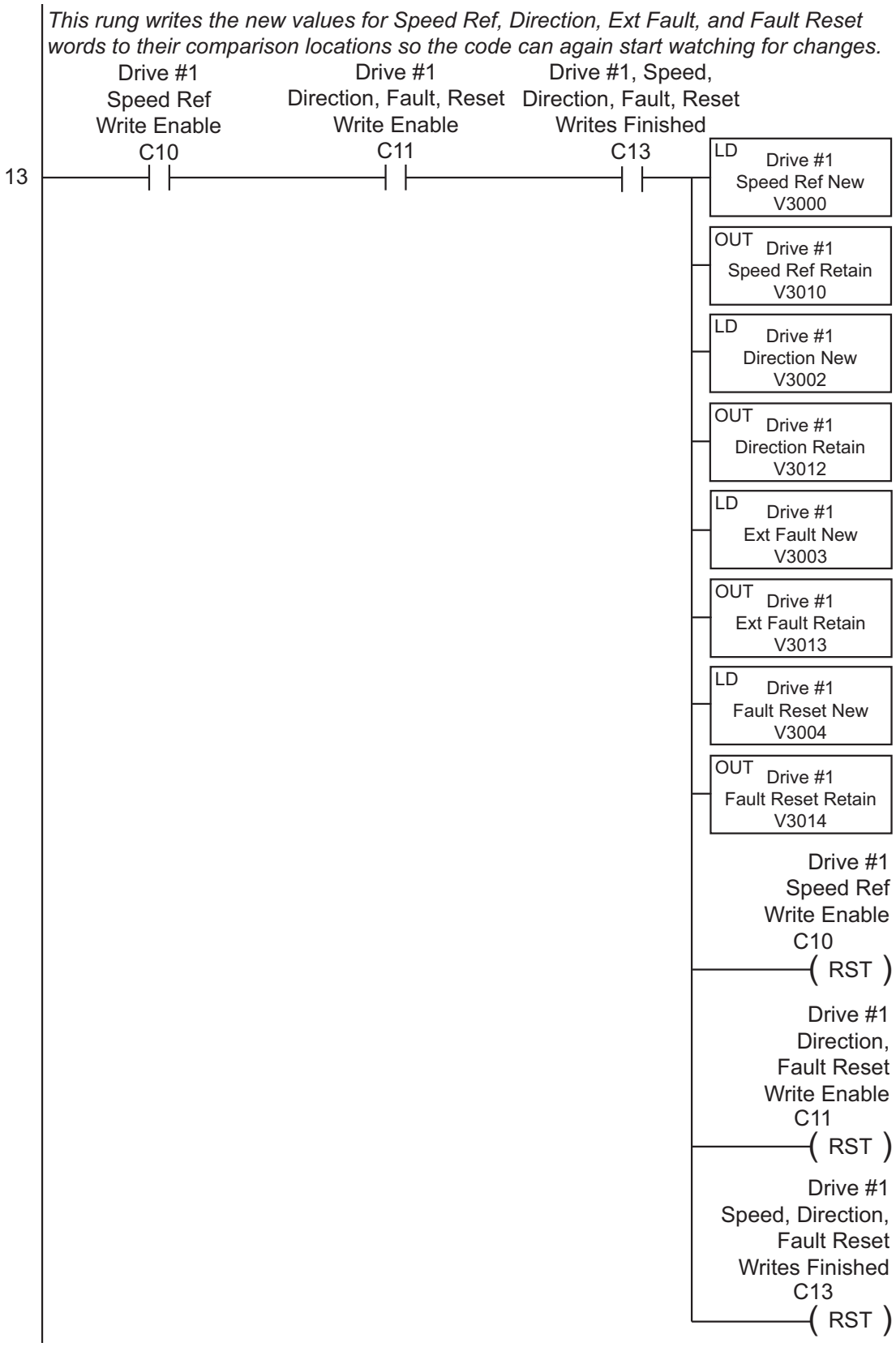
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DL RX/WX Communication Program (continued)



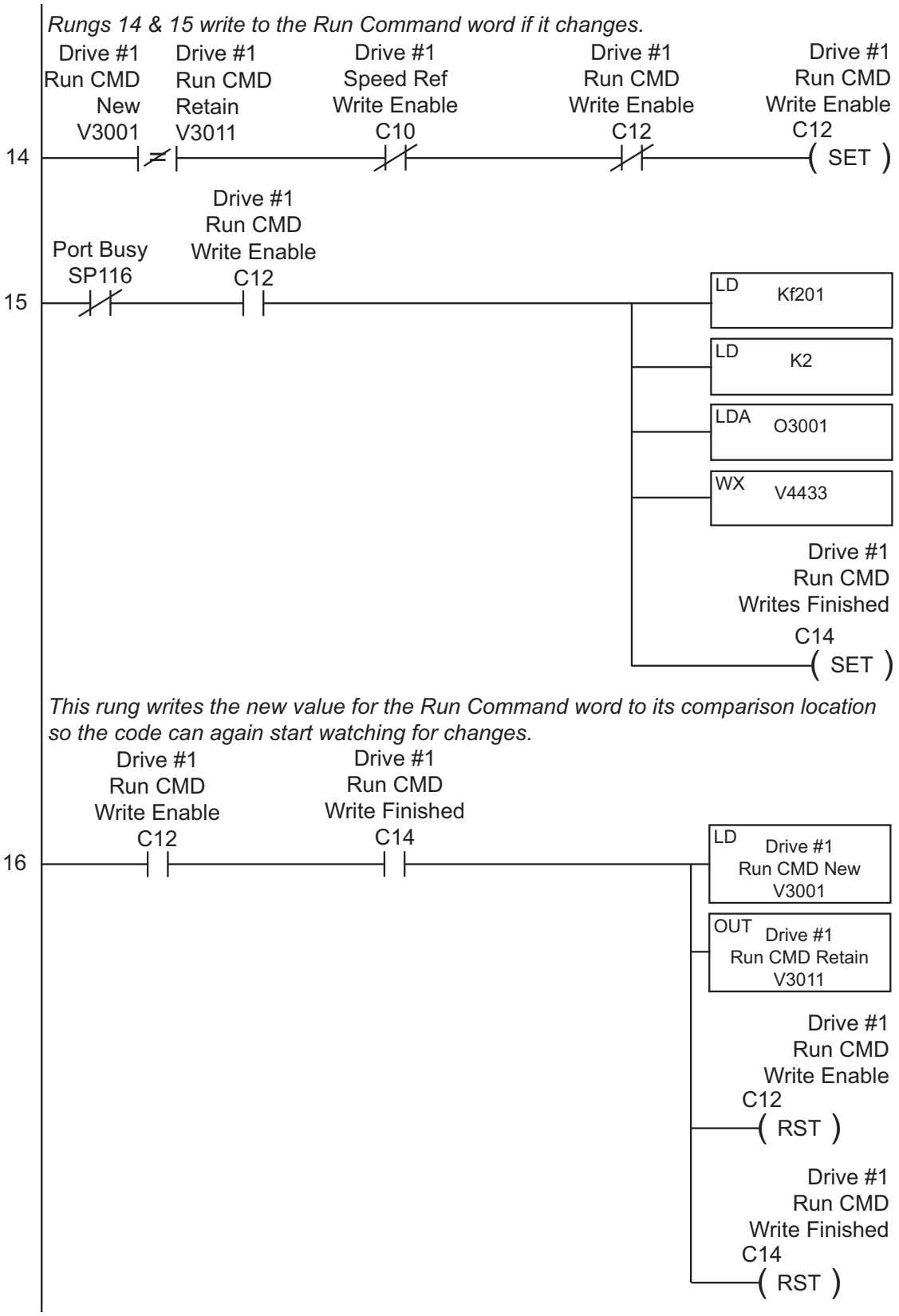
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DL RX/WX Communication Program (continued)



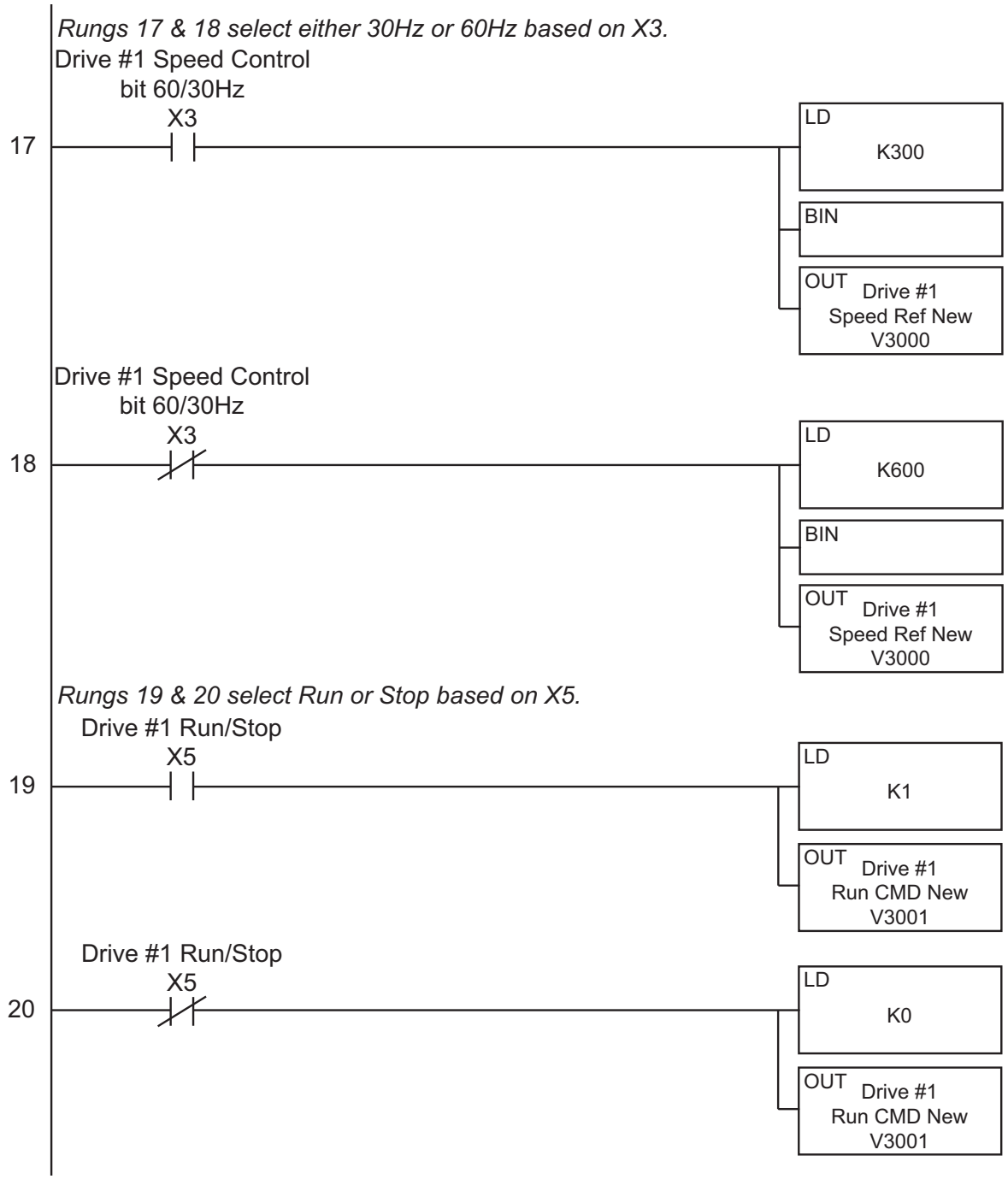
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DL RX/WX Communication Program (continued)



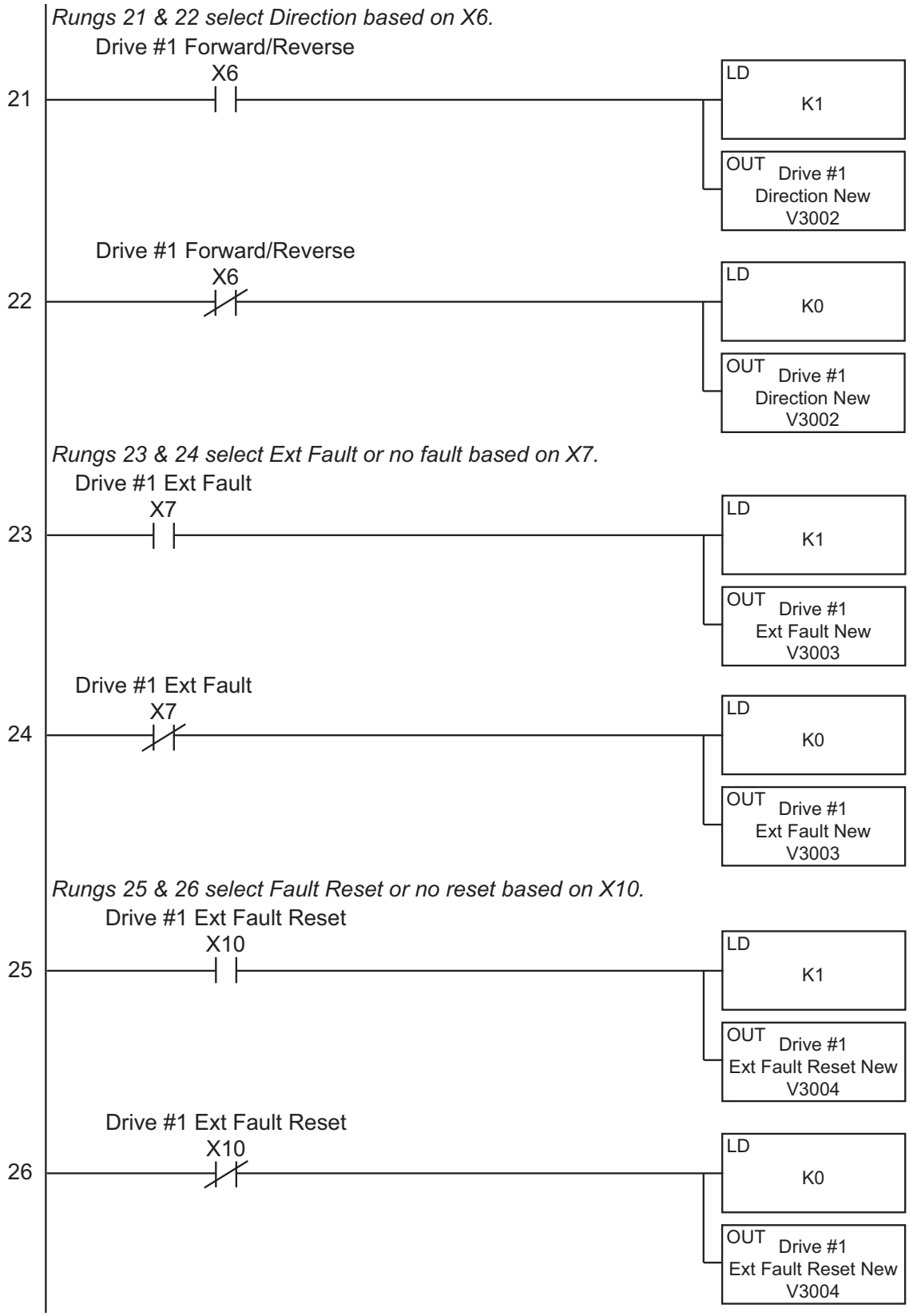
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DL RX/WX Communication Program (continued)



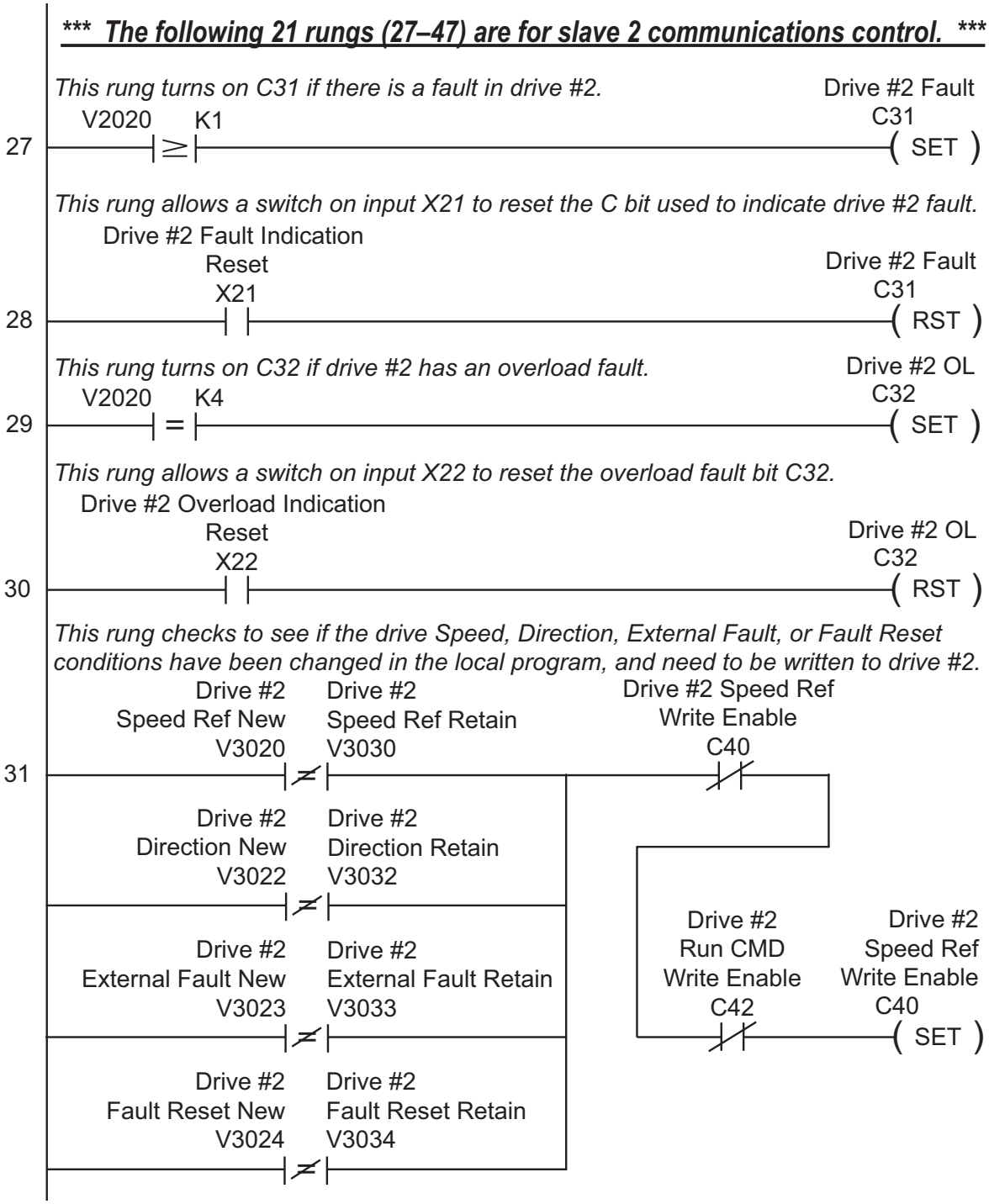
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DL RX/WX Communication Program (continued)



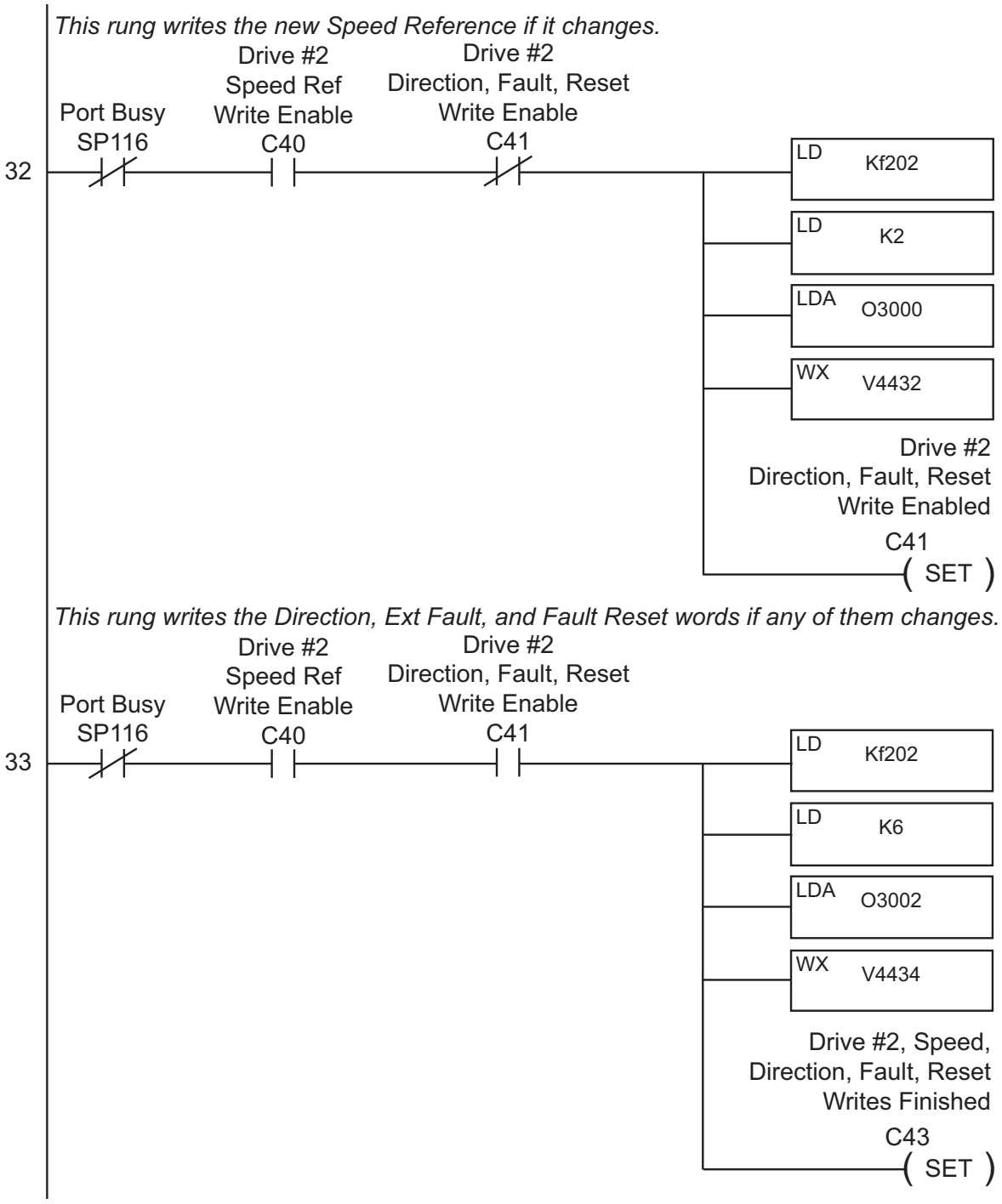
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DL RX/WX Communication Program (continued)



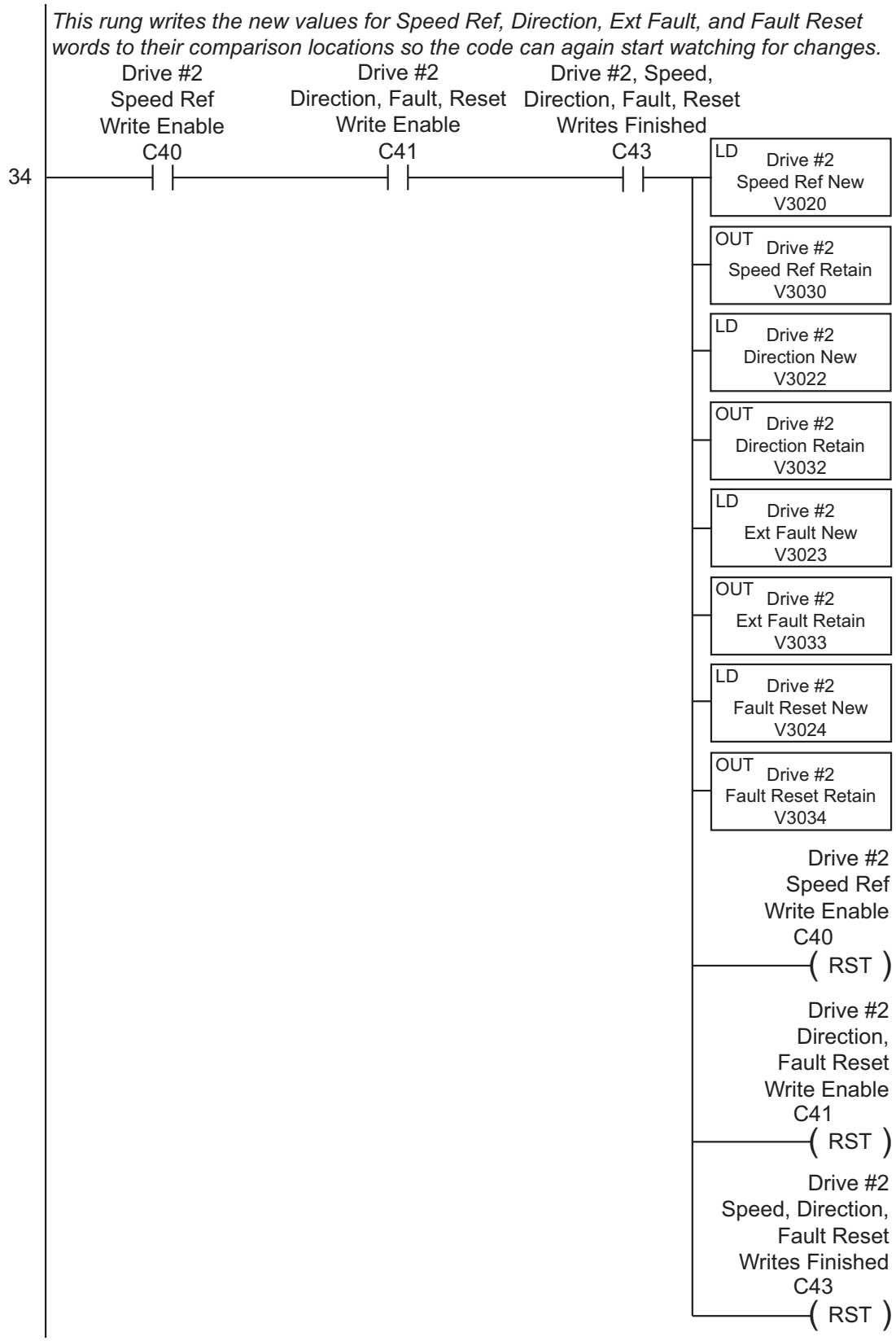
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DL RX/WX Communication Program (continued)



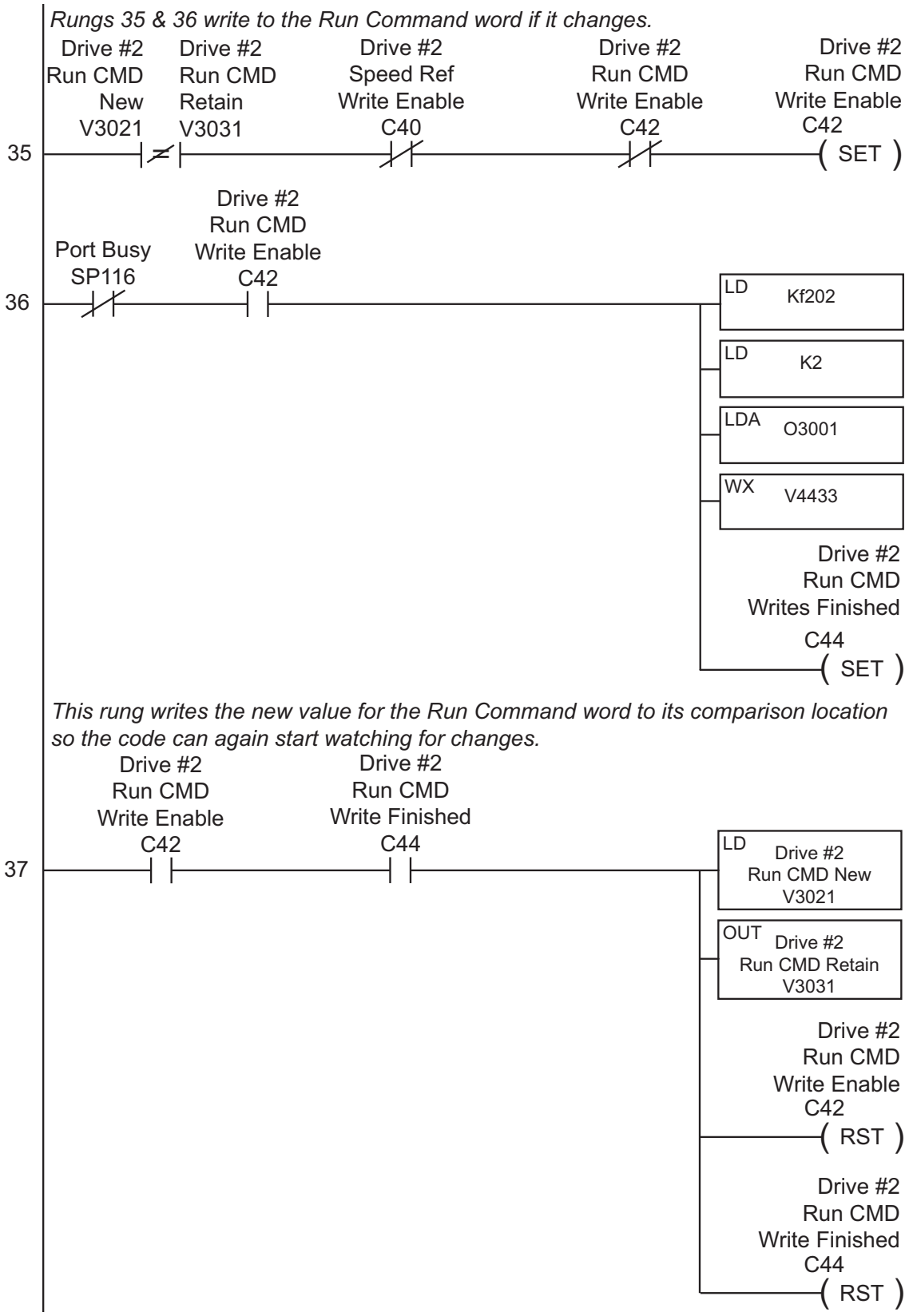
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DL RX/WX Communication Program (continued)



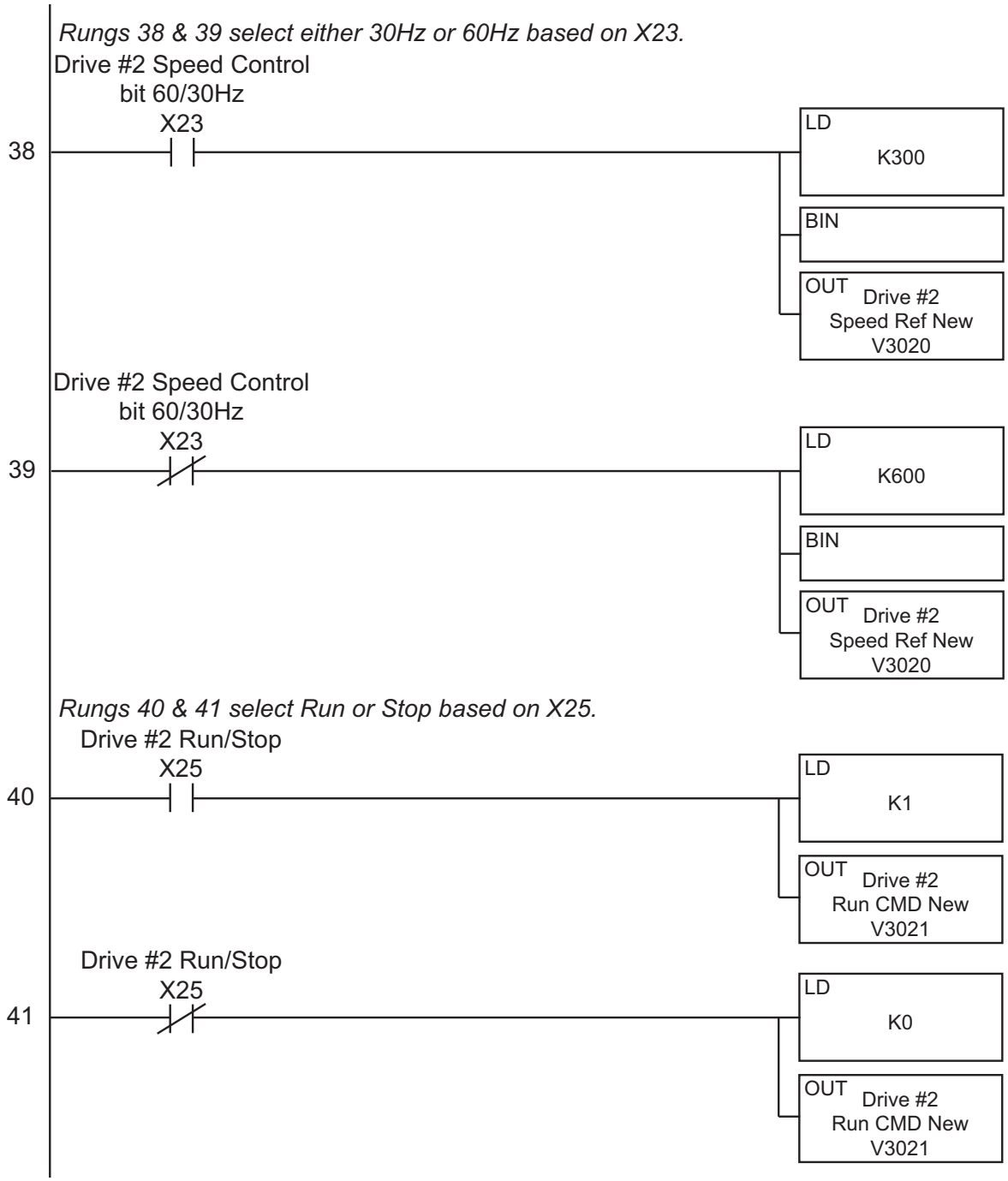
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DL RX/WX Communication Program (continued)



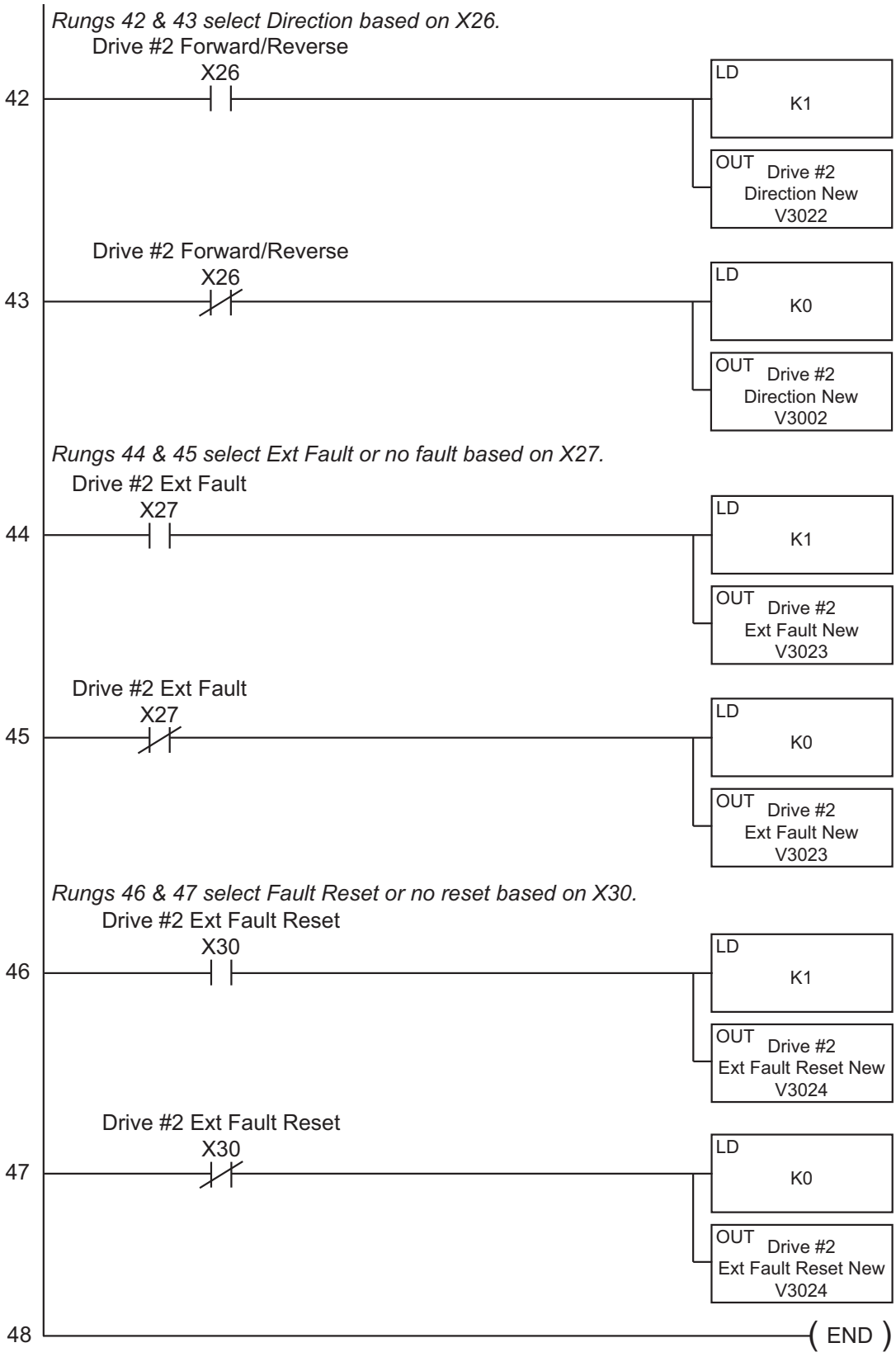
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DL RX/WX Communication Program (continued)



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DL RX/WX Communication Program (continued)



Communicating with Third-party Devices

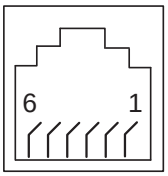
The *DURAPULSE* RJ-12 Serial Comm Port will accommodate an RS-485 connection.

An RS-485 network cable can span up to 1000 meters (4000 feet). The *DURAPULSE* AC drive communication address is specified by P9.00. The third party device then controls each AC drive according to its communication address.

The *DURAPULSE* AC drive can be set up to communicate on standard MODBUS networks using the following transmission modes: ASCII or RTU. Using the Communication Protocol parameter (P9.02), you can select the desired mode, data bits, parity, and stop bits. The mode and serial parameters must be the same for all devices on a MODBUS network.

DURAPULSE RS-485 Serial Comm Port

GS3 Serial Comm Port
RS-485 Interface
RJ12 (6P6C)



1: +15V
2: GND
3: SG–
4: SG+
5: nc
6: reserved

DURAPULSE drives have a provision for shutting down control or power to the inverter in the event of a communications time out. This feature can be set up through parameters P9.03, P9.04, and P9.05.

Common Third-party MODBUS RTU Masters

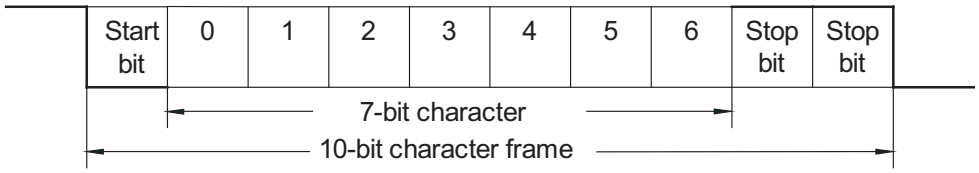
- MODSCAN from www.wintech.com
- KEPSERVER EX 4.0 from www.kepware.com
- Entivity Studio 7.2
- Think & Do Live 5.5.1

For additional technical assistance, go to our Technical support home page at: http://support.automationdirect.com/technotes.html

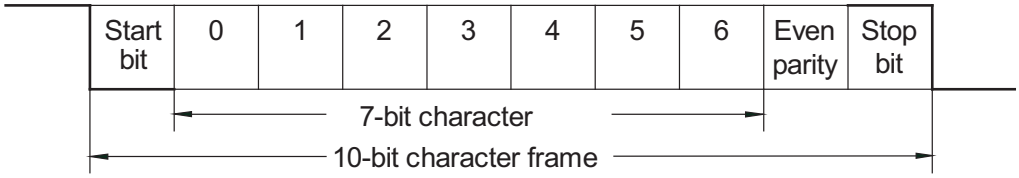
Data Format

ASCII Mode: 10-bit character frame (For 7-bit character):

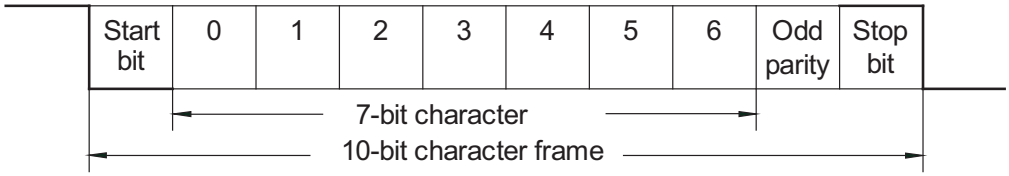
P9.02 = 00 (7 data bits, no parity, 2 stop bits)



P9.02 = 01 (7 data bits, even parity, 1 stop bit)

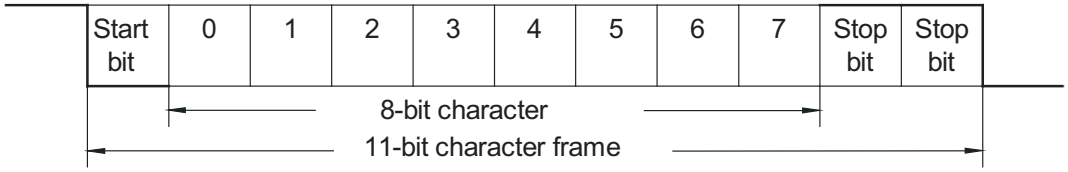


P9.02 = 02 (7 data bits, odd parity, 1 stop bit)

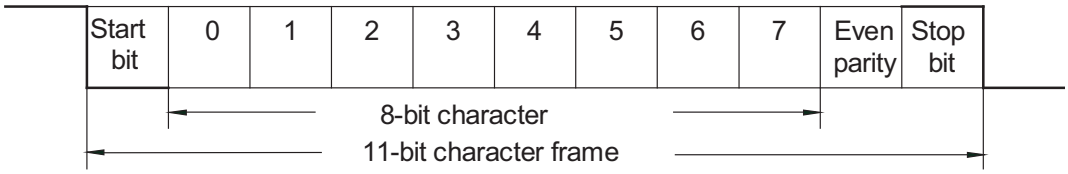


RTU Mode: 11-bit character frame (For 8-bit character):

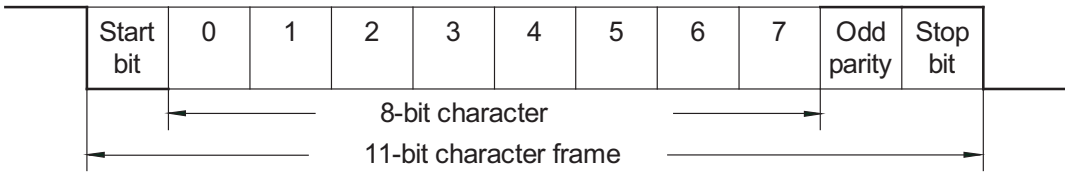
P9.02 = 03 (8 data bits, no parity, 2 stop bits)



P9.02 = 04 (8 data bits, even parity, 1 stop bit)



P9.02 = 05 (8 data bits, odd parity, 1 stop bit)



Communication Protocol

ASCII Mode:

STX	Start Character: (3AH)
ADR 1	Communication Address: 8-bit address consists of 2 ASCII codes
ADR 0	
CMD 1	
CMD 0	
DATA (n-1)	Contents of data: n x 8-bit data consists of 2n ASCII codes. n ≤ 25 maximum of 50 ASCII codes
.....	
DATA 0	
LRC CHK 1	LRC check sum: 8-bit check sum consists of 2 ASCII codes
LRC CHK 0	
END 1	END characters: END 1 = CR (0DH); END 0 = LF (0AH)
END 0	

RTU Mode:

START	A silent interval of more than 10 ms
ADR	Communication Address: 8-bit address
CMD	Command Code: 8-bit command
DATA (n-1)	Contents of data: n x 8-bit data, n ≤ 25
.....	
DATA 0	
CRC CHK Low	CRC check sum: 16-bit check sum consists of 2 8-bit characters
CRC CHK High	
END	A silent interval of more than 10 ms

ADR (Communication Address)

Valid communication addresses are in the range of 0 to 254. A communication address equal to 0 means broadcast to all AC drives, in which case the drives will not reply any message to the master device.

For example, communication to AC drive with address 16 decimal:

ASCII mode: (ADR 1, ADR 0)='1','0' => '1'=31H, '0'=30H
RTU mode: (ADR)=10H

CMD (command code) and DATA (data characters)

The format of data characters depends on the command code. The available command codes are described as followed: Command code: 03H, read N words. The maximum value of N is 12. For example, reading continuous 2 words from starting address 2102H of the AC drive with address 01H.

ASCII mode:

Command Message		Response Message	
STX	':'	STX ':'	':'
ADR 1 ADR 0	'0'	ADR 1 ADR 0	'0'
	'1'		'1'
CMD 1 CMD 0	'0'	CMD 1 CMD 0	'0'
	'3'		'3'
Starting data address	'2'	Number of data (Count by byte)	'0'
	'1'		'4'
	'0'	Content of starting data address 2102H	'1'
	'2'		'7'
Number of data (Count by word)	'0'		'7'
	'0'		'0'
	'0'	Content data address 2103H	'0'
	'2'		'0'
LRC CHK 1 LRC CHK 0	'D'		'0'
	'7'		'0'
END 1 END 0	CR	LRC CHK 1 LRC CHK 0	'7'
	LF		'1'
		END 1 END 0	CR
			LF

RTU mode:

Command Message		Response Message	
ADR	01H	ADR	01H
CMD	03H	CMD	03H
Starting data address	21H	Number of data (Count by byte)	04H
	02H		'0'
Number of data (Count by word)	00H	Content of data address 2102H	17H
	02H		70H
CRC CHK Low CRC CHK High	6FH	Content of data address 2103H	00H
	F7H		02H
		CRC CHK Low CRC CHK High	FEH
			5CH

Command code: 06H, write 1 word

For example, writing 6000(1770H) to address 0100H of the AC drive with address 01H.

ASCII mode:

Command Message			Response Message	
STX	':'		STX ':'	':'
ADR 1 ADR 0	'0'		ADR 1 ADR 0	'0'
	'1'			'1'
CMD 1 CMD 0	'0'		CMD 1 CMD 0	'0'
	'6'			'6'
Data Address	'0'		Data Address	'0'
	'1'			'1'
	'0'			'0'
	'0'			'0'
	'1'		Data Content	'1'
	'7'			'7'
	'7'			'7'
	'0'			'0'
LRC CHK 1 LRC CHK 0	'7'		LRC CHK 1 LRC CHK 0	'7'
	'1'			'1'
END 1 END 0	CR		END 1 END 0	CR
	LF			LF

RTU mode:

This is an example of using function code 16 for writing to multiple registers.

Command Message			Response Message	
ADR	01H		ADR	01H
CMD	10H		CMD	10H
Starting data address	20H		Starting data address	20H
	00H			00H
Number of registers	00H		Number of data (Count by word)	00H
	02H			02H
Byte count	04H		CRC CHK Low CRC CHK High	4AH
Content of data address 2000H	00H			08H
	02H			
Content of data address 2001H	02H			
	58H			
CRC CHK Low CRC CHK High	CBH			
	34H			

CHK (check sum)

ASCII Mode:

LRC (Longitudinal Redundancy Check) is calculated by summing up module 256, the values of the bytes from ADR1 to last data character, then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example, reading 1 word from address 0401H of the AC drive with address 01H.

Command Message	
STX	':'
ADR 1 ADR 0	'0' '1'
CMD 1 CMD 0	'0' '3'
Starting data address	'0' '4' '0' '1'
Number of data (Count by word)	'0' '0' '0' '1'
LRC CHK 1 LRC CHK 0	'F' '6'
END 1 END 0	CR LF

01H+03H+04H+01H+00H+01H=0AH;
the 2's complement negation of 0AH is F6H.

RTU Mode:

Response Message	
ADR	01H
CMD	03H
Starting data address	21H 02H
Number of data (Count by word)	00H 02H
CRC CHK Low CRC CHK High	6FH F7H

CRC (Cyclical Redundancy Check) is calculated by the following steps:

Step 1: Load a 16-bit register (called CRC register) with FFFFH.

Step 2: Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3: Shift the CRC register one bit to the right with MSB zero filling. Extract and examine the LSB.

Step 4: If the LSB of CRC register is 0, repeat step 3; else Exclusive OR the CRC register with the polynomial value A001H.

Step 5: Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

Step 6: Repeat steps 2 to 5 for the next 8-bit byte of the command message.

Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value.



When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.

The following is an example of CRC generation using C language. The function takes two arguments:

Unsigned char* data ← a pointer to the message buffer
Unsigned char length ← the quantity of bytes in the message buffer

The function returns the CRC value as a type of unsigned integer.

```
Unsigned int crc_chk(unsigned char* data, unsigned char length){
  int j;
  unsigned int reg_crc=0xFFFF;
  while(length--){
     reg_crc ^= *data++;
     for(j=0;j<8;j++){
        if(reg_crc & 0x01){  /* LSB(b0)=1 */
           reg_crc=(reg_crc>>1) ^ 0xA001;
      }else{
           reg_crc=reg_crc >>1;
      }
     }
  }
 return reg_crc;
}
```



RTU mode is preferred. Limited support is available to ASCII users.

Comm Delay – Optimizing Communications

Optimizing Communications to GS Drives



In most cases, optimizing communications to GS Drives MAY NOT BE NECESSARY.

If you are only communicating to one or two drives and reading or writing only a few parameters, the communication speed will most likely be sufficient for your application.

However, in the case that the communication speed (reaction time from reading or writing an event to a given drive) is too slow, you may need to take a more detailed look at how your code is designed to communicate to the GS Drives in your application.

To properly design the system, it is necessary to understand all of the propagation delays that are incurred when triggering the event to send a Modbus message to the point of receiving the data or status of the reply into the PLC or Modbus master.

To determine the time necessary to transmit a message from the Master to the Slave and vice versa, we must first determine the “Bit Time” and the “Character Time”. This is calculated by using the following formulas:

- Bit Time:
  The value one divided by the baud rate. A baud rate of 19,200 equals a bit rate of 0.0000528 (1/19200) or 52 µs (microseconds).
- Character Time:
  Bit Time multiplied by the number of bits. With Modbus this is typically 10–12 bits per character [1 start bit (fixed), 1 or 2 stop bits (usually configurable), 0 or 1 parity bit (Odd & Even = 1 bit; None = 0), & 8 data bits]. For a setting of Odd parity and 1 Stop bit, this would be 11 bits. So at 19200, Odd parity and 1 stop bit, a character time would be 0.000573 or 573 µs (0.0000528 · 11).

Now that we know the byte time, we can multiply that time by the number of characters in each message.

Types of Messages Sent to GS Drives

There are three different types of messages typically be sent to GS Drives:

1) Read Registers (Function Code 3).
2) Write Multiple Registers (Function Code 16).
3) Write Single Register (Function Code 6).

Format of "Read Registers" Messages:

Request:
XX = Node Address (1 Char)
03 = Function Code (1 Char)
XXXX = Starting Address to read (2 Chars)
XXXX = Number of Registers to read (2 Chars)
XXXX = 16 Bit CRC (2 Chars)

Reply:
XX = Node Address (1 Char)
03 = Function Code (1 Char)
XX = Byte count of data being sent from Slave (1 Char)
XXXX… = Depends upon Request (2 Chars per Register requested)
XXXX = 16 Bit CRC (2 Chars)

Format of "Write Multiple Registers" Messages:

Request:
XX = Node Address (1 Char)
10 = Function Code (Hex format) (1 Char)
XXXX = Starting Address to write to (2 Chars)
XXXX = Number of Registers to write to (2 Chars)
XX = Number of bytes of data to write (1 Char)
XXXX… = Depends upon Request (2 Chars per Register requested)
XXXX = 16 Bit CRC (2 Chars)

Reply:
XX = Node Address (1 Char)
10 = Function Code (Hex format)(1 Char)
XXXX = Starting Address to write to (2 Chars)
XXXX = Number of Registers to write to (2 Chars)
XXXX = 16 Bit CRC (2 Chars)

Format of "Write Single Register" Messages:

Request:
XX = Node Address (1 Char)
06 = Function Code (1 Char)
XXXX = Register to Write to (2 Chars)
XXXX = Data to Write (2 Chars)
XXXX = 16 Bit CRC (2 Chars)

Reply:
XX = Node Address (1 Char)
06 = Function Code (1 Char)
XXXX = Register to Write to (2 Chars)
XXXX = Data to Write (2 Chars)
XXXX = 16 Bit CRC (2 Chars)

Example Message:

Write a value of 60Hz to P9.26 and a value of 1 to P9.27 =
01 10 09 1b 00 02 04 02 58 00 01 5a 66

We receive a good reply = **01 10 09 1b 00 02 a3 9f**

Sending message (13 characters from above) = 7.4 ms (0.00744796)

Reply message (8 characters from above) = 4.6 ms (0.004583)



For more specific information on how Modbus messages are formed, refer to the Modbus specifications found at www.modbus.org.

Additional Message Delay Times

So we have the total transmission time for sending a message and receiving a reply but this does not include all of the delays for a given message. The receiving device must have time to process the receipt of a message and formulate a reply. The amount of time that the receiving device needs will vary greatly depending upon the hardware platform and other processes that the device is running.

For the previous example message, the GS Drive responds in 4ms when the drive is stopped and will respond in 5ms when the drive is running. This may vary somewhat depending upon the specific parameter values and the size of the request.

Modbus-specified Delays Between Messages

There is one additional time delay required in the Modbus protocol. The protocol specifies at least a 3.5 character delay between messages. For the settings above, a 3.5 character time in our example would be about 2ms.

So the total time required for the message sent above would be:

7.4 ms (Transmission time for sending message)
5.0 ms (response delay from GS Drive when drive running)
4.6 ms (Transmission time for reply message)
+ 2.0 ms (Modbus message wait delay)

19.0 ms (approximately)

Remember from our description, this is purely the time from when the message leaves the serial port to when the reply is received back in to the serial port.

Other Delays

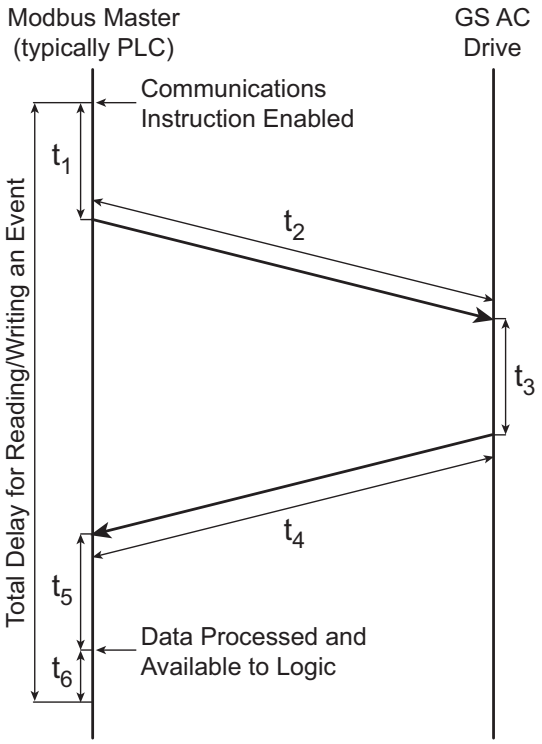
Depending upon the master device, there may be additional delays. For example:

In the *Direct*Logic PLC, the serial communications are serviced in the housekeeping portion of the PLC scan. So if the communications instruction is in rung #1 of a ladder program, the serial communications message does not get sent until the end of the total PLC scan. Likewise, if the reply message was received into the serial port at the beginning of the PLC scan, it would not be serviced until the end of the PLC scan.

So you would need to add an additional possible two PLC scan times to the number above to truly calculate the time necessary to read or write an event to the GS drive.

These delays are shown in the following Communication Delay Timing Diagram.

Communication Delay Timing Diagram



t_1 = Scan delay from the point of turning on a communications instruction to when it actually goes out of the serial port.

t_2 = Transmission time to send Message request (read or write).

t_3 = Response delay from GS drive to receive the reply and formulate the response.

t_4 = Transmission time to send Reply message.

t_5 = Scan delay from the point of receiving reply, processing it and placing in PLC memory for Logic usage.

t_6 = Wait time required by Modbus spec (3.5 byte times). This may or may not be present depending upon the Scan delay, but safer to factor in.

Communication Delay Summary

Now that you know how to calculate the time required for one message to one GS drive, you would simply multiply this value per message to each GS drive on the network, since only one message can be sent at a time.

As you can deduce from the statement above, the more messages being sent to GS drives, the longer it takes to communicate to an individual drive as each message has to take its turn.

So how do you optimize your communications to get messages faster to your GS drives?

There is no way to make a message go faster than what is specified above, but what you can affect is the amount of messages being sent to any given GS drive in two ways.

1) Group together messages into Block requests whenever possible. For example, if you wanted to read Status Monitor 1 and the Output Frequency status register from the drive, read the two together as a block (Status Monitor 1, Status Monitor 2, Frequency Command and Output Frequency), and ignore the other two status registers that you don't need instead of sending two separate read commands. If you do the calculations above, you will see that is much faster to take the additional hit from four extra bytes in the reply message than it would be to send a separate message. NOTE that you cannot read across non-contiguous Modbus addresses, so this typically only works when reading within the Status registers or in a Parameter category (P9.xx, P1.xx, etc…).

2) Only send a write message when the value changes in the Master device. It is simpler to setup your communications instructions to read and write all the time, but it wastes precious network time to write the same value to the GS drive over and over if that value is not changing. Write some simple logic that only triggers a write command when the value to be sent has changed.

For more specific instructions on how to configure and/or interlock, in detail, the individual communications instructions, consult your PLC or Modbus Master Device user manual. If using *Direct*Logic PLCs as the Modbus Master, consult the Dx-USER-M manuals for specifics on configuring the individual communications instructions and look at the Hx-ECOM-M manual for information on interlocking communications instructions.

CHAPTER 6

MAINTENANCE AND TROUBLESHOOTING

In This Chapter...

Maintenance and Inspection 6–2
- Monthly Inspection 6–2
- Annual Inspection 6–2
- Recharge Capacitors (for unused drives) 6–2

Troubleshooting 6–3
- Fault Messages 6–3
- Warning Messages: Serial Communication and Keypad Errors . . .6–7

Maintenance and Inspection

Modern AC drives are based on solid state electronics technology. Preventive maintenance is required to operate the AC drive in its optimal condition, and to ensure a long life. We recommend that a qualified technician perform a regular inspection of the AC drive. Some items should be checked once a month, and some items should be checked yearly.



If the drive is stored or is otherwise unused for more than a year, the drive's internal DC link capacitors should be recharged before use. Otherwise, the capacitors may be damaged when the drive starts to operate. We recommend recharging the capacitors of any unused drive at least once per year.



WARNING! Disconnect AC power and ensure that the internal capacitors have fully discharged before inspecting the AC drive!
Wait at least two minutes after all display lamps have turned off.

Monthly Inspection

Check the following items at least once a month.

1. Make sure the motors are operating as expected.
2. Make sure the installation environment is normal.
3. Make sure the cooling system is operating as expected.
4. Check for irregular vibrations or sounds during operation.
5. Make sure the motors are not overheating during operation.
6. Check the input voltage of the AC drive and make sure the voltage is within the operating range. Check the voltage with a voltmeter.

Annual Inspection

Check the following items once annually.

1. Tighten and reinforce the screws of the AC drive if necessary. They may loosen due to vibration or changing temperatures.
2. Make sure the conductors and insulators are not corroded or damaged.
3. Check the resistance of the insulation with a megohmmeter.
4. Check the capacitors and relays, and replace if necessary.
5. Clean off any dust and dirt with a vacuum cleaner. Pay special attention to cleaning the ventilation ports and PCBs. Always keep these areas clean. Accumulation of dust and dirt in these areas can cause unforeseen failures.
6. Recharge the capacitors of any drive that is in storage or is otherwise unused.

Recharge Capacitors (for unused drives)

Recharge the DC link before using any drive that has not been operated within a year:

1. Disconnect the motor from the drive.
2. Apply input power to the drive for 2 hours.

Troubleshooting

Fault Messages

The AC drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The fault messages are then displayed on the digital keypad LCD display. The six most recent faults can be read on the digital keypad display by viewing parameters P06.31 to P06.36.



NOTE: Faults can be cleared by a reset from the keypad or input terminal.

Fault Messages	
Fault Name/Description	**Corrective Actions**
OVER-CURRENT The AC drive detects an abnormal increase in current.	1. Check whether the motor's horsepower is equal to or less than the AC drive output power. 2. Check the wiring connections between the AC drive and motor for possible short circuits. 3. Increase the Acceleration time (P 1.01 or P 1.05). 4. Check for possible excessive loading conditions at the motor. 5. If there are any abnormal conditions when operating the AC drive after short-circuit is removed, or fault does not clear, call ADC Support for assistance.
OVER-VOLTAGE The AC drive detects that the DC bus voltage has exceeded its maximum allowable value.	1. Check whether the input voltage falls within the rated AC drive input voltage. 2. Check for possible voltage transients. 3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional braking resistor. 4. Check whether the required braking power is within the specified limits. 5. Check braking resistor on drives under 20HP and dynamic brake unit & braking resistor on drives 20HP and above.
OVER-TEMPERATURE The AC drive temperature sensor detects excessive heat.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects on the heat sinks and check for possible dirty heat sink fins. 4. Provide enough spacing for adequate ventilation.
UNDER-VOLTAGE The AC drive detects that the DC bus voltage has fallen below its minimum allowable value.	Check whether the input voltage falls within the rated AC drive input voltage.
OVERLOAD The AC drive detects excessive drive output current.	1. Check whether the motor is overloaded. 2. Reduce torque compensation setting as set in P 2.03. 3. Increase the AC drive's output capacity. **Note: The AC drive can withstand up to 150% of the rated current for a maximum of 60 seconds.**

Fault Messages	
Fault Name/Description	**Corrective Actions**
THERMAL OVERLOAD Parameter settings (P 6.07 to P 6.09) An external condition has occurred to cause an internal electronic or motor thermal overload fault	If P 6.07 is set to '1' to enable during steady state: 1. Check for possible motor overload. 2. Check electronic thermal overload relay setting (P 6.00).. 3. Increase motor capacity. 4. Reduce the current level so that the AC drive output current does not exceed the value set by the Motor Rated Current P 0.01.
OVER-TORQUE Parameter settings (P 6.07 to P 6.09) An external condition has occurred to cause an over-torque fault.	If P 6.07 is set to '2' to enable detection during accel/decel: 1. Reduce the motor overload. 2. Adjust the over-torque detection setting to an appropriate level.
OVER-CURRENT ACC Over-current during acceleration: 1. Short-circuit at motor output. 2. Torque boost too high. 3. Acceleration time too short. 4. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Decrease the torque boost setting in P 2.02. 3. Increase the acceleration time P 1.01 and P 1.05. 4. Replace the AC drive with one that has a higher output capacity.
OVER-CURRENT DEC Over-current during deceleration: 1. Short-circuit at motor output. 2. Deceleration time too short. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Increase the deceleration time P 1.02 and P 1.06. 3. Replace the AC drive with one that has a higher output capacity.
OVER-CURRENT STD Over-current during steady state operation 1. Short-circuit at motor output. 2. Sudden increase in motor loading. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Check for possible motor stall. 3. Replace the AC drive with one that has a higher output capacity.
CPU FAILURE 1 Internal memory IC cannot be programmed	1. Switch off power supply. 2. Check whether the input voltage falls within the AC drive's rated input voltage. 3. Switch the AC drive back on. If fault does not clear, contact ADC Support for assistance.
CPU FAILURE 2 Internal memory IC cannot be read.	1. Reset drive to factory defaults P 9.08 to 99. 2. Switch off power supply 3. Switch the AC drive back on. If fault does not clear, contact ADC Support for assistance.
CPU FAILURE 3 Internal memory IC failed to receive output status	1. Check all connections at L1, L2 and L3. 2. Verify correct voltage at L1, L2,L3. 3. Contact ADC Support for assistance.

Fault Messages	
Fault Name/Description	**Corrective Actions**
HARDWARE FAILURE Hardware protection failure	1. Check all connections at L1, L2 and L3. 2. Verify correct voltage at L1, L2,L3. 3. Contact ADC Support for assistance.
MOM POWER LOSS Input power has been lost	Check line power to drive
EXTERNAL FAULT The external terminal EF-CM goes from OFF to ON	When external terminal EF-CM is closed, the output will be turned off (under Normally Open. External Fault.).
AUTO RAMP FAULT Auto accel/decel failure	Refer to Over-current or Over-voltage error
GROUND FAULT 1. Possible unbalanced load 2. Possible current leakage	1. Check the motor for possible insulation damage. 2. Check for possible poor insulation at the output line.
EXT. BASE-BLOCK AC drive output is turned off.	1. When the external input terminal (base-block) is active, the AC drive output will be turned off. 2. Disable this connection and the AC drive will begin to work again.
INPUT POWER LOSS One phase of the input power is lost	1. Check for possible poor connection on the input power line. 2. Check for possible loss of phase on input power line.
OUTPUT SHORTED IGBT Short Circuit	Contact ADC Support for assistance.
PID FBACK LOSS 1. If P 7.27 = 0, (*warn and AC drive stop),* PID feedback loss recorded. 2. If P 7.27 = 1, (*warn and continue operation)*, PID feedback loss not recorded.	PID Warning: PID Feedback Loss - The 4-20mA PID signal has been lost. The corrective action can be set with the PID Feedback Loss parameter (P 7.27). The available settings are: 00 - Warn and AC Drive Stop 01 - Warn and Continue The default setting is 00.

Fault Messages	
Fault Name/Description	**Corrective Actions**
ENCODER LOSS 1. If P 10.05 = 1 or 2 (*warn and AC drive stop*), Encoder feedback loss would be recorded. 2. If P 10.05 = 0 (*warn and continue operation*), Encoder feedback loss would not be recorded.	1. Verify that the encoder board has power 2. Check to be sure it is not mis-wired 3. Check for incorrect voltage or encoder set-up 4. Check both the mechanical and electrical integrity of the encoder.
ENC SIGNAL ERROR Encoder A/B phase signal is in error when the control mode is from the encoder	1.Verify power to the encoder feedback card 2. Verify encoder and feedback card wiring 3. Check encoder feedback card dip switch settings and encoder voltage requirements

Warning Messages: Serial Communication and Keypad Errors

There are several Warning Messages that a *DURAPULSE* AC Drive may give. The *DURAPULSE* AC Drive allows you to decide its response to these messages. The descriptions of the Warning Messages are listed below.

Warning Messages	
Error Name	**Description**
No display shown on the keypad	1. The Keypad LCD display has failed. 2. Check input power 3. Make sure the keypad is tightly connected to the drive.
Invalid Cmd Code	Invalid Command Code when communicating
Invalid Address	Invalid Address when communicating
Invalid Data	Invalid Data when communicating
Slave Comm Fault	Slave Comm Fault device failure
Comm Time-Out	Communication Time Out
Drive Error	Drive model doesn't match keypad
EEPROM Fault	When the copy function is enabled (P 9.40), there is a Read/Write EEPROM Fault

Warning Messages	
Error Name	**Description**
Rating Mismatch	Data range doesn't match
Group# Overflow	When the copy function is enabled (P 9.40), keypad's group number data is more than the drive's.
No Space	When the copy function is enabled (P 9.40),EEPROM data block in the keypad is full.
Delete Failure	When the copy function is enabled (P 9.40), delete EEPROM block fails.
No Data	When the copy function is enabled (P 9.40), EEPROM data block is null.
R1 Detect Error Failure to detect motor resistance during Auto-tune procedure	1. Check to make sure the motor is connected to the drive correctly. 2. Check line power to drive 3. STOP key was pressed during Auto-Tune procedure
No Load Error Failure to detect any motor load during Auto-tune procedure	1. Check to make sure the motor is connected to the drive correctly. 2. Check line power to drive 3. STOP key was pressed during Auto-Tune procedure
Copy Error-COMMS Communications error during Copy Keypad function	1.Check connection between the keypad and drive and make sure it is not loose 2. Check communications protocol for correct settings
Copy Error-Data Data error during Copy Keypad function	1. Check connection between the keypad and drive and make sure it is not loose 2. Check communications protocol for correct settings

Warning Messages	
Error Name	**Description**
Overheat Warning The AC drive temperature has exceeded 85% of the Over-temperature condition.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects on the heat sinks and check for possible dirty heat sink fins. 4. Provide enough spacing for adequate ventilation.
Write Failure	When the copy function is enabled (P 9.40),Write to EEPROM fails.
Parameter Locked	Parameters have been locked: read only - cannot be set/cannot write.
--- ERR ---	Error: The configuration is not accepted, or the parameter is locked.
Value Accepted	Value Accepted.
Error: Duplicate Function	This occurs when attempting to set two mutually exclusive parameters to the same value. This is most commonly seen when P4.00 and P4.13 are both set to the same value. (Firmware version 1.04 or higher only.)

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ACCESSORIES



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Accessories Part Numbering

With the exception of EMI filters, RF filters, and LR series line reactors, each accessory part number begins with GS, followed by the AC Drive rating, and then the relevant accessory code. Following the accessory code, you will find a description code when applicable. The diagram below shows the accessory part numbering system.

GS Series-specific Part Number Explanation

GS - 22P0 - LR - 3PH

Description Code (optional)
1PH: Single phase **3PH**: Three phase **ENC**: Enclosure
Blank: For reactor, blank = 3-phase

Accessory Code
BR: Braking resistor **BZL**: Bezel **CBL**: Cable
DBU: Dynamic Brake Unit **EDRV**: Ethernet board
FB: Feedback board **FKIT**: Fuse Kit
FUSE: Replacement fuses for FKIT **KPD**: Keypad
LR: Line reactor (legacy) **RS**: Recommended Standard

Horsepower Rating
Example: **2P0** = 2.0 hp **7P5** = 7.5 hp **010** = 10 hp

Voltage Rating
1: 115V **2**: 230V **4**: 460V **5**: 575V

Series
GS: All GS and DURApulse Series Drives
GS1: GS1 Series **GS2**: GS2 Series
GS3: DURApulse Series
LR: Newer line reactor series

Line Reactors

Input line reactors protect the AC drive from transient overvoltage conditions typically caused by utility capacitor switching. Input line reactors also reduce the harmonics associated with AC drives, and are recommended for all installations.

Output line (load) reactors protect the motor insulation against AC drive short circuits and IGBT reflective wave damage, and also allow the motor to run cooler by "smoothing" the motor current waveform. They are recommended for operating "non-inverter-duty" motors, and for any motors when the length of wiring between the AC drive and motor exceeds 75 feet.

There are two types of AutomationDirect line reactors that can be used with *DURAPULSE* GS3 AC Drives; the original GS series reactors (legacy) and the newer LR series reactors.

LR series reactors have universal mounting feet with multiple mounting slots, and they can replace most reactors using the existing mounting holes. Use four bolts to mount the reactors to the mounting panel.

Line Reactors – LR Series

Line Reactors – LR Series								
Part Number	**Rated Amps**	**Imped -ance**	**Inductance**	**Watt Loss**	**System Voltage**	**Phase – Use***	**GS3 Drive Model**	**Drive hp**
LR-21P0-1PH **	8	3%	2.29 mH	15.9	240	1 – In	GS3-21P0	1
LR-22P0-1PH **	12		1.53 mH	24.3			GS3-22P0	2
LR-23P0-1PH **	17		1.08 mH	27.3			GS3-23P0	3
LR-21P0	4.6		2.46 mH	11	208/240	3 – I/O	GS3-21P0	1
LR-22P0	7.5		1.35 mH	21			GS3-22P0	2
LR-23P0	10.6		0.97 mH	38			GS3-23P0	3
LR-25P0	16.7		0.626 mH	48			GS3-25P0	5
LR-27P5	24.2		0.434 mH	65			GS3-7P5	7.5
LR-2010	30.8		0.342 mH	96			GS3-2010	10
LR-2015	46.2		0.22 mH	64			GS3-2015	15
LR-2020	59.4		0.172 mH	85			GS3-2020	20
LR-2025	74.8		0.138 mH	94			GS3-2025	25
LR-2030	88		0.116 mH	135			GS3-2030	30
LR-2040	114		0.0886 mH	149			GS3-2040	40
LR-2050	143		0.0699 mH	154			GS3-2050	50
LR-41P0	2.1		8.927 mH	10.4	480		GS3-41P0	1
LR-42P0	3.4		5.79 mH	19			GS3-42P0	2
LR-43P0	4.8		4.27 mH	23			GS3-43P0	3
LR-45P0	7.6		2.77 mH	49			GS3-45P0	5
LR-47P5	11		1.68 mH	40			GS3-47P5	7.5
LR-4010	14		1.29 mH	64			GS3-4010	10
LR-4015	21		0.912 mH	65			GS3-4015	15
LR-4020	27		0.694 mH	79			GS3-4020	20
LR-4025	34		0.569 mH	96			GS3-4025	25
LR-4030	40		0.469 mH	105			GS3-4030	30
LR-4040	52		0.387 mH	114			GS3-4040	40
LR-4050	65		0.295 mH	114			GS3-4050	50
LR-4060	77		0.227 mH	169			GS3-4060	60
LR-4075	96		0.196 mH	193			GS3-4075	75
LR-4100	124		0.152 mH	225			GS3-4100	100

**** Use: In = input side of drive only; I/O = input or output side of drive.***

***** Single phase line reactors should NOT be installed on the output side of the AC drive.***

Line Reactors – LR Series (continued)

Line Reactors – LR Series – Additional Specifications						
Part Number	Wire Range	Terminal Torque	Fasteners	Temperature Range		Environment
				Operating	Storage	
LR-21P0-1PH	#12–#18 AWG	10 lb·in	#6-32x5/16in flathead screw	-40 – 104 °F [-40 – 40 °C]	-40 – 149 °F [-40 – 65 °C]	NEMA: open IP00 no corrosive gases
LR-22P0-1PH		20 lb·in				
LR-23P0-1PH			1/4in-28x3/8in setscrew			
LR-21P0		10 lb·in	#6-32x5/16in flathead screw			
LR-22P0						
LR-23P0						
LR-25P0	#18–#4 AWG	20 lb·in	1/4in-28x3/8in setscrew			
LR-27P5						
LR-2010						
LR-2015						
LR-2020						
LR-2025		#18–#16 AWG: 25 lb·in #14–#6 AWG: 30 lb·in #4 AWG: 35 lb·in	captive Phillips screw			
LR-2030	2/0 – #6AWG (AL or CU)	120 lb·in	7/16in-20x5/8in setscrew			
LR-2040						
LR-2050	250kcmil – #6AWG (AL or CU)	275 lb·in				
LR-41P0	#12–#18 AWG	10 lb·in	#6-32x5/16in flathead screw			
LR-42P0						
LR-43P0						
LR-45P0						
LR-47P5						
LR-4010						
LR-4015	#18–#4 AWG	20 lb·in	1/4in-28x3/8in setscrew			
LR-4020						
LR-4025						
LR-4030						
LR-4040						
LR-4050	#22–#4 AWG	#22–#16 AWG: 25 lb·in #14–#6 AWG: 30 lb·in #4 AWG: 35 lb·in	captive Phillips screw			
LR-4060						
LR-4075	2/0 – #6AWG (AL or CU)	120 lb·in	7/16in-20x5/8in setscrew			
LR-4100	250kcmil – #6AWG (AL or CU)	275 lb·in	5/8in-18x7/8in setscrew			

Line Reactors – Legacy GS Series (do not use for new installations)

Line Reactors – GS Series					
230 VOLT Class – Three Phase					
Part Number	**Rated HP**	**Rated Amps**	**Impedance**	**Inductance**	**Watts Loss**
GS-21P0-LR-3PH	1	5	3%	3.00 mH	7
GS-22P0-LR-3PH	2	7	3%	1.50 mH	11
GS-23P0-LR-3PH	3	11	3%	1.30 mH	23
GS-25P0-LR	5	17	3%	0.80 mH	19
GS-27P5-LR	7.5	25	3%	0.50 mH	23
GS-2010-LR	10	33	3%	0.40 mH	36
GS-2015-LR	15	49	3%	0.30 mH	33
GS-2020-LR	20	65	3%	0.25 mH	39
GS-2025-LR	25	75	3%	0.20 mH	88
GS-2030-LR	30	90	3%	0.20 mH	88
GS-2040-LR	40	120	3%	0.10 mH	95
GS-2050-LR	50	145	3%	0.10 mH	95

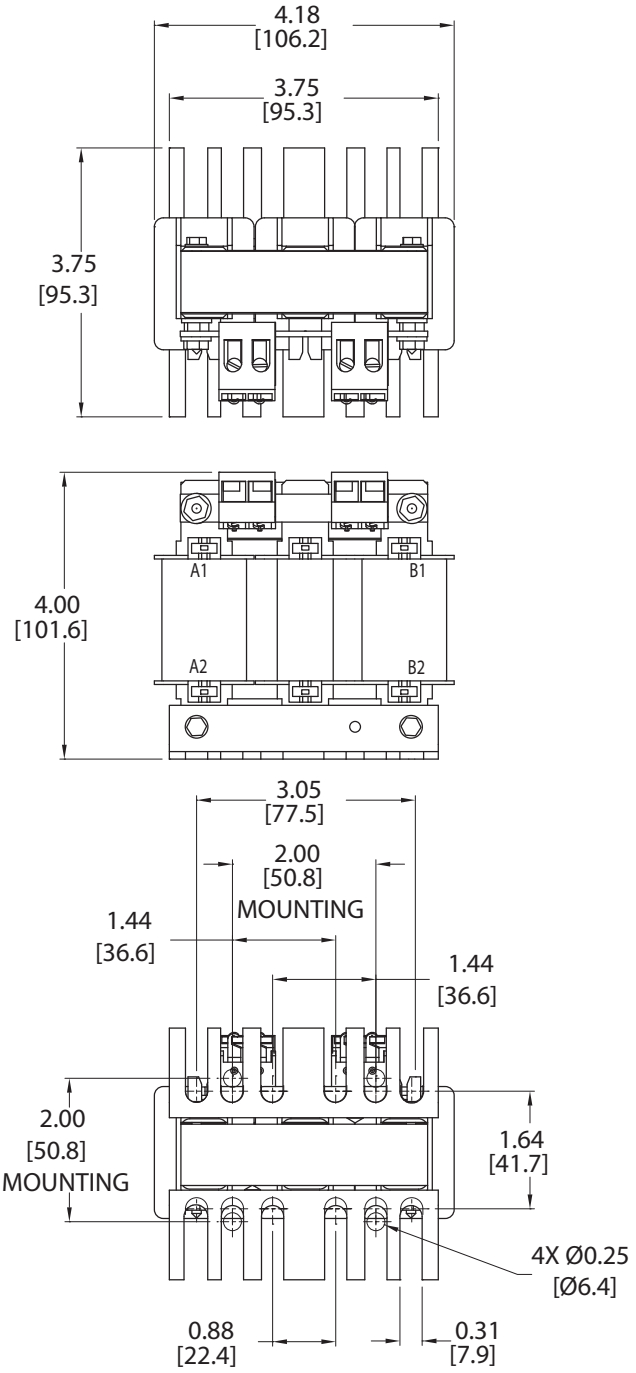
Line Reactors – GS Series					
460 VOLT Class – Three Phase					
Part Number	**Rated HP**	**Rated Amps**	**Impedance**	**Inductance**	**Watts Loss**
GS-41P0-LR	1	2	3%	12.0 mH	7
GS-42P0-LR	2	4	3%	6.50 mH	13
GS-43P0-LR	3	8	3%	5.00 mH	31
GS-45P0-LR	5	8	3%	3.00 mH	25
GS-47P5-LR	7.5	12	3%	2.50 mH	26
GS-4010-LR	10	18	3%	1.50 mH	29
GS-4015-LR	15	24	3%	1.20 mH	44
GS-4020-LR	22	32	3%	0.80 mH	51
GS-4025-LR	25	38	3%	0.80 mH	51
GS-4030-LR	30	45	3%	0.70 mH	64
GS-4040-LR	40	60	3%	0.50 mH	75
GS-4050-LR	50	73	3%	0.40 mH	138
GS-4060-LR	60	91	3%	0.40 mH	138
GS-4075-LR	75	105	3%	0.30 mH	123
GS-4100-LR	100	145	3%	0.20 mH	115

Line Reactor Dimensions – LR Series

LR-21P0-1PH

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

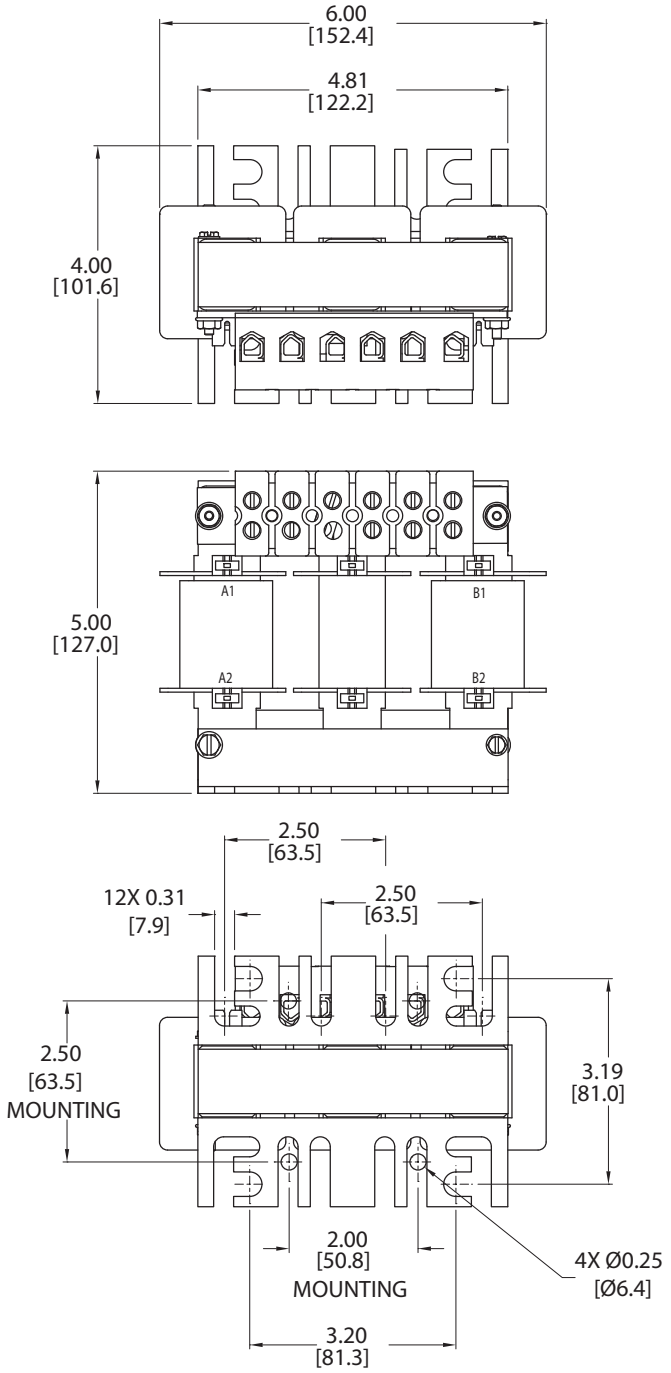


Line Reactor Dimensions – LR Series (continued)

LR-22P0-1PH, LR-23P0-1PH

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

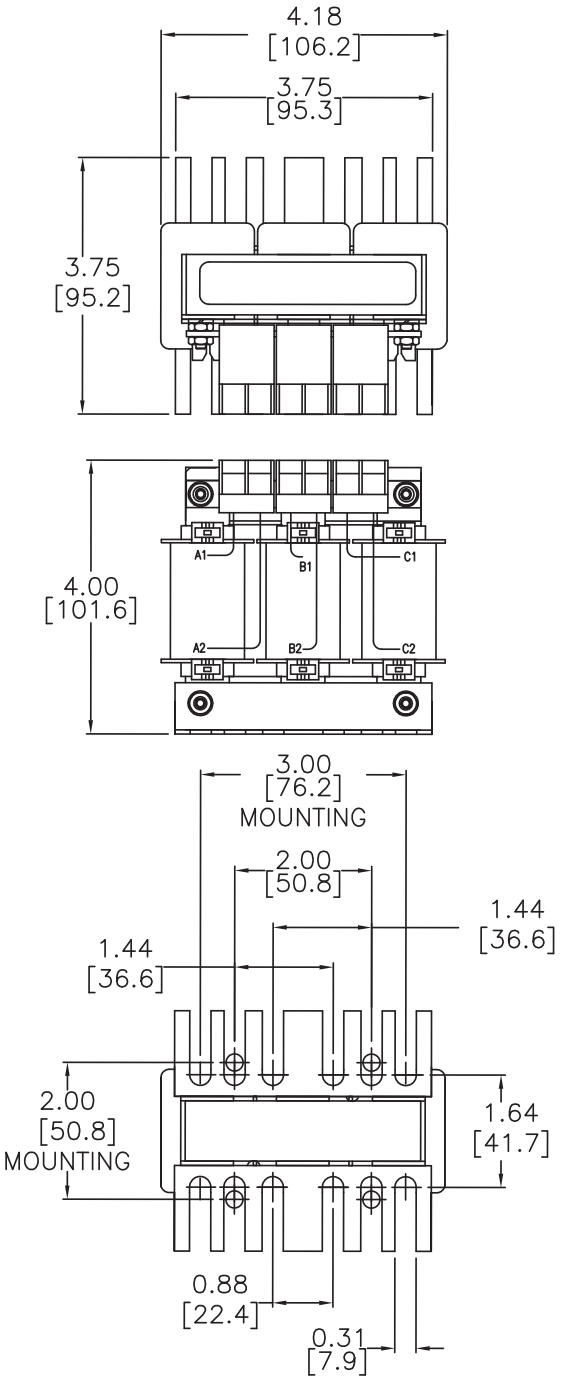


Line Reactor Dimensions – LR Series (continued)

LR-21P0, LR-22P0, LR-23P0, LR-41P0, LR-42P0, LR-43P0, LR-45P0, LR-47P5, LR-4010

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

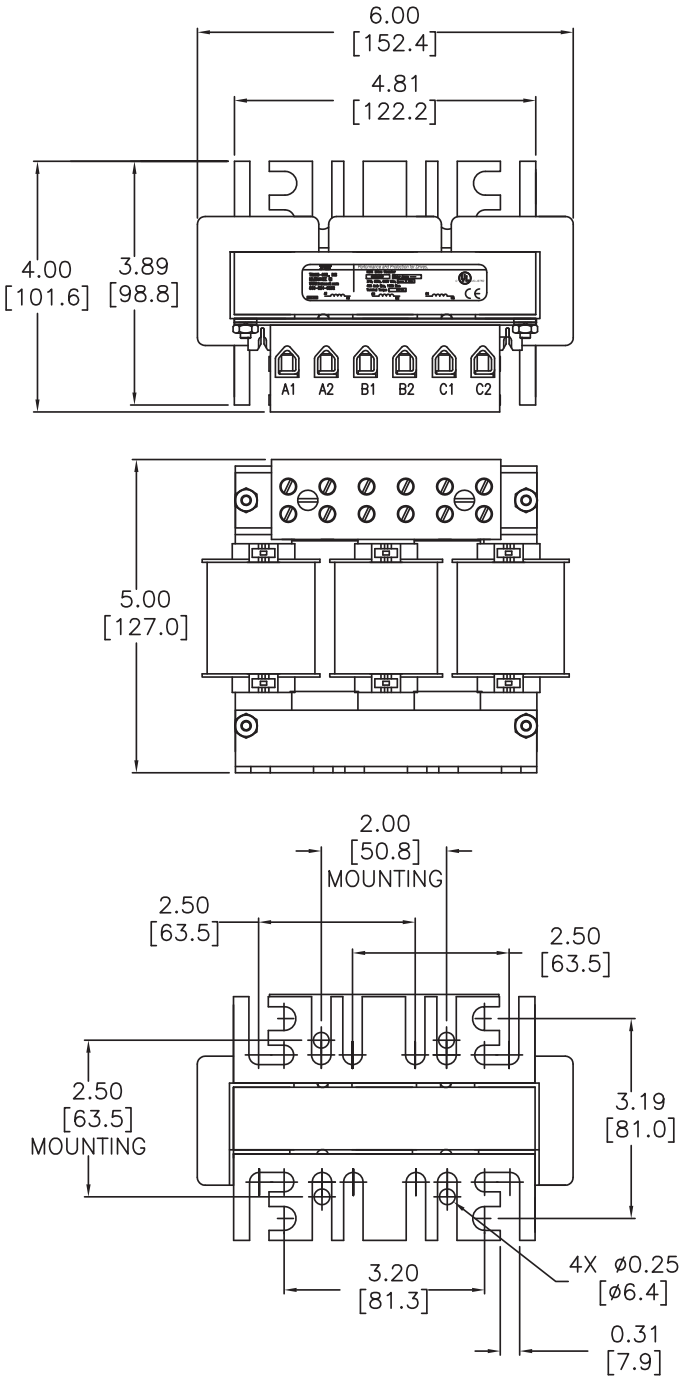


Line Reactor Dimensions – LR Series (continued)

LR-25P0, LR-27P5, LR-4015, LR-4020

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

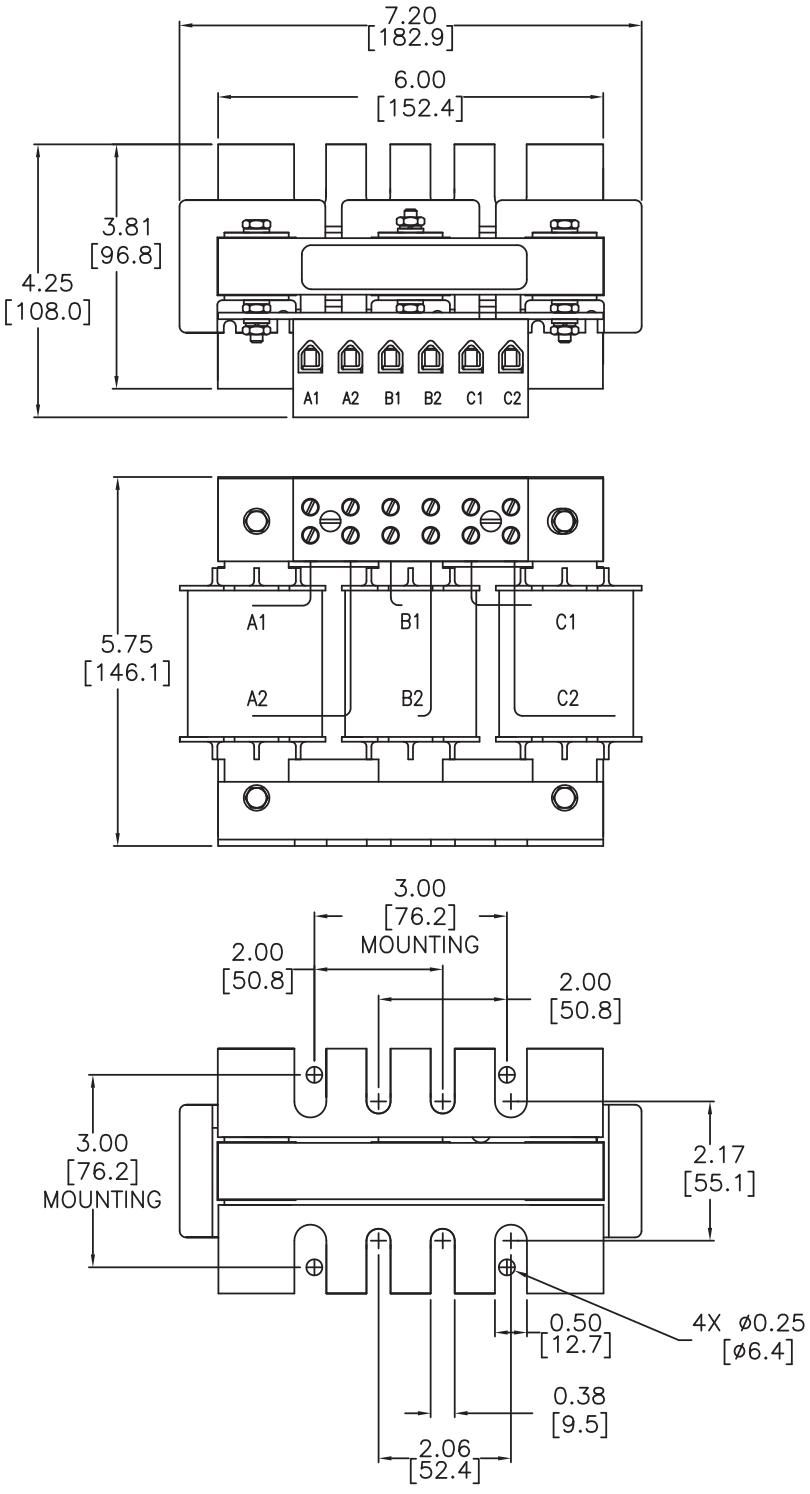


Line Reactor Dimensions – LR Series (continued)

LR-2010, LR-2015, LR-2020, LR-4025, LR-4030

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

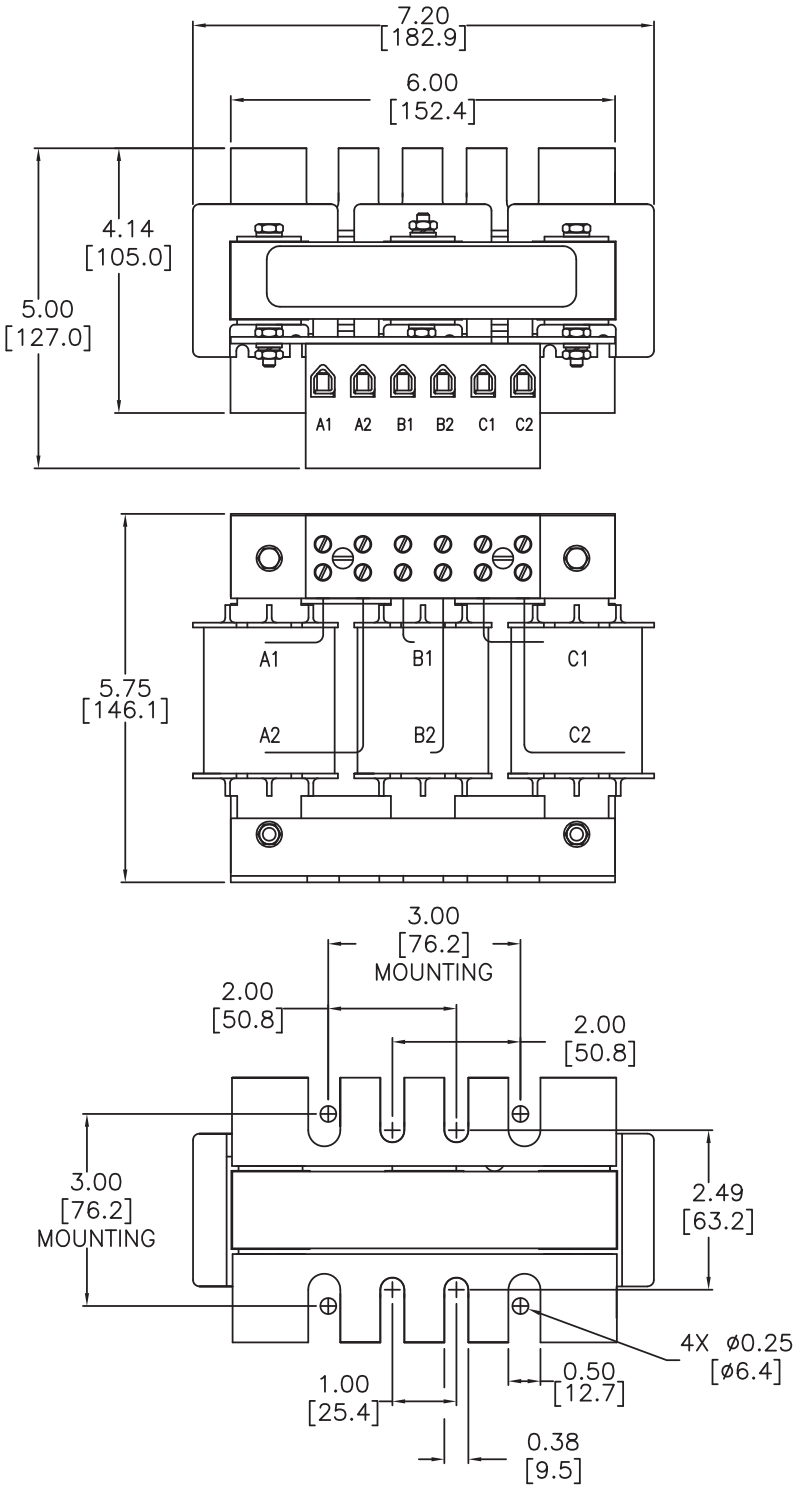


Line Reactor Dimensions – LR Series (continued)

LR-2025, LR-4040

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

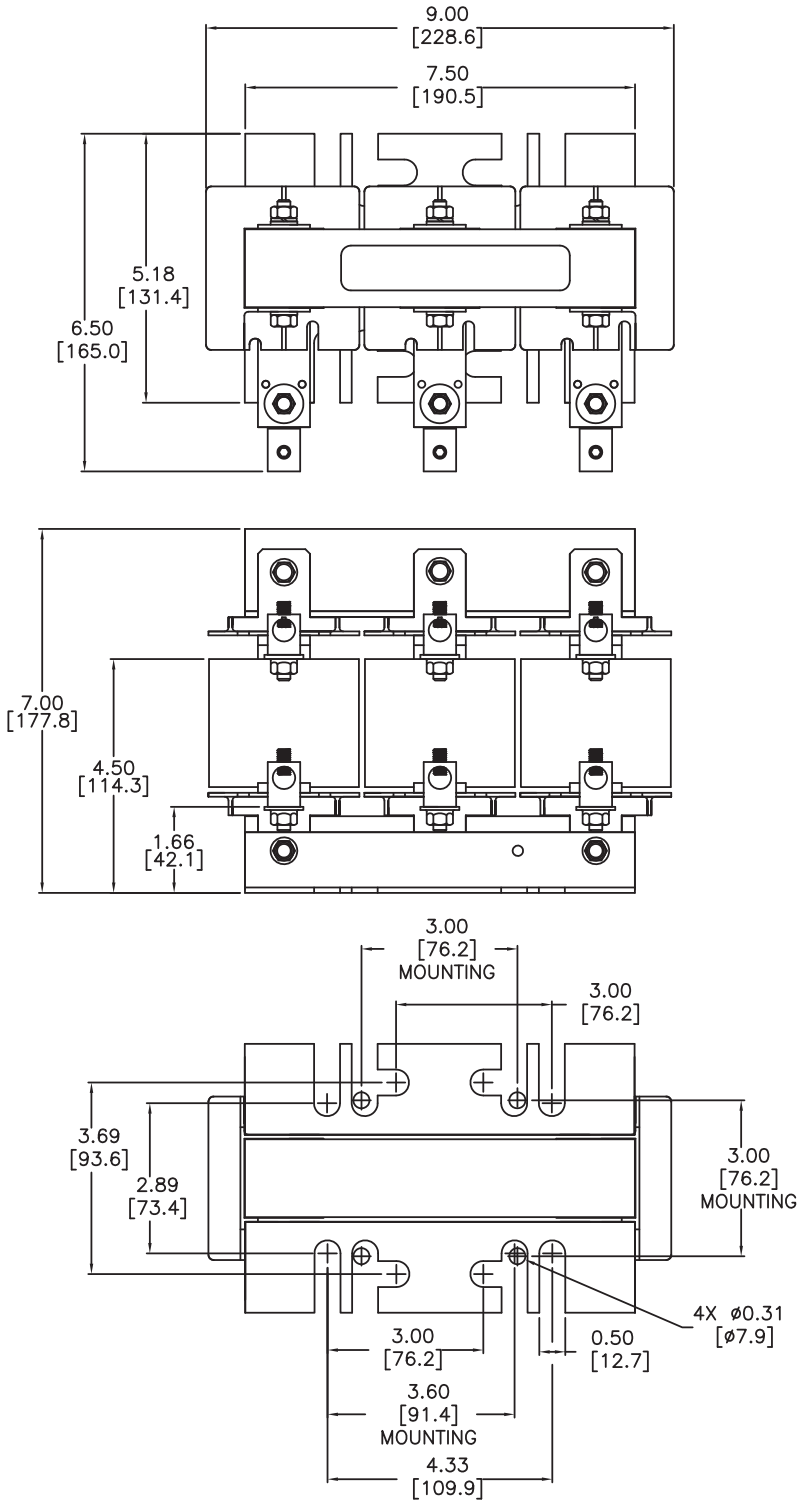


Line Reactor Dimensions – LR Series (continued)

LR-2030, LR-2040, LR-4075

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

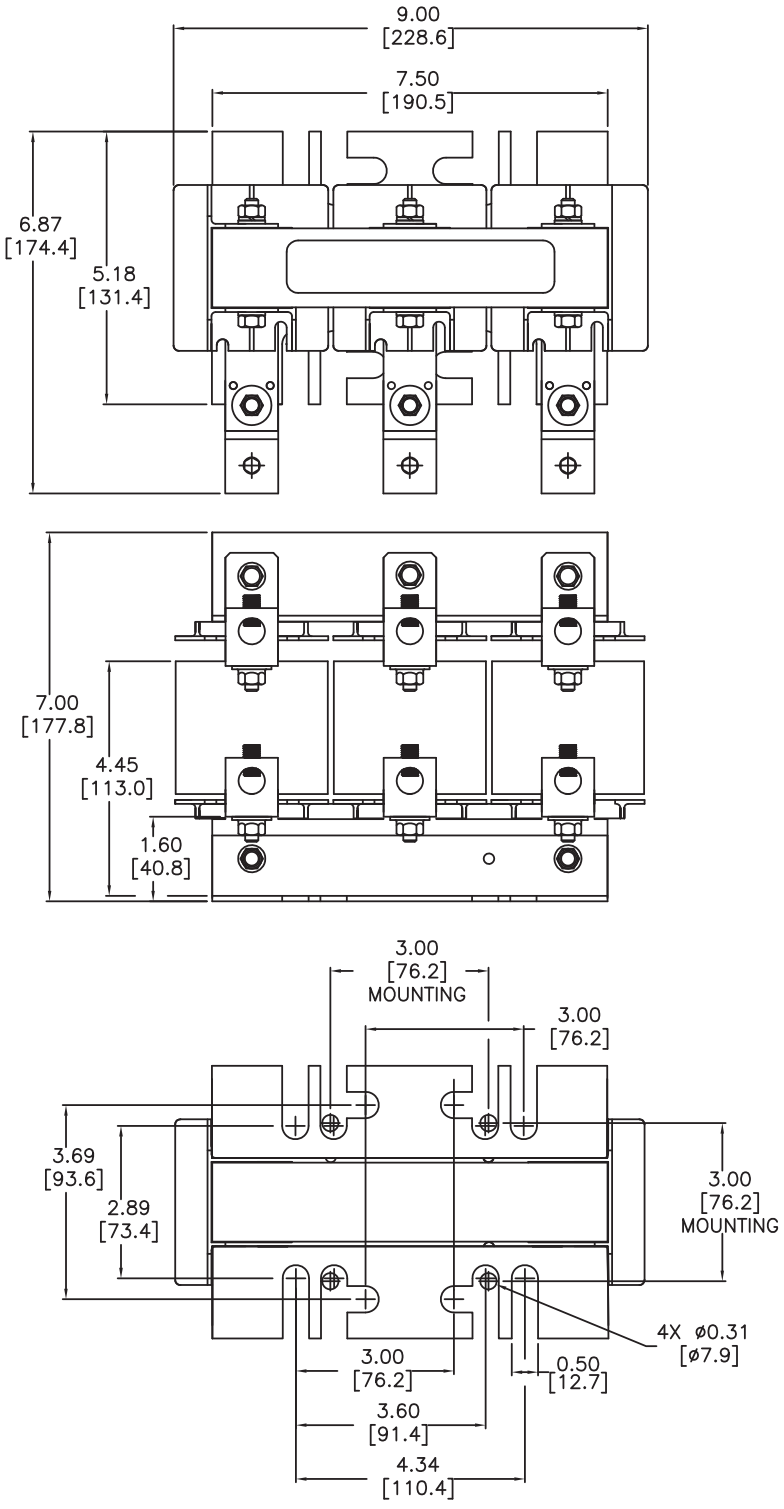


Line Reactor Dimensions – LR Series (continued)

LR-2050

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

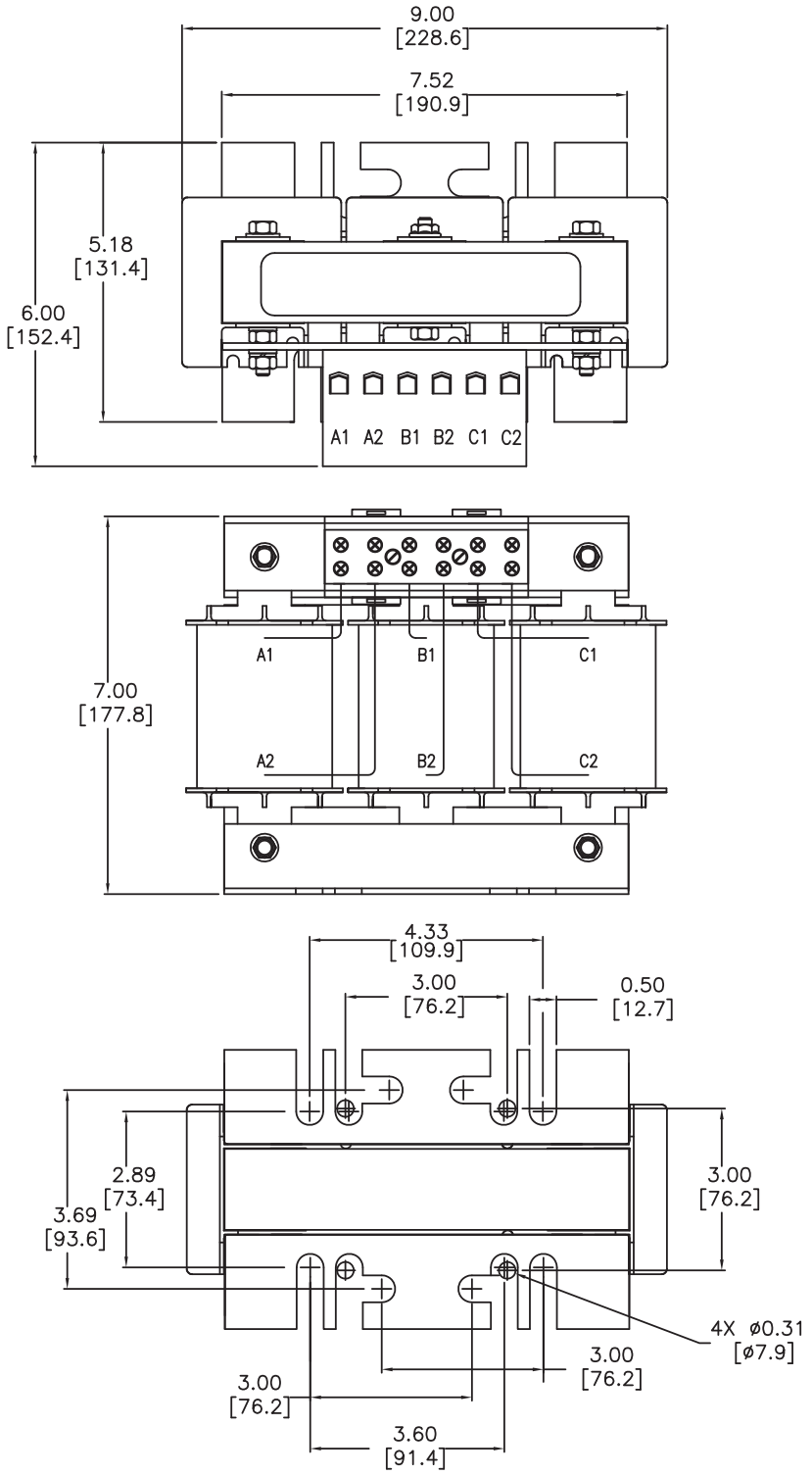


Line Reactor Dimensions – LR Series (continued)

LR-4050, LR-4060

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])

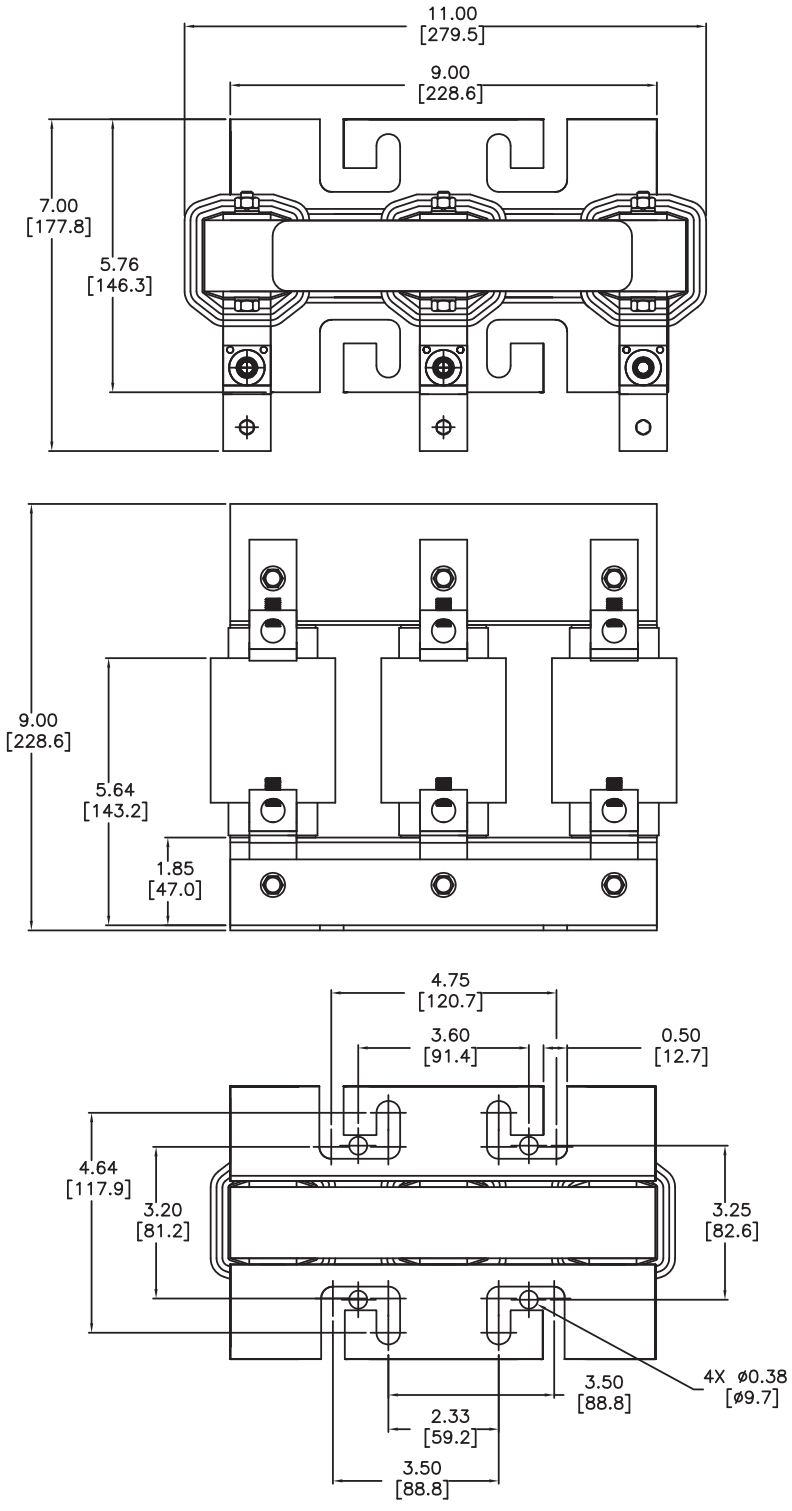


Line Reactor Dimensions – LR Series (continued)

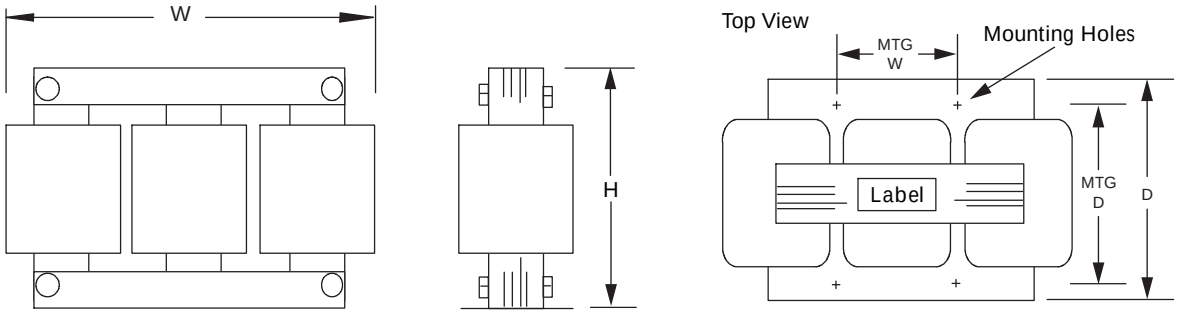
LR-4100

Mounting feet with multiple mounting slots allow replacement of most other reactors using existing mounting holes. Use four bolts to mount the LR reactors.

(Units = inches [mm])



Line Reactor Dimensions – Legacy GS Series (not for new installations)



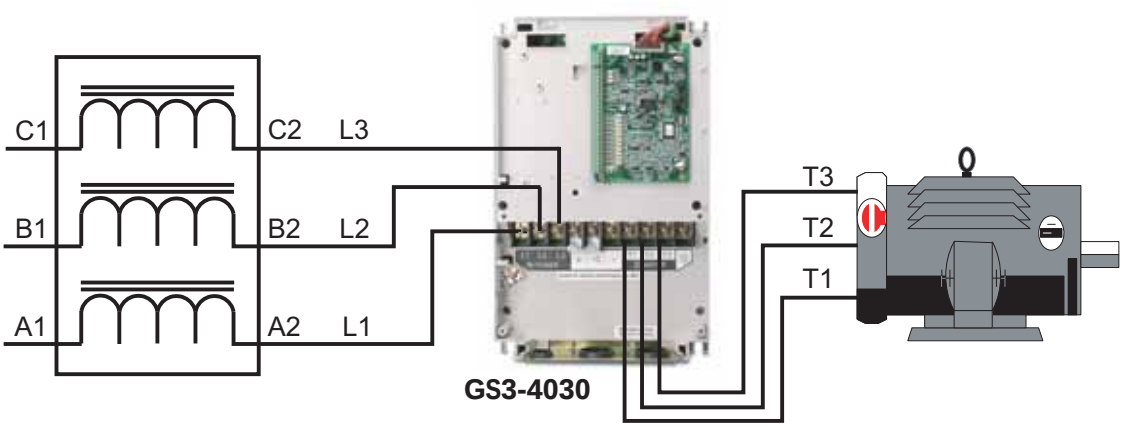
AC Line Reactor Dimensions

AC Line Reactor Dimensions – GS Series (inches)							
Part Number	**H**	**W**	**D**	**Mtg D**	**Mtg W**	**Mtg Slot Hole Size**	**Weight (lb)**
GS-21P0-LR-1PH	3.40	4.40	2.83	1.77	1.44	0.28 x 0.63	2.80
GS-21P0-LR-3PH	3.40	4.40	2.83	1.77	1.44	0.28 x 0.63	2.30
GS-22P0-LR-1PH	4.80	6.00	3.30	2.09	2.00	0.28 x 0.63	7.10
GS-22P0-LR-3PH	3.40	4.40	2.83	1.77	2.00	0.28 x 0.63	2.80
GS-23P0-LR-1PH	4.80	6.00	3.30	2.09	2.00	0.28 x 0.63	7.50
GS-23P0-LR-3PH	3.40	4.40	2.83	1.77	2.00	0.28 x 0.63	2.90
GS-25P0-LR	4.80	6.00	3.30	2.09	2.00	0.28 x 0.63	7.10
GS-27P5-LR	5.70	6.00	3.09	2.09	3.00	0.28 x 0.63	7.00
GS-2010-LR	5.70	6.00	3.34	2.34	3.00	0.28 x 0.63	9.00
GS-2015-LR	5.70	6.00	3.84	2.84	3.00	0.28 x 0.63	13..0
GS-2020-LR	5.70	6.00	3.84	2.84	3.00	0.28 x 0.63	12.0
GS-2025-LR	6.88	8.50	4.37	3.12	3.60	0.44 x 1.00	26.0
GS-2030-LR	6.88	8.50	4.37	3.12	3.60	0.44 x 1.00	26.0
GS-2040-LR	6.88	8.50	4.37	3.12	3.00	0.44 x 1.00	27.0
GS-2050-LR	6.88	8.50	4.37	3.12	3.00	0.44 x 1.00	27.0
GS-41P0-LR	3.40	4.40	2.83	1.77	1.44	0.28 x 0.63	2.30
GS-42P0-LR	3.40	4.40	2.83	1.77	1.44	0.28 x 0.63	2.80
GS-43P0-LR	3.40	4.40	3.39	2.39	2.00	0.28 x 0.63	4.30
GS-45P0-LR	3.40	4.40	2.83	1.77	2.00	0.28 x 0.63	3.10
GS-47P5-LR	4.80	6.00	3.30	2.09	2.00	0.28 x 0.63	7.50
GS-4010-LR	4.80	6.30	3.55	2.34	2.00	0.28 x 0.63	9.10
GS-4015-LR	5.70	6.00	3.34	2.34	3.00	0.28 x 0.63	10.0
GS-4020-LR	5.61	6.90	3.95	2.75	3.00	0.38 x 0.63	17.0
GS-4025-LR	5.61	6.90	3.95	2.75	3.00	0.38 x 0.63	17.0
GS-4030-LR	5.61	6.90	4.45	3.25	3.00	0.38 x 0.63	22.0
GS-4040-LR	6.88	8.50	4.37	3.12	3.00	0.44 x 1.00	26.0
GS-4050-LR	6.88	8.50	4.87	3.62	3.60	0.44 x 1.00	36.0
GS-4060-LR	6.88	8.50	4.87	3.62	3.60	0.44 x 1.00	36.0
GS-4075-LR	8.29	10.50	5.35	3.73	3.60	0.44 x 1.00	52.0
GS-4100-LR	8.29	10.50	5.35	3.73	3.60	0.44 x 1.00	41.0

Line Reactor Applications and Wiring Connections

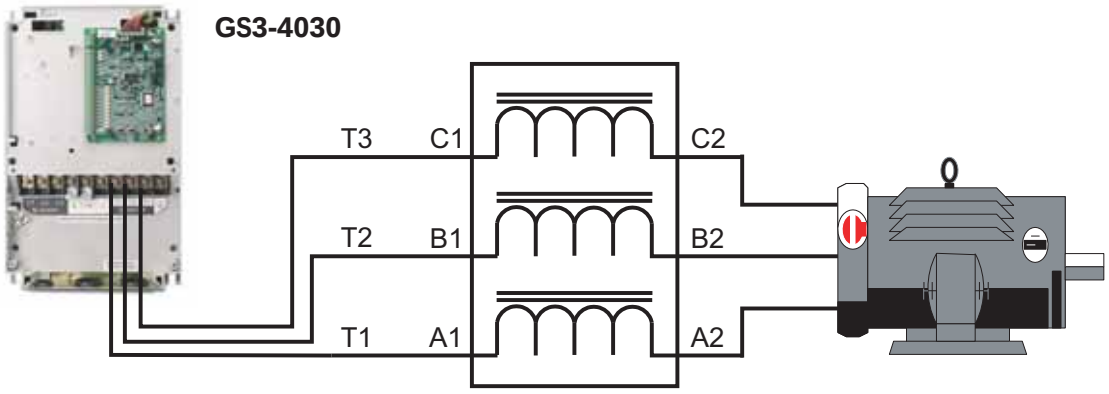
Input Side of AC Drive

When installed on the input side of the AC Drive, line reactors will reduce line notching, limit current and voltage spikes and surges from the incoming line, and reduce the available short circuit current. The line reactors will also reduce harmonic distortion from the AC Drive onto the line. Units are installed in front of the AC Drive as shown.



Output Side of AC Drive

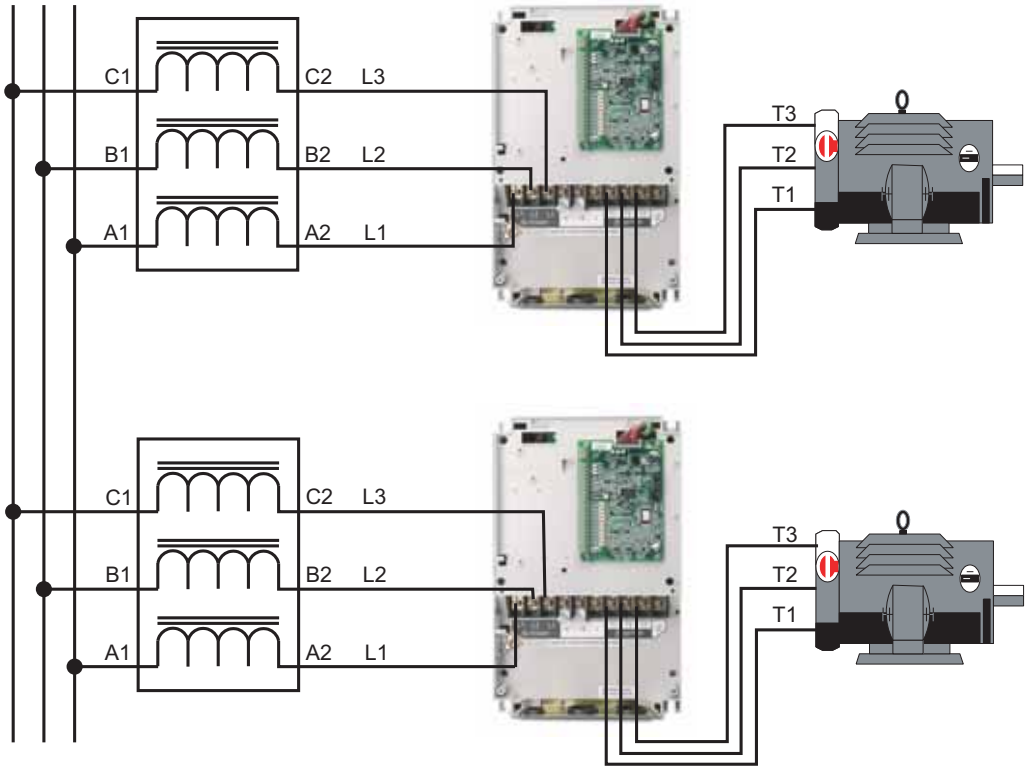
When installed on the output side of the AC Drive, line (load) reactors protect the AC Drive from short circuits at the load. Voltage and current waveforms from the AC Drive are enhanced, reducing motor overheating and noise emissions.



Single phase line reactors should not be installed on the output side of an AC Drive. Use only three-phase reactors on drive outputs, and only for three-phase motors.

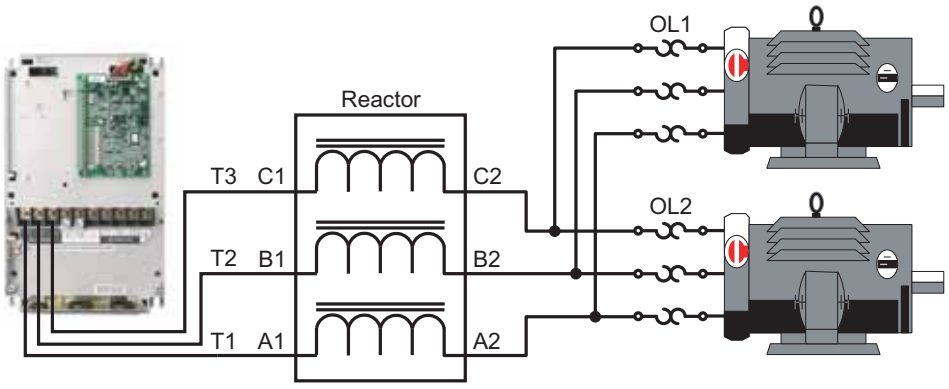
Multiple AC Drives

Individual line reactors are recommended when installing multiple AC Drives on the same power line. Individual line reactors eliminate cross-talk between multiple AC Drives and provide isolated protection for each AC Drive for its own specific load.



Multiple Motors

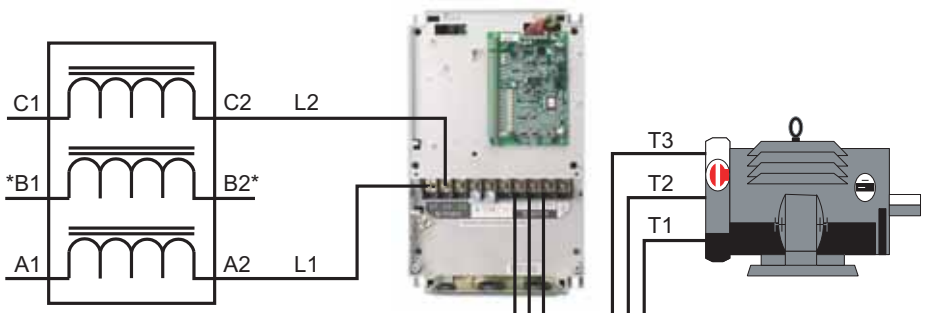
A single output (load) reactor can be used for multiple motors on the same AC Drive, but only if the motors operate simultaneously. Size the reactor based upon the total horsepower of all the motors, and select a reactor with a current rating greater than the sum of the motor full-load currents. Overload relays are recommended for use in multi-motor applications.



A single reactor should be used with multiple motors ONLY when the motors will operate simultaneously from a single AC drive. OVERLOAD RELAYS are recommended for use in multiple motor applications.

Single-Phase Applications

Some of the line reactors are listed for use with single-phase input power. Follow the connection diagram shown below. Make sure that terminals B1 and B2, if present, are properly insulated before any connections are made.



*GS series 1-phase reactors include a B-phase winding.
*LR series 1-phase reactors do not include a B-phase winding.

WARNING: Ensure that you properly insulate terminals B1 and B2 before making any connections to single-phase power.

Braking Units and Braking Resistors

Braking units are used to absorb the motor regeneration energy when the motor stops by deceleration. With the braking unit, the regeneration energy is dissipated by braking resistors. Our braking units are suitable for 230V and 460V *DURAPULSE* drives, and must be used in conjunction with GS series braking resistors to provide the best braking results.

To avoid possible injury, please refer to the dynamic braking manual, GS3-DB-M, before wiring.

Braking Units

AC Drive		Brake Unit		Braking Resistor			Torque	O/L
Voltage Class	AC Drive Part No.	QTY	Brake Unit Part No.	QTY	Resistor Part No.	Resistor Specification for Each Braking Unit	Braking Torque 10% Duty Cycle	Typical Thermal Overload Relay Value
230V	GS3-2020	1	GS-2DBU	1	GS-2020-BR-ENC	3000W 10Ω	125%	30A
	GS3-2025	1		1	GS-2025-BR-ENC	4800W 8Ω	125%	35A
	GS3-2030	1		1	GS-2030-BR-ENC	4800W 6.8Ω	125%	40A
	GS3-2040	2		2	GS-2040-BR-ENC	3000W 10Ω	125%	30A
	GS3-2050	2		2	GS-2050-BR-ENC	4800W 8Ω	125%	30A
460V	GS3-4020	1	GS-4DBU	1	GS-4020-BR-ENC	1500W 40Ω	125%	15A
	GS3-4025	1		1	GS-4025-BR-ENC	4800W 32Ω	125%	15A
	GS3-4030	1		1	GS-4030-BR-ENC	4800W 27.2Ω	125%	20A
	GS3-4040	1		1	GS-4040-BR-ENC	6000W 20Ω	125%	30A
	GS3-4050	1		1	GS-4050-BR-ENC	9600W 16Ω	125%	40A
	GS3-4060	1		1	GS-4060-BR-ENC	9600W 13.6Ω	125%	50A
	GS3-4075	2		2	GS-4075-BR-ENC	6000W 20Ω	125%	30A
	GS3-4100	2		2	GS-410 0-BR-ENC	9600W 13.6Ω	125%	50A

Dynamic Brake Unit Terminal Specifications

Dynamic Brake Unit Terminal Specifications				
Circuit	Terminal Mark	Wire Gauge AWG/mm^2	Terminal	Torque
Power Input Circuit	+ (P), – (N)	10 ~12AWG/3.5~5.5mm^2	M4 Screw	18 kg·cm
Braking Resistor	B1, B2			
Slave and Fault Circuit	M1, M2	20~18AWG/0.25~0.75mm^2 M1, M2, S1, S2 with shielded wires	M2 Screw	4 kg·cm
	S1, S2			
	RA, RB, RC			

Dynamic Brake Unit General Specifications

Dynamic Brake Unit Specifications			
Model		**230V Class**	**460V Class**
Part Number		GS-2DBU	GS-4DBU
Max. Motor Capacity HP (KW)		30 (22)	60 (45)
Output Rating	**Max. Peak Discharge Current (A) 10% ED (Duty Cycle)**	60	60
	Continuous Discharge Current (A)	20	18
	Braking Start-up Voltage (DC)	330/345/360/380/400/415 ±3V	660/690/720/760/800/830 ±6V
	Maximum On-Time	60 seconds	60 seconds
Input Rating	**DC Voltage**	200~400 VDC	400~800 VDC
Protection	**Heat Sink Overheat**	Temperature over +95 °C (203 °F)	
	Alarm Output	Relay contact 5A @ 120VAC/28VDC (RA, RB, RC)	
	Power CHARGE LED (Green)	ON until the bus (P-N) voltage is below 50VDC	
	Braking ACT LED (Yellow)	ON during braking	
	Fault ERR LED (Red)	ON if a fault has occurred	
Usage Environment	**Installation Location**	Indoor (no corrosive gases, metallic dust)	
	Operating Temperature	-10 °C to +50 °C (14 °F to 122 °F)	
	Storage Temperature	-20 °C to +60 °C (-4 °F to 140 °F)	
	Humidity	90% Non-condensing	
	Vibration	9.8m/s^2 (1G) under 20 2m/s^2 (0.2G) @ 20~50Hz	
Mechanical Configuration		Wall-mounted enclosed type IP50	

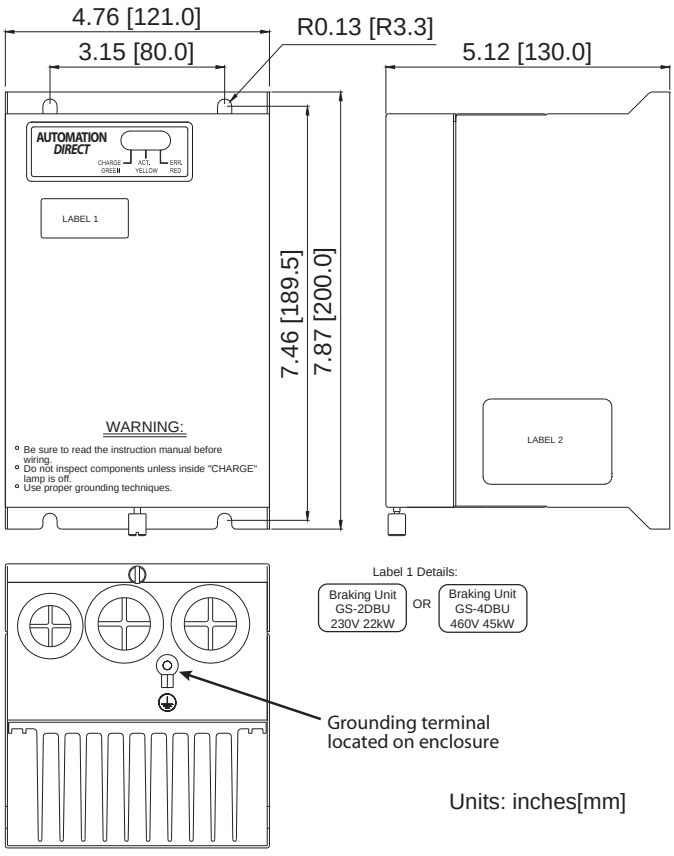
Braking Unit Wiring

For information on braking unit wiring, refer to the power wiring diagrams in "Chapter 2: Installation and Wiring" of this manual, and to the *DURAPULSE* Dynamic Braking Units User Manual GS3-DB-M.

Braking Unit Dimensions

Part Numbers: GS-2DBU, GS-4DBU





For more information regarding brake units, please refer to the brake unit user manual GS3-DB-M

Braking Resistors

Braking resistors are used to increase the control torque of the AC Drive, for frequently repeated ON-OFF cycles of the AC Drive, or for decelerating a load with large inertia.

Braking Resistor Specifications

Braking Resistor Specifications								
Voltage Class	AC Drive Model	Qty	Braking Resistor Part Number	Motor HP	Braking Torque ED 10%	Type (Ohms)	Power (W)	Duty Cycle
230V	GS3-21P0	1	GS-21P0-BR	1	125%	200Ω	80	10%
	GS3-22P0	1	GS-22P0-BR	2	125%	100Ω	300	10%
	GS3-23P0	1	GS-23P0-BR	3	125%	70Ω	300	10%
	GS3-25P0	1	GS-25P0-BR	5	125%	40Ω	400	10%
	GS3-27P5	1	GS-27P5-BR	7.5	125%	30Ω	500	10%
	GS3-2010	1	GS-2010-BR-ENC	10	125%	20Ω	1000	10%
	GS3-2015	1	GS-2015-BR-ENC	15	125%	13.6Ω	2400	10%
	GS3-2020	1	GS-2020-BR-ENC	20	125%	10Ω	3000	10%
	GS3-2025	1	GS-2025-BR-ENC	25	125%	8Ω	4800	10%
	GS3-2030	1	GS-2030-BR-ENC	30	125%	6.8Ω	4800	10%
	GS3-2040	2	GS-2040-BR-ENC	40	125%	10Ω	3000	10%
	GS3-2050	2	GS-2050-BR-ENC	50	125%	8Ω	4800	10%
460V	GS3-41P0	1	GS-41P0-BR	1	125%	750Ω	80	10%
	GS3-42P0	1	GS-42P0-BR	2	125%	400Ω	300	10%
	GS3-43P0	1	GS-43P0-BR	3	125%	250Ω	300	10%
	GS3-45P0	1	GS-45P0-BR	5	125%	150Ω	400	10%
	GS3-47P5	1	GS-47P5-BR	7.5	125%	100Ω	500	10%
	GS3-4010	1	GS-4010-BR	10	125%	75Ω	1000	10%
	GS3-4015	1	GS-4015-BR-ENC	15	125%	50Ω	1000	10%
	GS3-4020	1	GS-4020-BR-ENC	20	125%	40Ω	1500	10%
	GS3-4025	1	GS-4025-BR-ENC	25	125%	32Ω	4800	10%
	GS3-4030	1	GS-4030-BR-ENC	30	125%	27.2Ω	4800	10%
	GS3-4040	1	GS-4040-BR-ENC	40	125%	20Ω	6000	10%
	GS3-4050	1	GS-4050-BR-ENC	50	125%	16Ω	9600	10%
	GS3-4060	1	GS-4060-BR-ENC	60	125%	13.6Ω	9600	10%
	GS3-4075	2	GS-4075-BR-ENC	75	125%	20Ω	6000	10%
	GS3-4100	2	GS-4100-BR-ENC	100	125%	13.6Ω	9600	10%



For DURAPULSE drive models 20 hp and above, a dynamic braking unit must be used in conjunction with the braking resistor, as shown in the Braking Units and Braking Resistors table earlier in this chapter. For additional information, please refer to the dynamic braking manual, GS3-DB-M

Braking Resistor Wiring

For information on braking resistor wiring, refer to the power wiring diagrams in "Chapter 2: Installation and Wiring".

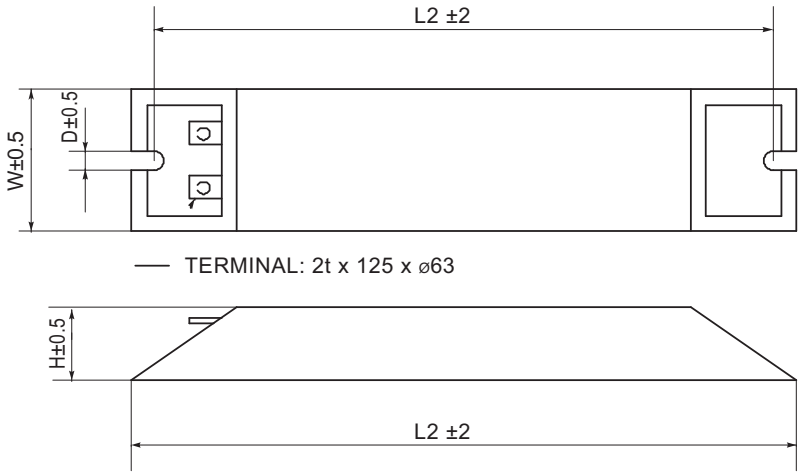
Braking Resistor Dimensions

Braking Resistor Dimensions				
Voltage Class	**AC Drive Model**	**Braking Resistor Part Number**	**Enclosure Type**	**Dimensions**
230V	GS3-21P0	GS-21P0-BR	none	Figure 1
	GS3-22P0	GS-22P0-BR		
	GS3-23P0	GS-23P0-BR		
	GS3-25P0	GS-25P0-BR		
	GS3-27P5	GS-27P5-BR	none	Figure 2
	GS3-2010	GS-2010-BR-ENC	GCE3	Figure 3
	GS3-2015	GS-2015-BR-ENC	GCE6	Figure 4
	GS3-2020	GS-2020-BR-ENC		
	GS3-2025	GS-2025-BR-ENC	GCE9	Figure 5
	GS3-2030	GS-2030-BR-ENC		
	GS3-2040	GS-2040-BR-ENC	(2) x GCE6	(2) x Figure 4
	GS3-2050	GS-2050-BR-ENC	(2) x GCE9	(2) x Figure 5
460V	GS3-41P0	GS-41P0-BR	none	Figure 1
	GS3-42P0	GS-42P0-BR		
	GS3-43P0	GS-43P0-BR		
	GS3-45P0	GS-45P0-BR		
	GS3-47P5	GS-47P5-BR	none	Figure 2
	GS3-4010	GS-4010-BR		
	GS3-4015	GS-4015-BR-ENC	GCE3	Figure 3
	GS3-4020	GS-4020-BR-ENC	GCE4	Figure 6
	GS3-4025	GS-4025-BR-ENC	GCE12	Figure 7
	GS3-4030	GS-4030-BR-ENC		
	GS3-4040	GS-4040-BR-ENC		
	GS3-4050	GS-4050-BR-ENC	GCE15	Figure 8
	GS3-4060	GS-4060-BR-ENC		
	GS3-4075	GS-4075-BR-ENC	(2) x GCE12	(2) x Figure 7
	GS3-4100	GS-4100-BR-ENC	(2) x GCE15	(2) x Figure 8

Braking Resistor Dimensions (continued)

Figure 1

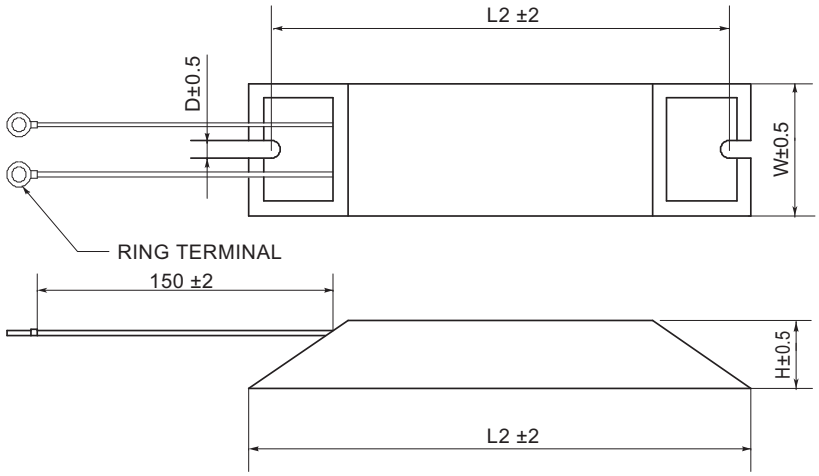
GS-21P0-BR
GS-22P0-BR
GS-23P0-BR
GS-25P0-BR
GS-41P0-BR
GS-42P0-BR
GS-43P0-BR
GS-45P0-BR



Resistor Part Number	L1 (mm)	L2 (mm)	H (mm)	D (mm)	W (mm)
GS-21P0-BR	140	125	20	5.3	60
GS-22P0-BR	215	200	30	5.3	60
GS-23P0-BR	215	200	30	5.3	60
GS-25P0-BR	265	250	30	5.3	60
GS-41P0-BR	140	125	20	5.3	60
GS-42P0-BR	215	200	30	5.3	60
GS-43P0-BR	215	200	30	5.3	60
GS-45P0-BR	265	250	30	5.3	60

Figure 2

GS-27P5-BR
GS-47P5-BR
GS-4010-BR

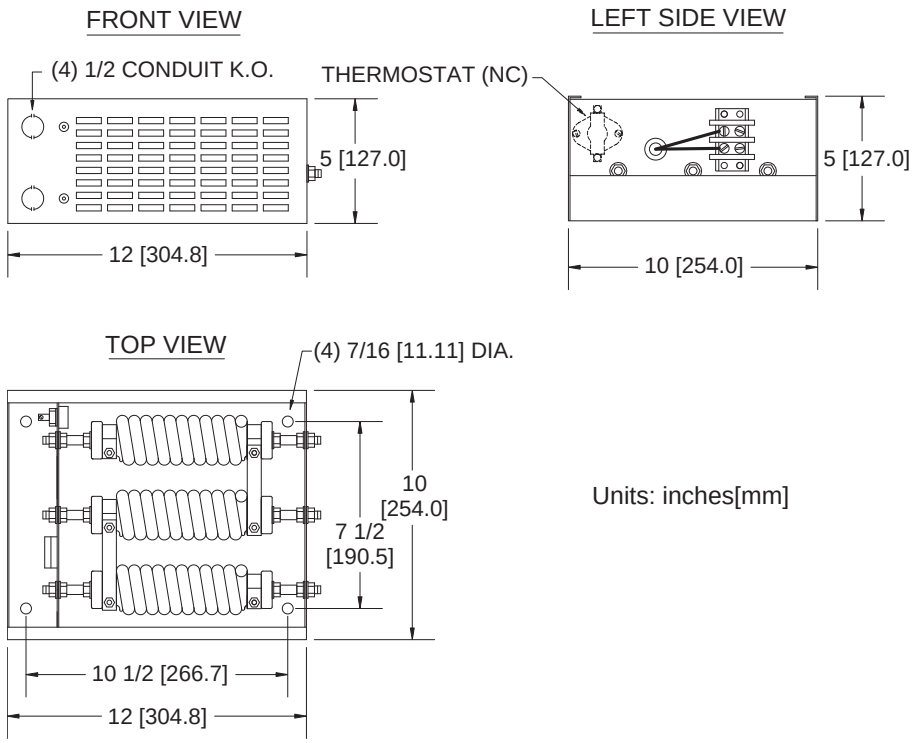


Resistor Part Number	L1 (mm)	L2 (mm)	H (mm)	D (mm)	W (mm)
GS-27P5-BR	335	320	30	5.3	60
GS-47P5-BR	335	320	30	5.3	60
GS-4010-BR	400	385	50	5.3	100

Brake Resistor Dimensions (continued)

GS-2010-BR-ENC, GS-4015-BR-ENC

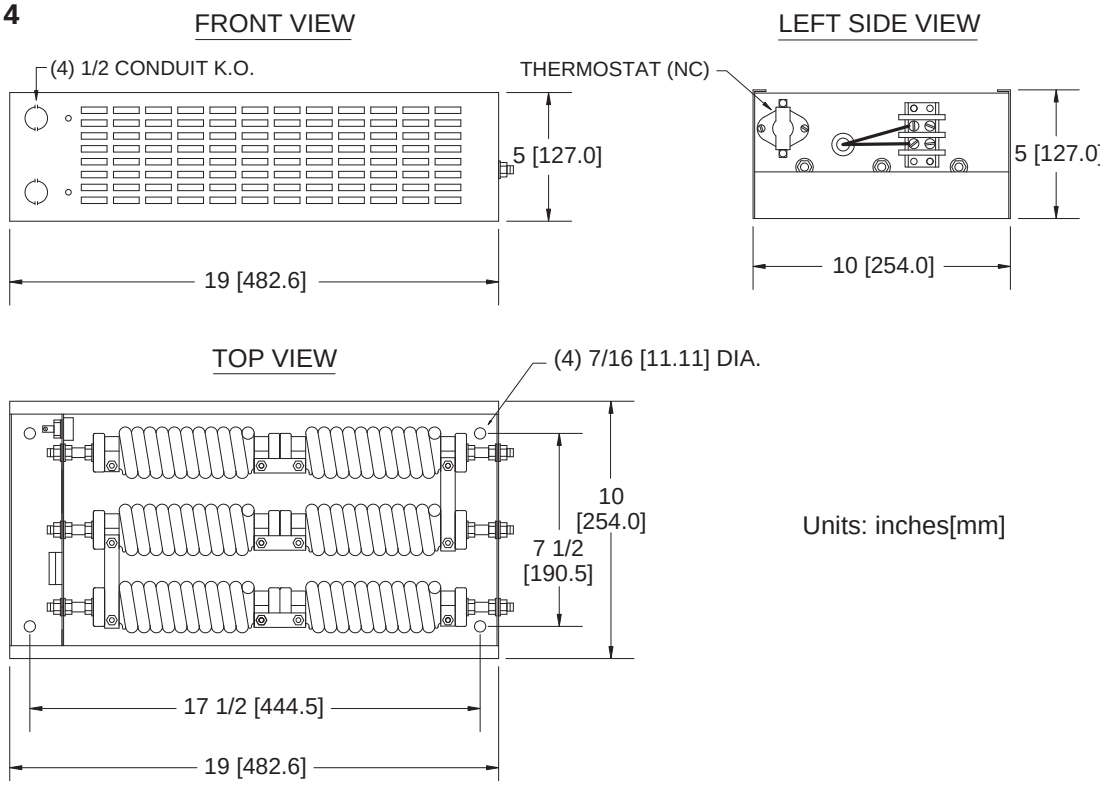
Figure 3



Units: inches[mm]

GS-2015-BR-ENC, GS-2020-BR-ENC, GS-2040-BR-ENC = 2 units

Figure 4

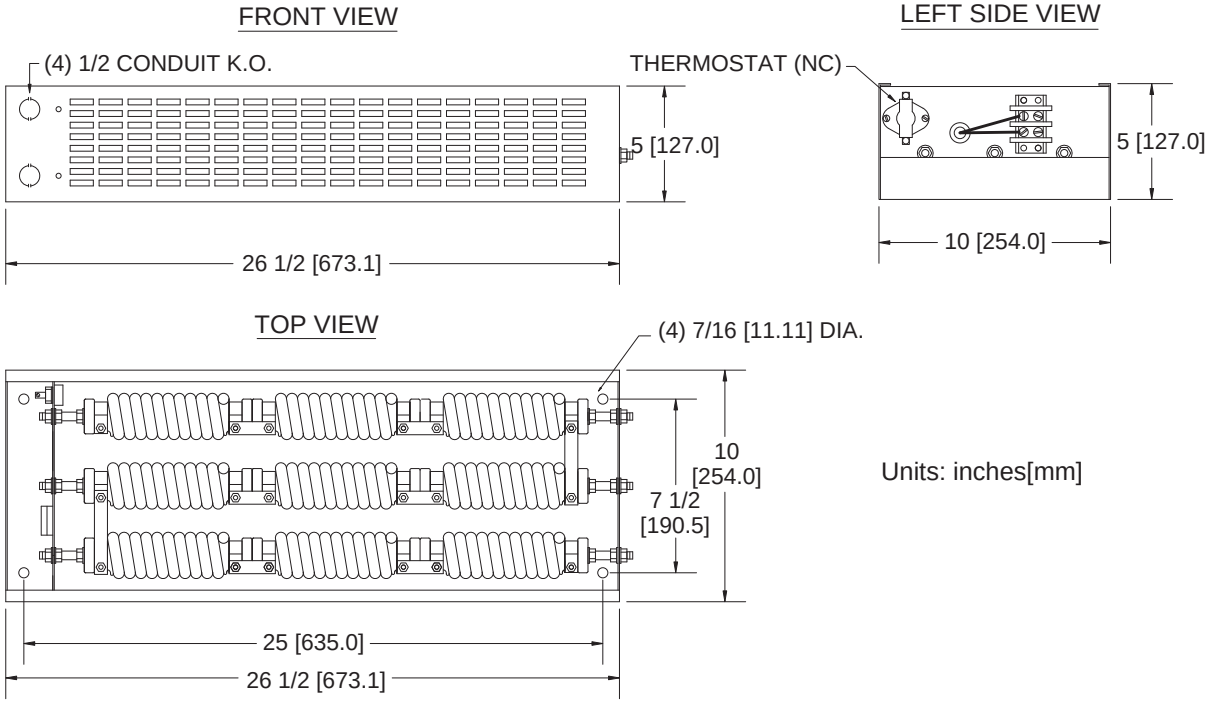


Units: inches[mm]

Brake Resistor Dimensions (continued)

GS-2025-BR-ENC, GS-2030-BR-ENC, GS-2050-BR-ENC = 2 units

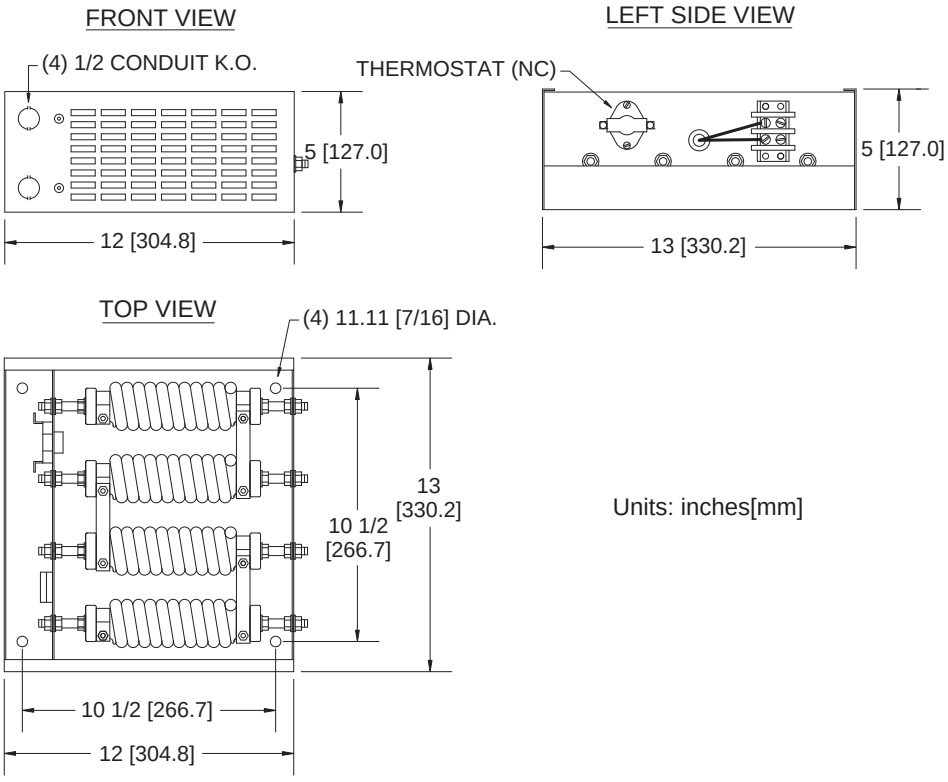
Figure 5



Units: inches[mm]

GS-4020-BR-ENC

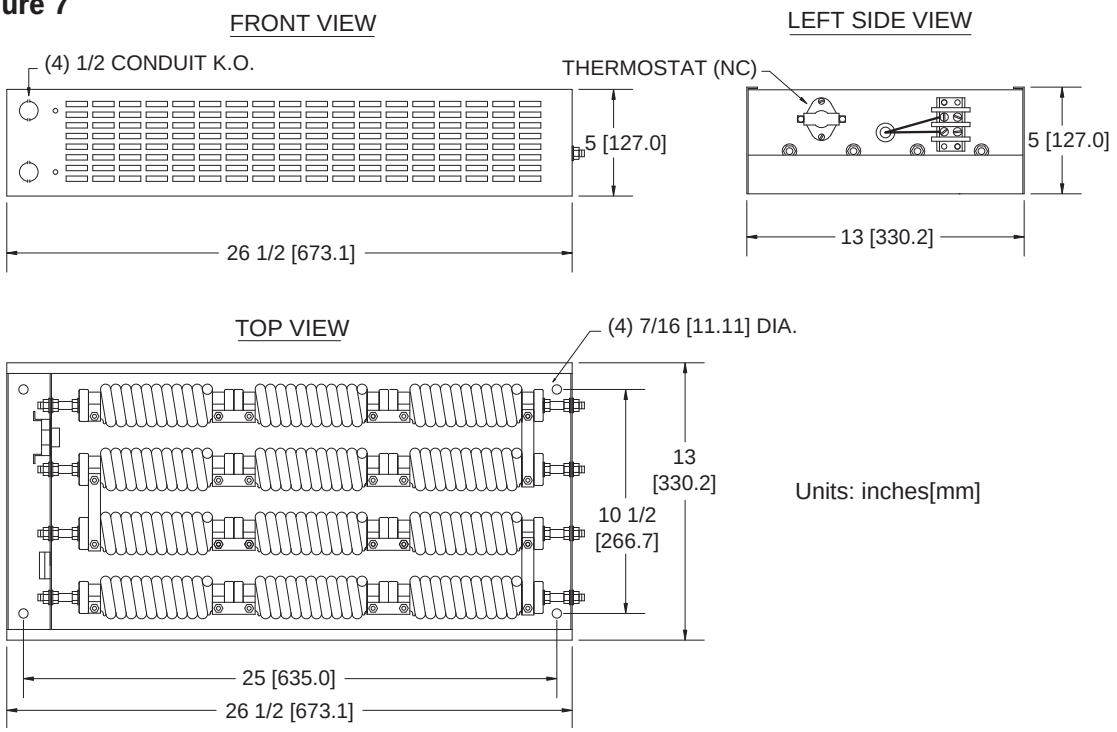
Figure 6



Units: inches[mm]

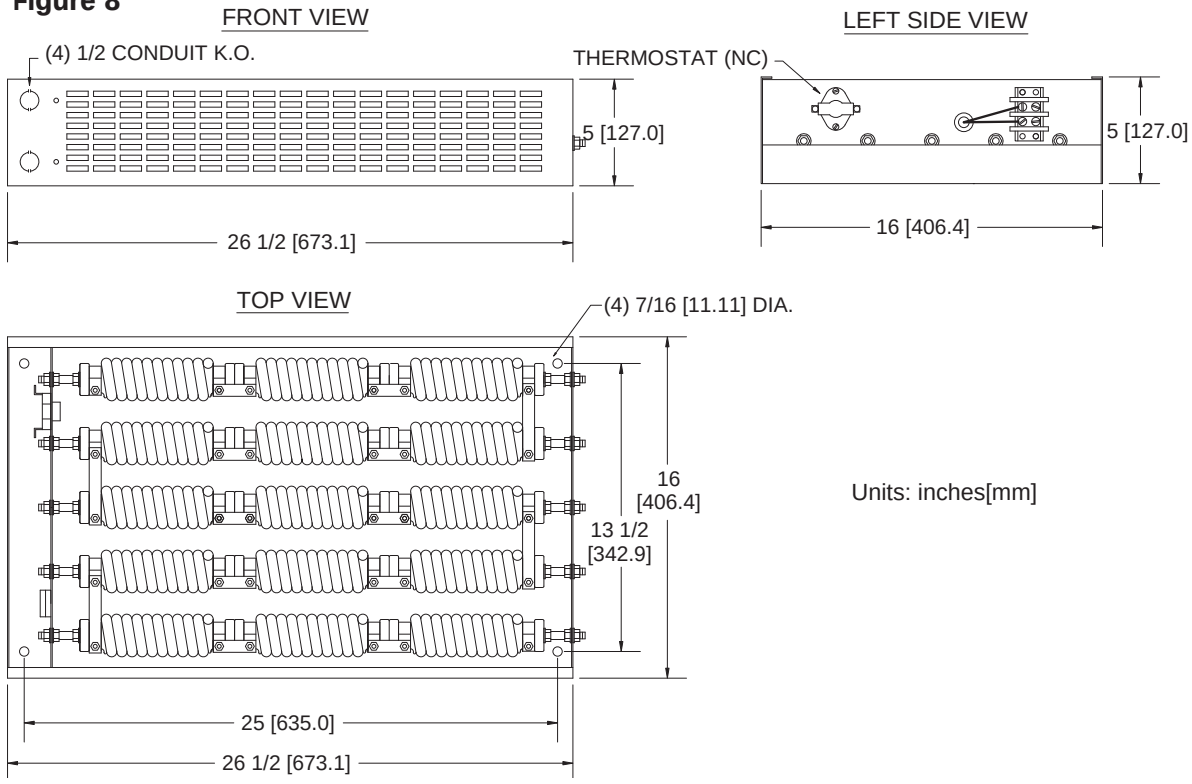
Brake Resistor Dimensions (continued)

Figure 7 **GS-4025-BR-ENC, GS-4030-BR-ENC, GS-4040-BR-ENC, GS-4075-BR-ENC = 2 Units**



Units: inches[mm]

Figure 8 **GS-4050-BR-ENC, GS-4060-BR-ENC, GS-4100-BR-ENC = 2 Units**



Units: inches[mm]

EMI Input Filters

The EC Declaration of Conformity for the *DURAPULSE* AC Drives was completed in conjunction with EMI Filters listed below. Use the following table to specify the corresponding EMI Filter for each AC Drive model.



CE compliance requires the use of EMI filters.

EMI Input Filter Specifications

EMI Input Filter Specifications					
AC Drive Model / Input Phase		EMI Filter	Input Power Max Rating	Dimension Drawing	Terminal Screw Max Torque
230V	460V				kg·cm [lb·in]
GS3-21P0 / 1ph GS3-22P0 / 1ph	–	**20DRT1W3S**	250V, 1-phase, 20A	Figure 1-1	18 [16]
GS3-23P0 / 1ph	–	**32DRT1W3C**	250V, 1-phase, 32A	Figure 1-2	
GS3-21P0 / 3ph GS3-22P0 / 3ph	–	**10TDT1W4C**	250V, 3-phase, 10A	Figure 3-1	
GS3-23P0 / 3ph GS3-25P0 / 3ph	–	**26TDT1W4C**	250V, 3-phase, 26A	Figure 3-2	
GS3-27P5 / 3ph GS3-2010 / 3ph	GS3-4020 / 3ph GS3-4025 / 3ph	**50TDS4W4C**	250/480V, 3-phase, 50A	Figure 3-3	30 [26]
GS3-2015 / 3ph GS3-2020 / 3ph	GS3-4030 / 3ph GS3-4040 / 3ph GS3-4050 / 3ph	**100TDS84C**	250/480V, 3-phase, 100A	Figure 3-4	65 [56]
GS3-2025 / 3ph GS3-2030 / 3ph GS3-2040 / 3ph	GS3-4060 / 3ph	**150TDS84C**	250/480V, 3-phase, 150A	Figure 3-5	
GS3-2050 / 3ph	–	**180TDS84C**	250V, 3-phase, 180A	Figure 3-6	
–	GS3-41P0 / 3ph GS3-42P0 / 3ph GS3-43P0 / 3ph	**RF022B43AA**	480V, 3-phase, 5.9A	Figure 3-7	n/a
–	GS3-45P0 / 3ph	**RF037B43BA**	480V, 3-phase, 11.2A	Figure 3-8	
–	GS3-47P5 / 3ph GS3-4010 / 3ph GS3-4015 / 3ph	**RF110B43CA**	480V, 3-phase, 25A	Figure 3-9	
–	GS3-4075 / 3ph GS3-4100 / 3ph	**200TDDS84C**	480V, 3-phase, 200A	Figure 3-10	65 [56]

EMI Filter Dimensions

Figure 1-1 (units = mm)
20DRT1W3S

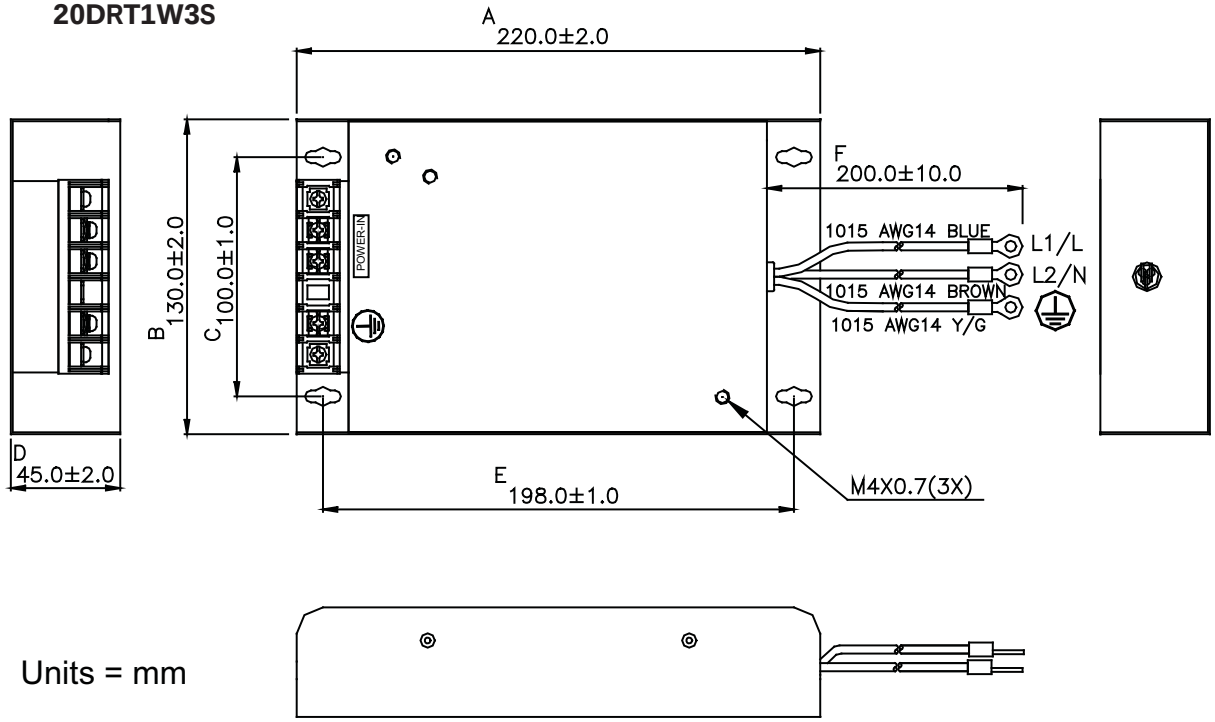
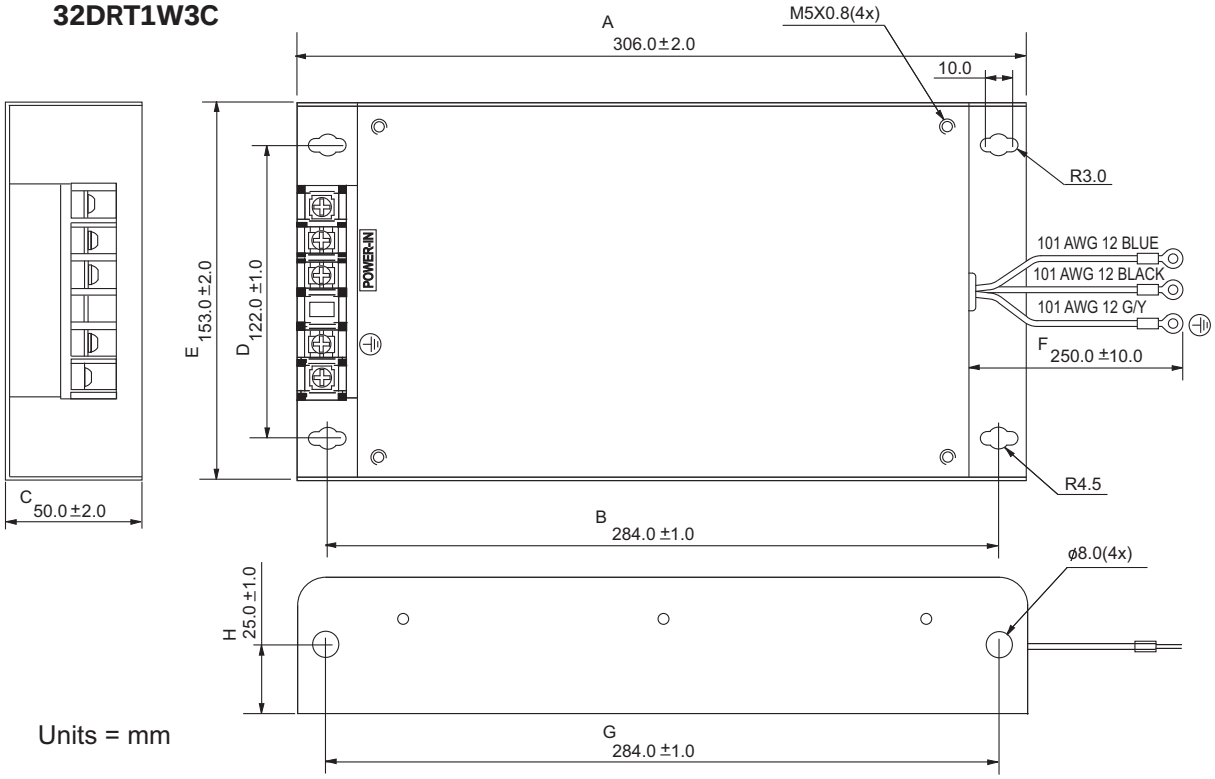


Figure 1-2 (units = mm)
32DRT1W3C



EMI Filter Dimensions (continued)

Figure 3-1 Units = mm (in)
10TDT1W4C

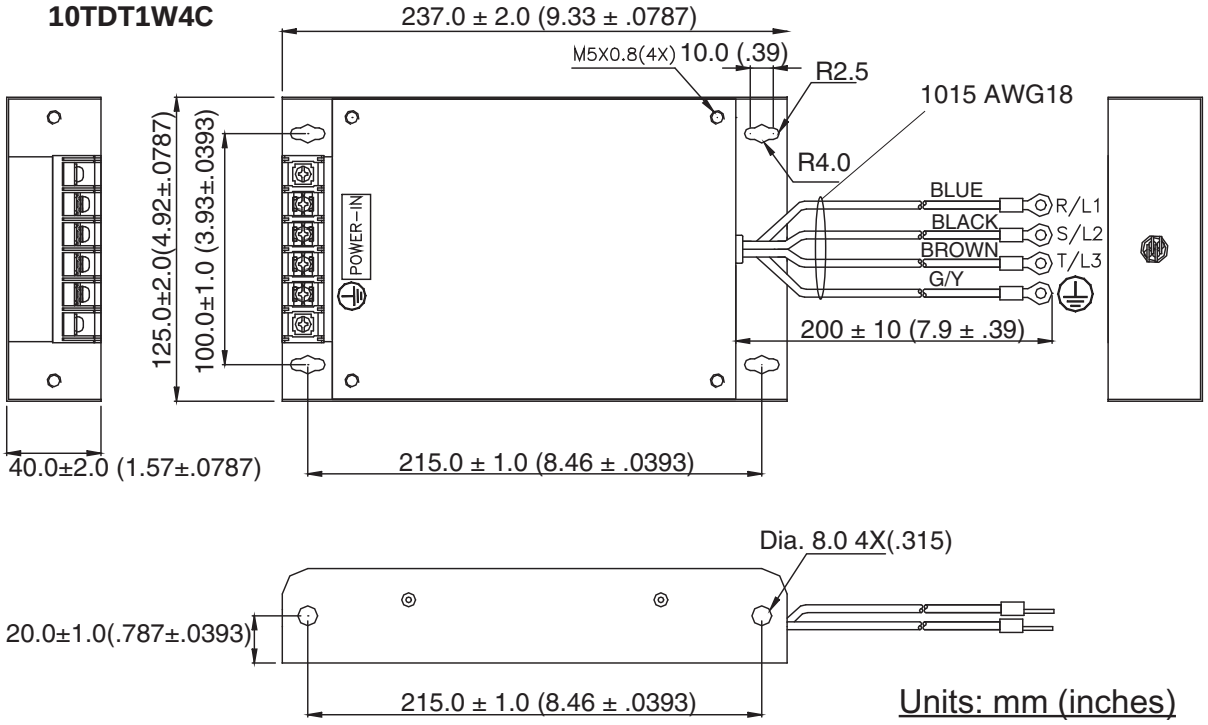
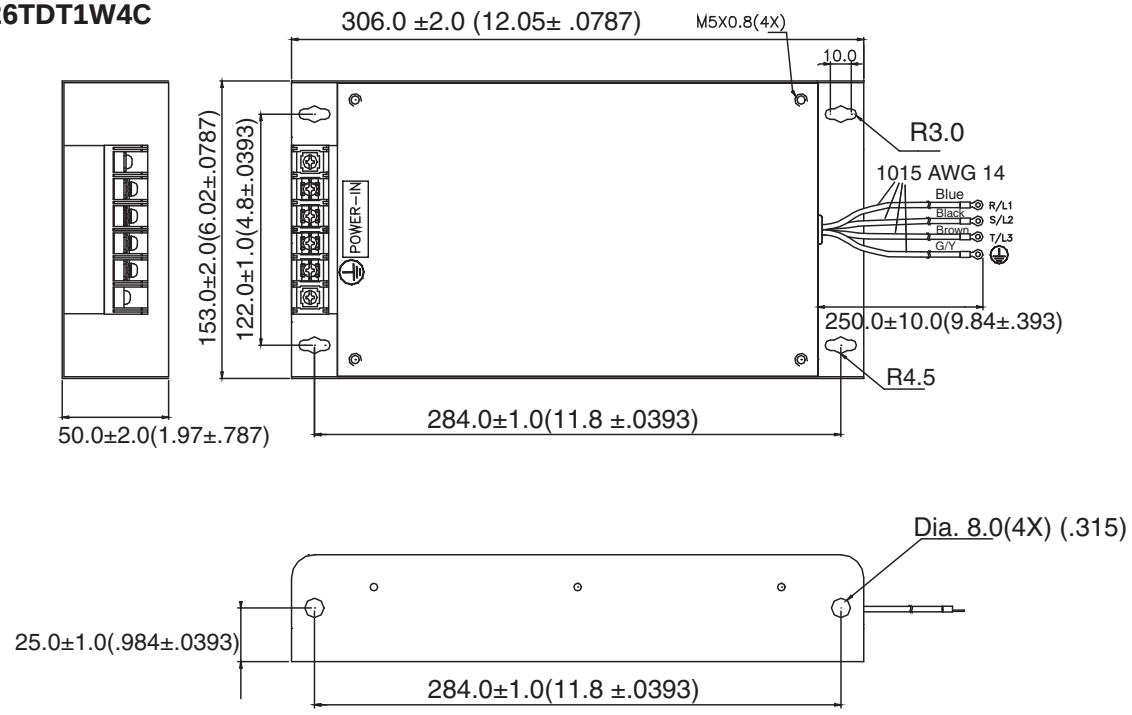


Figure 3-2 Units = mm (in)
26TDT1W4C



EMI Filter Dimensions (continued)

Figure 3-3 Units = mm (in)
50TDS4W4C

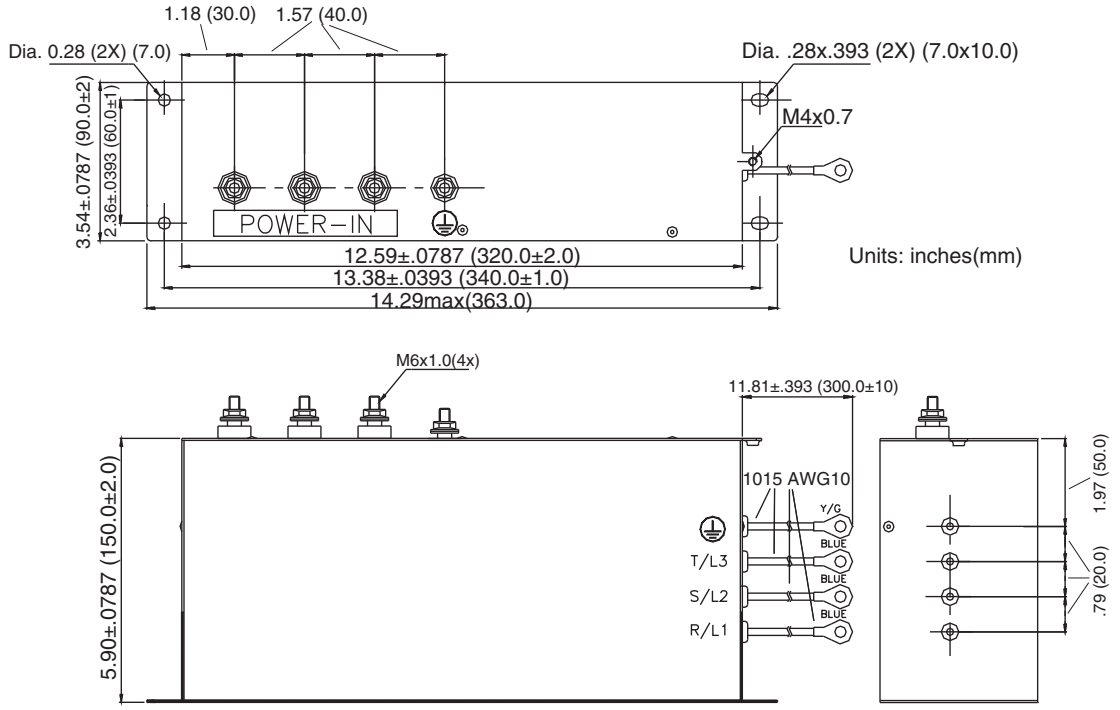
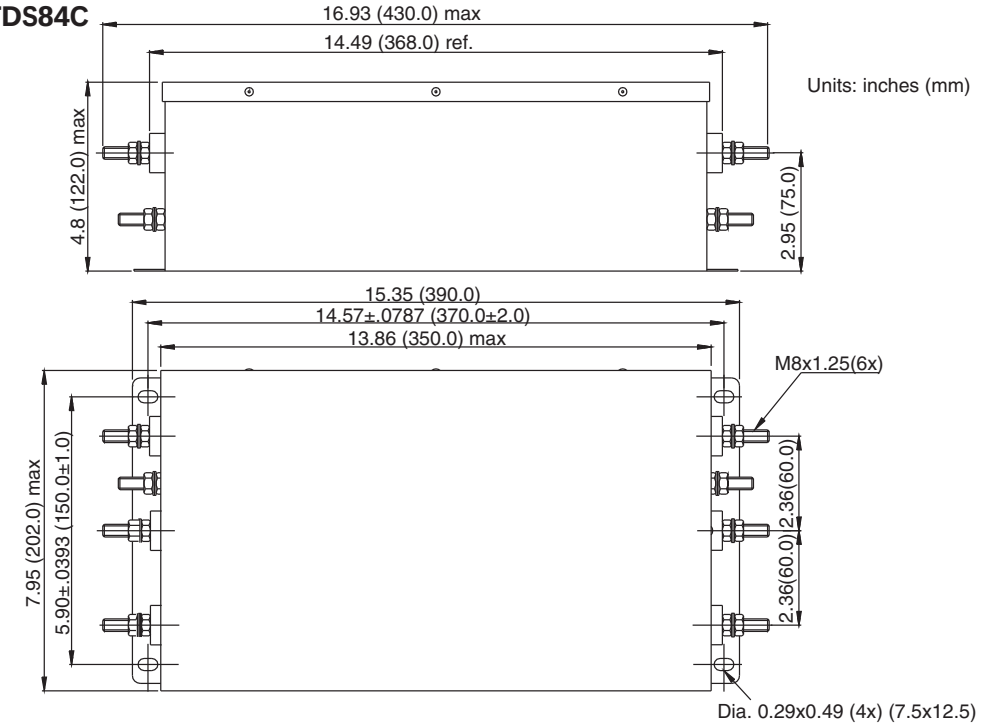


Figure 3-4 Units = mm (in)
100TDS84C



EMI Filter Dimensions (continued)

Figure 3-5 Units = mm (in)

150TDS84C

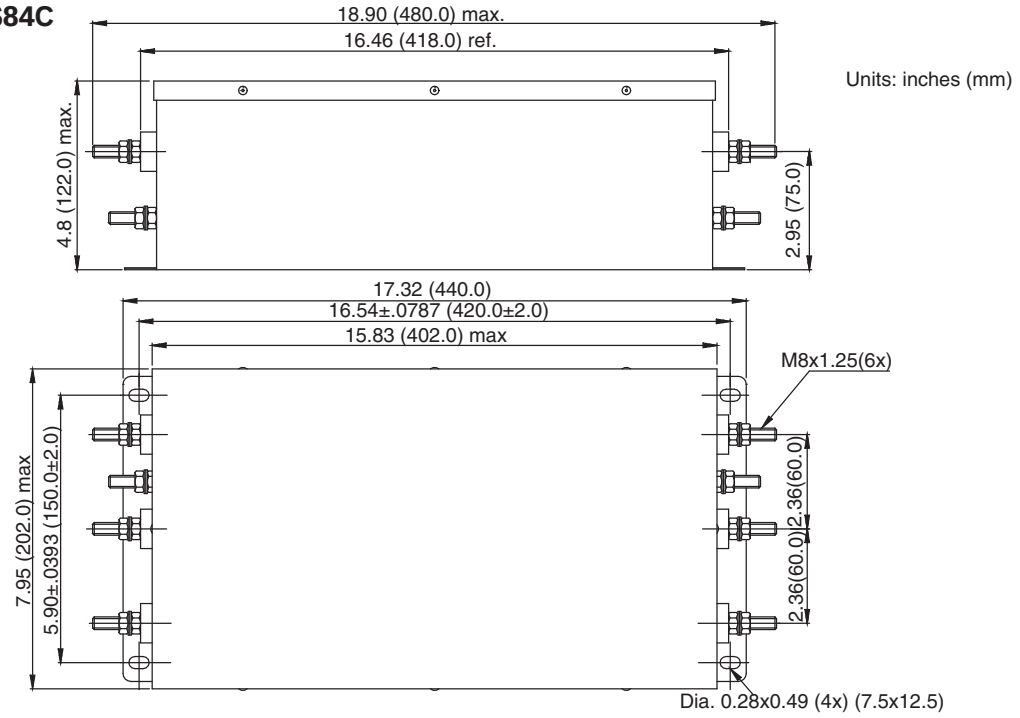
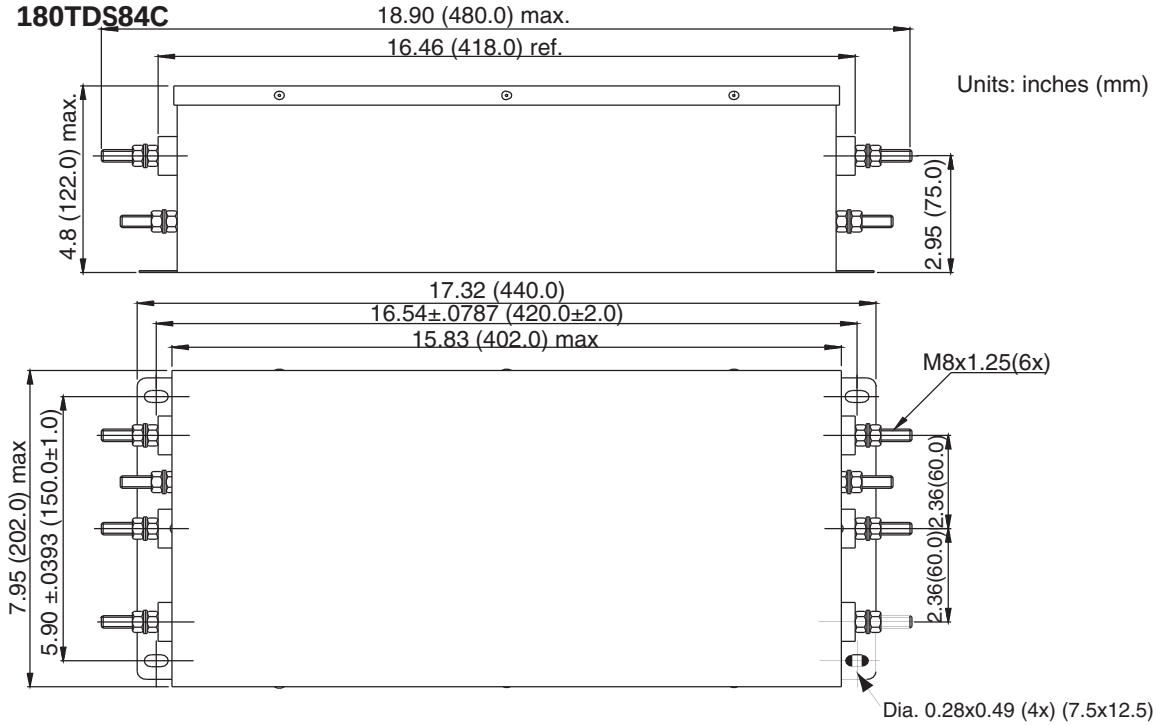


Figure 3-6 Units = mm (in)

180TDS84C



EMI Filter Dimensions (continued)

Figure 3-7 Units = mm (in)
RF022B43AA

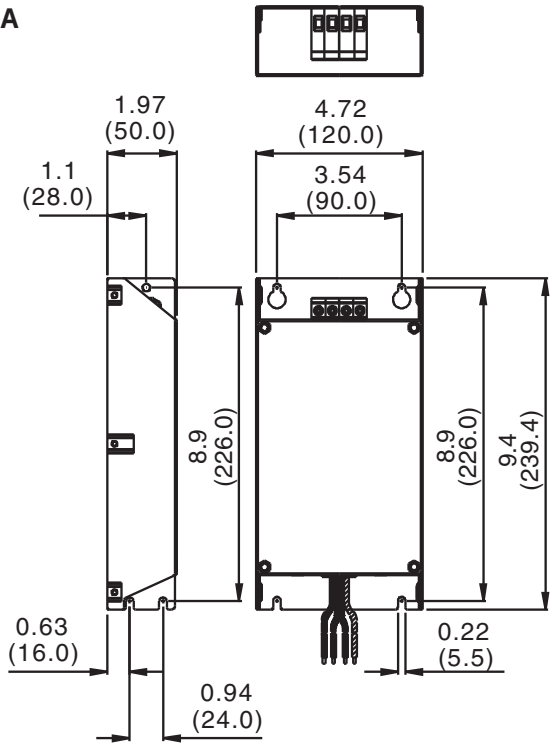
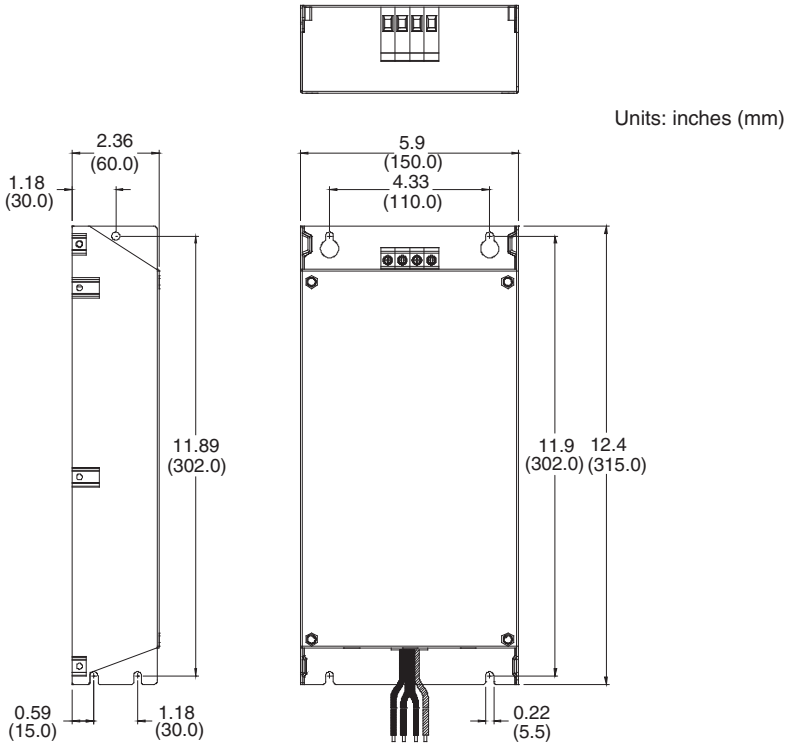


Figure 3-8 Units = mm (in)
RF037B43AA



EMI Filter Dimensions (continued)

Figure 3-9 Units = mm (in)
RF110B43CA

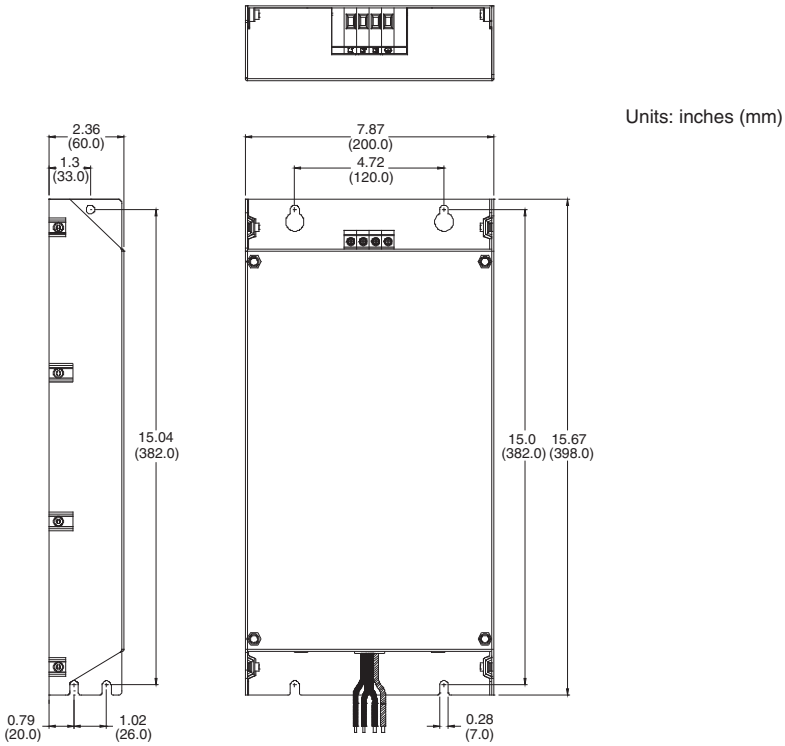
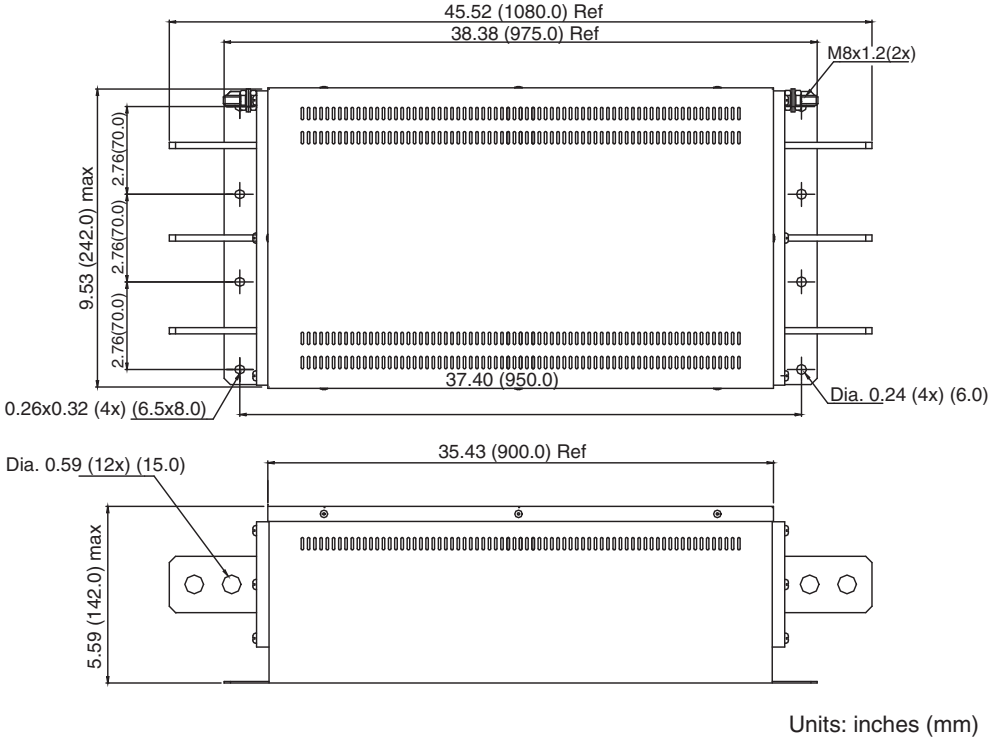


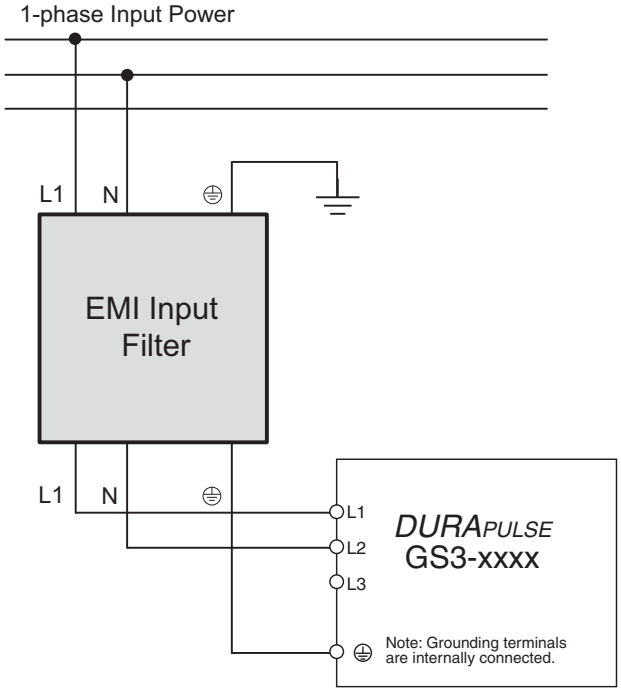
Figure 3-10 Units = mm (in)
200TDDS84C



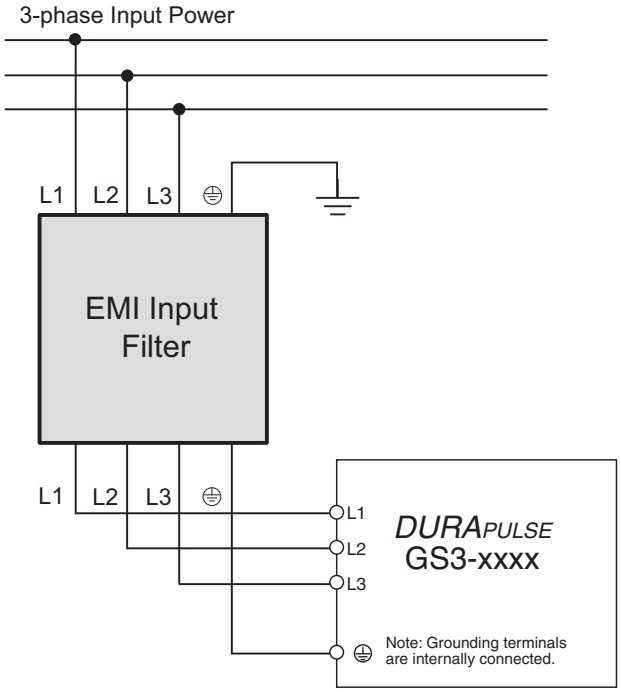
Units: inches (mm)

EMI Filter Wiring Connections

Single-Phase Input Connections



Triple-Phase Input Connections



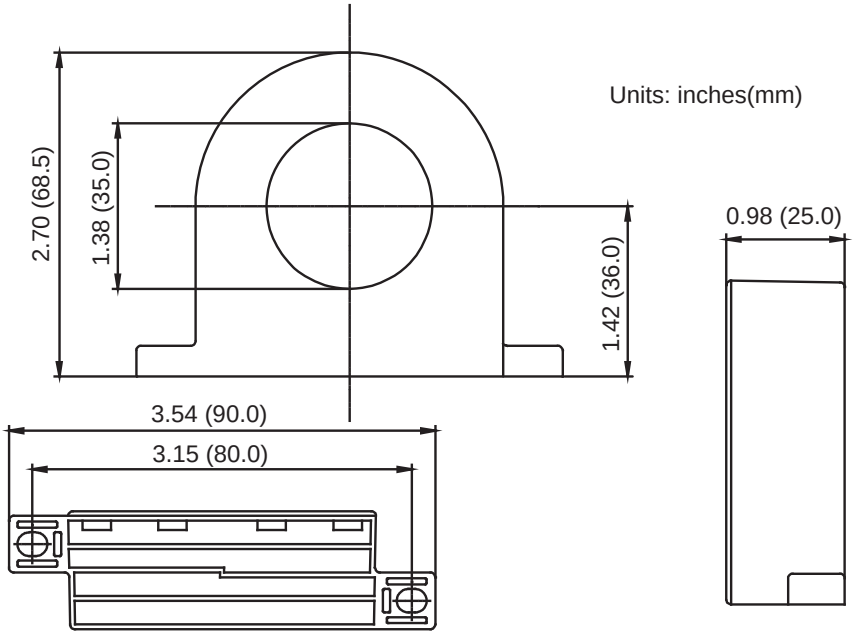
Distance of wires from filter to drive should be as short as possible.

RF Filter

RF Filter Part #: RF220X00A

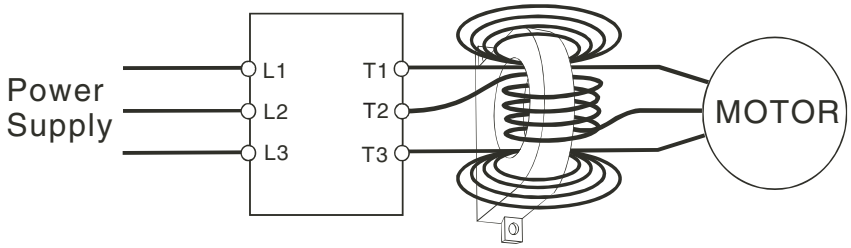
RF Filters are used to reduce the radio frequency interference or noise on the input or output side of the inverter. RF220X00A can be used with all GS model drives.

RF Filter Dimensions

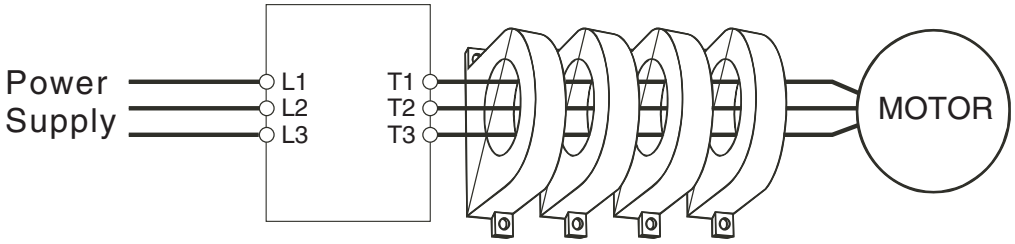


RF Filter Wiring

Wind each wire four times around the core. The RF filter must be located as close as possible to the output side of the inverter.



If you are unable to wire as shown above due to wire size, or another aspect of your application, put all wires through four cores in series without winding, as in the following diagram.



Fuses and Fuse Kits

Short-circuit and ground-fault protection devices are essential to prevent costly damage to your AC Drive application equipment. Fuse kits are available from AutomationDirect for the *DURAPULSE* AC Drives.

Warning: The fuse kits provide protection only for the semiconductor components inside the AC drive. Motor branch circuit overcurrent protection should be separately provided using applicable local codes.

The following fuse kits consist of one fuse block and fuses sized to match each *DURAPULSE* AC Drive. Replacement fuses are also available, as shown below.

Fuse Kit Specifications						
Part Number	**Fuse Block**	**Wire Range**	**Fuse Type**	**Dimensions**	**Fuse Rating**	**Replacement Fuses**
GS-21P0-FKIT-1P	2-pole	Al/Cu #2-14	A3T	Figure 1	300V @ 30A	**GS-21P0-FUSE-1P**
GS-22P0-FKIT-1P					300V @ 45A	**GS-22P0-FUSE-1P**
GS-23P0-FKIT-1P					300V @ 60A	**GS-23P0-FUSE-1P**
GS-21P0-FKIT-3P	3-pole			Figure 2	300V @ 20A	**GS-21P0-FUSE-3P**
GS-22P0-FKIT-3P					300V @ 25A	**GS-22P0-FUSE-3P**
GS-23P0-FKIT-3P					300V @ 40A	**GS-23P0-FUSE-3P**
GS-25P0-FKIT					300V @ 60A	**GS-25P0-FUSE**
GS-27P5-FKIT		Al/Cu 2/0-#6		Figure 3	300V @ 100A	**GS-27P5-FUSE**
GS-2010-FKIT				Figure 4	300V @ 125A	**GS-2010-FUSE**
GS-2015-FKIT					300V @ 175A	**GS-2015-FUSE**
GS-2020-FKIT				Figure 5	300V @ 250A	**GS-2020-FUSE**
GS-2025-FKIT					300V @ 300A	**GS-2025-FUSE**
GS-2030-FKIT					300V @ 350A	**GS-2030-FUSE**
GS-2040-FKIT *				Figure 6	300V @ 450A	**GS-2040-FUSE**
GS-2050-FKIT *					300V @ 500A	**GS-2050-FUSE**
GS-41P0-FKIT		Al/Cu #2-14	A6T	Figure 7	600V @ 10A	**GS-41P0-FUSE**
GS-42P0-FKIT					600V @ 15A	**GS-42P0-FUSE**
GS-43P0-FKIT					600V @ 20A	**GS-43P0-FUSE**
GS-45P0-FKIT					600V @ 30A	**GS-45P0-FUSE**
GS-47P5-FKIT				Figure 8	600V @ 50A	**GS-47P5-FUSE**
GS-4010-FKIT		Cu 2/0-#12		Figure 9	600V @ 70A	**GS-4010-FUSE**
GS-4015-FKIT					600V @ 90A	**GS-4015-FUSE**
GS-4020-FKIT		Al/Cu 2/0-#6		Figure 10	600V @ 125A	**GS-4020-FUSE**
GS-4025-FKIT					600V @ 150A	**GS-4025-FUSE**
GS-4030-FKIT					600V @ 175A	**GS-4030-FUSE**
GS-4040-FKIT *				Figure 11	600V @ 225A	**GS-4040-FUSE**
GS-4050-FKIT *					600V @ 250A	**GS-4050-FUSE**
GS-4060-FKIT *					600V @ 350A	**GS-4060-FUSE**
GS-4075-FKIT *					600V @ 400A	**GS-4075-FUSE**
GS-4100-FKIT *				Figure 12	600V @ 600A	**GS-4100-FUSE**
Short Circuit Current Rating (SCCR) = 200 kA						
**** Three units required***						

Fuse Block Dimensions

Figure 1

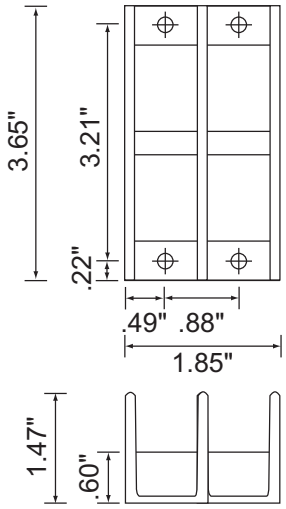


Figure 2

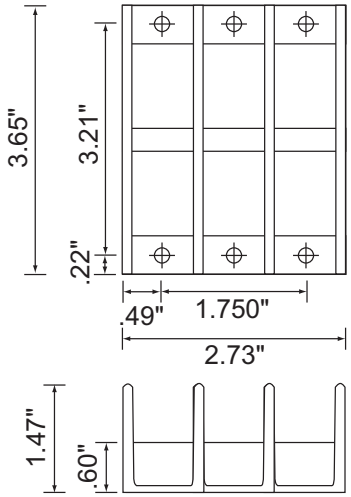


Figure 3

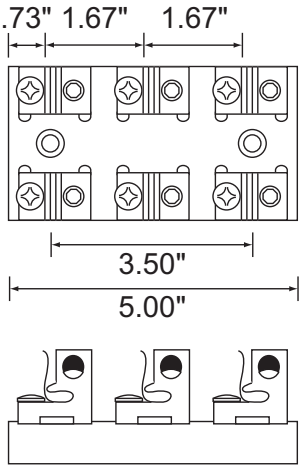


Figure 4

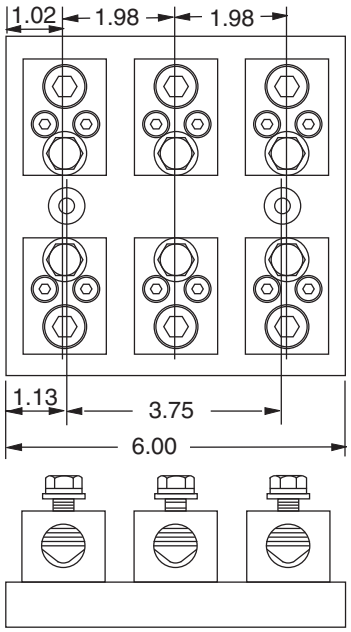


Figure 5

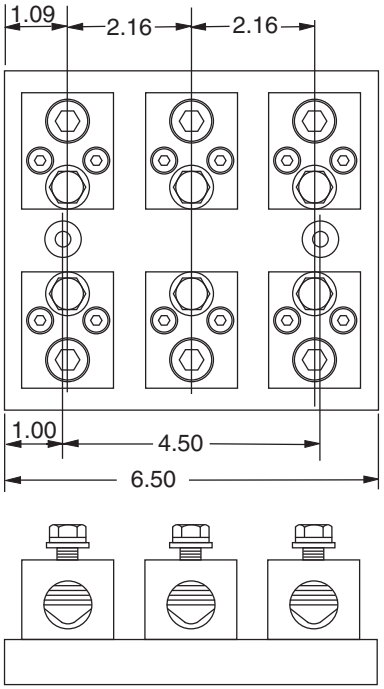
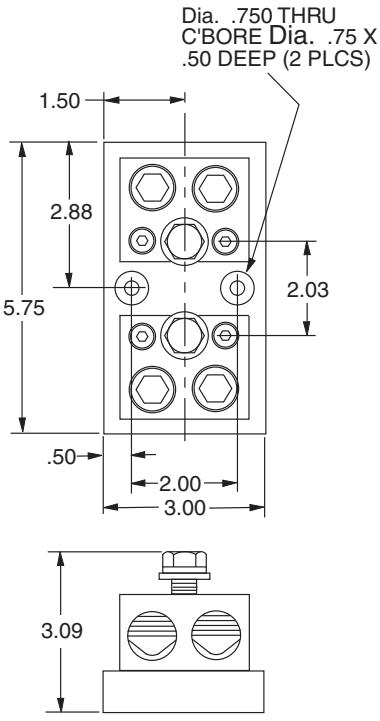


Figure 6



***Units = inches**

Fuse Block Dimensions (continued)

Figure 7

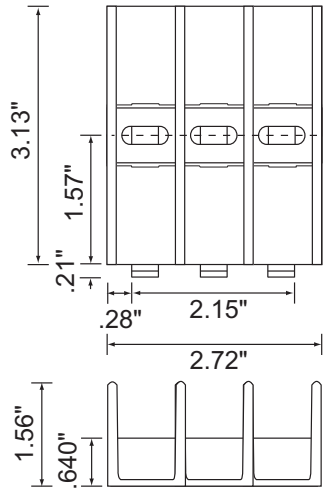


Figure 8

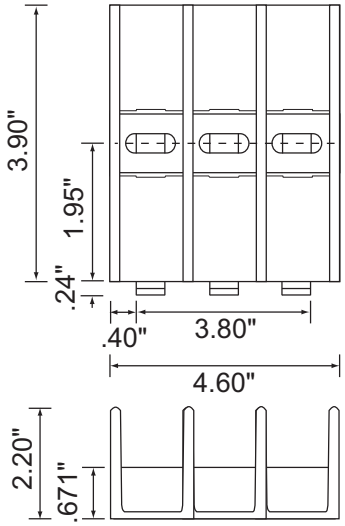


Figure 9

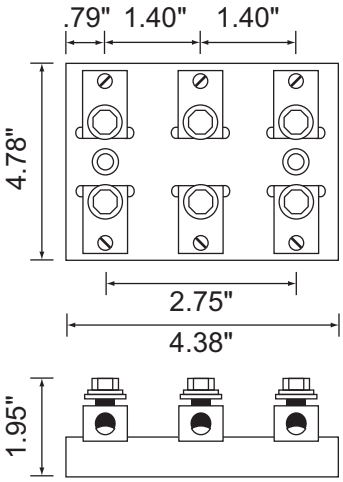


Figure 10

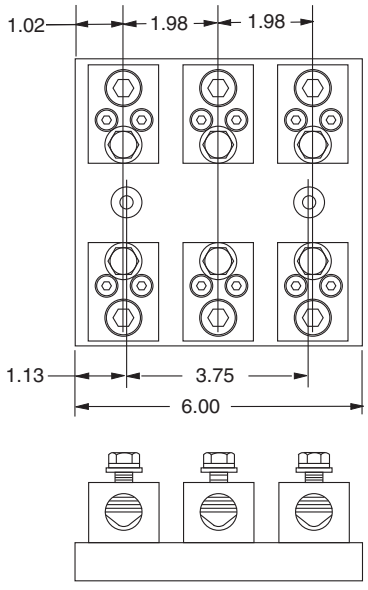


Figure 11

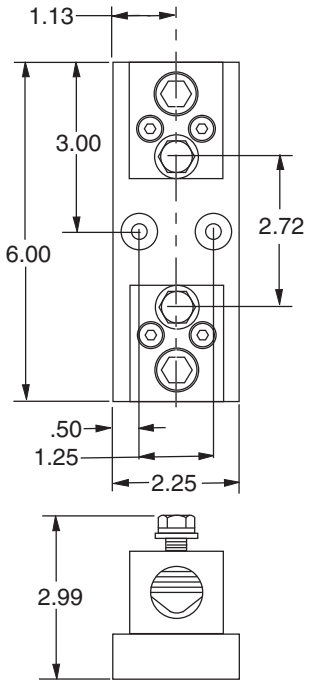
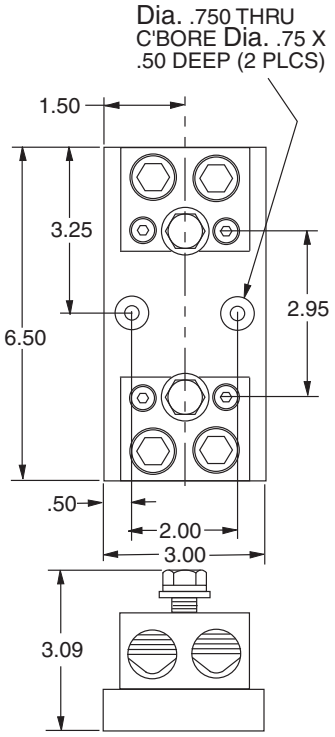


Figure 12



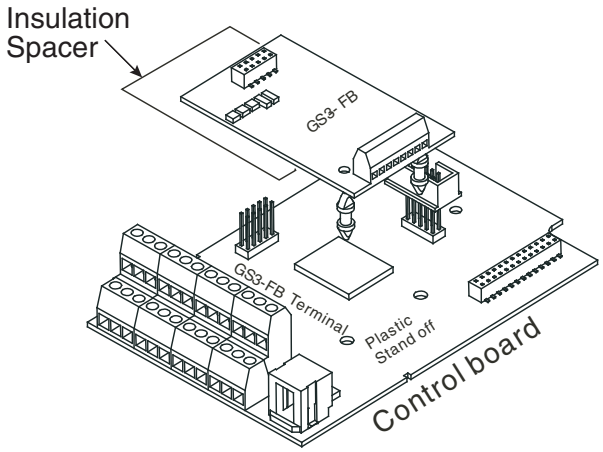
***Units = inches**

GS3-FB Feedback Card

1 to 2HP (0.75kW to 1.5kW)

INSTALLATION

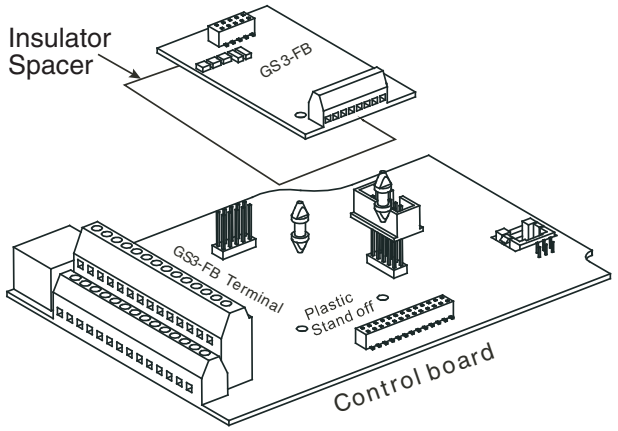
For 1 to 2hp (0.75kW to 1.5kW) drives



3 to 5HP (2.2kW to 3.7kW)

INSTALLATION

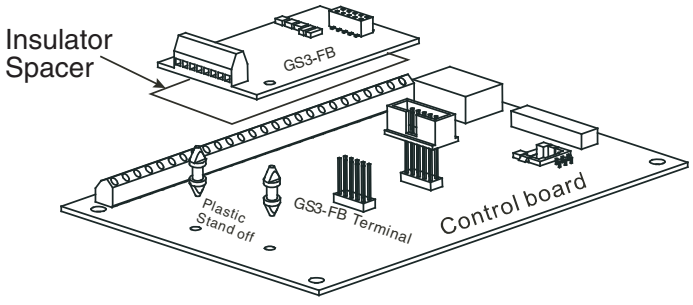
For 3 to 5hp (2.2kW to 3.7kW) drives



7.5HP (5.5kW) and above

INSTALLATION

For drives 7.5hp (5.5kW) and above



Make sure GS3-FB card snaps firmly into board. If it is not properly installed, LEDs will not light upon power-up.

GS3-FB Terminal Descriptions Wiring Notes

Terminal Symbols	Descriptions
VP	Power source of GS3-FB (SW1 can be switched to 12V or 5V) Output Voltage: (+12VDC ±5% 200mA) or (+5VDC ±2% 400mA)
DCM	Power source (VP) and input signal (A, B) common
A, NOT A, B, NOT B	Input signal from Encoder. Input type is selected by SW2. Maximum 500kP/Sec
A/O, B/O	GS3-FB output signal for use with RPM Meter. (Open Collector) Maximum DC24V 100mA
COM	GS3-FB output signal (A/O, B/O) common.
PG	Pulse generator or Encoder.
IM 3~	3-Phase motor

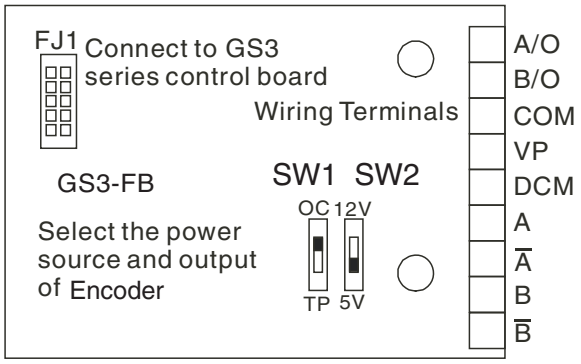
The control, power supply and motor leads must be laid separately. They must not be fed through the same cable conduit / trunking.

1. Please use a shield cable to prevent interference. Do not run control wire parallel to any high voltage AC power line (220V and up).
2. Connect shielded wire to Ground only.
3. Recommended wire size for shielded cable: AWG24 to AWG18 (0.21 to 0.81mm^2)
4. Wire length:

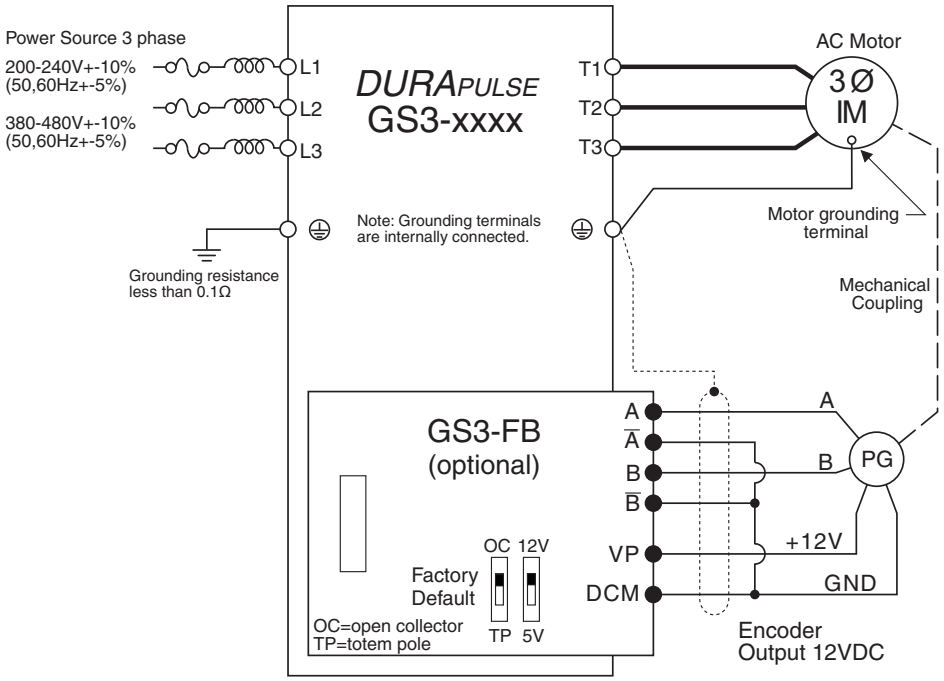
Types of Encoders	Maximum Wire Length	Wire Gauge at Maximum Wire Length
Output Voltage	165 ft (50m)	AWG16 (1.25mm^2) or larger
Open Collector	165 ft (50m)	
Line Driver	1000 ft (300m)	
Complimentary	230 ft (70m)	

Please refer to instructions supplied with product for additional installation information.

Control Terminals Block Designations

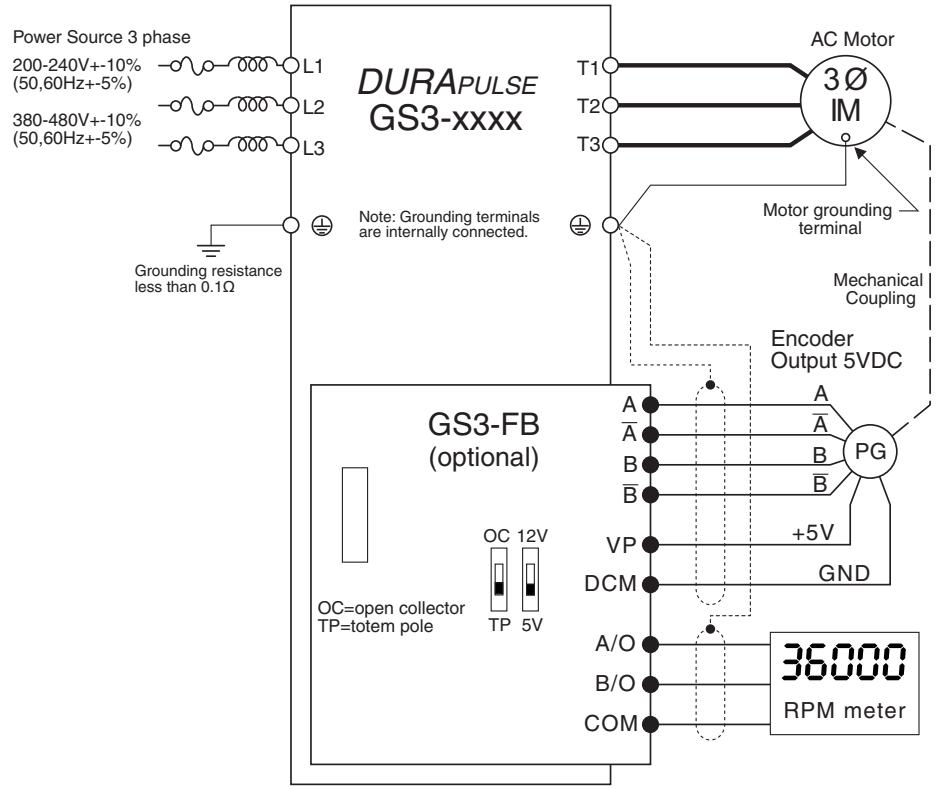


GS3-FB Basic Wiring Diagram – Open Collector type Encoder



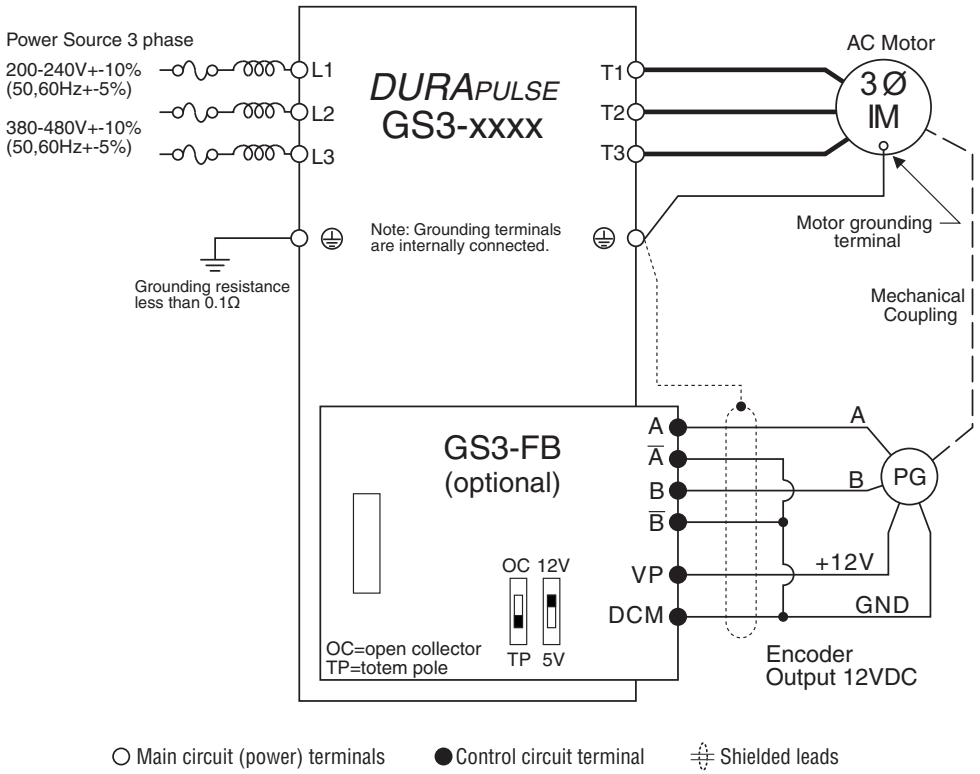
○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

GS3-FB Basic Wiring Diagram – Line Driver type Encoder with RPM Meter

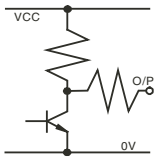
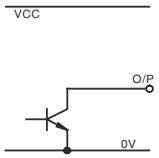
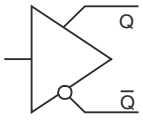
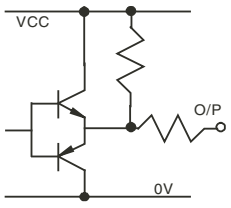


○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

GS3-FB Basic Wiring Diagram – Output Voltage or Complimentary type Encoder



Types of Encoders and Dip Switch Settings

Types of Encoders		SW1 and SW2 switches	
		5V	12V
Output Voltage			
Open collector			
Line driver			
Complimentary			

Ethernet Interface GS-EDRV(xxx)

GS-EDRV(xxx) Specifications			
Part Number	**Input Voltage**	**Input Current**	**Ethernet Communiation**
GS-EDRV	10-33 VDC	90-135 mA	10BaseT
GS-EDRV100	10-36 VDC	50-220 mA	10/100Mbps
Can be used with all DURAPULSE and other GS AC drives.			

GS-EDRV(xxx) Ethernet Interfaces provide low-cost, high-performance Ethernet links between control systems and any *DURAPULSE* or other GS-series AC Drives. With the appropriate cable connections and, if needed, Ethernet switches or hubs, the GS-EDRV(xxx) allows you to communicate with your AC drives over qualified Ethernet networks.

The control systems can be any of the following:

- DL205 CPU, DL405 CPU, or a WinPLC, with the appropriate Ethernet Remote Master module (H2-ERM or H4-ERM).
- A Productivity3000 CPU using the onboard Ethernet port.
- A PC running Entivity's ThinknDo software, a PC using a custom device driver that was developed using our Ethernet SDK, or a PC running KEP***Direct*** EBC or OPC Server.
- Any independent I/O controller with a Modbus TCP/IP driver.

The control function is performed by one of the control systems mentioned above. The I/O mapping function is performed by an H2(4)-ERM module (purchased separately). The H2(4)-ERM module is configured with the ERM Workbench Utility which is part of the ***Direct***SOFT PLC programming software.

The functions of the GS-EDRV(xxx) interface are as follows:

- process input signals from the AC drive.
- format these signals to conform to the Ethernet standard.
- transmit converted signals to the control system.
- receive and translate output signals from the control system.
- distribute the output signals to the appropriate drive.
- DIN-rail mounting.
- built-in web browser allows users to configure and control the drive from any web browser via the IP address of the GS-EDRV(xxx).



The GS-EDRV(xxx) requires an external 24 VDC power supply.



The GS series drives have a provision for shutting down control or power to the drive in the event of a communications time-out. This function can be set up through the drive parameter group 9.

Refer to the "GS Series AC Drive Ethernet Interface User Manual" or www.AutomationDirect.com for detailed information.

*ZIP*Link™ Cables for RS-485 Modbus RTU

*ZIP*Link communication cables make it very easy to set up RS-485 Modbus RTU control of a single *DURAPULSE* AC drive from a *Direct*LOGIC DL06 or D2-260 PLC.



GS-485HD15-CBL-2

PLC Connections for RS-485 Modbus RTU Control of *DURAPULSE* Drive					
Drive	**PLC * or Device**	**PLC Port ***	**Communication**	**Direct Cable**	**Length**
DURAPULSE (GS3)	CLICK	3	RS-485	ZL-RJ12-CBL-2P ***	2m [6.6 ft] ***
	DL05	2 **	RS-232 – RS-485 **	N/A **	
	DL06 D0-DCM	2	RS-485	**GS-485HD15-CBL-2 *** **	2m [6.6 ft] ***
	D2-DCM D2-250(-1)	2 **	RS-232 – RS-485 **	N/A **	
	D2-260	2	RS-485	**GS-485HD15-CBL-2 *** **	2m [6.6 ft] ***
	D4-450	3 **	RS-232 – RS-485 **	N/A **	
	FA-ISOCON		RS-485	**GS-ISOCON-CBL-2**	2m [6.6 ft] ***
	GS-EDRV100		RS-485	**GS-EDRV-CBL-2**	2m [6.6 ft] ***
	ZL-CDM-RJ12Xxx		RS-485	**GS-485RJ12-CBL-2**	2m [6.6 ft] ***

**** If a PLC type or port is not listed in this chart, it cannot function as a Modbus RTU master.***

***** Requires RS-232–RS-485 converter & generic cabling options described in Ch5 "GS1 Modbus Communications".***

****** Termination resistors not required due to short cable length.***

*In addition to these GS-specific cables, the ZIP*Link *product line also includes other components which can be useful for Modbus wiring, including distribution modules for wiring connections to multiple drives.*
For more information, refer to Ch5 "GS1 Modbus Communications" or to www.automationdirect.com/static/specs/fzipselection.pdf.

GS Drive Configuration Software

GSoft is the configuration software for the Automation Direct GS family of drives. It is designed to allow you to connect a personal computer to drives in the GS family, and perform a variety of functions:

- Upload/download drive configurations
- Create new drive configurations using Quick Start, Detailed, or Schematic Views
- Edit drive configurations
- Archive/store multiple drive configurations on your PC
- Trend drive operation parameters
- Tune the drive PID loop
- View real time key operating parameters
- Start/Stop drive and switch directions, provided drive is set up for remote operation
- View drive faults
- Print a schematic representation of the drive configuration
- Print a tabular report of the current drive configuration.

GSoft includes an integral help file with software instructions.

System Requirements

GSoft will run on PCs that meet the following requirements:

- Windows 95, 98, Me, NT, 2000, and XP
- Internet Explorer 4.0 or higher (for HTML help support)
- 24 Mb of available memory
- 8Mb hard drive space
- Available RS-232 serial port

GSoft requires use of a configuration cable, GS-232CBL, which is sold separately. RS-485 communication from an RS-232 PC port requires an FA-ISOCON or compatible converter, which is sold separately.



Miscellaneous Accessories

Configuration Cable

GS-232CBL

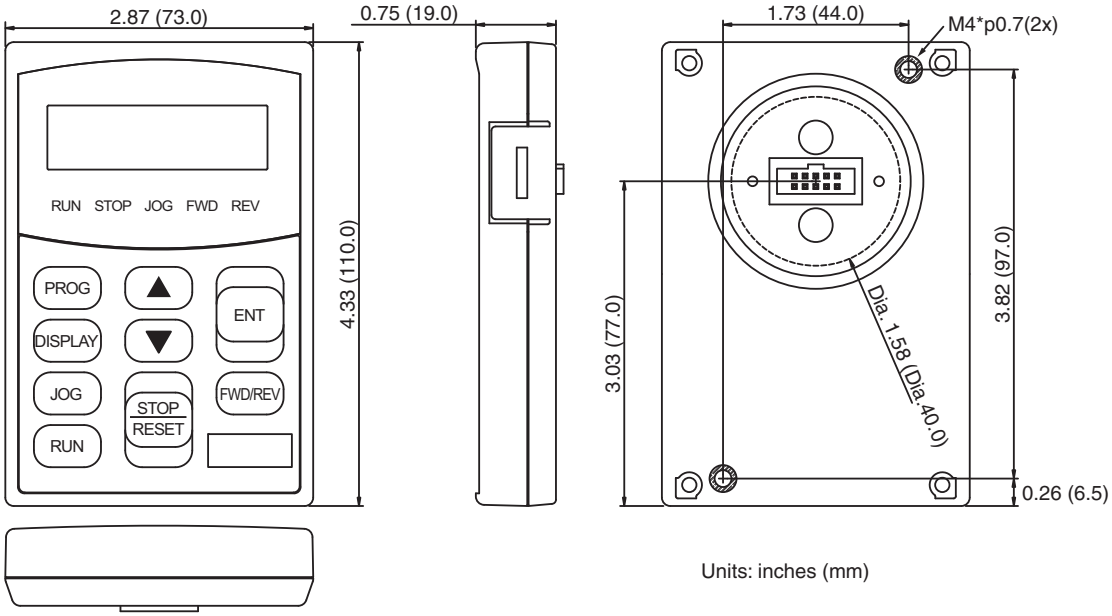
Required programming cable for GSOFT software.



Spare Keypad

GS3-KPD

Spare or replacement keypad for *DURAPULSE* AC drives.



Units: inches (mm)

Keypad Cables (installation screws included)

GS-CBL2-1L

1 meter keypad cable

GS-CBL2-3L

3 meter keypad cable

GS-CBL2-5L

5 meter keypad cable

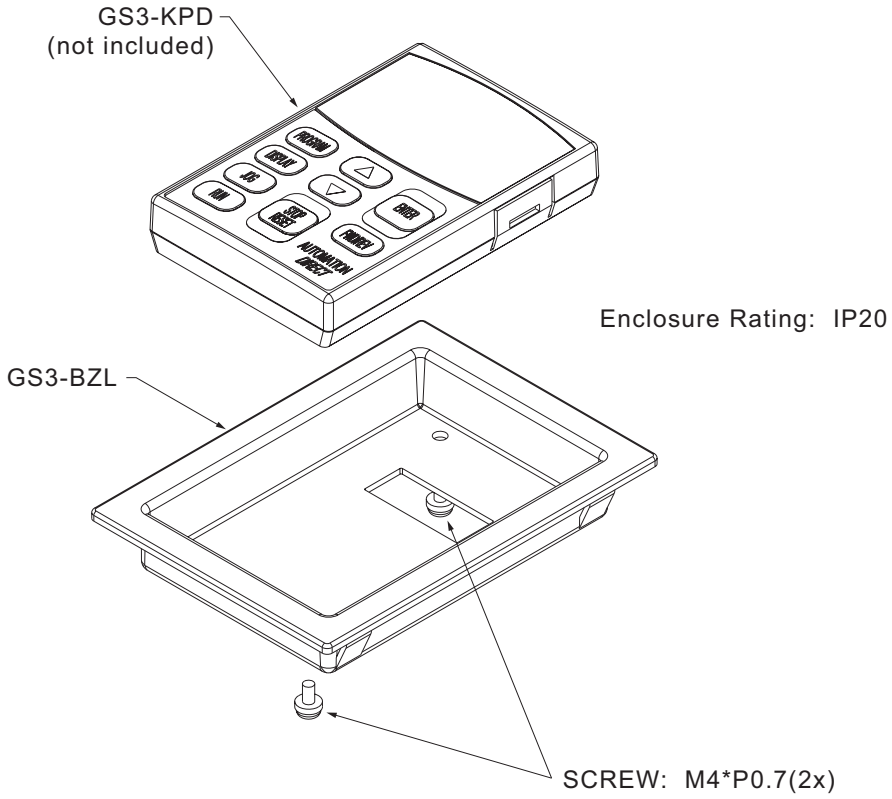
GS-CBL2-1L **GS-CBL2-3L** **GS-CBL2-5L**



Remote Panel Adapter, GS3-BZL

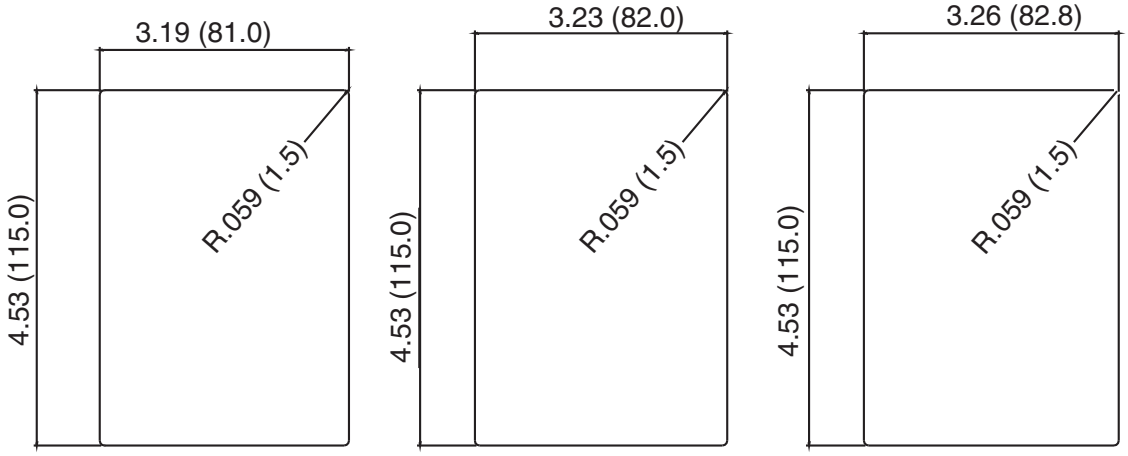
For remote mounting of *DURAPULSE* removable keypad.

Mounting Instructions



The thickness of the panel will determine required screw hole dimensions:

t = .0393 (1.0) - .0551 (1.4) t = .629 (1.6) - .0787 (2.0) t = .0866 (2.2) - .1181 (3.0)

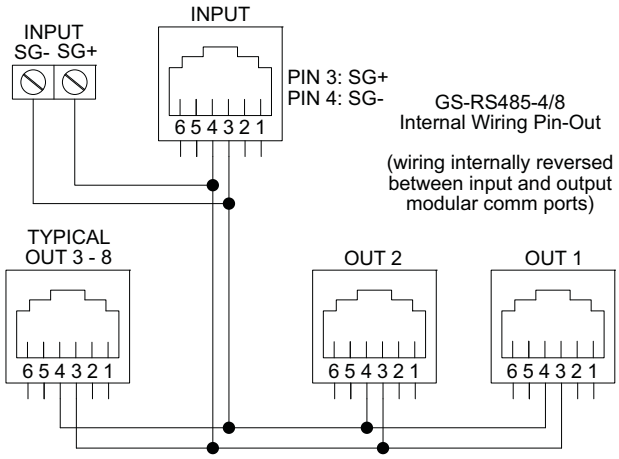


Units: inches(mm)

Communication Distribution Blocks – Legacy GS Series

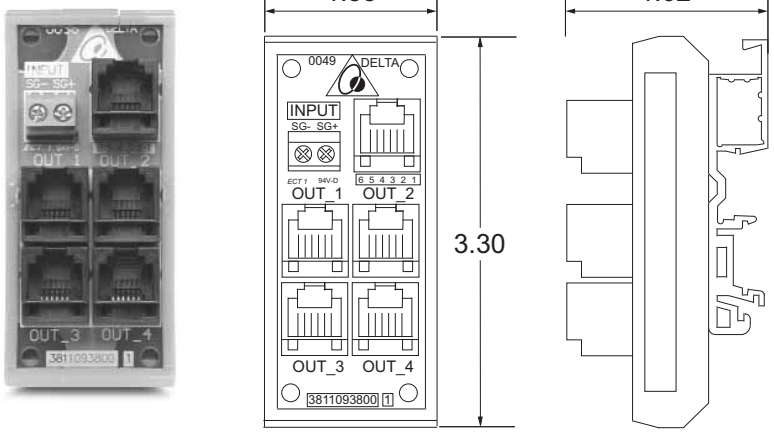
(Do not use for new installations. For new installations, please consider AutomationDirect *ZIP*Link ZL-CDM-RJ12Xxx distribution modules.)

Using the RS-485 communication board (GS-RS485-4 or GS-RS485-8) provides an easy means to break out the RS-485 signal to several drives at one location. This is a star configuration, but the transmission errors are negligible, so this configuration is acceptable for proper operation of the VFDs.



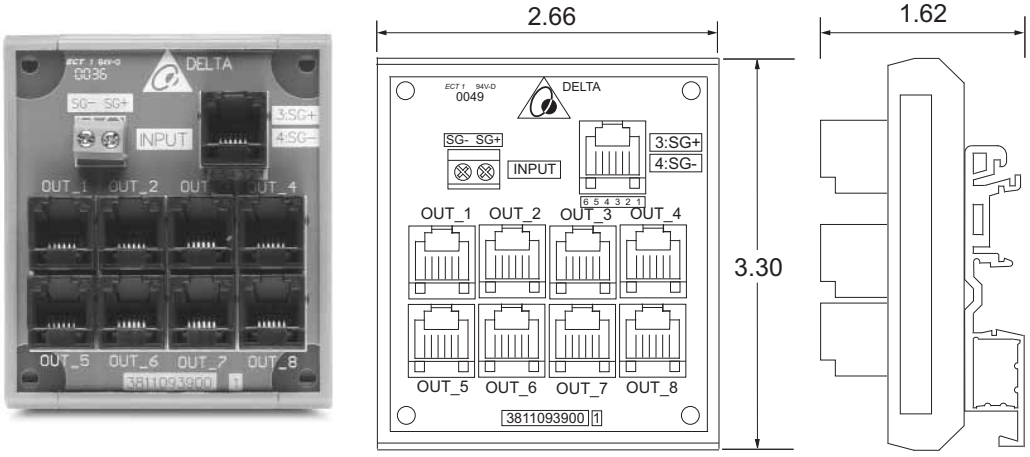
GS-RS485-4

4-port RS485 Communication Distribution Board



GS-RS485-8

8-port RS485 Communication Distribution Board



Replacement Accessories – Cooling Fans

All *DURAPULSE* AC drives have built-in cooling fans, and replacement fans are also available. These fans are direct replacements for the internal factory-installed fans.



Installation instructions are included with the fans.



Fan replacement should only be performed by personnel skilled in the disassembly and repair of variable frequency AC drives.

Replacement Fans for *DURAPULSE* (GS3 Series) AC Drives				
Part Number (1)	**Specifications (2)**	**Fans / Drive (3)**	**GS3 Drive Model (4)**	**Drive V / HP**
GS-FAN-1	50 mm, 12 VDC, 0.25A	1	GS3-43P0	460 / 3
GS-FAN-2	60 mm, 12 VDC, 0.25A	1	GS3-23P0 GS3-25P0 GS3-45P0	230 / 3 230 / 5 460 / 5
GS-FAN-3	80 mm, 12 VDC, 0.42A	2	GS3-27P5 GS3-2010 GS3-2015 GS3-47P5 GS3-4010 GS3-4015	230 / 7.5 230 / 10 230 / 15 460 / 7.5 460 / 10 460 / 15
GS-FAN-4	92 mm, 24 VDC, 0.30A	2	GS3-2020 GS3-2025 GS3-2030 GS3-4020 GS3-4025 GS3-4030	230 / 20 230 / 25 230 / 30 460 / 20 460 / 25 460 / 30
GS-FAN-5	120 mm, 24 VDC, 1.2A	2	GS3-2040 GS3-2050 GS3-4040 GS3-4050 GS3-4060 GS3-4075 GS3-4100	230 / 40 230 / 50 460 / 40 460 / 50 460 / 60 460 / 75 460 / 100

1) One fan per part number. Includes connectorized electrical cable and installation instructions.

2) Fans are replacements for the internal fans in GS3 drives, are dimensionally and electrically equivalent to the originals, and are not intended for other use. Fan electrical loading is included in the input amperage ratings of the drives, and DC voltage is internally provided by the drives.

3) Some drives require multiple fans.

4) Can be used only with applicable DURAPULSE AC Drive.

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Using *DURApulse* AC Drives with AutomationDirect PLCs



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Compatible AutomationDirect PLCs and Modules

The following tables show which AutomationDirect PLCs and modules can be used with the GS3-Series *DURAPULSE* AC Drive.

AutomationDirect PLC Modules for Use with *DURAPULSE* AC Drives	
CLICK PLCs *	
C0-00DD1-D	CLICK CPU, 8 DC in / 6 sinking DC out; requires 24 VDC power supply; RS-232C Modbus/ASCII comm port. Discrete Inputs: 8 DC inputs, 24 VDC sink/source, 2 isolated commons. Discrete Outputs: 6 DC outputs, 5-27 VDC sinking, 0.1A/pt, 2 isolated commons.
C0-00DD2-D	CLICK PLC CPU, 8 DC in / 6 sourcing DC out; requires 24 VDC power supply; RS-232C Modbus/ASCII comm port, 3-wire RS-485 Modbus/ASCII comm port. Discrete Inputs: 8 DC inputs, 24 VDC sink/source, 2 common. Discrete Outputs: 6 DC outputs, 24 VDC sourcing, 0.1A/point, 2 common.
C0-00DR-D	CLICK PLC CPU, 8 DC in / 6 relay out; requires 24VDC power supply; 8k steps program memory; 6.4k words data memory; RS-232C Modbus/ASCII comm port. Discrete Inputs: 8 DC inputs, 24VDC sink/source, 2 common. Discrete Outputs: 6 relay outputs, 6-240 VAC / 6-27 VDC Form A (SPST) relays, 1.0A/point, 1 common.
C0-02DD1-D	CLICK CPU, 4 DC in / 4 sinking DC out; 2 channels analog in / 2 channels analog out (current/voltage selectable); requires 24 VDC power supply; RS-232C Modbus/ASCII comm port, 3-wire RS-485 Modbus/ASCII comm port. Discrete Inputs: 4 DC inputs, 5-27 VDC sink/source, 1 common. Discrete Outputs: 4 DC outputs, 24 VDC sinking, 0.1A/point, 1 common. Analog Inputs: 2 channels 4-20 mA or 0-5 VDC. Analog Outputs: 2 channels 4-20 mA or 0-5 VDC.
C0-02DD2-D	CLICK PLC CPU, 4 DC in / 4 sourcing DC out, 2 channels analog in / 2 channels analog out (current / voltage selectable); requires 24 VDC power supply; RS-232C Modbus/ASCII comm port, 3-wire RS-485 Modbus/ASCII comm port. Discrete Inputs: 4 DC inputs, 24 VDC sink/source, 1 common. Discrete Outputs: 4 DC outputs, 24 VDC sourcing, 0.1A/point, 1 common. Analog Inputs: 2 channels 4-20 mA or 0-5 VDC. Analog Outputs: 2 channels 4-20 mA or 0-5 VDC.
C0-02DR-D	CLICK PLC CPU, 4 DC in / 4 relay out, 2 channels analog in / 2 channels analog out (current / voltage selectable); requires 24 VDC power supply; RS-232C Modbus/ASCII comm port, 3-wire RS-485 Modbus/ASCII comm port. Discrete Inputs: 4 DC inputs, 24 VDC sink/source, 1 common. Discrete Outputs: 4 relay outputs, 6-240 VAC / 6-27 VDC Form A (SPST) relays, 1.0A/point, 1 common. Analog Inputs: 2 channels 4-20 mA or 0-5 VDC. Analog Outputs: 2 channels 4-20 mA or 0-5 VDC.
CLICK DC Input Modules	
C0-08ND3	8-point 12-24 VDC current sinking/sourcing input module; 2 isolated commons.
C0-16ND3	16-point 24VDC current sinking/sourcing input module; 4 isolated commons.
CLICK DC Output Modules	
C0-08TD1	8-point 3.3-27 VDC current sinking output module, 2 isolated commons, 0.3A/point.
C0-08TD2	8-point 12-24 VDC current sourcing output module; 1 isolated common, 0.3A/point.
C0-16TD1	16-point 5-27 VDC current sinking output module, 2 isolated commons, 0.1A/point.
C0-16TD2	16-point 12-24 VDC current sourcing output module; 2 isolated commons, 0.1A/point.
**** "Brick" PLCs may contain some I/O that are not compatible with GS3/DURAPULSE drives. Refer to "Typical Connections..." section to determine specifically which I/O are compatible.***	

AutomationDirect PLC Modules for Use with *DURAPULSE* AC Drives (continued)	
DL05 PLCs *	
D0-05AR	DL05 CPU, 8 AC in / 6 Relay out, 110/220VAC Power Supply. Inputs: 8 AC inputs, 90-120 VAC, 2 isolated commons. Outputs: 6 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 2 isolated commons
D0-05DR	DL05 CPU, 8 DC in / 6 Relay out, 110/220VAC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 2 isolated commons
D0-05DD	DL05 CPU, 8 DC in / 6 DC out, 110/220VAC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 DC outputs, 6-27 VDC current sinking, 1.0A/pt. max.
D0-05DD-D	DL05 CPU, 8 DC in / 6 DC out, 12/24VDC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 DC outputs, 6-27 VDC current sinking, 1.0A/pt. max.
D0-05DR-D	DL05 CPU, 8 DC in / 6 Relay out, 12/24VDC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 2 isolated commons
DL06 PLCs *	
D0-06DD1	DL06 CPU, 20 DC in / 16 DC out, 110/220VAC Power Supply, with 0.3A 24VDC Auxiliary Device Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sinking, 1.0A/pt. max., 4 commons non-isolated (4 points per common)
D0-06DD2	DL06 CPU, 20 DC in / 16 DC out, 110/220VAC power supply, with 0.3A 24VDC auxiliary device power supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sourcing 1.0A/pt. max., 4 commons non-isolated (4 points per common).
D0-06DR	DL06 CPU, 20 DC in / 16 Relay out, 110/220VAC Power Supply, with 0.3A 24VDC Auxiliary Device Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 4 isolated commons (4 points per common)
D0-06AR	DL06 CPU, 16 AC in / 20 Relay out, 110/220VAC power supply, with 0.3A 24VDC auxiliary device power supply. Inputs: 20 AC inputs, 90-120 VAC, 5 isolated commons (4 inputs per common). Outputs: 16 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 4 isolated commons (4 points per common)
D0-06DD1-D	DL06 CPU, 20 DC in / 16 DC out, 12/24VDC Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sinking, 1.0A/pt. max., 4 commons non-isolated (4 points per common).
D0-06DD2-D	DL06 CPU, 20 DC in / 16 DC out, 12/24VDC power supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sourcing, 1.0A/pt. max., 4 commons non-isolated (4 points per common).
D0-06DR-D	DL06 CPU, 20 DC in / 16 Relay out, 110/220VAC Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 4 isolated commons (4 points per common)
**** "Brick" PLCs may contain some I/O that are not compatible with GS3/DURAPULSE drives. Refer to "Typical Connections..." section to determine specifically which I/O are compatible.***	

AutomationDirect PLC Modules for Use with *DURAPULSE* AC Drives (continued)	
DL05/DL06 DC Input/Output Modules	
D0-08CDD1	4 pt. 12-24VDC current sinking/sourcing input, 1 common, 4 pt. 12-24VDC sinking output, 0.3A/point, 1.2A/module, removable terminal, no fuse
DL05/DL06 DC Output Modules	
D0-10TD1	10 pt. 12-24 VDC current sinking output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse
D0-10TD2	10 pt. 12-24 VDC current sourcing output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse
D0-16TD1	16 pt. 12-24 VDC current sinking output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse
D0-16TD2	16 pt. 12-24 VDC current sourcing output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse. One pre-wired Ziplink cable (0.5 meter) and terminal block connector module required for this I/O module
DL05/DL06 Analog Modules	
F0-04DAH-1	4 channel current analog output module; 4-20 mA; 16-bit resolution
F0-04DAH-2	4 channel voltage analog output module; 0-10V; 16-bit resolution
F0-08DAH-1	8 channel current analog output module; 4-20 mA; 16-bit resolution
F0-08DAH-2	8 channel voltage analog output module; 0-10V; 16-bit resolution
F0-2AD2DA-2	2 channel in, 2 channel out voltage analog option card; 0-5V, 0-10V
F0-4AD2DA-1	4 channel in, 2 channel sourcing out current analog option card; 4-20mA
F0-4AD2DA-2	4 channel in, 2 channel out voltage analog option card; 0-5V, 0-10V
DL105 PLCs *	
F1-130DR	DL130 CPU, 10 DC in / 8 Relay out, 110/220VAC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 relay outputs, 12-30 VDC, 12-250VAC, 7A/pt. max., 4 isolated commons
F1-130DD	DL130 CPU, 10 DC in / 8 DC out, 110/220VAC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 DC outputs, 5-30VDC current sinking, 0.5A/pt. max, 3 internally connected commons
F1-130DR-D	DL130 CPU, 10 DC in / 8 Relay out, 12/24VDC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 relay outputs, 12-30 VDC, 12-250VAC, 7A/pt. max., 4 isolated commons
F1-130DD-D	DL130 CPU, 10 DC in / 8 DC out, 12/24VDC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 DC outputs, 5-30VDC current sinking, 0.5A/pt. max, 3 internally connected commons
DL205 DC Input/Output Modules	
D2-08CDR	4 pt. 24VDC sinking/sourcing input, 1 common, 4 pt. relay output, 1A/pt., 4A/module, 1 common, replaceable fuse
**** "Brick" PLCs may contain some I/O that are not compatible with GS3/DURApulse drives. Refer to "Typical Connections..." section to determine specifically which I/O are compatible.***	

AutomationDirect PLC Modules for Use with *DURAPULSE* AC Drives (continued)	
DL205 DC Output Modules	
D2-08TD1	8 pt. 12-24 VDC current sinking output module, 1 common (2 common terminals), 0.3A/point, 2.4A/module, fused per common (non-replaceable), removable terminal
D2-08TD2	8 pt. 12-24 VDC current sourcing output module, 1 common (2 common terminals), 0.3A/point, 2.4A/module, fused per common (non-replaceable), removable terminal
D2-16TD1-2	16 pt. 12-24 VDC current sinking output module, 1 common (2 common terminals), 0.1A/point, 1.6A/module, no fuse, European type removable terminal
D2-16TD2-2	16 pt. 12-24 VDC current sourcing output module, 1 common (2 common terminals), 0.1A/point, 1.6A/module, no fuse, European type removable terminal
D2-32TD1	32 pt. 12-24 VDC current sinking output module. 1 common (4 common terminals), 0.1A/point, 3.2A/module, no fuse
D2-32TD2	32 pt. 12-24 VDC current sourcing output module, 4 commons (isolated), 0.1A/point, 3.2A/module, no fuse. Requires one connector, sold separately. NOTE: Recommended pre-wired Ziplink connector cable for this I/O Module is part number ZL-4CBL4#; where # designates either 0.5, 1, or 2 meter cable lengths. Accessory cable connector module for ZL-4CBL4# cable is part number ZL-CM40. (Or build a custom cable with D4-IO3264R, D4-IO3264S or D4-IOCBL-1.)
DL205 Relay Output Modules	
D2-04TRS	4-pt. 5-30 VDC or 5-240 VAC isolated relay output module, 4 Form A (SPST) relays, 4 commons, 4A/point, 8.0A/module, replaceable fuse, removable terminal
D2-08TR	8-pt. 5-30 VDC or 5-240 VAC output module, 8 Form A (SPST) relays, 1 common (2 common terminals), 1A/point, 4.0A/module, replaceable fuse, removable terminal
F2-08TR	8-pt relay output, 10A/common, 5-30VDC or 5-240VAC
F2-08TRS	8-pt. 12-28 VDC or 12-240 VAC output module, 5 Form A (SPST) relays, 3 Form C (SPDT) relays, 8 isolated commons, 7A/point max., no fuses, removable terminal
D2-12TR	12 pt. 5-30 VDC or 5-240 VAC relay output module, 12 Form A (SPST) relays, 2 commons, 1.5A/point max., 3.0A/common, 2 replaceable fuses, removable terminal
DL205 Analog Output Module	
F2-02DAS-1	2 channel, 16-bit resolution, Isolated 4-20mA sourcing (2 isolated commons). Designed to operate with 24 VDC user-supplied power supply
F2-02DAS-2	2 channel analog output, 16 bit resolution, isolated, range: 0-5V, 0-10V (2 isolated commons). Designed to operate with 24 VDC user-supplied power supply
F2-08DA-1	8 channel analog output module, 12 bit resolution, range: 4-20mA, sink or source output configurable. Designed to operate with 24 VDC user-supplied power supply.
F2-02DA-2	2 channel analog output module, 12 bit resolution, ranges: 0-5V, 0-10V, -5 to +5V, -10 to +10V. Designed to operate with 24 VDC user-supplied power supply.
F2-08DA-2	8 channel analog output module, 12 bit resolution, ranges: 0-5V, 0-10V. Designed to operate with 24 VDC user-supplied power supply.
DL205 Analog Input Modules	
F2-04AD-2	4 channel, 12-bit, 0-5V, 0-10V, -5 to +5V, -10 to +10V. Designed to operate with a 24VDC user supplied power supply
F2-08AD-2	8 channel, 12-bit, 0-5V, 0-10V, -5 to +5V, -10 to +10V. Designed to operate with a 24VDC user supplied power supply
DL205 Analog Combination Modules	
F2-8AD4DA-1	8 channel, 16-bit, 0-20mA in; 4 channel, 16-bit, 4-20mA out. Designed to operate with a 24VDC user supplied power supply.
F2-8AD4DA-2	8 channel, 16-bit, 0-5V, 0-10V in; 4 channel, 16-bit, 0-5V, 0-10V out. Designed to operate with a 24VDC user supplied power supply.

AutomationDirect PLC Modules for Use with *DURAPULSE* AC Drives (continued)	
DL305 Relay Output Modules	
D3-08TR	8-pt. 5–30VDC or 5–220VAC output module, 5A/point DC or 4A/point AC, 8 Form A relays (SPST), 2 commons (isolated), non-removable terminal, 2 user replaceable fuses
D3-16TR	16-pt. 5–30VDC or 5–220VAC output module, 2A/point,16 Form A relays (SPST), 2 commons (isolated), removable terminal, no internal fuses
DL305 Analog Input Modules	
F3-04ADS	4-channel isolated analog input module, 12-bit resolution, ranges: 0–5V, 0–10V, 1–5V, -5V to +5V, -10V to +10V, 0–20mA, 4–20mA. -750 to +750 VDC channel-to-channel isolation.
F3-16AD	16-channel analog input module, 12-bit resolution, ranges: -5 to +5V, -10 to +10V, 0 to 10V, 0 to 20mA. Each point can be either a voltage or current input.
DL305 Analog Output Modules	
F3-04DAS	4-channel isolated analog output module, 12-bit resolution, ranges: 0–5V, 0–10V, -5 to +5V, -10 to +10V, 4–20mA, 0–20mA. -750 to +750 VDC channel-to-channel isolation.
DL405 DC Output Modules	
D4-08TD1	8-pt. 12–24VDC current sinking output module, 2 commons (internally connected), 2A/point, 5A/common, removable terminal
D4-16TD1	16-pt. 5–24VDC current sinking output module, 2 commons (internally connected), 0.5A/point, 3A/common, removable terminal
D4-16TD2	16-pt. 12–24VDC current sourcing output module, 2 commons (isolated), 0.5A/point, 3A/common, removable terminal
D4-32TD1	32-pt. 5–24VDC current sinking output module, 4 commons (isolated), 0.2A/point, 1.6A/common. Requires one connector, sold separately.
D4-32TD2	32-pt. 12–24VDC current sourcing output module, 4 commons (isolated), 0.2A/point, 1A/common. Requires one connector, sold separately.
DL405 Relay Output Modules	
D4-08TR	8-pt. 5–30VDC or 5–250VAC output module, 8 Form A (SPST) relays, 2 commons (isolated), 2A/point, 5A/common, removable terminal
F4-08TRS-1	8-pt. 12–30VDC or 12–250VAC isolated output module, 4 Form A (SPST) and 4 Form C (SPDT) relays, 8 commons (isolated), 10A/point, 40A/module, removable terminal
F4-08TRS-2	8-pt. 12–30VDC or 12–250VAC isolated output module, 4 Form A (SPST) relays and 4 Form C (SPDT) relays, 8 commons (isolated), 5A/point, 40A/module, replaceable fuses, removable terminals
D4-16TR	16-pt. 5–30VDC or 5–250VAC output module, 8 Form A (SPST) relays, 2 commons (isolated), 1A/point, 5A/common, removable terminals
DL405 Analog Input Modules	
F4-04ADS	4-channel isolated analog input module, 12-bit resolution, ranges: 0–5V, 0–10V, 1–5V, -5V to +5V, -10V to +10V, 0–20mA, 4–20mA
F4-08AD	8-channel analog input module, 12-bit resolution, ranges: 4 to 20mA, 1 to 5V, 0 to 20mA, 0 to 5V, 0 to 10V, -5V to +5V, -10V to +10V
F4-16AD-2	16-channel analog input module, 12-bit resolution, ranges: 0–5V, 0–10V
DL405 Analog Output Modules	
F4-04DAS-1	4-channel analog output module, 16-bit resolution, isolated, range: 4 to 20mA current sourcing
F4-04DAS-2	4-channel analog output module, 16-bit resolution, isolated, range: 0–5V, 0–10V
F4-08DA-2	8-channel analog output module, 12-bit resolution, range: 0–5V or 0–10V
F4-16DA-2	16-channel analog output module, 12-bit resolution, range: 0–5V or 010V

AutomationDirect PLC Modules for Use with *DURAPULSE* AC Drives (continued)	
Terminator I/O DC Output Modules	
T1K-08TD1	8 pt. 12-24 VDC current sinking output module, 4 points per common, 1.0A/point, 2 replaceable fuses (T1K-FUSE-1). (Use with T1K-08B or T1K-08B-1 terminal base.)
T1K-08TD2-1	8 pt. 12-24 VDC current sourcing output module, 4pts/common, 1.0A/point, 2 replaceable fuses. (Use with T1K-08B or T1K-08B1 terminal base.)
T1K-16TD1	16 pt. 12-24 VDC current sinking output module, 4 points per common, 1.0A/point, 4 replaceable fuses (T1K-FUSE-1). (Use with T1K-16B or T1K-16B-1 terminal base.)
T1K-16TD2-1	16 pt. 12-24 VDC current sourcing output module, 4pts/common, 1.0A/point, 4 replaceable fuses. (Use with T1K-16B or T1K-16B-1 terminal base.) Note: Replaces T1K-16TD2 with improved derating. Not a direct replacement; simple device wiring change if used as replacement part for T1K-16TD2.
Terminator I/O Relay Output Modules	
T1K-08TR	8 pt. 5-30 VDC or 5-240 VAC output module, 8 Form A (SPST) relays, 4 points per common, 2.0A/point max., 2 replaceable fuses (T1K-FUSE-2). (Use with T1K-08B or T1K-08B-1 terminal base.)
T1K-16TR	16 pt. 5-30 VDC or 5-240 VAC output module, 16 Form A (SPST) relays, 4 points per common, 2.0A/point max., 4 replaceable fuses (T1K-FUSE-2). (Use with T1K-16B or T1K-16B-1 terminal base.)
T1K-08TRS	8 pt. 5-30 VDC or 5-240 VAC isolated relay output module, 8 Form A (SPST) relays, 1 point per common, 7.0A/point max., 8 replaceable fuses (T1K-FUSE-3). (Isolation requires use of T1K-16B or T1K-16B-1 terminal base.)
Terminator I/O Analog Input Modules	
T1F-08AD-2	8 channel analog input module, 14 bit resolution (13 bit plus sign bit), range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. (Use with T1K-08B or T1K-08B-1 terminal base.)
T1F-16AD-2	16 channel analog input module, 14 bit resolution (13 bit plus sign bit), range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. (Use with T1K-16B or T1K-16B-1 terminal base.)
Terminator I/O Analog Output Modules	
T1F-08DA-1	8 channel analog output, 12 bit resolution, range: 0-20mA, 4-20mA. (Use with T1K-08B or T1K-08B-1 terminal base.)
T1F-08DA-2	8 channel analog output, 12 bit resolution, range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. (Use with T1K-08B or T1K-08B-1 terminal base.)
T1F-16DA-1	16 channel analog output, 12 bit resolution, range: 0-20mA, 4-20mA. (Use with T1K-16B or T1K-16B-1 terminal base.)
T1F-16DA-2	16 channel analog output, 12 bit resolution, range: 1-5VDC, 1-10VDC, +/-5VDC, +/-10VDC. (Use with T1K-16B or T1K-16B-1 terminal base.)
Terminator I/O Analog Input/Output Modules	
T1F-8AD4DA-1	8 channel analog input module and 4 channel analog output module. Inputs: 14 bit resolution (13 bit plus sign bit), range: -20 to 20mA, 0-20mA, 4-20mA. Outputs: 12 bit resolution, range: 4-20mA, sinking or sourcing compatible. (Use with T1K-08B or T1K-08B-1 terminal base.)
T1F-8AD4DA-2	8 channel analog input module and 4 channel analog output module. Inputs: 14 bit resolution (13 bit plus sign bit), range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. Outputs: 12 bit resolution, range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. (Use with T1K-08B or T1K-08B-1 terminal base.)

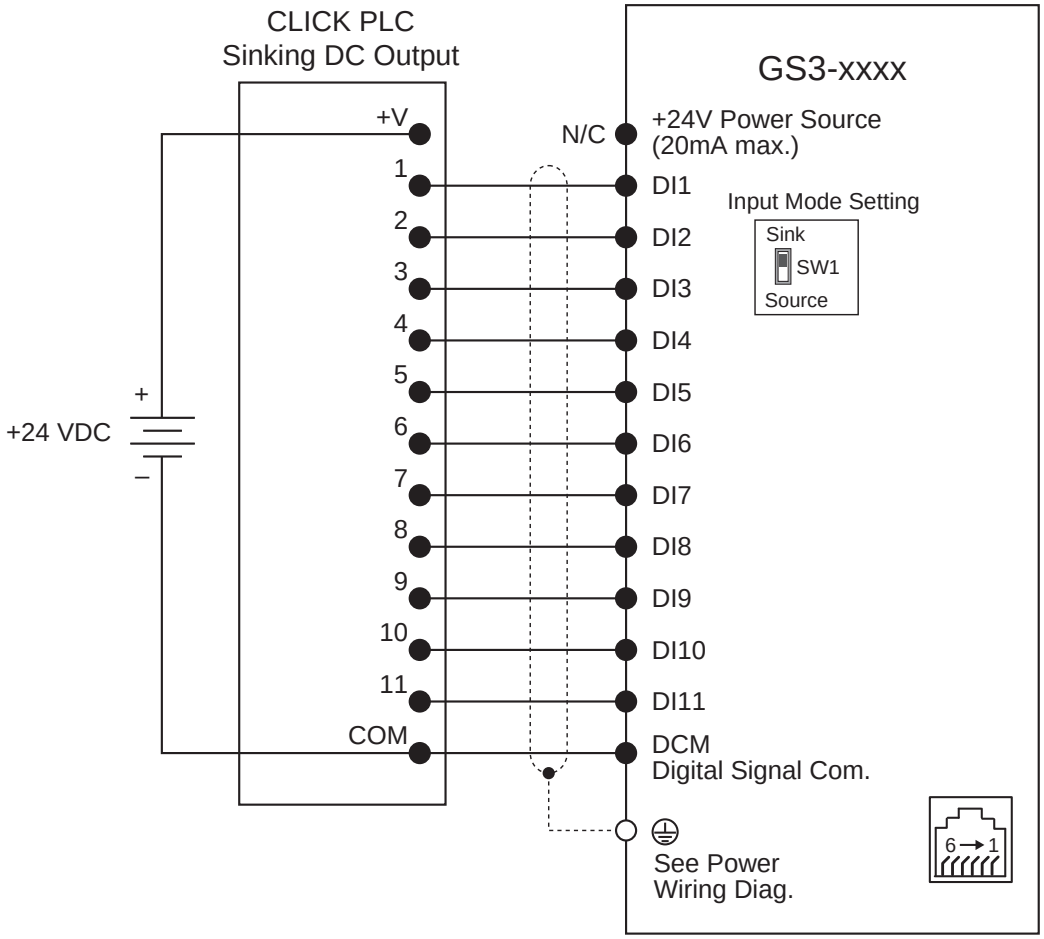
Typical PLC Connections to *DURAPULSE* AC Drives

The following drawings show some typical connections between *DURAPULSE* AC Drives and AutomationDirect PLCs and modules.

CLICK PLC and Sinking DC Output Modules

- C0-00-DD1-D
- C0-02-DD1-D
- C0-08-TD1
- C0-16-TD1

DC Voltage Supplied from PLC or external source:



○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

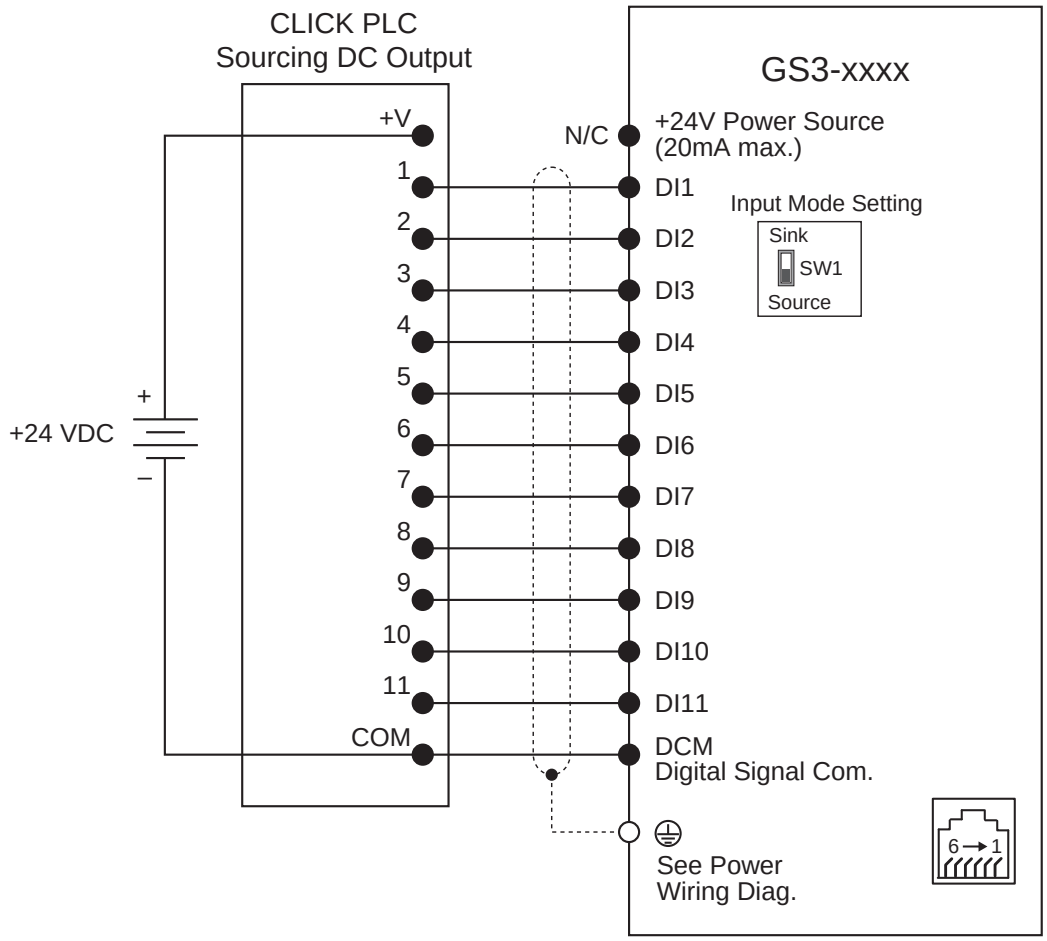
Mode switch SW1 needs to be set to the "Sink" position when connecting to a "sinking" output module.

Typical PLC Connections to *DURAPULSE* AC Drives (continued)

CLICK PLC and Sourcing DC Output Modules

- C0-00DD2-D
- C0-02DD2-D
- C0-08TD2
- C0-16TD2

DC Voltage Supplied from PLC or external source:



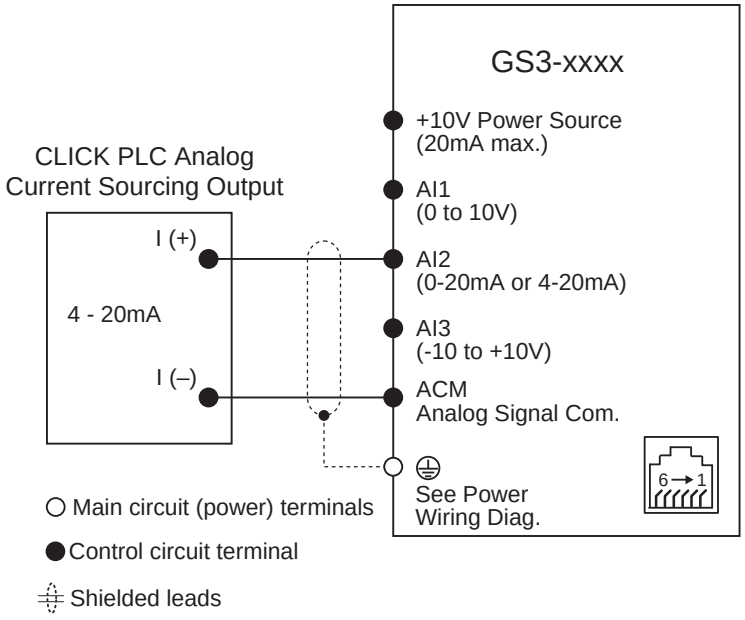
○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

Mode switch SW1 needs to be set to the "Source" position when connecting to a "sourcing" output module.

Typical PLC Connections to *DURAPULSE* AC Drives (continued)

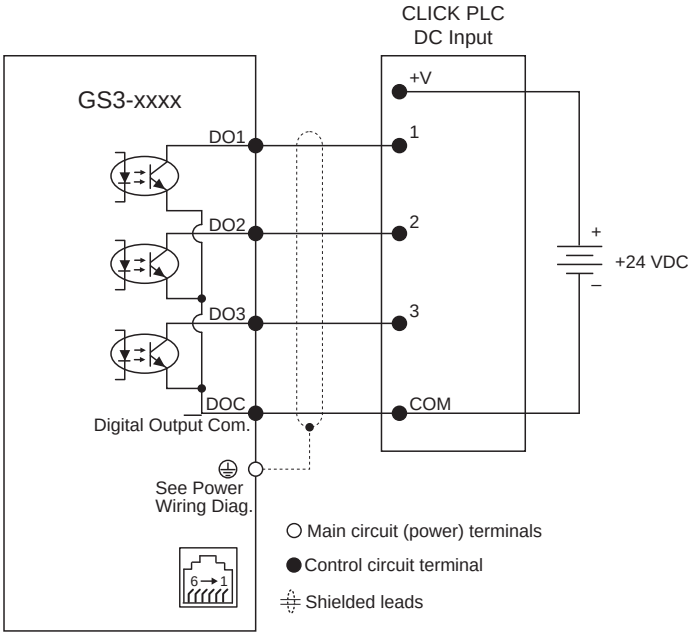
CLICK PLC Sourcing Analog Current Output Modules

- C0-02DD1-D
- C0-02DD2-D
- C0-02DR-D



CLICK PLC DC Input Modules

- C0-00DD1-D
- C0-00DD2-D
- C0-00DR-D
- C0-02DD1-D
- C0-02DD2-D
- C0-02DR-D
- C0-08ND3
- C0-16ND3



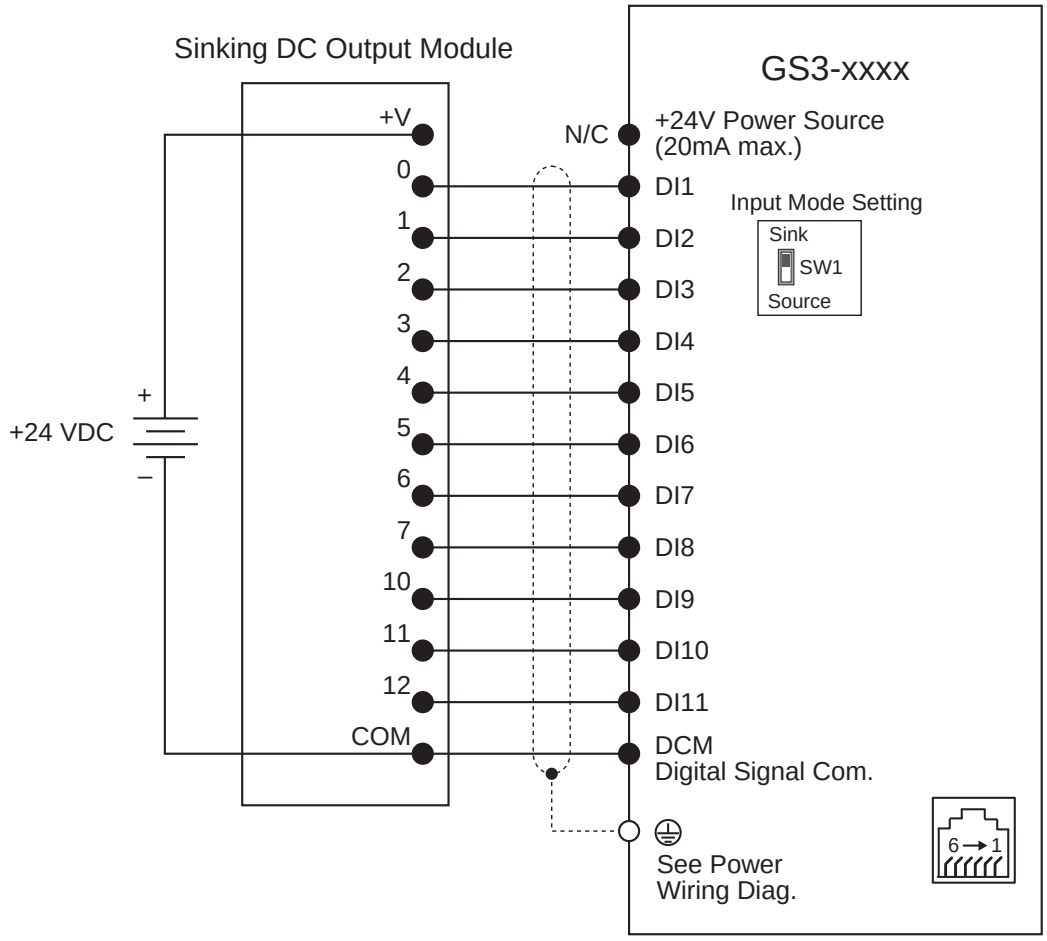
Typical PLC Connections to *DURAPULSE* AC Drives (continued)

The following drawings show some typical connections between *DURAPULSE* AC Drives and ***Direct*LOGIC** PLCs and modules.

*Direct*LOGIC Sinking DC Output Modules

- D0-05DD
- D0-05DD-D
- D0-06DD1
- D0-06DD1-D
- D0-08CDD1
- D0-10TD1
- D0-16TD1
- F1-130DD
- F1-130DD-D
- D2-08TD1
- D2-16TD1-2
- D2-32TD1
- D4-08TD1
- D4-16TD1
- D4-32TD1
- T1K-08TD1
- T1K-16TD1

DC Voltage Supplied from PLC or external source:



○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

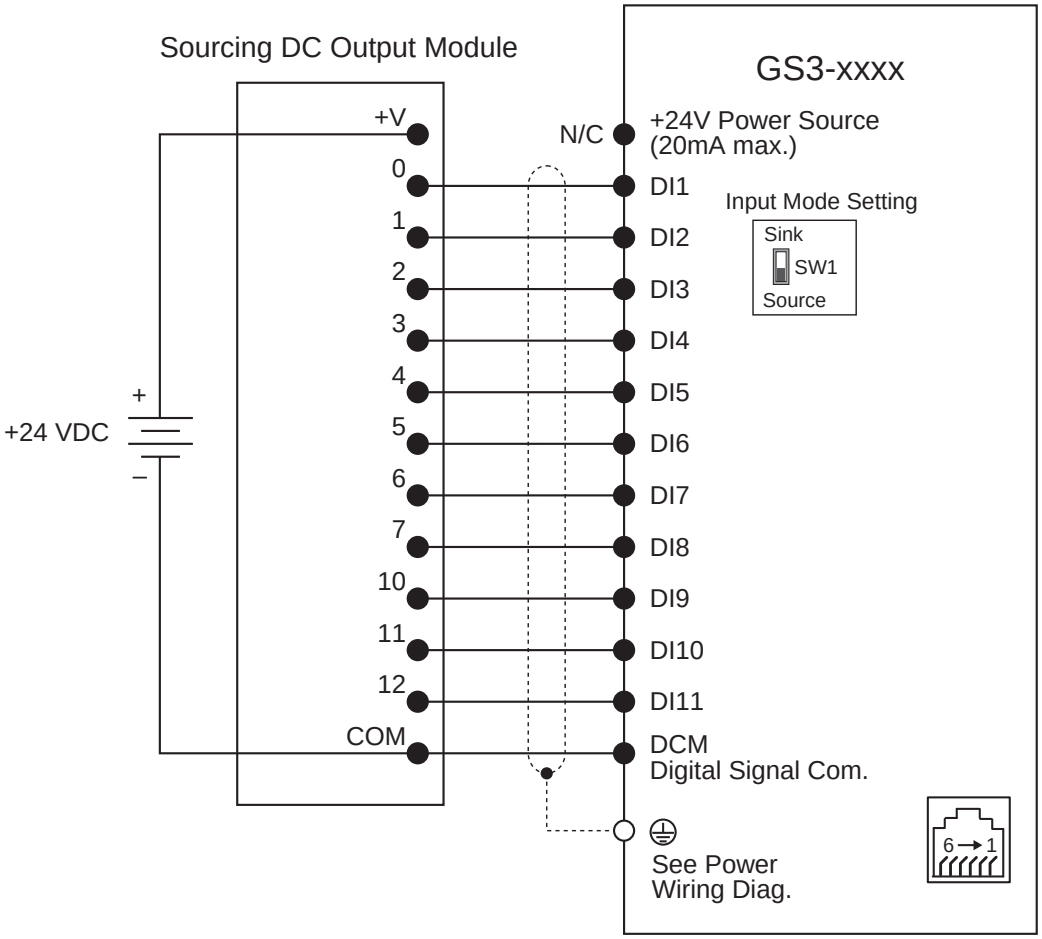
Mode switch SW1 needs to be set to the "Sink" position when connecting to a "sinking" output module.

Typical PLC Connections to *DURAPULSE* AC Drives (continued)

*Direct*LOGIC Sourcing DC Output Modules

- D0-06DD2
- D0-06DD2-D
- D0-10TD2
- D0-16TD2
- D2-08TD2
- D2-16TD2-2
- D2-32TD2
- D4-08TD2
- D4-16TD2
- D4-32TD2
- T1K-08TD2-1
- T1K-16TD2-1

DC Voltage Supplied from PLC or external source:



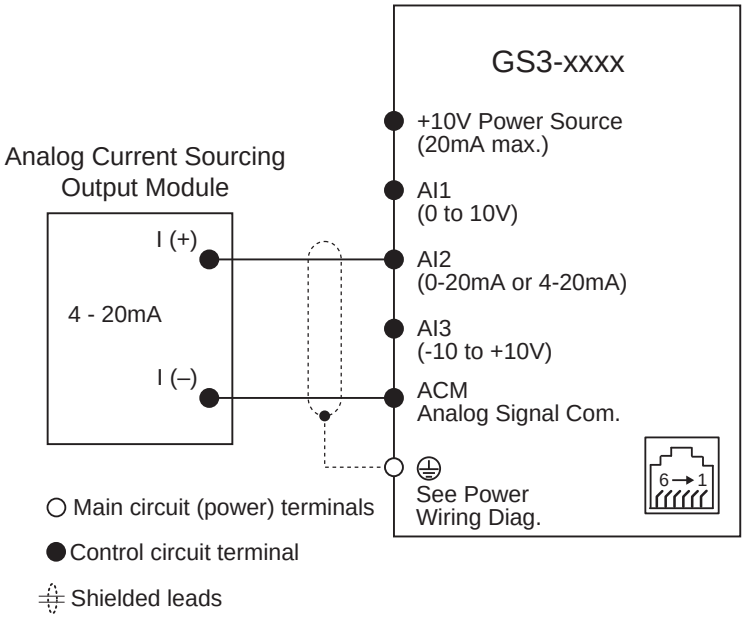
○ Main circuit (power) terminals ● Control circuit terminal ⫩ Shielded leads

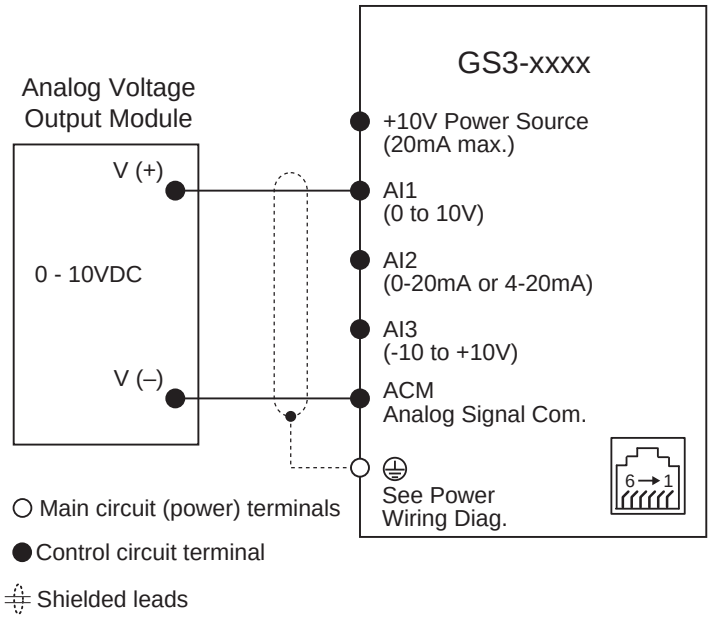
Mode switch SW1 needs to be set to the "Source" position when connecting to a "sourcing" output module.

Typical PLC Connections to *DURAPULSE* AC Drives (continued)

*Direct*LOGIC Voltage or Current Sourcing Analog Output Modules

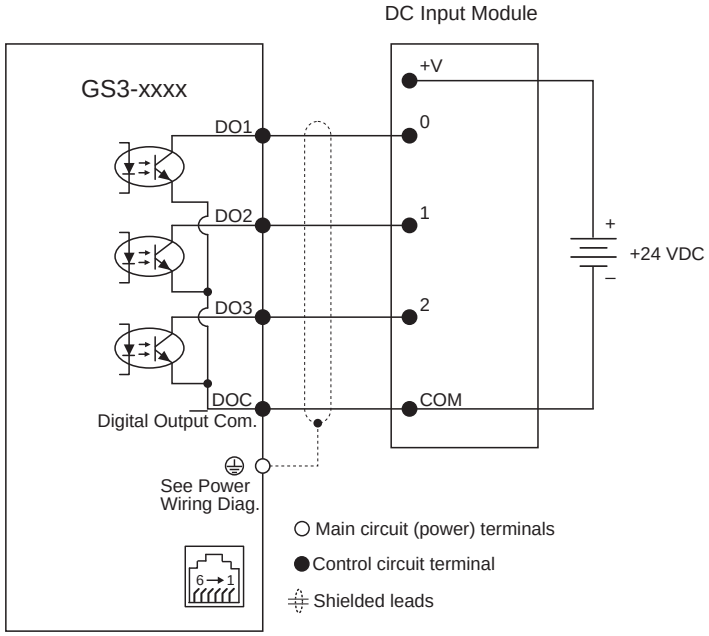
- F0-04DAH-1
- F0-04DAH-2
- F0-08DAH-1
- F0-08DAH-2
- F0-2AD2DA-2
- F0-4AD2DA-1
- F0-4AD2DA-2
- F2-02DAS-1
- F2-02DAS-2
- F2-08DA-1
- F2-02DA-2
- F2-08DA-2
- F2-8AD4DA-1
- F2-8AD4DA-2
- F4-08DA-2
- F4-16DA-2
- F4-04DAS-1
- F4-04DAS-2
- T1F-08DA-2
- T1F-16DA-2
- T1F-8AD4DA-1
- T1F-8AD4DA-2



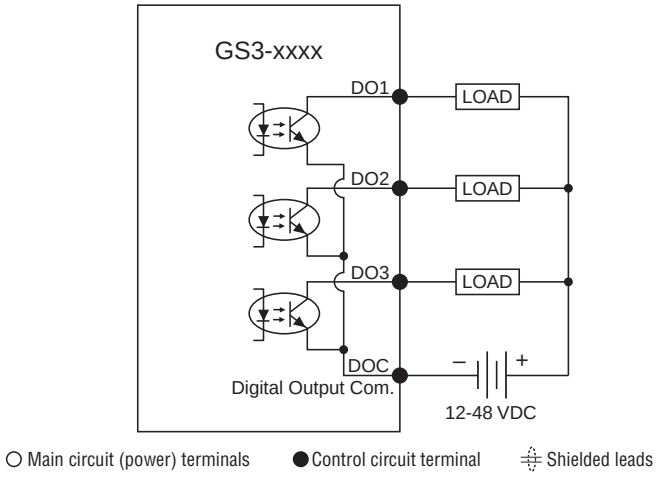


Typical PLC Connections to *DURAPULSE* AC Drives (continued)

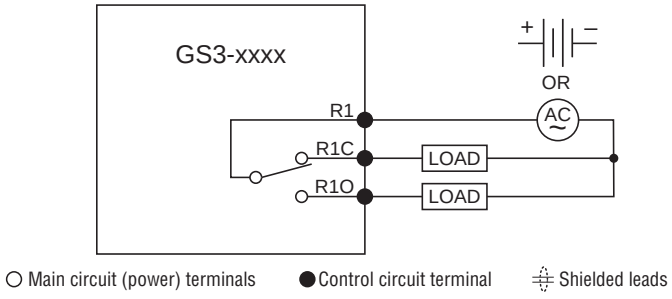
*Direct*LOGIC PLC DC Input Modules



Digital Output Terminal Wiring



Relay Contact Output Terminal Wiring





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Wiring; Line Reactors: A–17
Wiring; Multi- Speed / PID SP: 4–32
Wiring; Relay Output: 4–36
Wiring; RF Filters: A–37
Wiring; Start/Stop/Direction: 4–29
Write Parameter Settings to Drive: 3–18
Write Parameter Settings to Keypad: 3–17

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GS3-M


3M04

GS/*DURAPULSE* Accessories – Ethernet Interface

GS-EDRV100 Overview

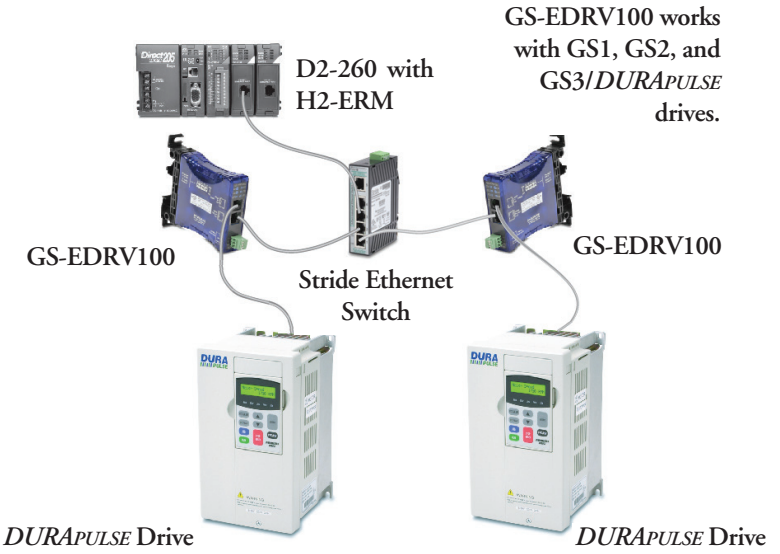
The GS-EDRV100 Ethernet interface provides a high-performance Ethernet link between a control system and any GS or *DURAPULSE* AC drive. The GS-EDRV100 processes signals to and from the drive, mounts on 35mm DIN rail, and connects the drive to an Ethernet hub or PC. It formats drive signals to conform with the Ethernet standard and transmits these signals to the H2-ERM or H4-ERM, Productivity3000, KEP*Direct* OPC Server, KEP*Direct* EBC I/O Server, or independent controller with a Modbus TCP/IP driver. This allows for greater connectivity to many control system architectures.

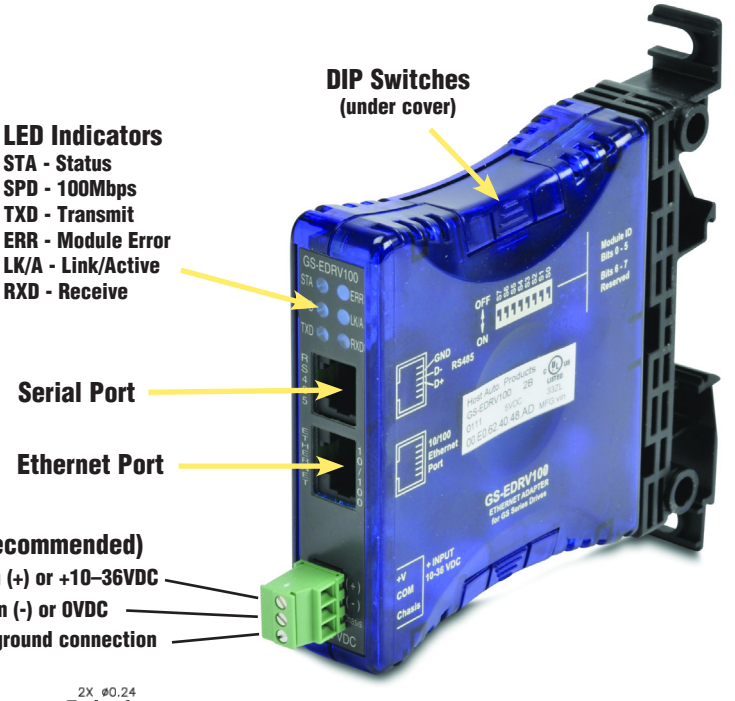
An additional feature is the built-in Web server which allows users to configure and control the drive from any Web browser via the IP address of the GS-EDRV100 card.

Note: The GS-EDRV100 requires an external 24 VDC power supply.

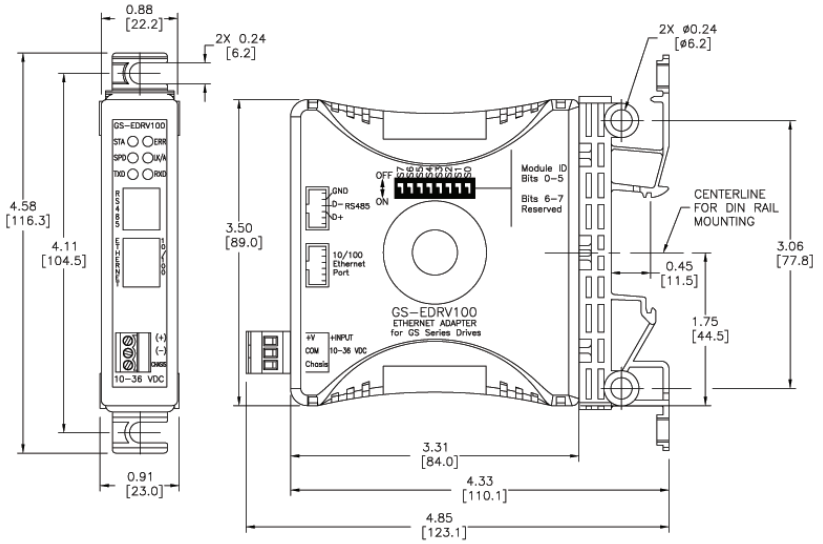
Automatic power shut-down

The GS series drives have a provision for shutting down control or power to the inverter in the event of a communications time-out. This function can be set up through the drive's parameter group 9.





Dimensions: inches[mm]



Specifications	
Part Number	***GS-EDRV100***
Price	$185.00
Approvals	cUL Listed, file number E185989
Input Voltage	10–36 VDC
Input Current	50–220 mA
NOTE: Can be used with all GS/DURApulse series AC drives.	
NOTE: Package includes 2-ft. serial communications cable.	
NOTE: Mounts on 35mm DIN rail.	

National Environmental Systems
84 Dunham Street
Attleboro, MA 02703

NES MAJOR COMPONENT SUMMARY **REVISION 0 (90%)** MARCH 23, 2016

PROJECT NO.: **15-183** GES - BASF FACILITY - RENSSELAER, NY

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
TRUE UNION BALL VALVE, PVC, 3 IN	BV-302	1	SPEARS	1832-030	
CHECK VALVE, BRASS, 2 IN	CK-301	1	LEGEND	105-108NL	
GATE VALVE, BRASS, 2 IN	GV-301, 302	2	LEGEND	104-468	
VACUUM RELIEF VALVE, 3 IN FNPT, ADJUSTABLE	VRV-301	1	FPZ	VRL9	
TRUE UNION BALL VALVE, PVC, 2 IN	BV-401 / 404	4	SPEARS	3629-020	
BALL VALVE, BRASS, 1-1/2 IN	BV-405 / 408	4	APOLLO	94A10701	
BUTTERFLY VALVE, DUCTILE IRON, SS DISC, 3 IN	BFV-501 / 513	13	JOMAR	600-03 DSPL	
BALL VALVE, BRASS, 0.75IN	BV-501 / 503	3	APOLLO	94A10401	
TRUE UNION BALL VALVE, PVC, 2 IN	BV-601,602	2	SPEARS	3629-020	
BALL VALVE, BRASS, 0.5 IN DRAIN	BV-603,604	2	APOLLO	94A10301	
TRUE UNION BALL VALVE, PVC, 2 IN	MOV-601,602	2	HAYWARD	TB1200ST-EK61	
ELECTRIC ACTUATOR	MOV-601,602	2	MAXAIRTECH	AE02-120VAC-LED	
BALL VALVE, BRASS, 1 IN DRAIN	BV-701	1	APOLLO	94A10501	
TRUE UNION BALL VALVE, PVC, 3 IN	BV-702	1	SPEARS	1832-030	
CHECK VALVE, BRASS, 3 IN	CK-701	1	LEGEND	105-110NL	
GATE VALVE, BRASS, 3 IN	GV-701	1	LEGEND	104-470	
BALL VALVE, BRASS, 1 IN DRAIN	BV-801	1	APOLLO	94A10501	
TRUE UNION BALL VALVE, PVC, 2 IN	BV-802 / 807	6	SPEARS	3629-020	
BALL VALVE, BRASS, 2 IN	BV-808	1	APOLLO	94A10801	
BALL VALVE, BRASS, 3/4 IN DRAIN	BV-809	1	APOLLO	94A10401	
CHECK VALVE, BRASS, 1 IN	CK-801	1	LEGEND	105-105NL	
GATE VALVE, BRASS, 1 IN	GV-801	1	LEGEND	104-465	
BALL VALVE, PLATED BRASS, 1/4 IN	SP	26	MIDLAND	46-931	
SECTION 5 - PROCESS INSTRUMENTATION					
PRESSURE INDICATOR, 0 - 60 PSI	PI-101 / 106	6	DWYER	SGZ-D10422N-GF	
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-101 / 106	6	GF SIGNET	3-2551-P0-22	
FLOW SENSOR INSTALLATION FITTING, 0.75 IN	FIT-101 / 106	6	GF SIGNET	PV8T007	
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-101	1	DWYER	A1F-PC-SS-1-2	
PRESSURE INDICATOR, 0 - 60 PSI	PI-107,108	2	DWYER	SGZ-D10422N-GF	
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-107	1	GF SIGNET	3-2551-P0-22	
FLOW SENSOR INSTALLATION FITTING, 2 IN	FIT-107	1	GF SIGNET	PV8T020	
EQ TANK ULTRASONIC LEVEL TRANSMITTER	LT-201	1	FLOWLINE - ECHOSPAN	LU80-5101	
EQ TANK EMERGENCY HIGH LEVEL SWITCH	LSHH-200	1	GEMS	MYEL40T	
PRESSURE INDICATOR, 0 - 100 PSI	PI-200 / 204	5	DWYER	SGZ-D10522N-GF	
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-201	1	DWYER	A1F-PC-SS-1-2	
TEMPERATURE INDICATOR, (-20) TO 120 F	TI-300	1	AV	1NFY8	
PRESSURE INDICATOR, 0 - 10 PSI	PI-301	1	DWYER	SGX-D8022N	
TRAY STRIPPER LEVEL TRANSMITTER	LT-301	1	FPI SENSOR	L500-TRANS	
TRAY STRIPPER EMERGENCY HIGH LEVEL SWITCH	LSHH-300	1	GEMS	MYEL40T	
POST-TRAY STRIPPER MS LEVEL SWITCH HIGH-HIGH	LSHH-301	1	DWYER	F6-HPS-31	
VACUUM SWITCH - LOW, 4 TO 20 IWC	VSL-301	1	DWYER	1950-20-2F	
VACUUM INDICATOR, (-)60 - 0 IWC(V)	VI-301, 302	1	DWYER	LPG4-D7522N	
VACUUM INDICATOR, (-)100 - 0 IWC(V)	VI-303	1	DWYER	LPG4-D7722N	
TEMPERATURE INDICATOR, 0 TO 250 F	TI-301	1	AV	1NFY4	
FLOW ELEMENT PITOT TUBE, 6 IN	FE-301	1	DWYER	DS-300-6	
PITOT TUBE MAGNEHELIC GAUGE, 0-4 IWC	FI-301	1	DWYER	2003	
PRESSURE INDICATOR, 0 - 60 IWC	PI-303	1	DWYER	LPG4-D8422N	
PRESSURE SWITCH - HIGH, 0.5 TO 2 PSID	PSH-301	1	DWYER	1950P-2-2F	
PRESSURE INDICATOR, 0 - 100 PSI	PI-302	1	DWYER	SGZ-D10522N-GF	
PRESSURE INDICATOR, 0 - 100 PSI	PI-401 / 404	4	DWYER	SGZ-D10522N-GF	
PRESSURE TRANSMITTER, 0 - 25 PSID	DPT-401	1	DWYER	629-03-CH-P2-E5-S1	
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-501	1	DWYER	A1F-PC-SS-1-2	
PRESSURE INDICATOR, 0 - 100 PSI	PI-501 / 506	6	DWYER	SGZ-D10522N-GF	
PRESSURE SWITCH - HIGH, 4 - 75 PSI	PSH-600	1	DWYER	A1F-PC-SS-1-2	
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-601, 602	2	GF SIGNET	3-2551-P0-22	
FLOW SENSOR INSTALLATION FITTING, 1.5 IN	FIT-601	2	GF SIGNET	PV8T015	
BACKWASH SUPPLY TANK EMERGENCY HIGH LEVEL SWITCH	LSHH-700	1	GEMS	MYEL40T	
BACKWASH SUPPLY TANK HIGH & LOW LEVEL SWITCH	LSH-700, LSL-700	2	GEMS	MBLU40T	
PRESSURE INDICATOR, 0 - 60 PSI	PI-701	1	DWYER	SGZ-D10422N-GF	
MAGNETIC FLOW SENSOR TRANSMITTER	FIT-701	1	GF SIGNET	3-2551-P0-22	
FLOW SENSOR INSTALLATION FITTING, 3 IN	FIT-701	1	GF SIGNET	PV8T030	
BACKWASH SUPERNATANT TANK EMERGENCY HIGH LEVEL SWITCH	LSHH-800	1	GEMS	MYEL40T	
PRESSURE INDICATOR, 0 - 60 PSI	PI-801 / 803	3	DWYER	SGZ-D10422N-GF	
CHEMICAL DRUM LOW LEVEL SWITCH	LSL, 1001,1002	2	DWYER	F7-SS2	
BUILDING SUMP HIGH LEVEL SWITCH	LSHH-1200	1	DWYER	F7-SB	

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COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
CONTAINMENT PAD SUMP HIGH LEVEL SWITCH	LSHH-1201	1	DWYER	F7-SB	
PROCESS AREA TEMPERATURE SWITCH LOW	TSL-1200	1	DAYTON	2NNR6	
SECTION 6 - ELECTRICAL DRAWINGS & TABLE(S)					
HMI SCREEN SUMMARY / INSTRUCTIONS					
T-2, INTERLOCK SCHEDULE	T-2				
I-1A, MASTER CONTROL PANEL LAYOUT DRAWING	I-1A				
I-1B, MOTOR CONTROL PANEL LAYOUT DRAWING	I-1B				
T-3, PANEL BILL OF MATERIAL(S)	T-3				
SECTION 7 - MASTER CONTROL PANEL COMPONENTS					
ENCLOSURE NEMA 4 36 X 36 X 12 - MILD STEEL/GRAY	ENCL	1	HAMMOND	EN4SD363612GY	
BACK-PANEL 36 X 36 MILD STEEL/WHT	ENCL	1	HAMMOND	EP3636	
MOUNTING FEET SET OF 4 - ZINC PLATED	ENCL	1	HAMMOND	EZPMFHD	
PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	ENCL	2	SCE	SCE-PLWKB	
UPS 350VA 200W 120V 1PH 3 UPS & SURGE OUTLET 3 SURGE ONLY	UPS	1	APC	BE350G	
3G WIRELESS GATEWAY EVDO 800/1900 MHZ - VERIZON	CM	1	SIERRA WIRELESS	LS300 - 1101489	
LS300 BRACKET-DIN MOUNT	CM	1	SIERRA WIRELESS	6000558	
STATIC IP 12 IN MAGNET MOUNT ANTENNA 10FT RG174 CABLE SMA-MALE	CM	1	WILSON ELECTRONICS	301125	
RF COAXIAL SURGE PROTECTOR 698 MHZ 2.7 GHZ	CM	1	POLYPHASER	TSX-NFF	
FOR POLYPHASER 1 FT LMR-195 COAXIAL CABLE ASSEMBLY	CM	1	GET WIRELESS	GW195-12-SM-NM	
FOR POLYPHASER N MALE TO SMA FEMALE ADAPTER	CM	1	RF INDUSTRIES	RSA-3478	
11-SLOT I/O BASE FOR P3000 PAC REQ P3-01AC OR P3-01DC	PLC	1	ADI	P3-01B	
POWER SUPPLY 100-240VAC FOR P3000 PAC	PLC	1	ADI	P3-01AC	
CPU 266 MHz PROCESSOR 50MB MEMORY FOR P3000 PAC	PLC	1	ADI	P3-550	
16PT 12-24VDC INPUT SINK/SOURCE FOR P3000 PAC	PLC	4	ADI	P3-16ND3	
16CH ANALOG CURRENT INPUT 16-BIT MODULE FOR P3000 PAC	PLC	1	ADI	P3-16AD-1	
ANALOG 4-CH OUT VOLTAGE/CURRENT 16-BIT FOR P3000	PLC	1	ADI	P3-04DA	
16PT RELAY OUTPUT SPST 6-27VDC / 6-240VAC FOR P3000 PAC	PLC	2	ADI	P3-16TR	
FILLER MODULE FOR P3000 PAC	PLC	3	ADI	P3-FILL	
TERMINAL BLOCK FOR ALL 8 & 16 POINT I/O MODULES FOR P3000 PAC	PLC	8	ADI	P3-RTB	
CABLE C-MORE PANEL TO ADI PLC RJ12 PORT 10 FT RS232C	HMI	1	ADI	EA-2CBL	
C-MORE TOUCH PANEL 8 IN COLOR TFT ETHERNET & USB	HMI	1	ADI	EA9-T8CL	
C-MORE AC DC POWER ADAPTER FOR EA7 & EA9	HMI	1	ADI	EA-AC	
VER97303 HMI MEMORY CARD 8 GB NON-VOLATILE DATA STORAGE	HMI	1	VERBATIM	19NY57	
POWER SUPPLY 24 VDC 5A 120W DIN RAIL SLIM LINE	PS	1	ADI	PSP24-120S	
RELAY 120V 1PDT W/LIGHT BLADE PARALLEL	CR1-10,12	11	IDEC	RH1B-UL-AC120V	
SOCKET DIN RAIL/SURFACE 5-BLADE FOR RH1B	CR1-10,12	11	IDEC	SH1B-05	
RELAY 2PDT 10AMP 120VAC W/INDICATOR LIGHT	CR11	1	IDEC	RH2B-UL-AC120V	
SOCKET DIN RAIL/SURFACE 8-BLADE FOR RH2B	CR11	1	IDEC	SH2B-05	
DUPLEX GFCI RECEPTACLE 125 VAC 15 AMP 2-POLE NEMA 5-15R WHITE	SR	1	LEGRAND	1595-TRWRW	
1-GANG WEATHERPROOF RECEPT. BOX	SR	1	RED DOT	IHD3- 1	
CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	CB	1	SQUARE D	MG24430_	
MUSHROOM SWITCH RED TRIGGER ACTION - TURN TO RELEASE	ESTOP	1	SQUARE D	ZB5AS844_	
PILOT LIGHT HEAD - RED	LT	2	SQUARE D	ZB5AV043_	
PILOT LIGHT HEAD - YELLOW	LT	1	SQUARE D	ZB5AV053_	
CONTACT BLOCK 1-N.O. SCREW CLAMP	PB	2	SQUARE D	ZBE101_	
CONTACT BLOCK 1-N.C. SCREW CLAMP	PB	1	SQUARE D	ZBE102_	
PUSH BUTTON OPERATOR NON-ILLUM BLACK	PB	1	SQUARE D	ZB5AA2_	
MOUNTING COLLAR LATCH	PB	2	SQUARE D	ZB5AZ009_	
MOUNTING BASE120V GREEN PROTECTED LED	SW	1	SQUARE D	ZB5AVG3_	
MOUNTING BASE120V RED PROTECTED LED	SW	2	SQUARE D	ZB5AVG4_	
MOUNTING BASE120V YELLOW PROTECTED LED	SW	1	SQUARE D	ZB5AVG5_	
2 POS SELECTOR SWITCH ILLUM. GREEN MAINTAINED	SW	1	SQUARE D	ZB5AK1233_	
TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	TB	145	SQUARE D	NSYTRV22	
TERMINAL BLOCK END BARRIERS GRAY	TB	8	SQUARE D	NSYTRAC22	
TERMINAL BLOCK END ANCHORS	TB	4	SQUARE D	NSYTRAABV35	
TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	TB	6	SQUARE D	NSYTRV22PE	
LOAD CENTER GROUND BAR 15 TERMINALS	GB	1	SQUARE D	PK15GTA	
SECTION 8 - MOTOR CONTROL PANEL COMPONENTS					
ENCLOSURE NEMA 4 36 X 30 X 12 - MILD STEEL/GRAY	ENCL	1	HAMMOND	EN4SD363012GY	
BACK-PANEL 36 X 30 MILD STEEL/WHT	ENCL	1	HAMMOND	EP3630	
MOUNTING FEET SET OF 4 - ZINC PLATED	ENCL	1	HAMMOND	EZPMFHD	
PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	ENCL	2	SCE	SCE-PLWKB	
VENT FAN 210CFM 115VAC 6 IN	VF	1	HAMMOND	FAN150AC115	
VENT FAN ADJ. 30-140F BI-METAL TEMP SWITCH N.O.	VF	1	HAMMOND	SKT011419NO	

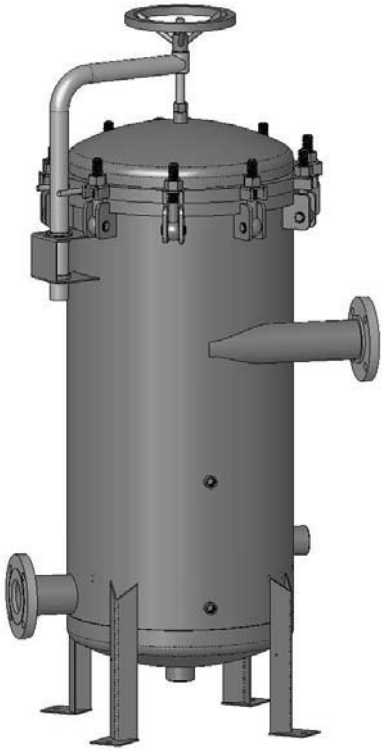
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PROJECT NO.: **15-183** GES - BASF FACILITY - RENSSELAER, NY

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
VENT FAN FINGER GUARD 6 IN	VF	1	HAMMOND	FAN150FG	
VENT FAN 6 IN RAIN HOOD GRILL & SOLID COVER KIT	VF	2	HAMMOND	RHA40000G	
VENT FAN 6 IN RAIN HOOD NEMA 3R	VF	2	HAMMOND	RHA40000GY	
VENT FAN POWER CORD 24 IN	VF	1	HAMMOND	DNMFC	
VENT FAN 6 IN FILTER FOR LOUVER KIT	VF	1	HOFFMAN	AFLT66	
CONTACTOR 3PST-NO 120VAC 50A DIN RAIL (EXISTING EXTRACTION WELLS)	C1, C2	2	SQUARE D	LC1D50AG7	
CONTACTOR 3PST-NO 120VAC 50A DIN RAIL	M1	3	SQUARE D	LC1D50AG7	
3PH O/L RELAY 25-40 AMPS	M1	1	SQUARE D	LRD340L	
CONTACTOR 3PST-NO 120VAC 20A DIN RAIL	M2,M3,M4	3	SQUARE D	LC1D09G7	
3PH O/L RELAY 5.5-8 AMPS	M2	1	SQUARE D	LRD12	
3PH O/L RELAY 2.5-4 AMPS	M3	1	SQUARE D	LRD08	
3PH O/L RELAY 1.6-2.5 AMPS	M4	1	SQUARE D	LRD07	
ETHERNET SWITCH UNMANAGED 10/100 BASET RJ45 PORTS	ESW	1	ADI	SE-SW5U	
DURAPULSE VFD 5 HP 9.6 AMP 460V 3-PHASE	VFD 1,2	2	ADI	GS3-45P0	
GS3 VFD FLUSH MOUNT BEZEL FOR KEYPAD (MOUNT IN MCP)	VFD 1,2	2	ADI	GS3-BZL	
DURAPULSE REMOTE VFD KEYPAD CABLE 16 FT	VFD 1,2	2	ADI	GS-CBL2-5L	
CABLE GS DRIVE/EDRV 6.6FT RJ12-RJ12 6-WIRE RS485	VFD 1,2	2	ADI	GS-EDRV-CBL-2	
ETHERNET MODULE 100Mbps FOR GS SERIES AC DRIVES	EIC 1,2	2	ADI	GS-EDRV100	
TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	TB	25	SQUARE D	NSYTRV22	
TERMINAL BLOCK END BARRIERS GRAY	TB	3	SQUARE D	NSYTRAC22	
TERMINAL BLOCK END ANCHORS	TB	2	SQUARE D	NSYTRAABV35	
TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	TB	1	SQUARE D	NSYTRV22PE	
LOAD CENTER GROUND BAR 15 TERMINALS	GB	1	SQUARE D	PK15GTA	

PRODUCT SPECIFICATION
Harmsco® Model #: HUR 3X170FL-XP



Description: Tangential Entry, Up-Flow Cartridge Filter Housing with; Swing Bolt Closure, Davit Cover Lift, and Flanged Connections.

Details:

1. Stainless steel construction, wetted metallic components are 304/304L ASTM A-240.
2. Electro-polish finish.
3. Swing bolt style housing closure. Swing bolts are SS alloy per ASTM A-193 B7.
4. NSF Certified using Genuine Harmsco® Hurricane® replacement filter cartridges.*
5. Tangential inlet and the integral inner-can, create a centrifugal flow that induces pre-filtration by heavy particulate separation.
6. Patented "Up-Flow" design that;
   a. Self purges housing of air.
   b. Eliminates by-pass contamination during servicing.
   c. Improves efficiency by creating an even flow distribution across filtering media.
7. Strong, durable, built to ASME Design Standards.
8. Utilizes three (3) Genuine Harmsco® Hurricane® HC/170 series filter cartridges. *
9. Inlet & Outlet are NPS 3 Flanges ANSI/ASME B16.5 Class 150
10. Drains (Qty 2) are 1-1/2" Female NPT (FPT) Couplings, Class 1000
11. Vent is 1/2" Female NPT (FPT) Coupling, Class 1000
12. Gauge Ports (Qty 2) are 1/2" Female NPT (FPT) Couplings, Class 1000
13. Closure Gasket is EPDM 70 Durometer O-ring.
14. Pressure Rating - 150 P.S.I.G.
15. Temperature Rating – Up to 140°F
    Note: Higher temperatures are possible, check cartridge specifications. **
16. Flow Rate – 450 GPM Maximum.
    See Pressure Drop vs. Flow Rate Curve, page 2.
17. One person can perform maintenance.

Requirements:

Floor Load:	Dry weight = 435 lbs. Volume = 61 US gallons x 8.337 lbs./US gallon (water) = 509 lbs. Total weight = 435 + 509 = 944 lbs. (housing + water) Floor contact area = .292 ft² Floor Load = 944 lbs. divided by .292 ft² = **3,250 pounds per square foot** (approx.) Note: Piping shall conform to all applicable codes and be independently supported. If floor strength is suspect, use appropriate measures to adequately distribute load.
Floor Space:	**4.5 ft²** (does not include Cover/Davit swing position), See Installation Diagram, page 3.
Service Height:	98-1/2", See Installation Diagram, page 3.
Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided.

Recommended Spare Parts:
Closure Gasket O-ring: PN 363-E
Set of 3 Harmsco® Hurricane® HC/170 replacement cartridges

* The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges in this filter housing voids certifications by NSF International.
** Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.
Notice: The information contained in this publication is considered accurate, and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest, most up to date, specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. End users should perform their own tests to determine suitability for each application.

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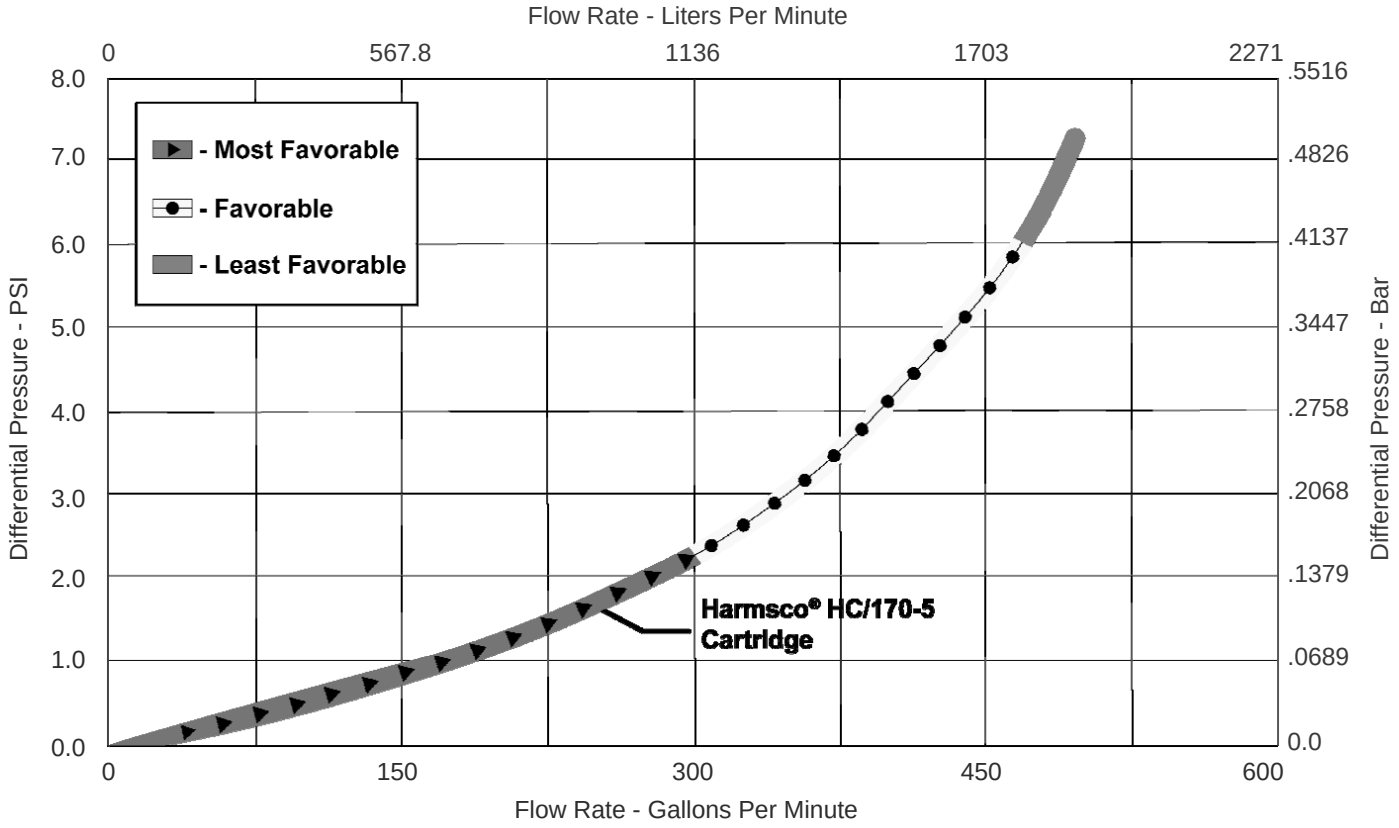
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561-848-9628

Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 3X170FL-XP

Hurricane® HC/170-5 Cartridges, Qty 3; with clean water.

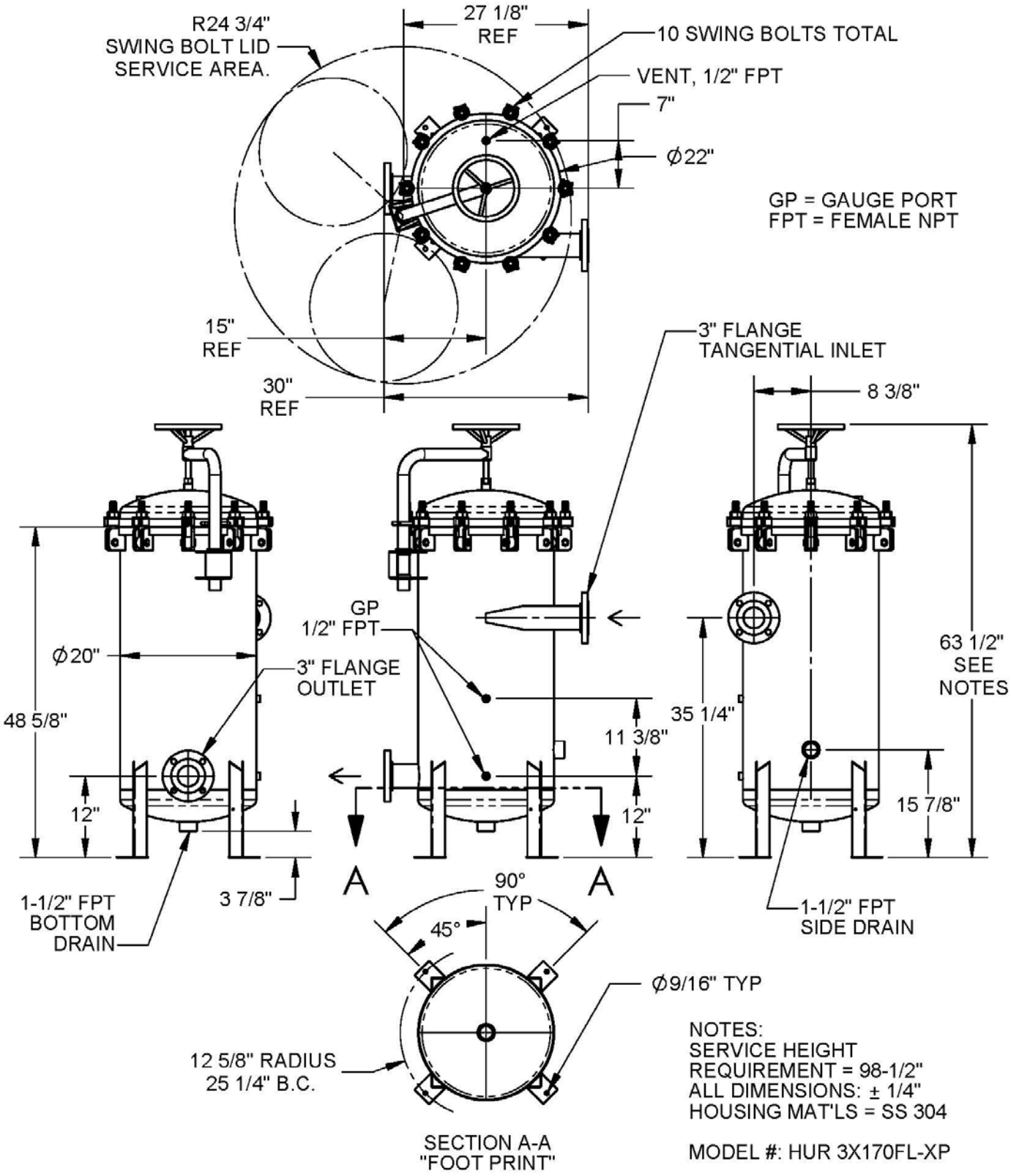


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Harmsco® Filtration Products
Installation Diagram
Hurricane® 3X170FL-XP Swing Bolt Housing



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sales@harmsco.com
800-327-3248
561-848-9628

Aqua Treatment Service, Inc.

AMALGAM SERIES VERTICAL

UV SYSTEMS

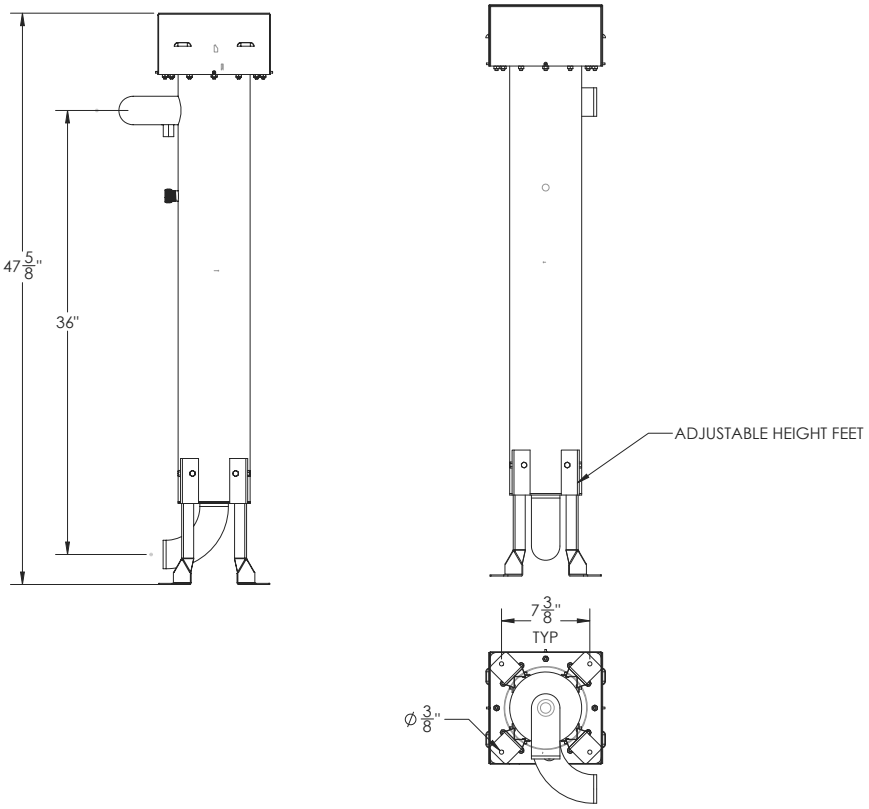


OPTIONS:

- Adjustble Settings Thermistor Overheat Safety Control
- Remote PLC Monitoring Connection
- Control Box Mounting Stand (powder coated)
- UV Intensity Monitor / NIST Traceable Calibrated UV Sensor
- Energy Saver Pacing
- 1/4" Sample Ports on Inlet / Outlet Riser
- 304 SS #4 Brushed Finish on Nema 4 Type Control Box
- 220 - 240 Volt / 50 - 60 Hz Electrical Components
- UV Light Traps on Inlet / Outlet
- Sanitary - Tri - Clamp Fittings
- Manual Quartz Sleeve Wiper
- 316 Stainless Steel Wetted Parts

FEATURES:

- Amalgam High Output UV Lamps
- 12,000 Hour Lamp Life
- UV Chamber Overheat Control
- UV Sight Port
- Flange or Threaded Inlet / Outlet Connections
- Internal Water Flow Diverter
- Internal Multi-Level Flow Balance System
- Internal Multi-Level Quartz Sleeve Stabilizer
- Removable UV Lamp / Quartz Sleeve Service Rack
- Nema 4 Type Electrical Box Enclosure
- Power ON/OFF Switch
- Fused Circuits
- Drain Valve
- Integral UV Light Traps



SPECIFICATIONS:

Model#	No. Lamps	KW @ 120V	AMP @ 120V	Pipe Size	Overall Dimensions L x W x D	Wetted Material	Shipping Weight
AS - V16	1	0.17	1	1.5”	47.5” x 10” x 17”	304 SS	35 lbs.
AS - V26	2	0.33	2	2”	47.5” x 11.25” x 17”	304 SS	45 lbs.
AS - V36	3	0.49	3	3”	47.5” x 11.25” x 17”	304 SS	60 lbs.
AS - V38	3	0.49	3	3”	47.5” x 12” x 19”	304 SS	98 lbs.
AS - V48	4	0.66	4	4”	47.5” x 12” x 19”	304 SS	105 lbs.
AS - V58	5	0.83	5	4”	47.5” x 12” x 19”	304 SS	165 lbs.
AS - V510	5	0.83	5	4”	47.5” x 14” x 21”	304 SS	45 lbs.
AS - V610	6	0.97	6	6”	47.5” x 14” x 21”	304 SS	60 lbs.
AS - V612	6	0.97	6	6”	47.5” x 16” x 21”	304 SS	98 lbs.
AS - V810	8	1.3	8	6”	47.5” x 16” x 21”	304 SS	105 lbs.
AS - V812	8	1.3	8	6”	47.5” x 16” x 23”	304 SS	165 lbs.

ULTRAVIOLET DOSAGE:

Model#	Flow = GPM @30K EOL	Flow = GPM @40K EOL	Flow = GPM @30K EOL	Flow = GPM @90K EOL	Flow = GPM @300K EOL
AS - V16	59	44	**63**	21	**6**
AS - V26	115	86	**121**	40	**12**
AS - V36	167	125	**175**	58	**17**
AS - V38	233	175	**246**	82	**24**
AS - V48	305	228	**321**	107	**32**
AS - V58	373	280	**393**	131	**39**
AS - V510	484	363	**510**	170	**51**
AS - V610	574	430	**604**	201	**60**
AS - V612	705	529	**743**	247	**74**
AS - V810	745	559	**785**	261	**78**
AS - V812	924	693	**973**	324	**97**

COLOR KEY: Clear Fresh Water at 94% UVT; DI / RO Water (-03D) at 99% UVT; DI / RO Water at 99% UVT; DI / RO Water (TOCR) at 99% UVT

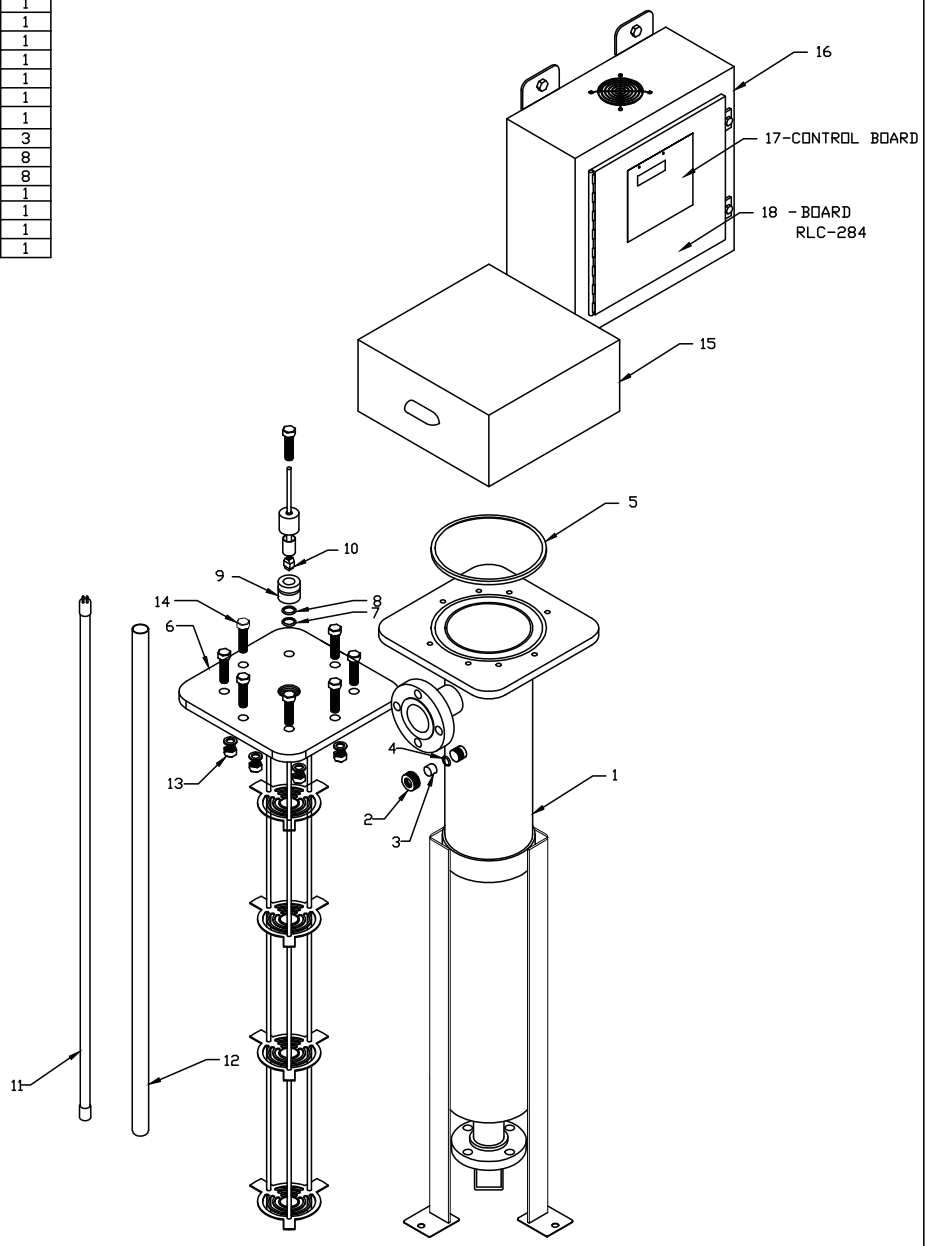
NOTES: 220V Specs are available upon request

ATS *Aqua Treatment Service, Inc.*
Providing Better Water For Better Living

Aqua Treatment Service, Inc
194 Hempt Rd,
Mechanicsburg, PA 17050
800 . 224 . 7476 fax: 800 . 787 . 0197
www.aquat.com

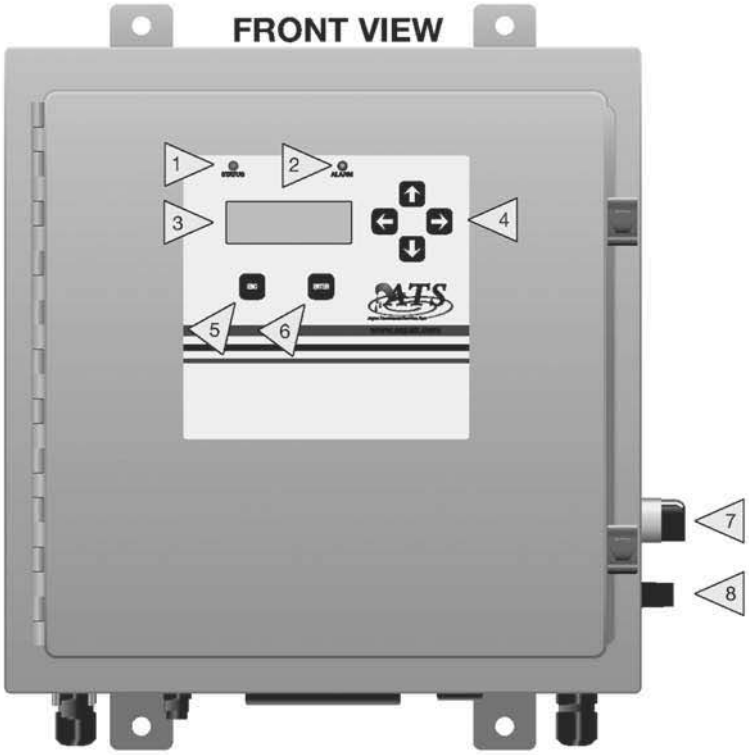
Parts Breakdown - AS-V16

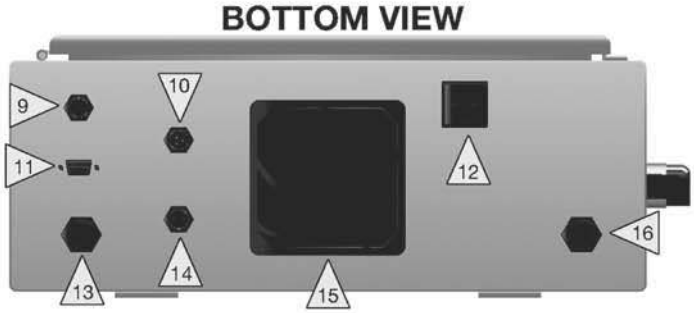
	P/N	QTY
1	ASV-20106-2.0	1
2	ATS-5171	1
3	ATS-5172	1
4	ATS-5173	1
5	ASV-90006-DR	1
6	ASV-30106	1
7	ATS8-544	1
8	AS0-90000-RR	1
9	AS0-90000-EN	1
10	ASV-50100-4	1
11	ATS AS19-254	1
12	ATS28-889D	3
13	1170861	8
14	1170059	8
15	ASV-70006	1
16	CONTROL BOX	1
17	BALLAST ATS1-417	1
18	BOARD RLC-284	1



mat'l code 304 STAINLESS STEEL				tolerances unless otherwise specified			COPY 1	AQUA TREATMENT SERVICE, INC. 194 HEMPT ROAD MECHANICSBURG, PA 17050 (717) 697-4998 FAX (800) 787-0197
ltr	ecn no	dr	date	linear			CUSTOMER	
				angles				
				dr	T.GARLICK	8/13/12		P/N AS-V16
				engr				
				chr				AMALGAM STERILIZER VERTICAL SERIES
				appd				
Q/Graphics folder/Drawings/Shop Drawings/UV Drawings/Bom								

Parts Breakdown - Electronic Control System





Monitor Parts Breakdown

Front View

1. System Status Lamp
2. Alarm Status Indicator Lamp
3. System Display Screen
4. Curser Direction Keys
5. Escape/Back Key
6. Enter Key
7. Off/On Power Switch
8. Fuse

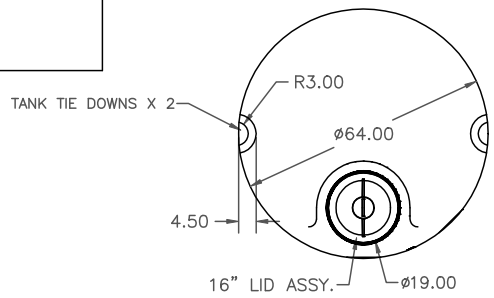
Bottom View:

9. UV Probe Connection
10. Flow Meter Connection
11. RS232 Connection for Software
12. Shutoff Solenoid Power Plug-in
13. Power Cord
14. Pressure Siwtch Connection
15. Cooling Fan
16. Cables Leads to Skid Unit

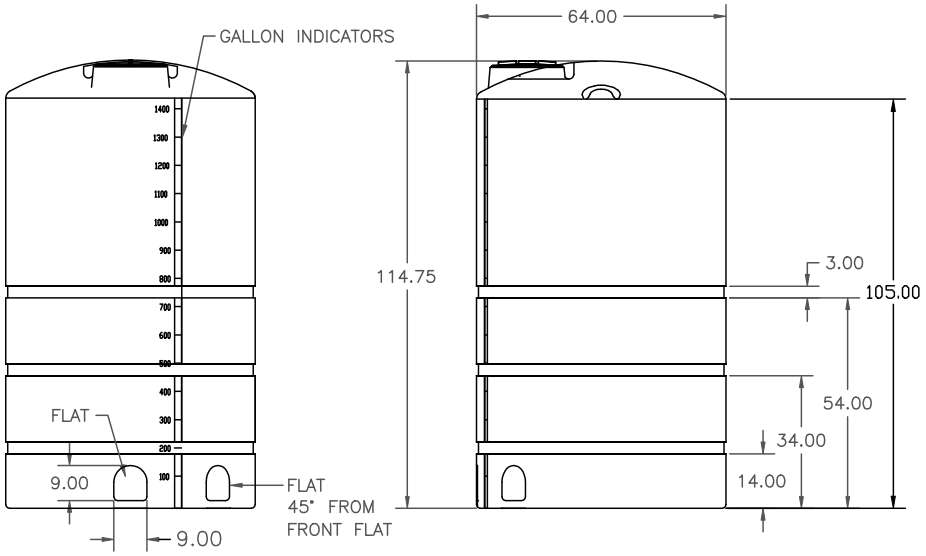
PROPRIETARY DATA

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VT1500-64



1. HEAVY DUTY POLYETHYLENE CONSTRUCTION
2. 1 PIECE ROTATIONALLY MOLDED
3. TRANSLUCENT
4. FDA APPROVED RESIN
5. CALIBRATED IN GALLONS
6. THREE YEAR WARRANTY
7. UV STABILIZED



REV	DESCRIPTION	DATE	APPRD

DRAWN / DATE: DHJ 01/02/03

APPRD. / DATE: ADH 11/19/07

MATERIAL: HDPE OR EQUIVALENT REFERENCE MATERIAL DATA SHEET FOR SPECIFIC PROPERTIES.

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M

NOTES:
1. BLUE, YELLOW, WHITE, OR BLACK COLOR
2. SHOT WEIGHT 335 LBS.
3. NOM. WALL .340

ACE ROTO-MOLD
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4018 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION: 1500 GALLON VERTICAL TANK

SCALE: N.S.

PART NO.: VT1500-64

VERTICAL TANKS - DOME TOP *Syphon tube included with tanks 300 gallon or greater*

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
VT0010-12†	10 GAL	9	12 X 25	8"	3/4"	2.0
VT0020-16†	20 GAL	15	16 X 28	8"	3/4"	2.0
VT0025-18†	25 GAL	14	18 X 30	5"	3/4"	2.0
VT0040-18†	40 GAL	19	18 X 43	5"	3/4"	2.0
VT0055-20†	55 GAL	23	20 X 47	5"	1"	2.0
VT0065-23†	65 GAL	27	23 X 42	5"	1"	2.0
VT0110-32	110 GAL	42	32 X 41	5"	2" TOP	2.0
VT0135-23	135 GAL	47	23 X 82	16"	1"	2.0
VT0300-42	300 GAL	74	42 X 55	8"	2"	2.0
VT0405-52	405 GAL	92	52 X 48	8"	2"	2.0
VT0425-42	425 GAL	102	42 X 75	8"	2"	2.0
VT0505-46	505 GAL	120	46 X 80	16"	2"	2.0
VT0550-52	550 GAL	118	52 X 66	8"	2"	2.0
VT0600-46	600 GAL	132	46 X 91	16"	2"	2.0
VT0625-64	625 GAL	102	64 X 50	8"	2"	2.0
VT0800-46	800 GAL	177	46 X 118	16"	2"	1.7
VT0900-46	900 GAL	222	46 X 132	16"	2"	1.7
VT1000-64	1000 GAL	252	64 X 81	16"	2"	1.7
VT1050-86	1050 GAL	192	86 X 54	16"	2"	1.7
VT1200-64	1200 GAL	277	64 X 97	16"	2"	1.7
VT1350-86	1350 GAL	230	86 X 65	16"	2"	1.7
VT1500-64	1500 GAL	337	64 X 115	16"	2"	1.7
VT1500-86	1500 GAL	252	86 X 69	16"	2"	1.7
VT1525-64	1525 GAL	352	64 X 122	16"	2"	1.7
VT1650-86	1650 GAL	280	86 X 74	16"	2"	1.7
VT2000-64	2000 GAL	467	64 X 156	16"	2"	1.7
VT2000-90	2000 GAL	377	90 X 84	16"	2"	1.7
VT2050-86	2050 GAL	402	86 X 93	16"	2"	1.7
VT2150-102	2150 GAL	417	102 X 71	16"	2"	1.7
VT2500-90	2500 GAL	422	90 X 103	16"	2"	1.7
VT3000-90	3000 GAL	552	90 X 120	16"	2"	1.7
VT3100-102*	3100 GAL	552	102 X 103	16"	2"	1.7
VT3400-102*	3400 GAL	587	102 X 107	16"	2"	1.7
VT4000-96*	4000 GAL	902	96 X 140	16"	2"	1.7
VT4200-96*	4200 GAL	952	96 X 148	16"	2"	1.7
VT4995-142*	4995 GAL	952	142 X 90	16"	3"	1.7
VT5000-102*	5000 GAL	1302	102 X 156	16"	3"	1.7
VT5150-102*	5150 GAL	1352	102 X 161	16"	3"	1.7
VT6250-102*	6250 GAL	1552	102 X 194	16"	3"	1.7
VT6500-120*	6500 GAL	1502	120 X 152	16"	3"	1.7
VT7000-142*	7000 GAL	1752	142 X 125	16"	3"	1.7
VT7800-120*	7800 GAL	1902	120 X 176	16"	3"	1.7
VT8000-120*	8000 GAL	1932	120 X 180	16"	3"	1.7
VT9150-120*	9150 GAL	2202	120 X 203	16"	3"	1.7
VT9500-120*	9500 GAL	2352	120 X 213	16"	3"	1.7
VT10500-2500*	10,500 GAL	2502	142 X 177	16"	3"	1.6
VT10500-2800*	10,500 GAL	2802	142 X 177	16"	3"	1.8
VT12500-142*	12,500 GAL	3402	142 X 208	16"	3"	1.7

† INDICATES CAN BE SHIPPED VIA UPS/FED EX
* HEAVY DUTY FITTING



VT1050-86

VT2050-86



WATER ONLY TANKS *Additional water only tanks available*

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
WO2500-VT	2500 GAL	392	96 X 92	16"	2"	1.0
WO3000-VT	3000 GAL	487	96 X 109	16"	2"	1.0



WO2500-VT

WO3000-VT

Water Only Vertical Tanks

Water tanks are free standing for indoor or outdoor stationary applications. Tanks are manufactured from FDA compliant high-density polyethylene with UV inhibitors. They are designed for the storage of chemicals with a specific gravity of 1.0 or less and available in dark green. Contact customer service for additional water only options.

TECHNICAL BROCHURE
BNPE R2



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F R

Casing Rotation, Optional
R = 3 o'clock L = 9 o'clock
B = 6 o'clock
NOTE: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

Rotación de la cubierta, opcional
R = 3 hora L = 9 hora
B = 6 hora
NOTA: *Rotación cuando está visto del extremo de la succión de la bomba. La posición estándar de la descarga es las 12.*

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	Pump Size, *Tamaño de la bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

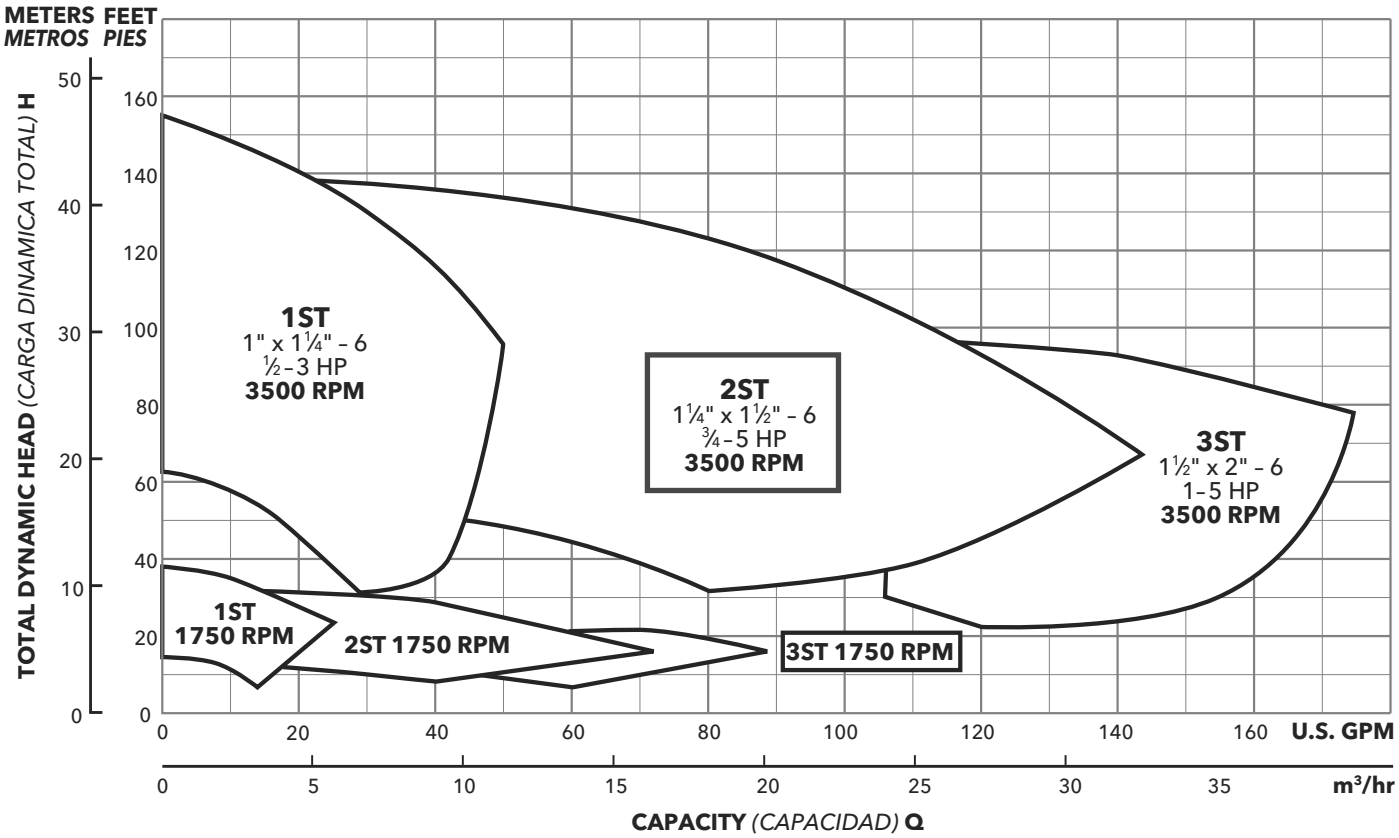
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

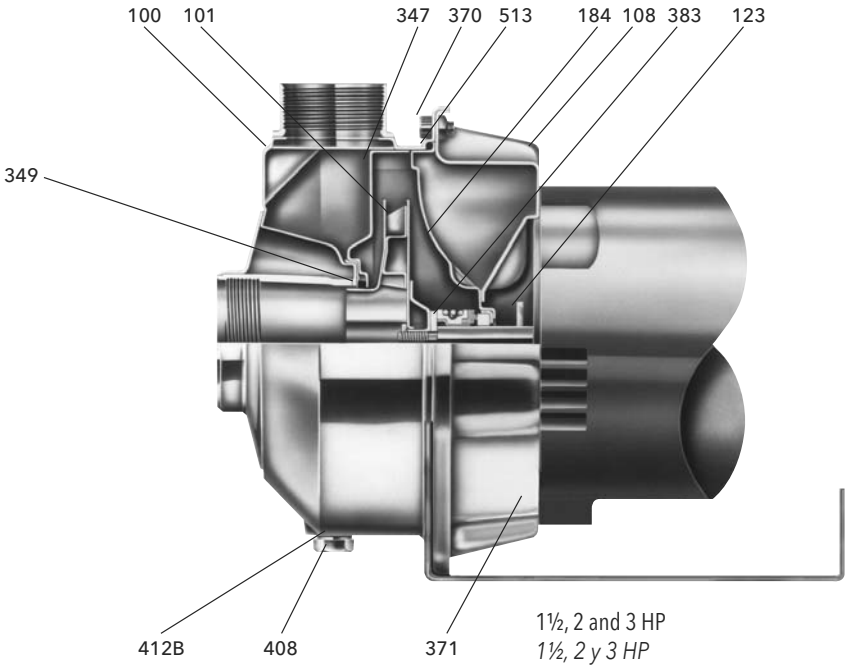
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

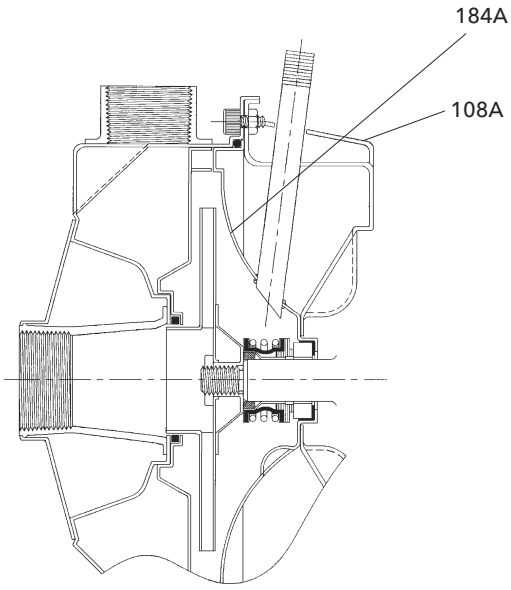
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

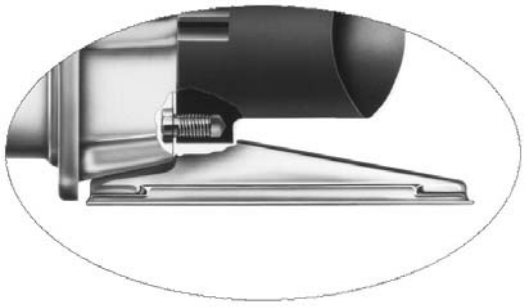


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370 *able*	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxid-*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408 *able*	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxid-*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

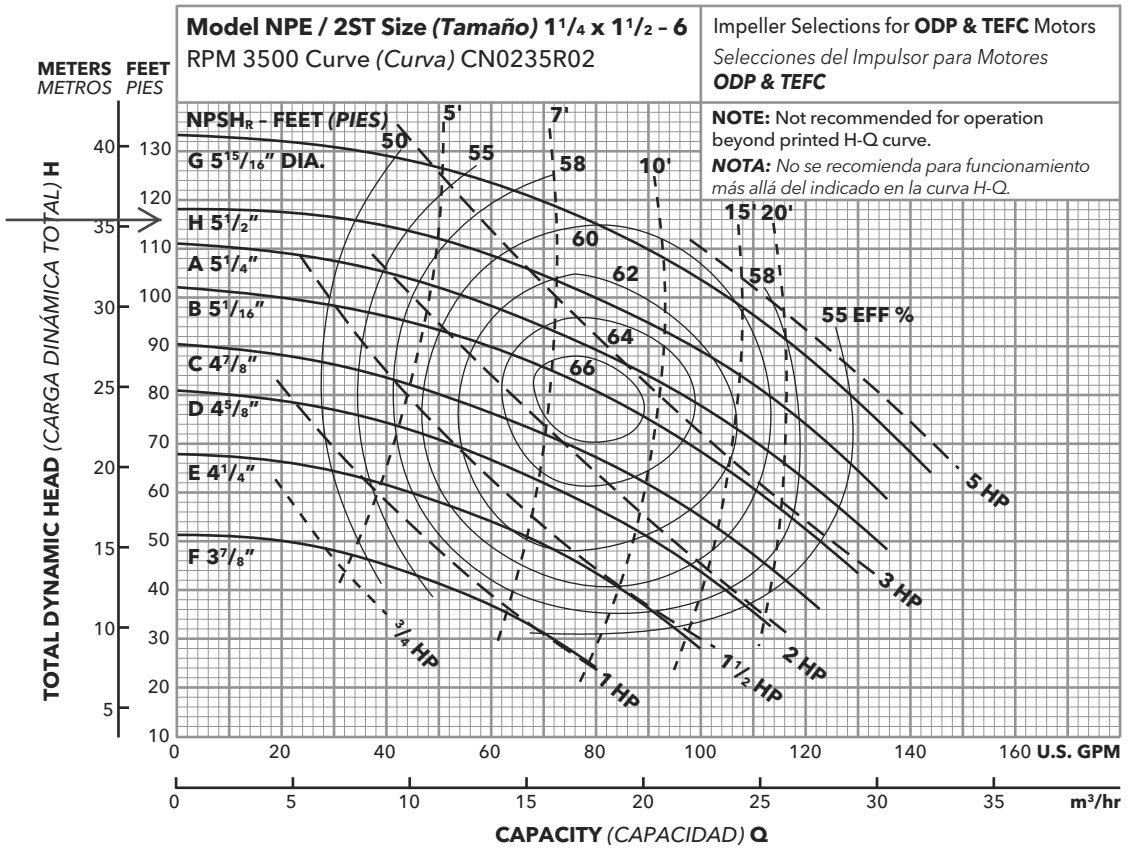


½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

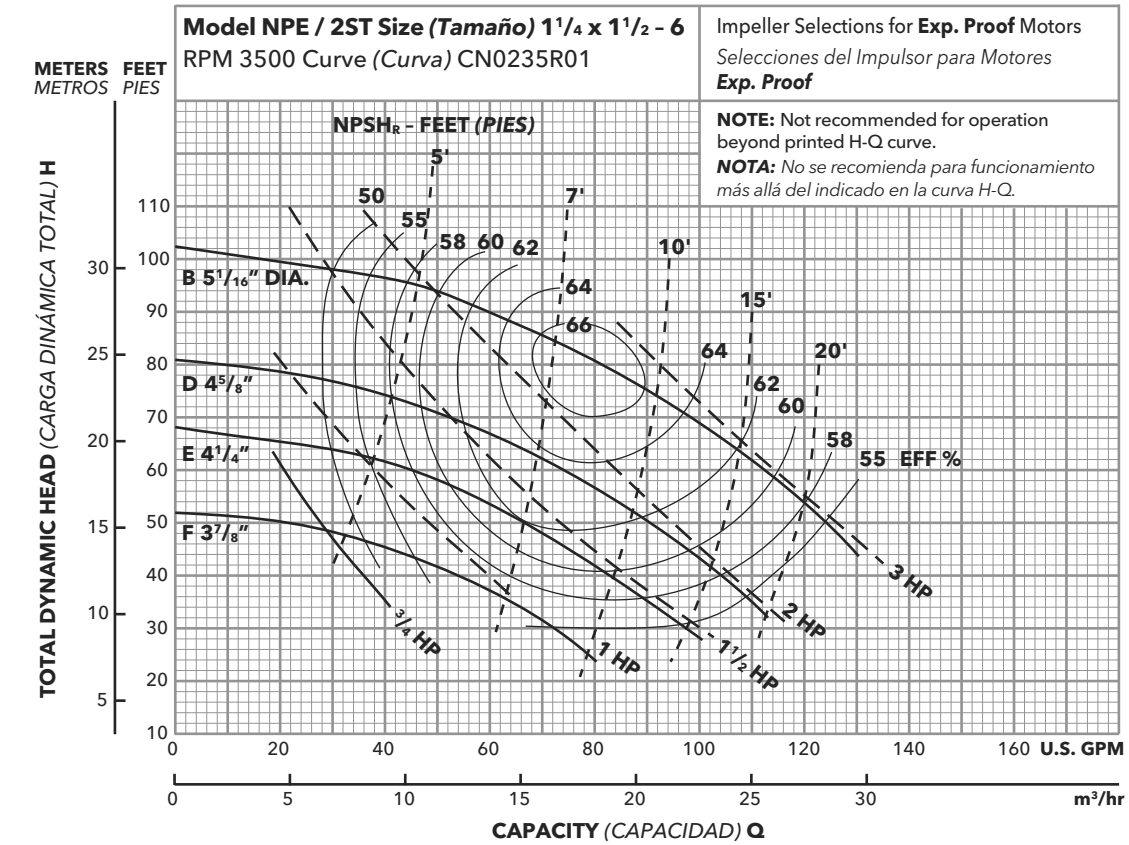
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	¾	3 7/8"
E	1	4 1/4
D	1½	4 5/8
C	2	4 7/8
B	3	5 1/16
A	3	5 1/4
H	5	5 1/2
G	5	5 15/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*



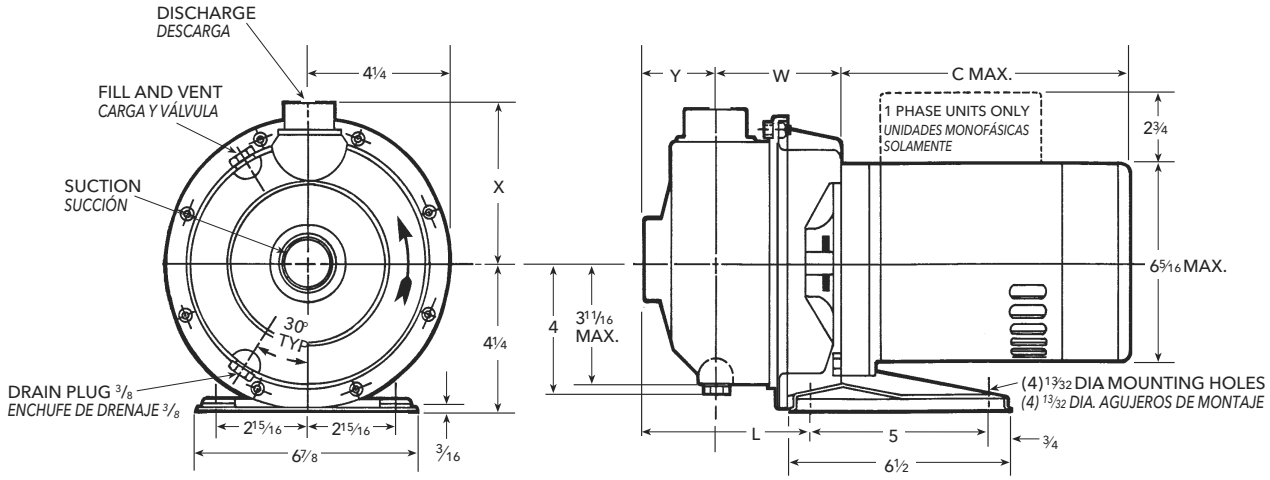
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	1	3 7/8"
E	1½	4 1/4
D	2	4 5/8
B	3	5 1/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

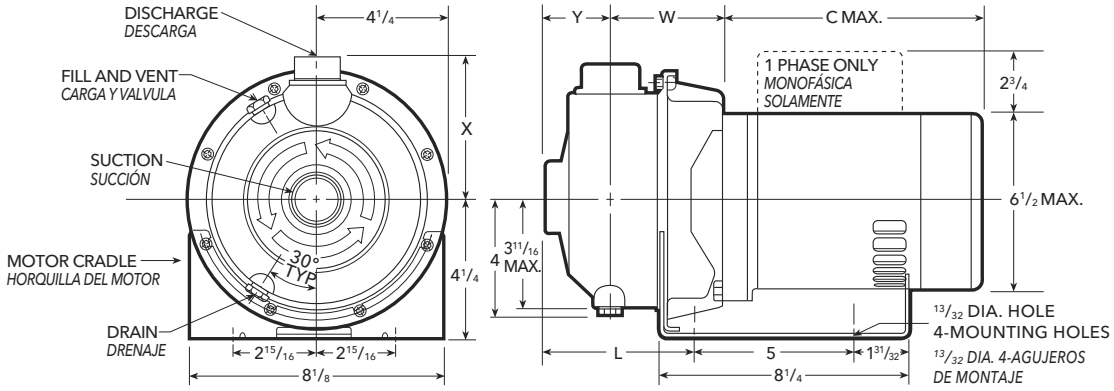
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121 ° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón*		
									56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM				C Max.	Wt. Max., *Peso Máx.*
	Single Phase, *Monofásicos*		Three Phase, *Trifásicos*			
	ODP	TEFC	ODP	TEFC		
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	–	–	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	–	5	18 1/8	112

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

TECHNICAL BROCHURE
BNPE R2



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F R

Casing Rotation, Optional
R = 3 o'clock L = 9 o'clock
B = 6 o'clock
NOTE: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

Rotación de la cubierta, opcional
R = 3 hora L = 9 hora
B = 6 hora
NOTA: *Rotación cuando está visto del extremo de la succión de la bomba. La posición estándar de la descarga es las 12.*

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	Pump Size, *Tamaño de la bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

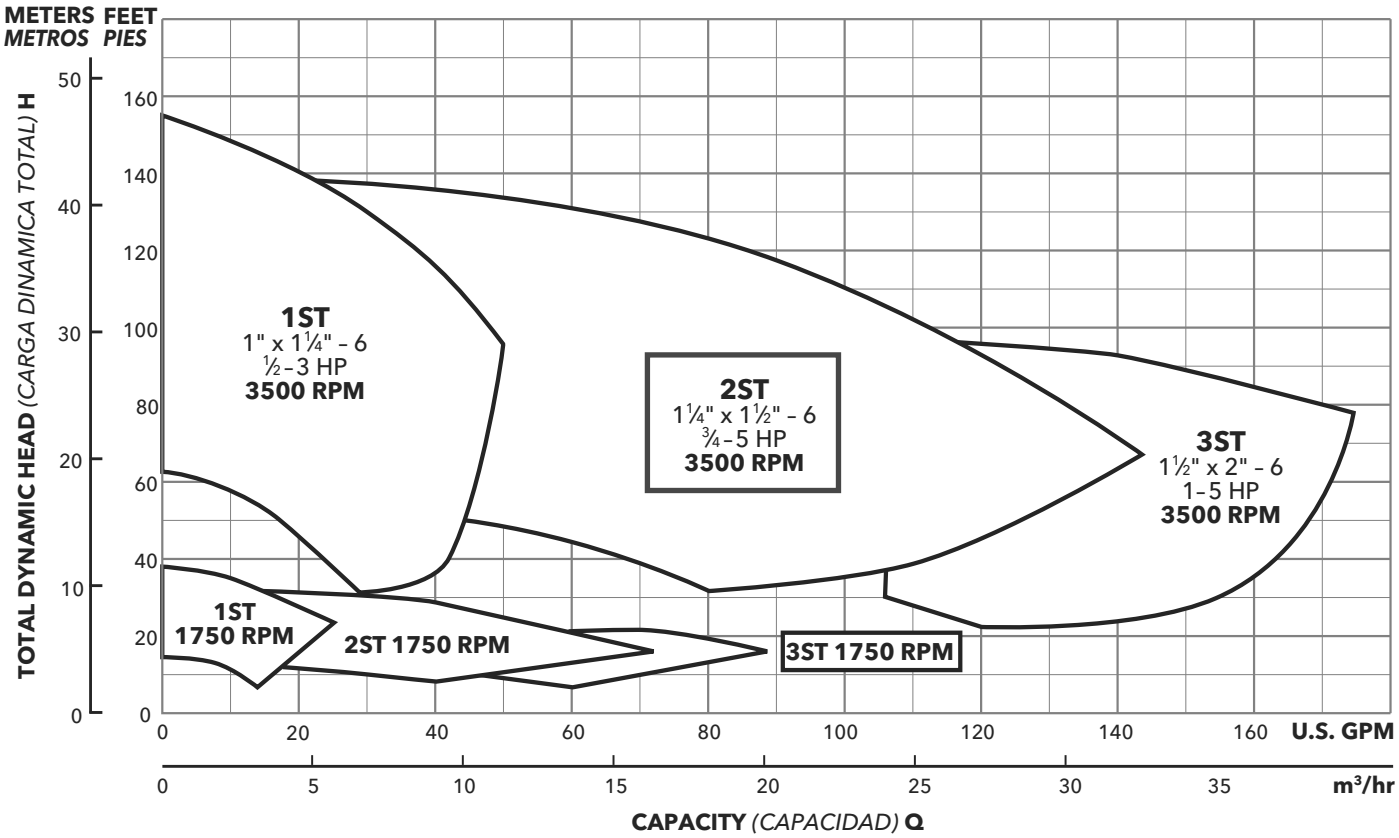
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

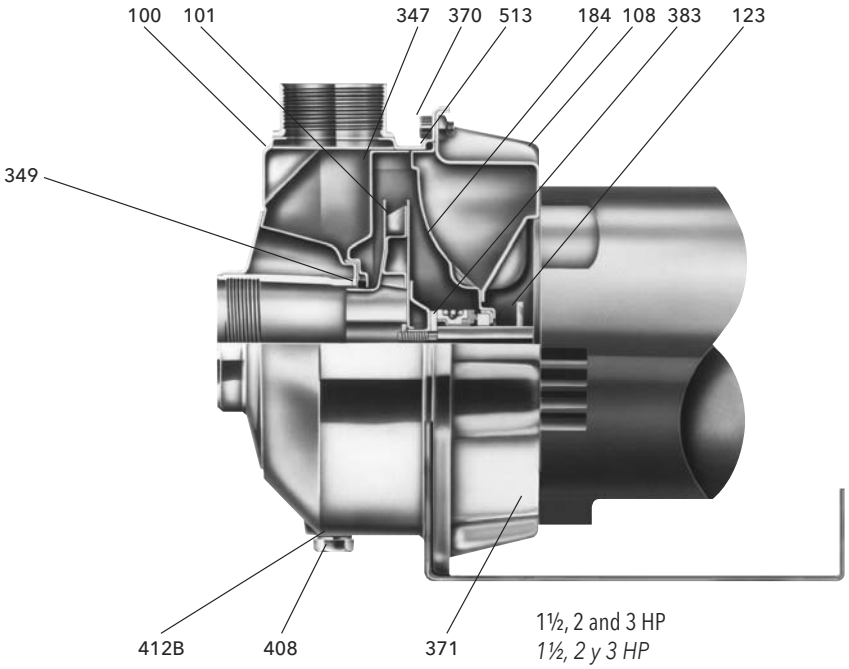
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

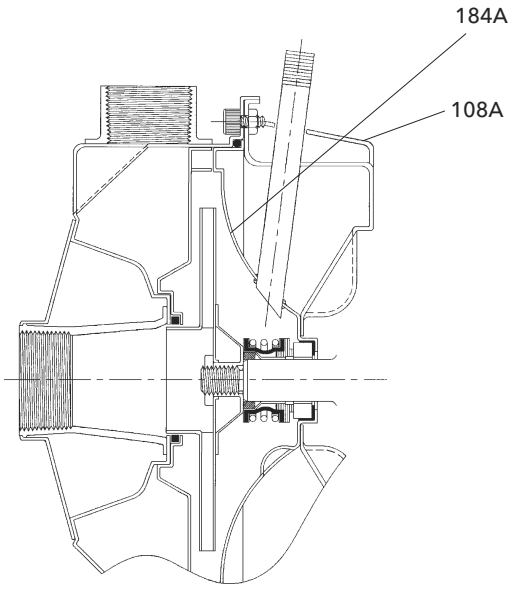
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

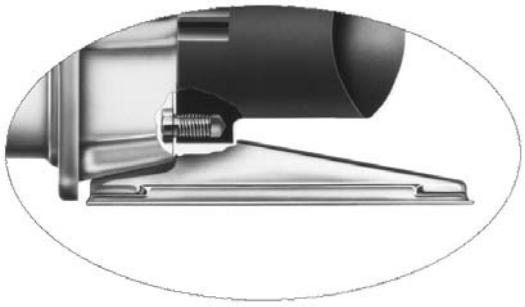


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

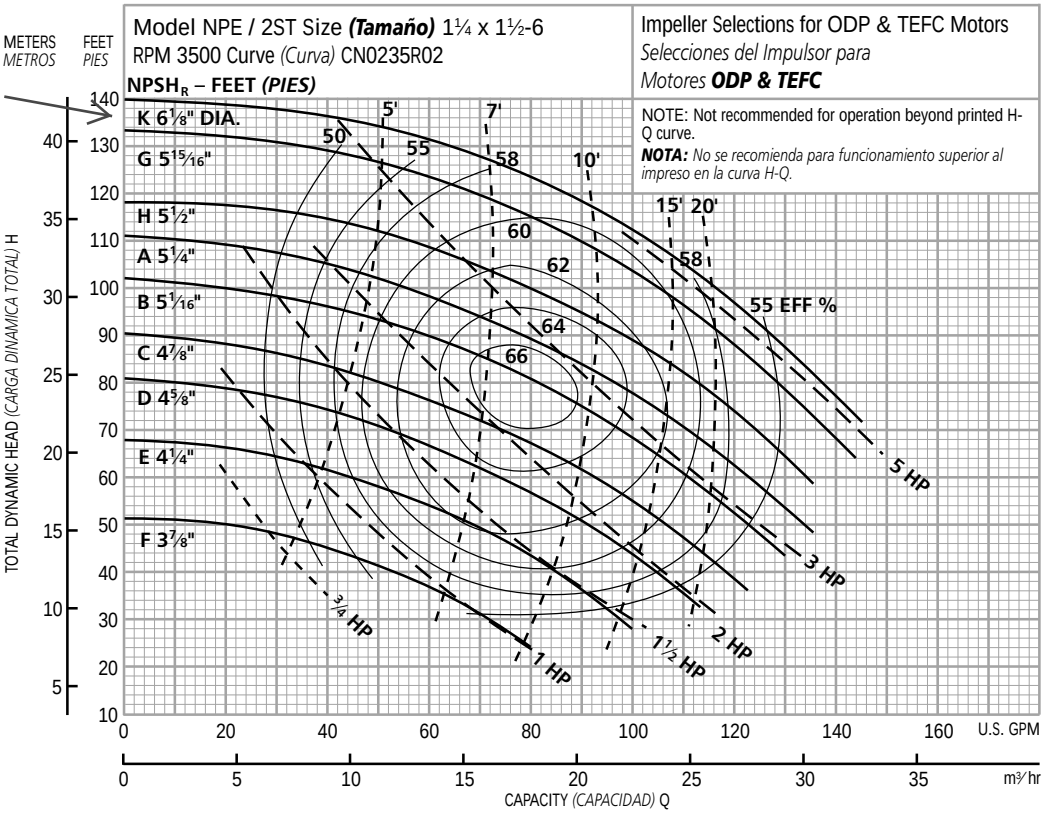
Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370 *able*	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxid-*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408 *able*	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxid-*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	



½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

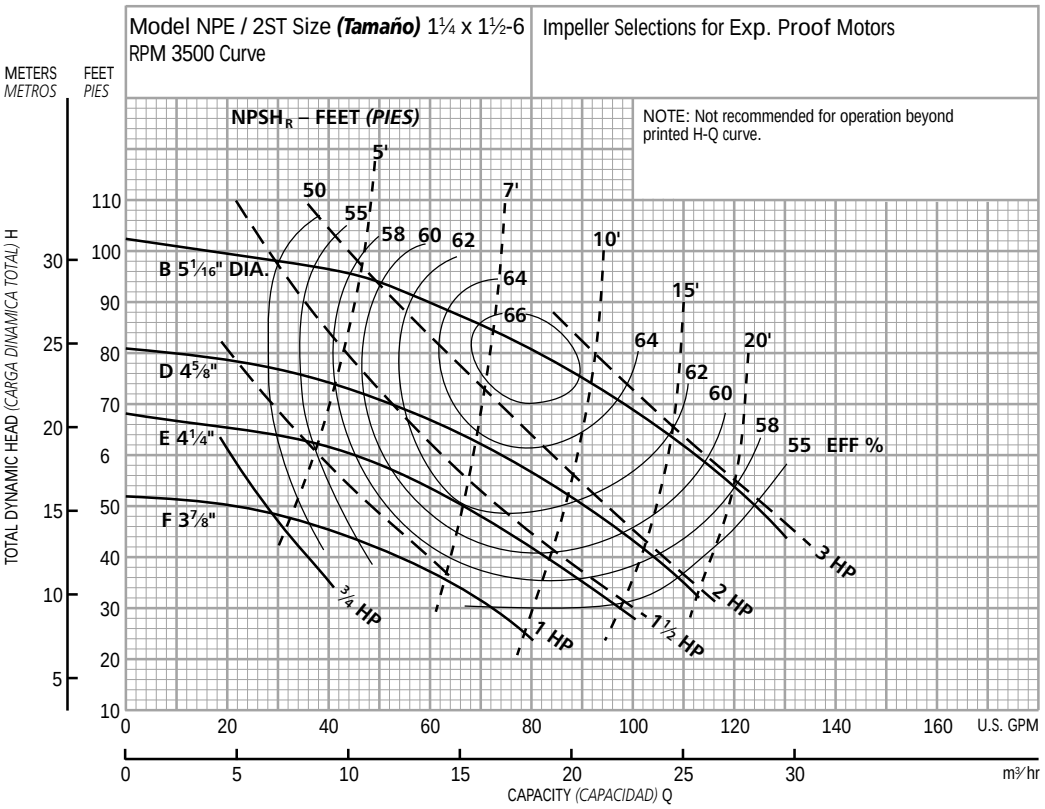
Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.



Ordering Code, ***Código de Pedido***	Standard HP Rating, ***Estándar HP Potencia***	Imp. Dia.
F	¾	3⅞"
E	1	4¼
D	1½	4⅝
C	2	4⅞
B	3	5¹⁄₁₆
A	3	5¼
H	5	5½
G	5	5¹⁵⁄₁₆
K	5	6⅛

NOTE: Although not recommended, the pump may pass a 3⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3⁄16".*



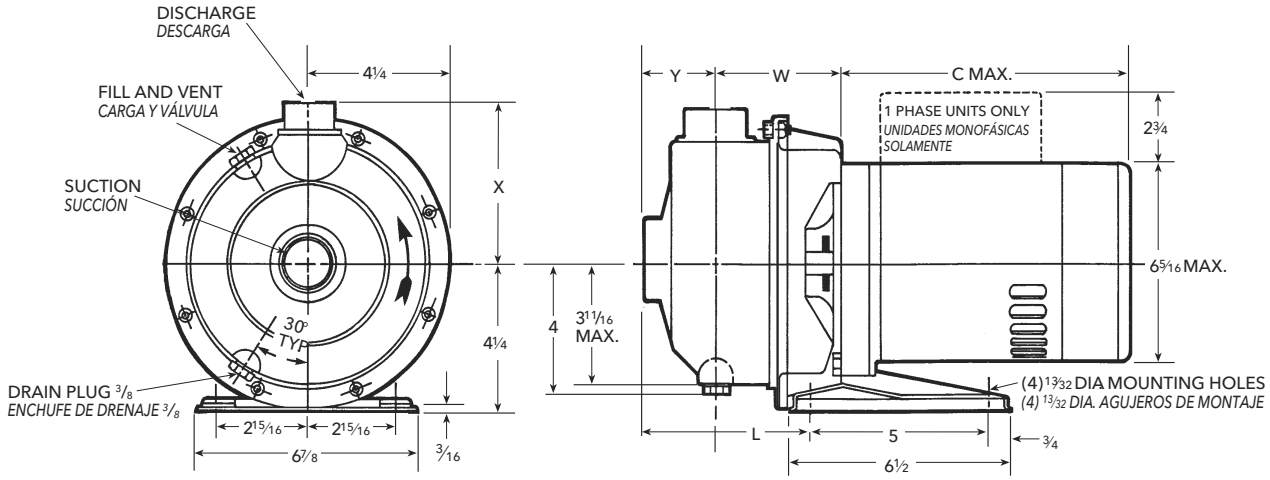
Ordering Code, ***Código de Pedido***	Standard HP Rating, ***Estándar HP Potencia***	Imp. Dia.
F	1	3⅞"
E	1½	4¼
D	2	4⅝
B	3	5¹⁄₁₆

NOTE: Although not recommended, the pump may pass a 3⁄16" sphere.

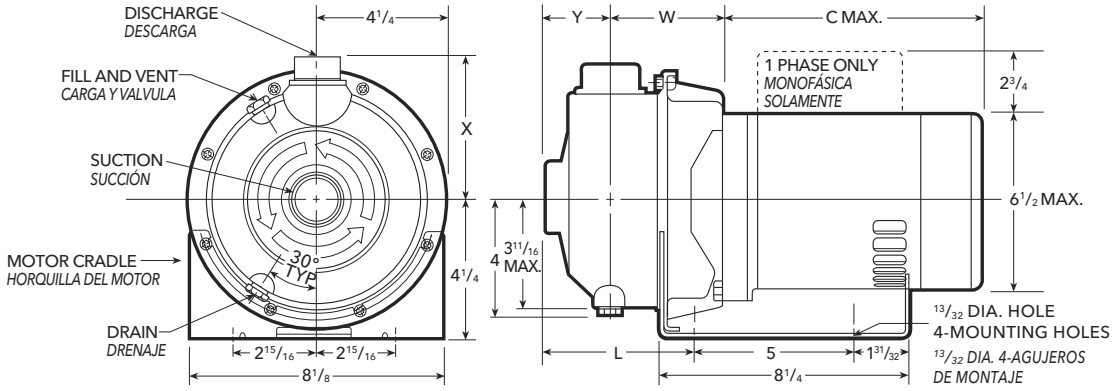
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3⁄16".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121 ° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón*		
									56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM				C Max.	Wt. Max., *Peso Máx.*
	Single Phase, *Monofásicos*		Three Phase, *Trifásicos*			
	ODP	TEFC	ODP	TEFC		
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	–	–	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	–	5	18 1/8	112

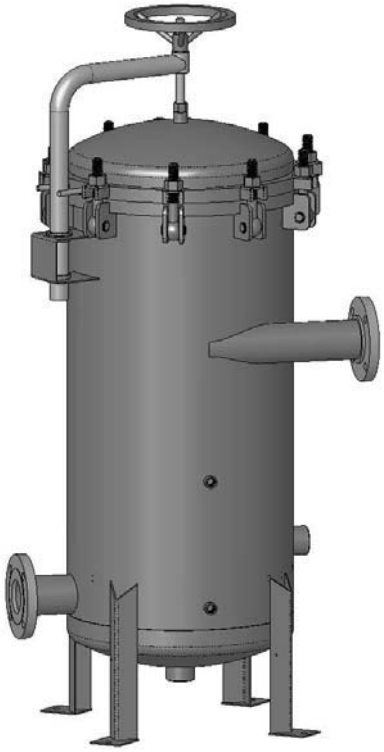
NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

PRODUCT SPECIFICATION
Harmsco® Model #: HUR 3X170FL-XP



Description: Tangential Entry, Up-Flow Cartridge Filter Housing with; Swing Bolt Closure, Davit Cover Lift, and Flanged Connections.

Details:

1. Stainless steel construction, wetted metallic components are 304/304L ASTM A-240.
2. Electro-polish finish.
3. Swing bolt style housing closure. Swing bolts are SS alloy per ASTM A-193 B7.
4. NSF Certified using Genuine Harmsco® Hurricane® replacement filter cartridges.*
5. Tangential inlet and the integral inner-can, create a centrifugal flow that induces pre-filtration by heavy particulate separation.
6. Patented "Up-Flow" design that;
   a. Self purges housing of air.
   b. Eliminates by-pass contamination during servicing.
   c. Improves efficiency by creating an even flow distribution across filtering media.
7. Strong, durable, built to ASME Design Standards.
8. Utilizes three (3) Genuine Harmsco® Hurricane® HC/170 series filter cartridges. *
9. Inlet & Outlet are NPS 3 Flanges ANSI/ASME B16.5 Class 150
10. Drains (Qty 2) are 1-1/2" Female NPT (FPT) Couplings, Class 1000
11. Vent is 1/2" Female NPT (FPT) Coupling, Class 1000
12. Gauge Ports (Qty 2) are 1/2" Female NPT (FPT) Couplings, Class 1000
13. Closure Gasket is EPDM 70 Durometer O-ring.
14. Pressure Rating - 150 P.S.I.G.
15. Temperature Rating – Up to 140°F
    Note: Higher temperatures are possible, check cartridge specifications. **
16. Flow Rate – 450 GPM Maximum.
    See Pressure Drop vs. Flow Rate Curve, page 2.
17. One person can perform maintenance.

Requirements:

Floor Load:	Dry weight = 435 lbs. Volume = 61 US gallons x 8.337 lbs./US gallon (water) = 509 lbs. Total weight = 435 + 509 = 944 lbs. (housing + water) Floor contact area = .292 ft² Floor Load = 944 lbs. divided by .292 ft² = **3,250 pounds per square foot** (approx.) Note: Piping shall conform to all applicable codes and be independently supported. If floor strength is suspect, use appropriate measures to adequately distribute load.
Floor Space:	**4.5 ft²** (does not include Cover/Davit swing position), See Installation Diagram, page 3.
Service Height:	98-1/2", See Installation Diagram, page 3.
Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided.

Recommended Spare Parts:
Closure Gasket O-ring: PN 363-E
Set of 3 Harmsco® Hurricane® HC/170 replacement cartridges

* The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges in this filter housing voids certifications by NSF International.
** Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.
Notice: The information contained in this publication is considered accurate, and is intended to be used as a guide. This information is subject to change without notification. Contact Harmsco® Filtration Products for the latest, most up to date, specifications. Harmsco® Filtration Products does not assume any liability for the accuracy and completeness of the data in this publication. Temperature ratings, flow rates and chemical resistance can be affected by a number of unknown factors. End users should perform their own tests to determine suitability for each application.

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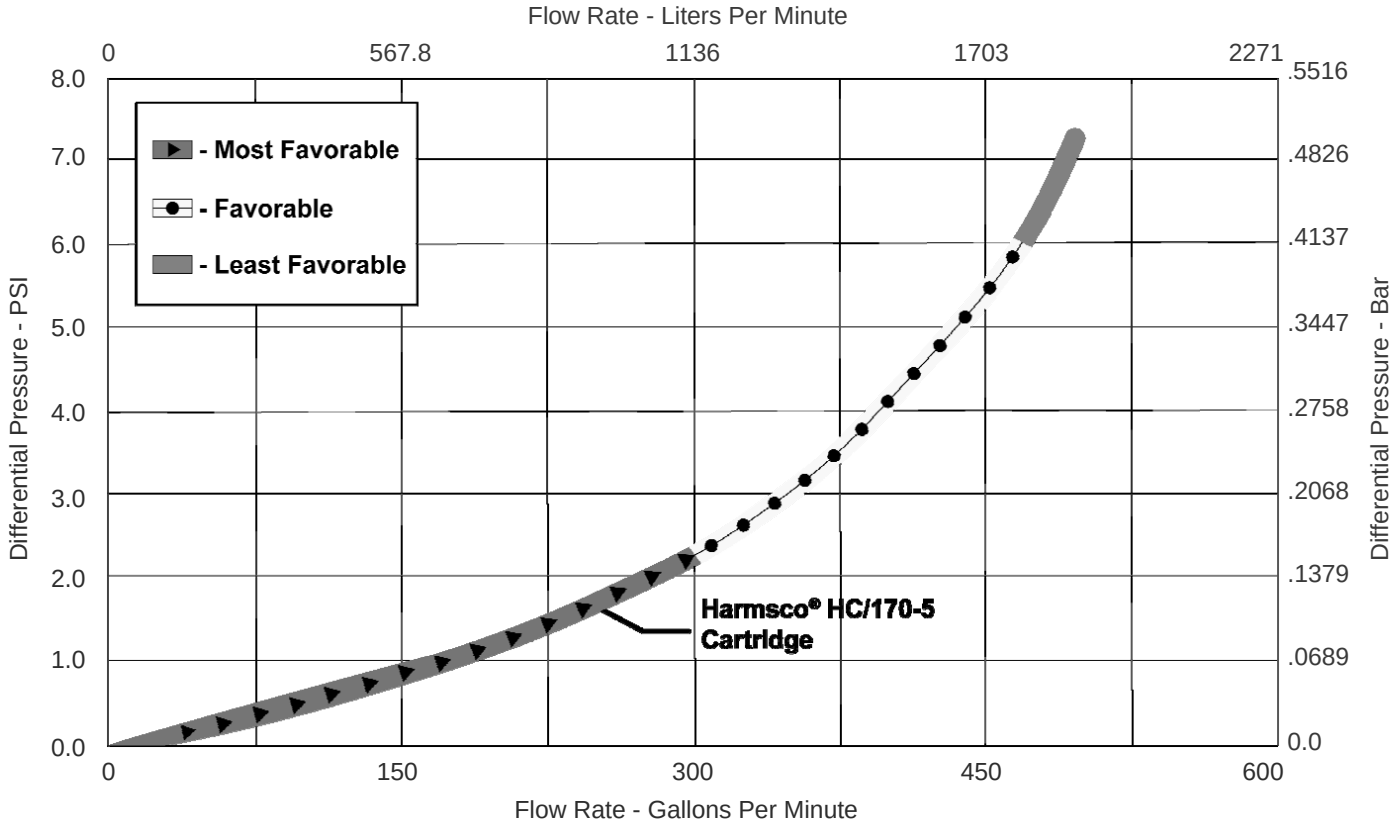
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Economical Solutions to Liquid Filtration Challenges

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sales@harmsco.com
800-327-3248
561-848-9628

Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 3X170FL-XP

Hurricane® HC/170-5 Cartridges, Qty 3; with clean water.

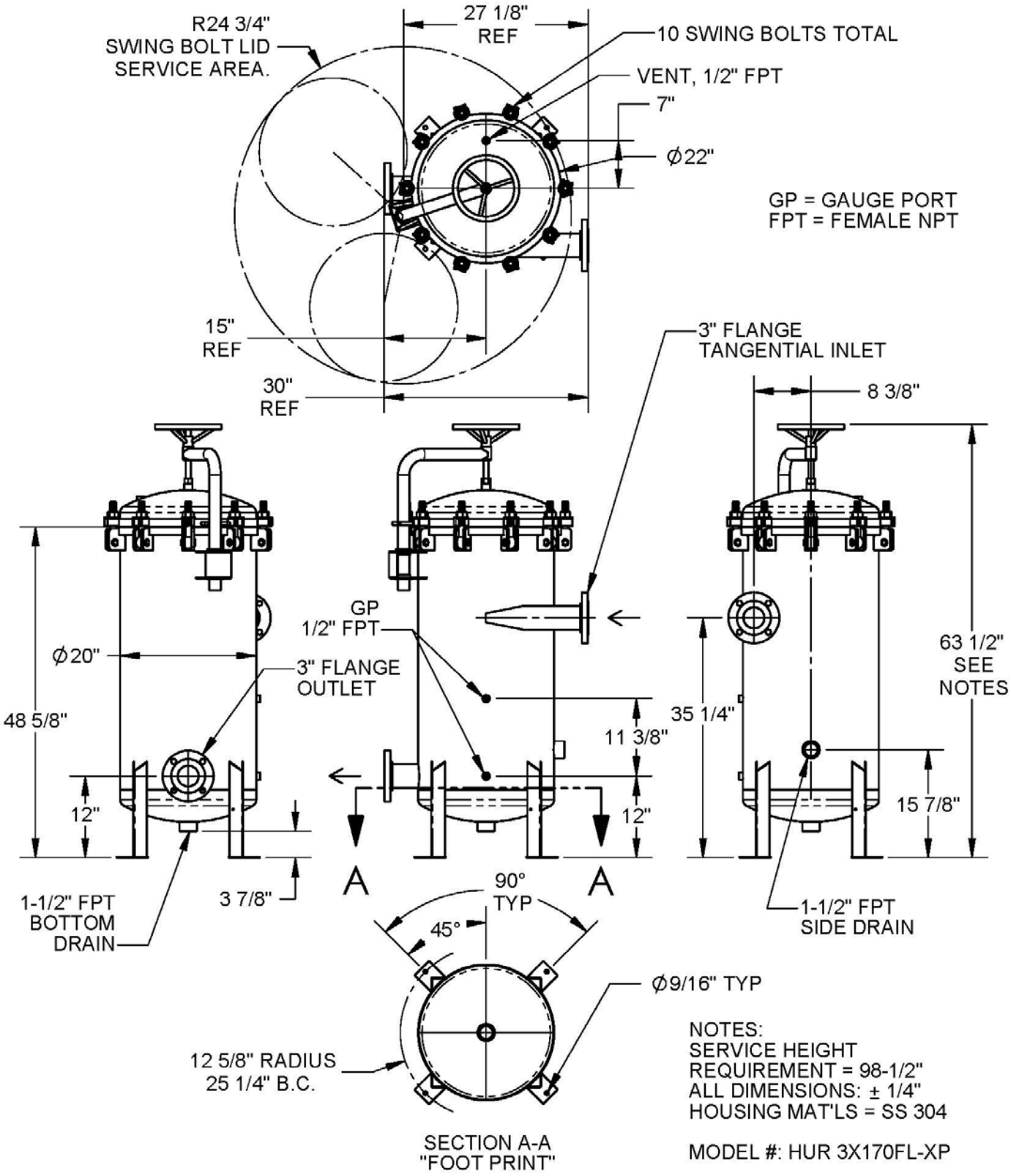


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Harmsco® Filtration Products
Installation Diagram
Hurricane® 3X170FL-XP Swing Bolt Housing



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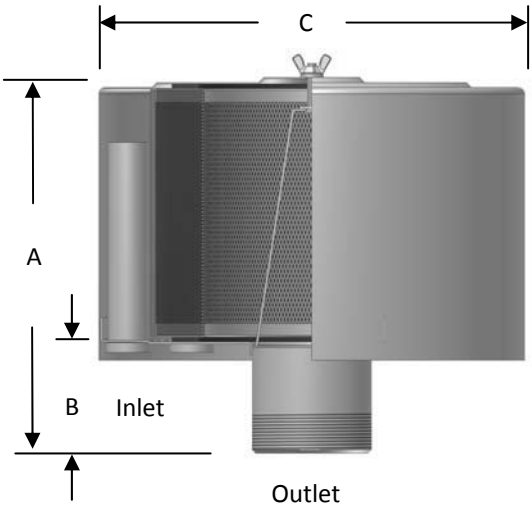
Compact Filter Silencers
FS Series 1/2” - 6” MPT, Flange





Features

- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tubes are positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish & powder coated weatherhood



Technical Specifications

- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H2O over initial Δ P
- Pressure drop graphs available upon request
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

Options

- 1/8” tap holes available for 3” and larger connections
- Pressure drop indicator (See page 3-11)
- Various media for different environments
- Stainless steel construction
- Epoxy coated finish
- Special connections
- Side Access Silencer Filters (LQB Series) for space restricted enclosures (select models)

Tidbit: Charlie Solberg Sr. “Senior” designed our first filter silencer in 1966. The FS-15 size filter was created for small air compressors.

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Outlet Connections

MPT Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	B	C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
1/2"	10	FS-15-050	FS-14-050	4	1 1/2	6	1	2	15	14	35
3/4"	25	FS-15-075	FS-14-075	4	1 1/2	6	2	2	15	14	35
1"	35	FS-15-100	FS-14-100	4	1 1/2	6	3	2	15	14	35
1"	55	FS-19P-100	FS-18P-100	6 5/8	1 5/8	6	3	3	19P	18P	100
1 1/4"	70	FS-19P-125	FS-18P-125	6 5/8	1 5/8	6	5	3	19P	18P	100
1 1/2"	85	FS-19P-150	FS-18P-150	6 5/8	1 5/8	6	5	4	19P	18P	100
2"	135	FS-31P-200	FS-30P-200	7 1/4	2 1/4	10	5	8	31P	30P	195
2"	135	FS-231P-200	FS-230P-200	12 1/4	2 1/4	10	5	14	231P	230P	300
2 1/2"	195	FS-31P-250	FS-30P-250	7 1/2	2 1/2	10	5	8	31P	31P	195
2 1/2"	195	FS-231P-250	FS-230P-250	12 1/2	2 1/2	10	9	15	231P	230P	300
3"	300	FS-231P-300	FS-230P-300	13	3	10	9	15	231P	230P	300
3"	300	FS-235P-300	FS-234P-300	13	3	16	9	29	235P	234P	570
3"	300	FS-275P-300	FS-274P-300	13	3	16	9	33	275P	274P	1100
4"	520	FS-235P-400	FS-234P-400	14	4	16	9	30	235P	234P	570
4"	520	FS-275P-400	FS-274P-400	14	4	16	9	34	275P	274P	1100
5"	800	FS-245P-500	FS-244P-500	14	4	16	14	33	245P	244P	880
5"	800	FS-275P-500	FS-274P-500	14	4	16	14	36	275P	274P	1100
6"	1100	FS-275P-600	FS-274P-600	15	5	16	18	38	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

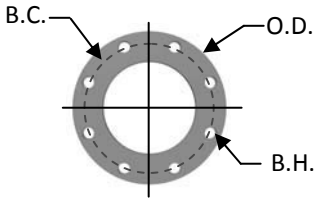
Flange Outlet Connections

Flange Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	B	C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
4"	520	FS-235P-400F	FS-234P-400F	14	4	16	9	33	235P	234P	570
4"	520	FS-275P-400F	FS-274P-400F	14	4	16	9	39	275P	274P	1100
5"	800	FS-245P-500F	FS-244P-500F	14	4	16	14	38	245P	244P	880
5"	800	FS-275P-500F	FS-274P-500F	14	4	16	14	41	275P	274P	1100
6"	1100	FS-275P-600F	FS-274P-600F	15	5	16	18	42	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

125/150# Pattern Flg	Dimensions - inches O.D.	B.C.	B.H.	No. of Holes	Flange Thickness
4"	9	7 1/2	0.75	8	0.38
5"	10	8 1/2	0.88	8	0.38
6"	11	9 1/2	0.88	8	0.38



O.D.: Outside Dimension
B.C.: Bolt Circle
B.H.: Bolt Hole

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

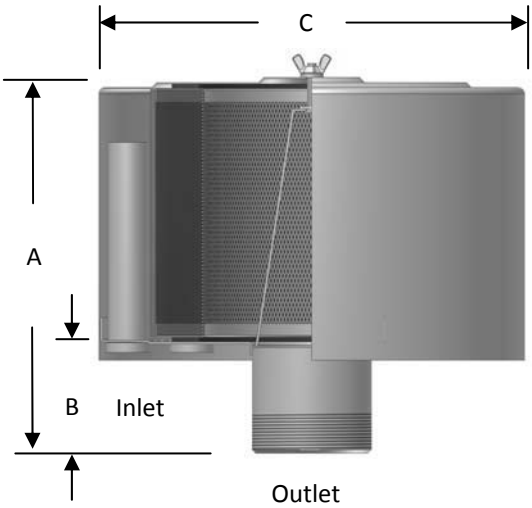
Compact Filter Silencers
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- Filter change out differential: 15-20” H2O over initial Δ P
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- Polyester: 99%+ removal efficiency standard to 5 micron
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- 1/8” tap holes available for 3” and larger connections
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3/4"	25	FS-15-075	FS-14-075	4	1 1/2	6	2	2	15	14	35
1"	35	FS-15-100	FS-14-100	4	1 1/2	6	3	2	15	14	35
1"	55	FS-19P-100	FS-18P-100	6 5/8	1 5/8	6	3	3	19P	18P	100
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5"	800	FS-275P-500	FS-274P-500	14	4	16	14	36	275P	274P	1100
6"	1100	FS-275P-600	FS-274P-600	15	5	16	18	38	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4"

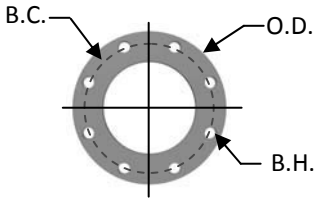
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4"	520	FS-275P-400F	FS-274P-400F	14	4	16	9	39	275P	274P	1100
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6"	1100	FS-275P-600F	FS-274P-600F	15	5	16	18	42	275P	274P	1100

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6"	11	9 1/2	0.88	8	0.38



O.D.: Outside Dimension
B.C.: Bolt Circle
B.H.: Bolt Hole

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

QED Air Stripper Model ver. 2.0

12/22/2015

Site Data

Name: KWB
e-mail: kbindas@nes-inc.biz
Project: t2t3t5 -uaf >>650>>
Units: English
Altitude: 22 ft
Air Temp: 55 F
Flow: 50 gpm
Water Temp: 55 F
Stripper: EZ-Tray 12.x - Click for details
Stripper Air Flow: 650 cfm
Stripper Max Flow: 120 gpm

Water Results

Contaminant	Influent (ppb)	Target (ppb)	4-Tray Results (ppb)	4-Tray %Removal	6-Tray Results (ppb)	6-Tray %Removal
1,2,4-trimethylbenzene	1	0	< 1	100.000	< 1	100.000
1,2-dichlorobenzene	5.2	0	< 1	100.000	< 1	100.000
1,2-dichloroethane	1300	0	63.0	95.154	17.0	98.692
1,3-dichlorobenzene	2.1	0	< 1	100.000	< 1	100.000
1,4-dichlorobenzene	1.6	0	< 1	100.000	< 1	100.000
benzene	800	0	1.4	99.825	< 1	100.000
chlorobenzene	2100	0	6.6	99.686	< 1	100.000
chloroethylene	240	0	< 1	100.000	< 1	100.000
vinyl chloride (chloroethylene)	40	0	< 1	100.000	< 1	100.000

Air Results

Contaminant	4-Tray (ppmV)	4-Tray (lb/hr)	6-Tray (ppmV)	6-Tray (lb/hr)
1,2,4-trimethylbenzene	0.0020	0.00002	0.0020	0.00003
1,2-dichlorobenzene	0.0084	0.00013	0.0085	0.00013
1,2-dichloroethane	3.0158	0.03097	3.1278	0.03212
1,3-dichlorobenzene	0.0034	0.00005	0.0034	0.00005
1,4-dichlorobenzene	0.0026	0.00004	0.0026	0.00004
benzene	2.4666	0.01999	2.4707	0.02003
chlorobenzene	4.4870	0.05241	4.5003	0.05257
chloroethylene	0.9264	0.00601	0.9264	0.00601
vinyl chloride (chloroethylene)	0.1544	0.00100	0.1544	0.00100

Fractional Tray Results

Contaminant	Influent (ppb)	2-Tray Results (ppb)	3-Tray Results (ppb)	4-Tray Results (ppb)	5-Tray Results (ppb)	6-Tray Results (ppb)
1,2,4-trimethylbenzene	1	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	5.2	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	1300	247.6	123.2	63.0	32.6	17.0

1,3-dichlorobenzene	2.1	< 1	< 1	< 1	< 1	< 1
1,4-dichlorobenzene	1.6	< 1	< 1	< 1	< 1	< 1
benzene	800	32.0	6.6	1.4	< 1	< 1
chlorobenzene	2100	112.3	27.2	6.6	1.6	< 1
chloroethylene	240	1.5	< 1	< 1	< 1	< 1
vinyl chloride (chloroethylene)	40	< 1	< 1	< 1	< 1	< 1

Fractional Tray Air Results - ppmV

Contaminant	2-Tray (ppmV)	3-Tray (ppmV)	4-Tray (ppmV)	5-Tray (ppmV)	6-Tray (ppmV)
1,2,4-trimethylbenzene	0.0019	0.0020	0.0020	0.0020	0.0020
1,2-dichlorobenzene	0.0077	0.0083	0.0084	0.0085	0.0085
1,2-dichloroethane	2.5658	2.8690	3.0158	3.0897	3.1278
1,3-dichlorobenzene	0.0032	0.0034	0.0034	0.0034	0.0034
1,4-dichlorobenzene	0.0023	0.0025	0.0026	0.0026	0.0026
benzene	2.3722	2.4504	2.4666	2.4700	2.4707
chlorobenzene	4.2605	4.4428	4.4870	4.4977	4.5003
chloroethylene	0.9206	0.9260	0.9264	0.9264	0.9264
vinyl chloride (chloroethylene)	0.1534	0.1543	0.1544	0.1544	0.1544

Fractional Tray Air Results - (lb/hr)

Contaminant	2-Tray (lb/hr)	3-Tray (lb/hr)	4-Tray (lb/hr)	5-Tray (lb/hr)	6-Tray (lb/hr)
1,2,4-trimethylbenzene	0.00002	0.00002	0.00002	0.00003	0.00003
1,2-dichlorobenzene	0.00012	0.00013	0.00013	0.00013	0.00013
1,2-dichloroethane	0.02635	0.02946	0.03097	0.03173	0.03212
1,3-dichlorobenzene	0.00005	0.00005	0.00005	0.00005	0.00005
1,4-dichlorobenzene	0.00004	0.00004	0.00004	0.00004	0.00004
benzene	0.01923	0.01986	0.01999	0.02002	0.02003
chlorobenzene	0.04976	0.05189	0.05241	0.05254	0.05257
chloroethylene	0.00597	0.00601	0.00601	0.00601	0.00601
vinyl chloride (chloroethylene)	0.00100	0.00100	0.00100	0.00100	0.00100

Warnings

Warning: User request of fractional tray results.

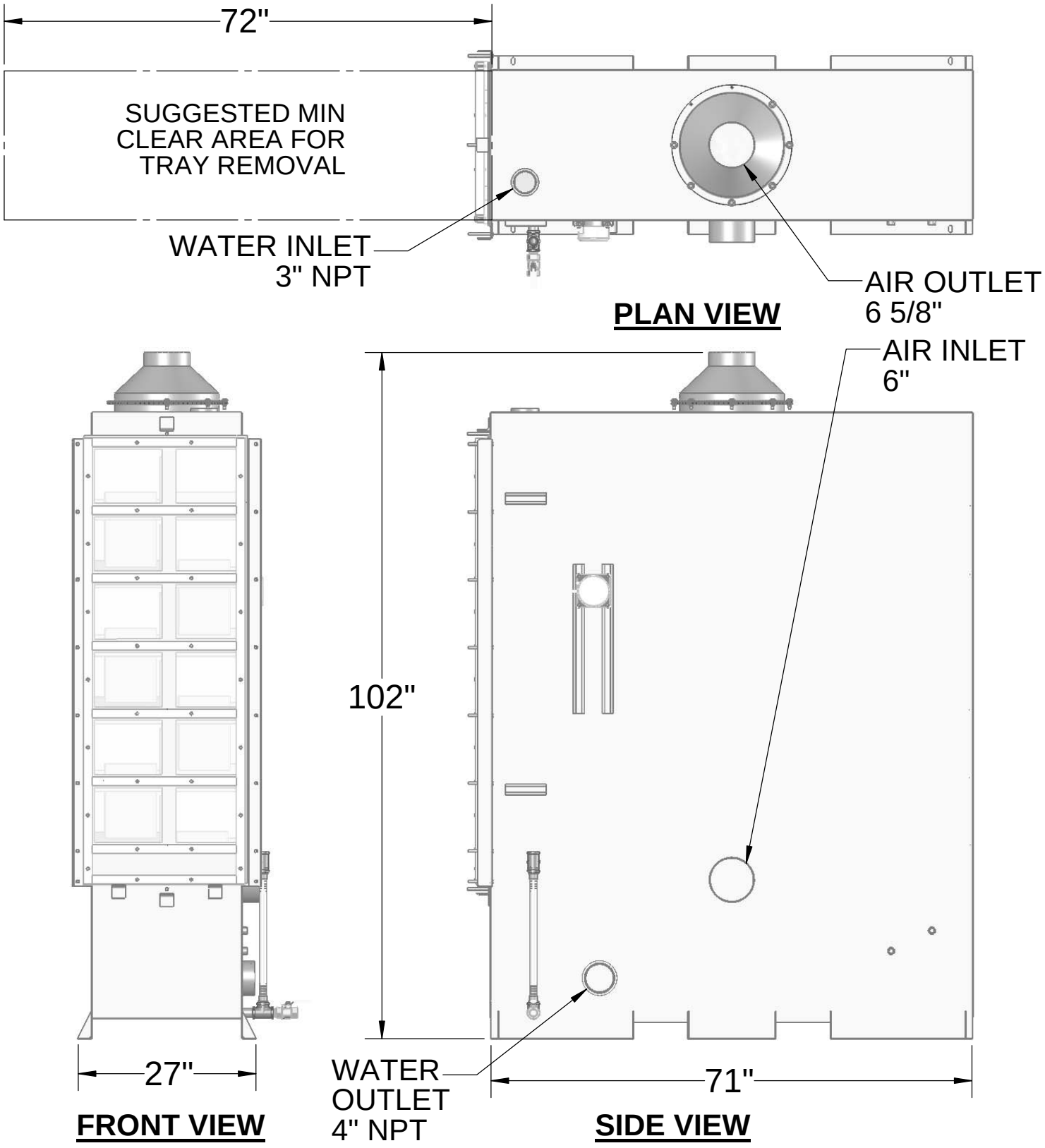
Warning: User entered air flow. Use with caution - blower air flow should stay within 20 percent of recommended flow.

Notes

Copyright -- QED Treatment Equipment, PO Box 3726, Ann Arbor, MI 48106.

PH-> 1-800-624-2026 or 1-734-995-2547, FX-> 1-734-995-1170. E-mail->info@qedenv.com. WEB->www.qedenv.com.

*The QED modeler estimates unit performance for the listed contaminants. **Results assume -***



EZ-12.6SS (AIR STRIPPER ONLY)

FOR MORE SPECIFICATIONS CLICK ON:

http://www.qedenv.com/Products/Airstrippers_VOC_Removal/Air_Stripper_Specifications/

NOT TO SCALE

NOT FOR CONSTRUCTION, FOR REFERENCE ONLY

ENGINEERING DATA SHEET 1
AIR STRIPPER (REMOVABLE TRAY)

GENERAL PRODUCT DATA

Model No.	Max. Flow (GPM)	Dry Weight (lbs)	Oper. Weight (lbs)	Area required Dimension (“DxWxH)	Trays per tier (no x lbs)	Active Area (sq ft)	Nom. air flow (cfm)	*Oper. Clearance (inches)
4.4	1-50	630	985	29 x 27 x 82	4 x 29	2.8	210	27
4.6	1-50	780	1,219	29 x 27 x 102	6 x 29	2.8	210	27
6.4	1-65	790	1,285	37 x 27 x 82	4 x 40	3.8	320	35
6.6	1-65	978	1,591	37 x 27 x 102	6 x 40	3.8	320	35
8.4	1-75	955	1,580	49 x 27 x 82	4 x 50	5.6	420	47
8.6	1-75	1,182	1,956	49 x 27 x 102	6 x 50	5.6	420	47
12.4	1-120	1,165	2,105	73 x 27 x 82	4 x 60	8.8	600	71
12.6	1-120	1,442	2,606	73 x 27 x 102	6 x 60	8.8	600	71
16.4	1-150	1,625	2,870	49 x 52 x 84	8 x 50	11.1	850	47
16.6	1-150	2,011	3,553	49 x 52 x 104	12 x 50	11.1	850	47
24.4	1-250	2,100	3,980	73 x 52 x 84	8 x 60	17.5	1300	72
24.6	1-250	2,599	4,926	73 x 52 x 104	12 x 60	17.5	1300	72
36.4	1-375	3,200	6,085	73 x 100 x 104	12 x 60	26.25	1900	72
36.6	1-375	3,900	7,532	73 x 100 x 124	18 x 60	26.25	1900	72
48.4	1-500	5,000	12,500	73 x 120 x 104	16 x 60	35	2600	72
48.6	1-500	5,500	13,000	73 x 120 x 124	24 x 60	35	2600	72
72.4	1-750	6,400	14,600	146 x 100 x 104	24 x 60	52.5	3800	2x72
72.6	1-750	7,800	15,100	146 x 120 x 124	36 x 60	52.5	3800	2x72
96.4	1-1000	11,000	25,000	146 x 124 x 104	32 x 60	70	5200	2x72
96.6	1-1000	11,500	30,000	146 x 124 x 124	48 x 60	70	5200	2x72

* Additional clearance required for tray removal. Models 96 and 72 need tray removal clearance at front and back. One side requires space for piping, blower, appurtenances, etc. (depends on design layout).

REV 01-21-11 Copyright 2011 QED

INSTALLATION DATA

Model	+Water Inlet (“FNPT)	+Water Outlet (“FNPT)	Air Inlet (“OD pipe)	*Exhaust Stack Size (inches)	Water drain (“FNPT)	#Max. back pressure (“H_2O)
4.4	2	3	4.63	6.63	1	10
4.6	2	3	4.63	6.63	1	5
6.4	3	3	4.63	6.63	1	10
6.6	3	3	4.63	6.63	1	5
8.4	3	4	4.63	6.63	1	10
8.6	3	4	4.63	6.63	1	5
12.4	4	4	6.63	6.63	1	10
12.6	4	4	6.63	6.63	1	5
16.4	4	4	6.63	8.63	1	10
16.6	4	4	6.63	8.63	1	5
24.4	4	6	8 flange	8.63	1	10
24.6	4	6	8 flange	8.63	1	5
36.4	8	6	10 flange	12 flange	1	5
36.6	8	6	10 flange	12 flange	1	5
48.4	8	8	10 flange	12 flange	1	5
48.6	8	8	10 flange	12 flange	1	5
72.4	8	10	12 flange	16 flange	1	5
72.6	8	10	12 flange	16 flange	1	5
96.4	8	10	12 flange	16 flange	1	5
96.6	8	10	12 flange	16 flange	1	5

+ Models 36.X and larger use flange inlet and outlet connections

* Minimum recommended nominal diameter of exhaust stack, if added

Maximum clean-tray exhaust back-pressure allowed without auxiliary blower

REV 01-21-11 Copyright 2011 QED

FPZ BLOWER TECHNOLOGY

SCL K07 / K08 / K09 / K10 / K11 / K12

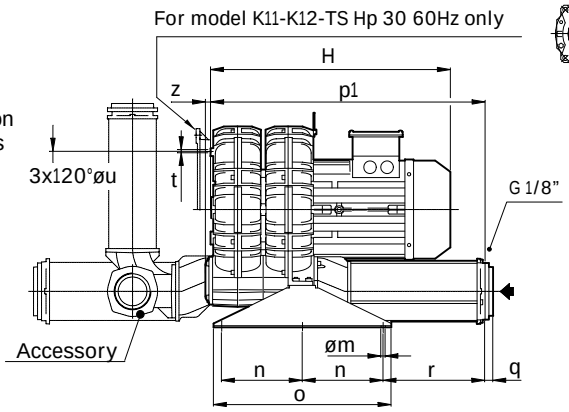
TS SERIES

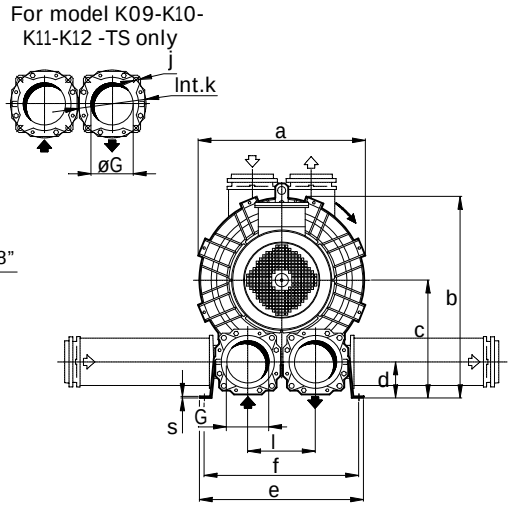
SN 1826-12

TECHNICAL CHARACTERISTICS
- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - cURus motor
- G1/8" female thread on both suction and discharge silencer port flanges

OPTIONS
- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES
- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors





Dimensions in inches.
Dimension for reference only.

Model	a	b	c	d	e	f	G	l	j	k	m	n	o	p1	q	r	s	t	u	z
K07-TS	16.69	20.91	12.56	3.86	18.43	17.24	4"NPT	7.17	-	-	0.51	9.84	21.65	31.57	0.98	11.77	0.20	M8	11.61	0.63
K08-TS	18.03	21.57	12.56	3.86	18.82	17.64	4"NPT	7.17	-	-	0.51	9.84	21.65	31.57	0.98	11.77	0.20	M8	12.20	0.63
K09-TS	19.37	24.02	14.37	4.4	20.00	18.82	5.12	8.27	M16	8.27	0.51	9.84	21.65	33.46	-	12.40	0.20	M8	14.17	0.63
K10-TS	20.31	24.53	14.37	4.41	20.00	18.82	5.12	8.27	M16	8.27	0.51	9.84	21.65	33.46	-	12.40	0.20	M8	14.17	0.63
K11-TS	21.26	25.59	14.96	4.17	21.26	20.08	5.12	8.98	M16	8.27	0.51	9.84	21.65	34.25	-	12.60	0.20	M8	15.35	0.63
K12-TS	21.57	25.66	14.96	4.17	21.26	20.08	5.12	8.98	M16	8.27	0.51	9.84	21.65	34.37	-	12.60	0.20	M8	15.35	0.63

Model	Maximum flow cfm		Installed power Hp		Maximum differential pressure Δp (In Hg)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	Inches	Lbs
K07-TS	588	487	7 ½	7 ½	2.6	3.5	84.5	82.5	23.76	197.31
			10	10	4.4	5.2	84.8	82.8	23.76	206.13
			15	15	8.1	8.9	85.4	83.4	24.55	223.77
K08-TS	715	592	7 ½	7 ½	1.3	2.2	80.9	78.9	23.76	205.47
			10	10	2.7	3.7	81.2	79.2	23.76	214.29
			15	15	5.5	6.4	82.9	80.9	24.55	231.92
K09-TS	941	780	20	20	5.9	6.6	84.1	82.1	29.92	350.53
			25	25	8.1	8.8	86.1	84.1	30.79	383.60
K10-TS	1093	906	20	20	4.8	5.5	89.4	87.4	29.92	354.94
			25	25	5.9	7.0	89.7	87.7	30.79	388.01
K11-TS	1254	1039	25	25	3.7	5.0	90.7	88.7	31.38	429.02
			30 (2)	30 (2)	5.1	6.6	91.3	89.3	31.38	434.53
K12-TS	1410	1168	30 (2)	30 (2)	3.3	5.9	91.9	89.9	31.50	436.75

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(2) K11-K12-TS Hp 30 vertical assembly only.

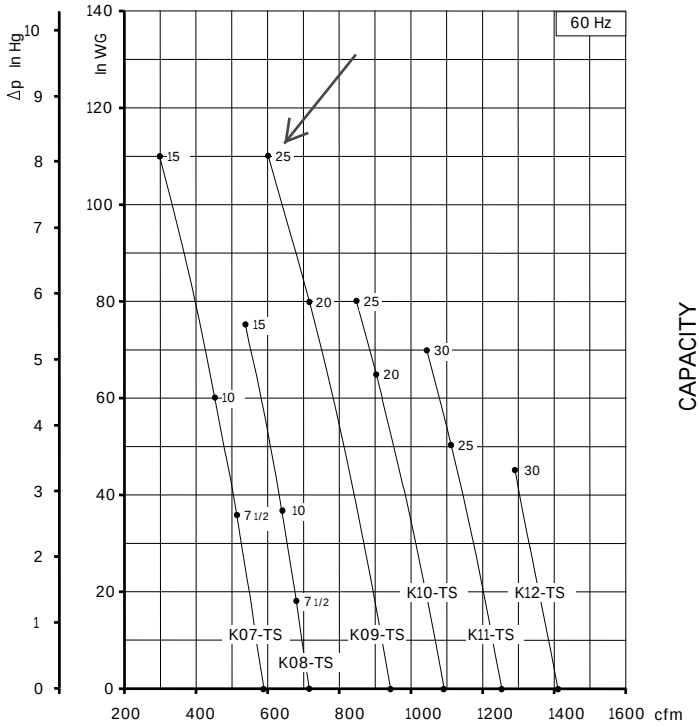
- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

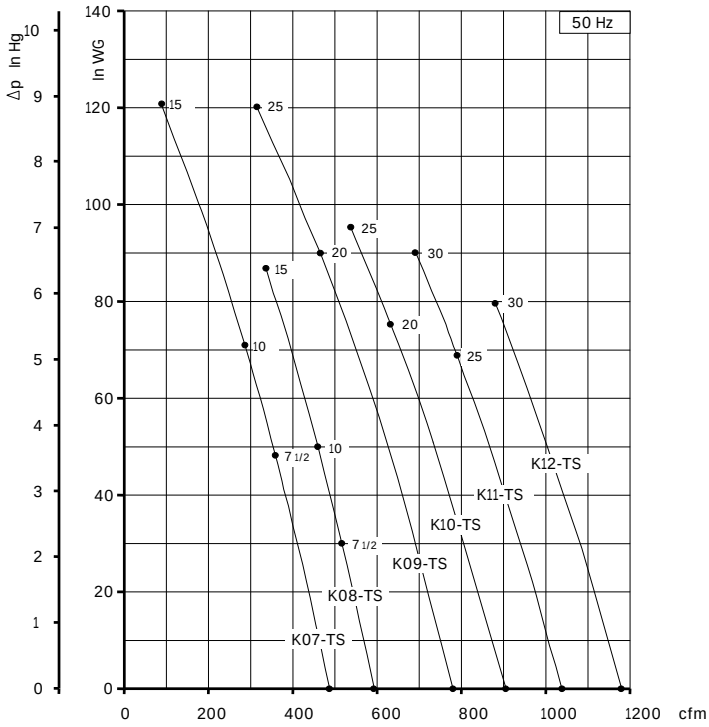
SCL K07 / K08 / K09 / K10 / K11 / K12

TS SERIES

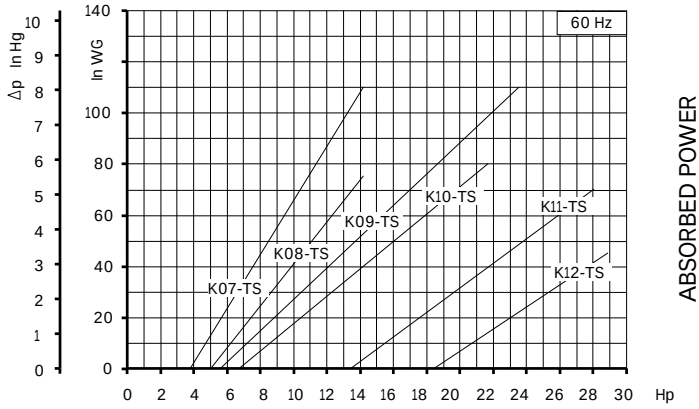
SN 1826-12

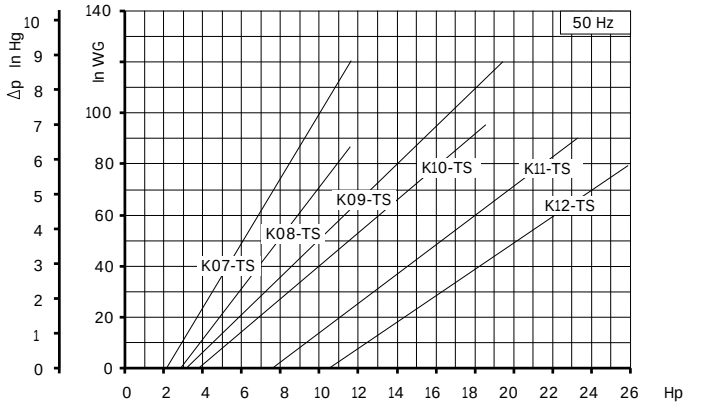
CAPACITY



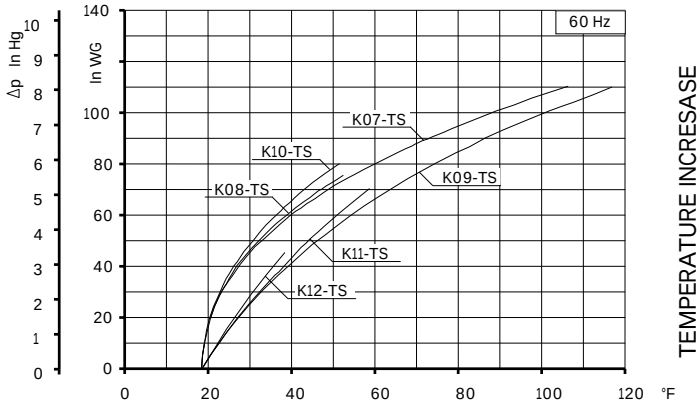


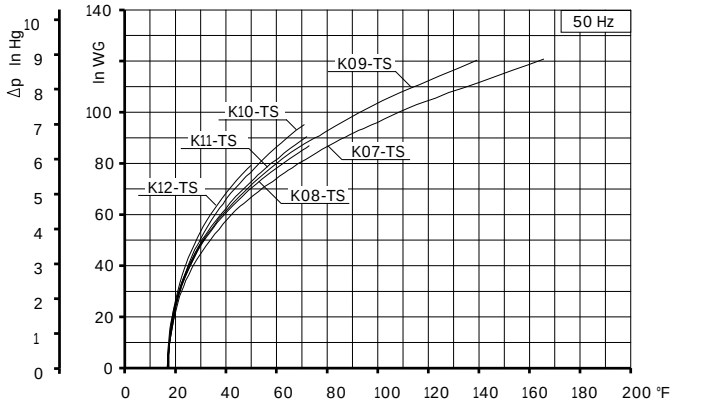
ABSORBED POWER



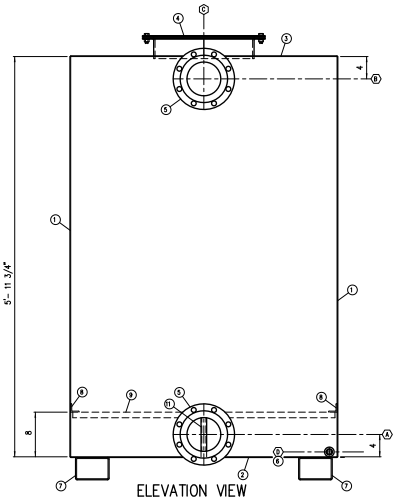


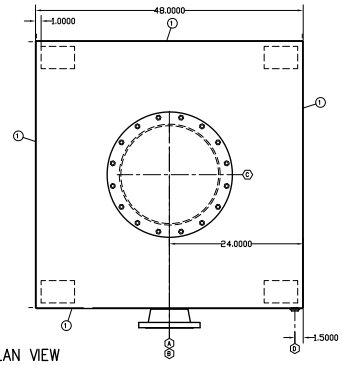
TEMPERATURE INCRESASE





Curves refer to air at 68° F temperature, measured at inlet port and 29.92 In Hg atmospheric backpressure (abs).
Values for flow, power consumption and temperature rise: +/-10% tolerance.
Data subject to change without notice.





SCHEDULE OF OPENINGS

MARK	SIZE	QTY	RATING	TYPE	DESCRIPTION	INT PROJ	WELD DETAIL	A	B	C
A	6"	1	150#	RFWN	INLET					
B	6"	1	150#	RFWN	OUTLET					
C	16"	1	N/A	FF CMPRG	MANWAY c/w BLIND	9/16"	15	1/8		
D	1/2"	1	FNPT	WLD FLG	DRAIN	SEE WLD DTL	17			
E										
F										
G										
H										
J										
K										
L										
M										
N										
P										
Q										
R										
S										

DESIGN DATA

Registration	NOT APPLICABLE	Year Built	2001
Construction	NOT APPLICABLE	Serial No.	00-____
Design Pressure	3 PSIG	Capacity (Vol.)	96 cu. ft.
Design Temperature	350 Deg F	Shipping Wt. (Empty)	630 POUNDS
External Pressure	NOT APPLICABLE	Wt. full of water	_____ POUNDS
Min. Des. Metal Temp	-20 Deg F AT 3 PSIG	Gaskets	NEOPRENE
MAWP (New & Cold)	3 PSIG	Studs & Nuts	MILD STEEL (ZINC PLATED)
MAWP (Hot & Corr'd)	3 PSIG	Internal Surface Prep	INTERNAL POWER CLEAN
Hydro Test Pressure	N / A	External Surface Prep	EXTERNAL POWER CLEAN
Corrosion Allowance	NONE	Internal Coating	SERIES 120 POTAPOX PLUS 5-8 mils DFT
Radiography	NONE	External Coating	MAB PLYMASTIC (LT GRAY) 5-7 mils DFT

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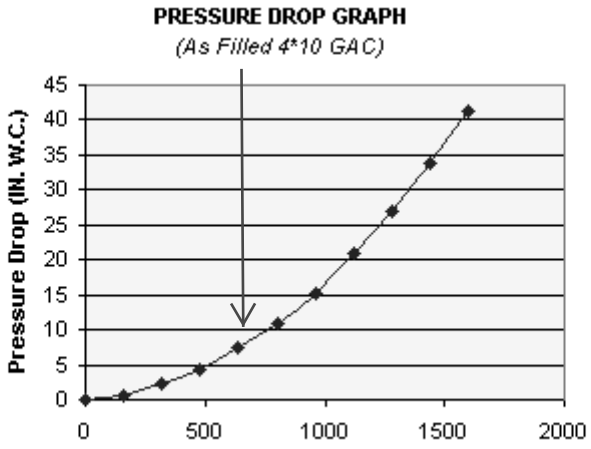
Tetrasolv Filtration
WWW.TETRASOLV.COM
1200 EAST 26th STREET
ANDERSON, INDIANA 46016
Ph: (765) 643-3941
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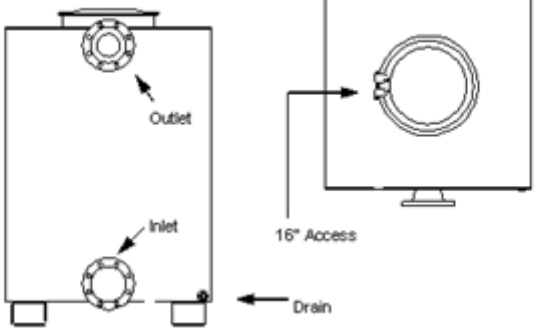
BODY	FINISH
Stock	Stock

GENERAL ASSEMBLY LAYOUT – ELEVATION AND ORIENTATION
FOR
MODEL VF-2000 FILTER 48" x 48" x 6'- 0" SEAM – SEAM

DRN BY	CHK'D BY	APP'D BY	DATE	SCALE	JOB No.	DRAWING No.	REV
DB (TF)	TB (TF)	EP (TF)	JAN 29/01	1 1/2" = 1'-0"	xxxxxxx	VF2000-STD	0

VF-2000
Low Pressure Drop Vapor Phase Filter





VF-2000 SPECIFICATIONS			
Overall Height	6'8"	Vessel/Internal Piping Materials	Polypropylene
Footprint	4' x 4'	Internal Coating	Polyamide (2-Part) Epoxy Resin
Inlet / Outlet (150# FLNG)	6"	External Coating	Epoxy Mastic (Light Grey)
Drain / Vent (FNPT)	1/2"	Maximum Pressure / Temp	3 PSIG / 250° F
GAC Fill (lbs)	2000	Cross Sectional Bed Area	16 FT^2
Shipping / Operational Weight (lbs)	2,650/3,200	Bed Depth/Volume	4.5 FT / 71 FT^3

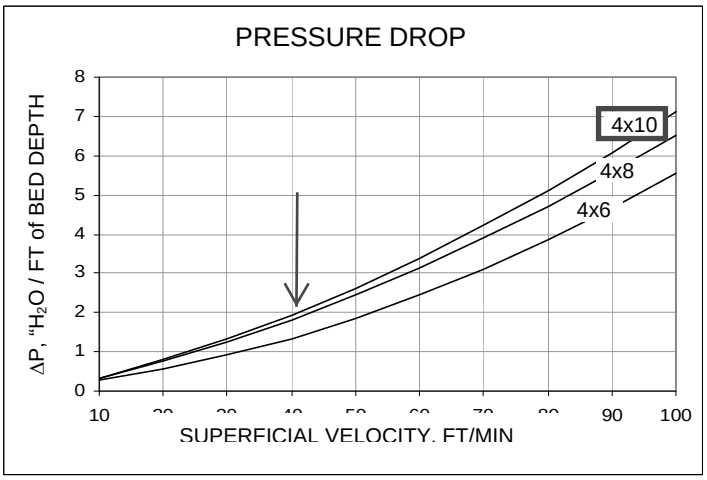
Carbon Filtration Systems, Inc.

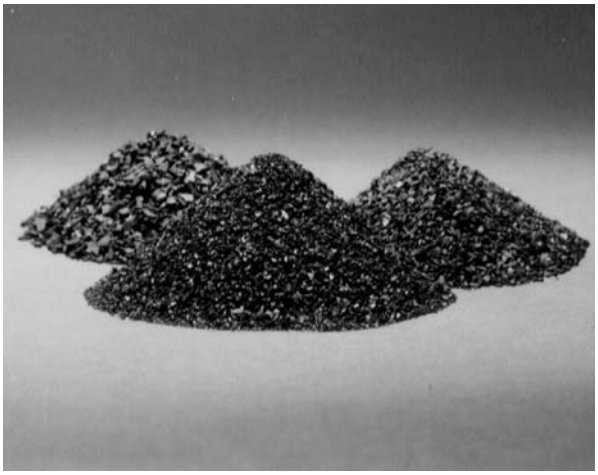
PRODUCT BULLETIN

COC-A 60

Vapor Phase, Coconut Shell Carbon

COC-A 60 is a highly active Granular Activated Carbon (GAC) manufactured via high temperature steam activation from selected grades of coconut shell and designed for use in a wide variety of air purification and vapor phase applications. Available in industry standard 4x6, 4x8 and 4x10 mesh sizes, these high quality carbons provide extraordinary surface area, fine pore structure, high density and superior hardness.





TYPICAL PHYSICAL PROPERTIES / SPECIFICATIONS

Iodine Number, mg/gm.	1150 - 1250
CCl_4 Activity, Min. (ASTM D-3467)	60
Apparent Density (ASTM D-2854), gm/cc	0.45 - 0.48
lb/ft^3	28 - 30
Hardness, Min. (ASTM D-3802)	98
U.S. Standard Sieve Size	4 x 6, 4 x 8, 4 x 10
Larger than No. 4, Max.	5%
Smaller than No. 6, 8, or 10, Max	5%
Total Surface Area (BET), m^2/gm	1150 - 1250
Ash, Max (ASTM D-2866)	3%
Moisture, Max. (ASTM D-2867)	2%

STANDARD PACKAGING:

55lb or 27.5lb POLYLINED POLYPROPYLENE BAGS. 200lb FIBER DRUMS. 1100lb SUPERSACKS.

This information is offered solely for your consideration and verification. It has been gathered from reference materials and/or test procedures and is believed to be true and accurate. None of this information shall constitute a warranty or representation, expressed or implied for which we assume legal responsibility or that the information or goods is fit for any particular use either alone or in combination with other goods or processes.

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Anderson, IN 46016
508-631-3203 Phone
www.tetrasolv.com

REGIONAL OFFICE
POB 1034
Truth or Consequences, NM 87901
508-448-0256 Fax
jbarbour@tetrasolv.com

HS-600

6% potassium permanganate impregnated media. The number one method for removing acid gasses and other air born pollutants.

The Environmental Remediation Heavyweight

HS-600 is a major breakthrough in oxidation of acid gases, fumes and odors. HS-600, a unique molecular sieve impregnated with potassium permanganate, was created in our laboratories to oxidize gaseous pollutants such as hydrogen sulfide, sulfur dioxide, formaldehyde, ethylene, mercaptans, and various aldehydes and alcohols.

The potassium permanganate impregnated media shall have no less than 3.6 pounds of potassium permanganate per cubic foot, a bulk density of no less than 60 pounds per cubic foot, a moisture content of 12-15% by weight and shall not dust. The media shall have an irregular particle size of 4 x 8 mesh.

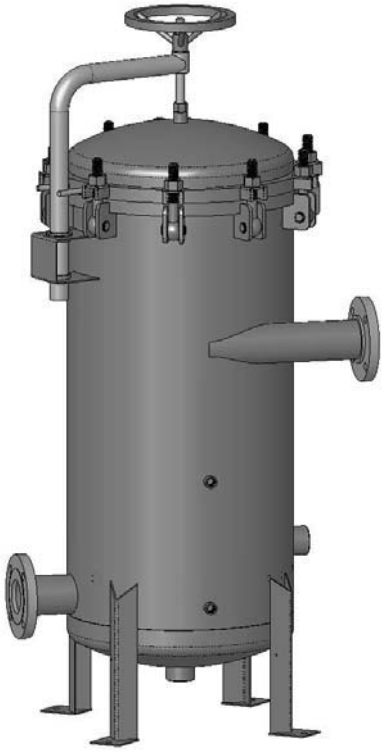
The performance characteristics of the air filtration media shall meet or exceed a service life of no less than 72 hours for breakthrough of hydrogen sulfide at the following test conditions:

Media Bed Volume: 76.00 cubic centimeters
Bed Configuration: 2.54 cm (id) x 15.00 cm
Flow Rate: 3000 (+/- 100) ml/minute
Relative Humidity: 70%
Challenge Gas: hydrogen sulfide
Challenge Gas Concentration: 10 (+/- 0.25) PPM

Removes

- Vinyl Chloride, DCE, TCE, PCE, Ethyl Mercaptan, Methyl Mercaptan
- Penta Mercaptan, Propylene Glycol, Chloroethane

PRODUCT SPECIFICATION
Harmsco® Model #: HUR 3X170FL-XP



Description: Tangential Entry, Up-Flow Cartridge Filter Housing with; Swing Bolt Closure, Davit Cover Lift, and Flanged Connections.

Details:

1. Stainless steel construction, wetted metallic components are 304/304L ASTM A-240.
2. Electro-polish finish.
3. Swing bolt style housing closure. Swing bolts are SS alloy per ASTM A-193 B7.
4. NSF Certified using Genuine Harmsco® Hurricane® replacement filter cartridges.*
5. Tangential inlet and the integral inner-can, create a centrifugal flow that induces pre-filtration by heavy particulate separation.
6. Patented "Up-Flow" design that;
   a. Self purges housing of air.
   b. Eliminates by-pass contamination during servicing.
   c. Improves efficiency by creating an even flow distribution across filtering media.
7. Strong, durable, built to ASME Design Standards.
8. Utilizes three (3) Genuine Harmsco® Hurricane® HC/170 series filter cartridges. *
9. Inlet & Outlet are NPS 3 Flanges ANSI/ASME B16.5 Class 150
10. Drains (Qty 2) are 1-1/2" Female NPT (FPT) Couplings, Class 1000
11. Vent is 1/2" Female NPT (FPT) Coupling, Class 1000
12. Gauge Ports (Qty 2) are 1/2" Female NPT (FPT) Couplings, Class 1000
13. Closure Gasket is EPDM 70 Durometer O-ring.
14. Pressure Rating - 150 P.S.I.G.
15. Temperature Rating – Up to 140°F
    Note: Higher temperatures are possible, check cartridge specifications. **
16. Flow Rate – 450 GPM Maximum.
    See Pressure Drop vs. Flow Rate Curve, page 2.
17. One person can perform maintenance.

Requirements:

Floor Load:	Dry weight = 435 lbs. Volume = 61 US gallons x 8.337 lbs./US gallon (water) = 509 lbs. Total weight = 435 + 509 = 944 lbs. (housing + water) Floor contact area = .292 ft² Floor Load = 944 lbs. divided by .292 ft² = **3,250 pounds per square foot** (approx.) Note: Piping shall conform to all applicable codes and be independently supported. If floor strength is suspect, use appropriate measures to adequately distribute load.
Floor Space:	**4.5 ft²** (does not include Cover/Davit swing position), See Installation Diagram, page 3.
Service Height:	98-1/2", See Installation Diagram, page 3.
Bonding:	Housing shall be bonded in accordance with all applicable codes. A grounding lug is provided.

Recommended Spare Parts:
Closure Gasket O-ring: PN 363-E
Set of 3 Harmsco® Hurricane® HC/170 replacement cartridges

* The use of any filter cartridges other than Genuine Harmsco® Hurricane® filter cartridges in this filter housing voids certifications by NSF International.
** Contact a Harmsco® sales representative for Harmsco® Hurricane® HC/170 filter cartridge specifications.

This product is manufactured under one or more of the following patents: U.S. NO. 4,187,179; 3,720,322; CANADA NO. 977,693; GT. BRIT. NO. 1,372,014; W. GERMANY NO. 2,261,817; FRANCE NO. 7,246,864; EUROPEAN NO. 0,191,844, Other patents pending.
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Revised: 12-5-14
File Name: SPECIFICATION HUR 3X170FL-XP (pg. 1 of 3)

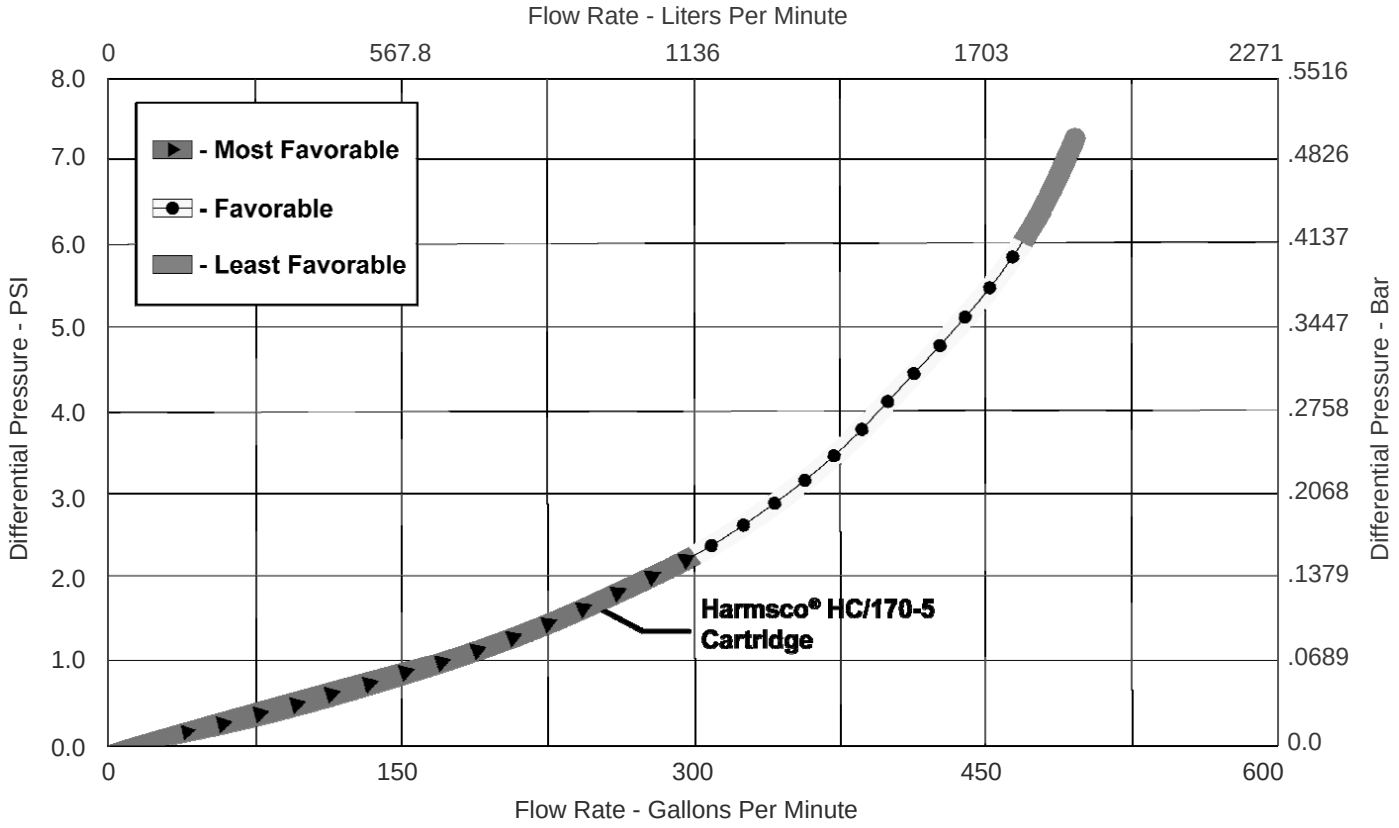
Harmsco® FILTRATION PRODUCTS
Economical Solutions to Liquid Filtration Challenges

www.harmsco.com
sales@harmsco.com
800-327-3248
561-848-9628

Pressure Drop vs. Flow Rate Curve

Harmsco® HUR 3X170FL-XP

Hurricane® HC/170-5 Cartridges, Qty 3; with clean water.

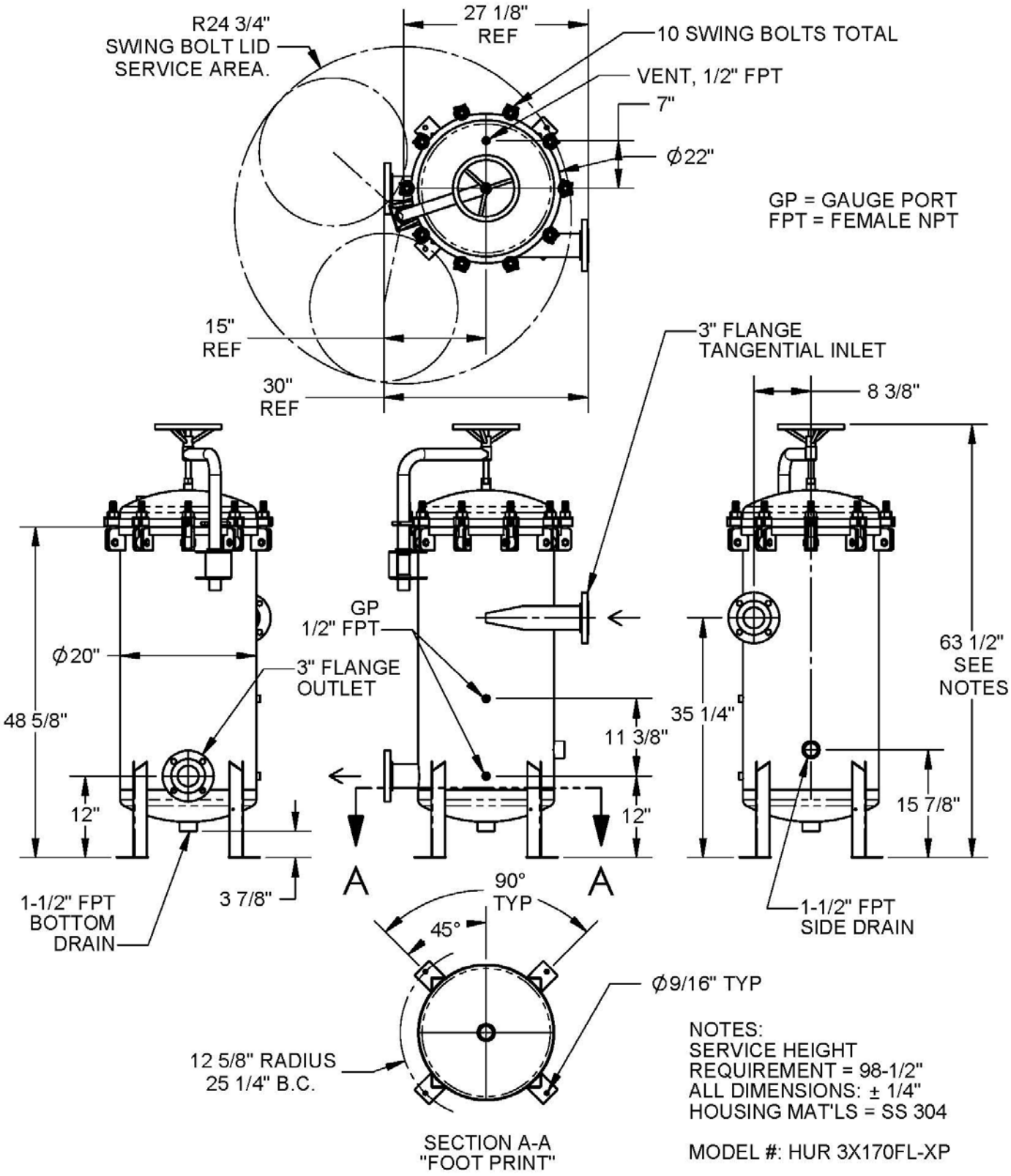


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Harmsco® Filtration Products
Installation Diagram
Hurricane® 3X170FL-XP Swing Bolt Housing

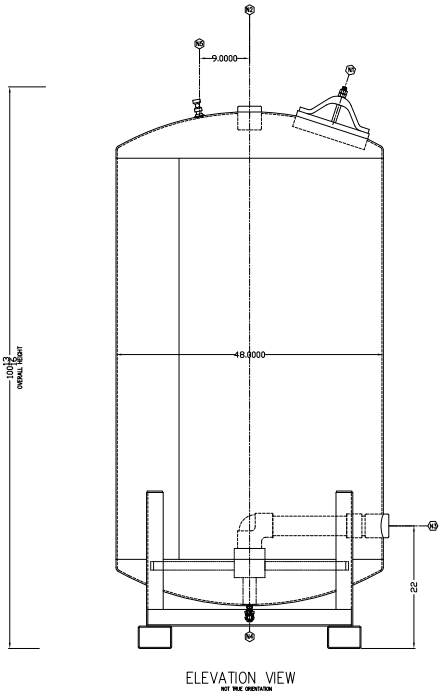


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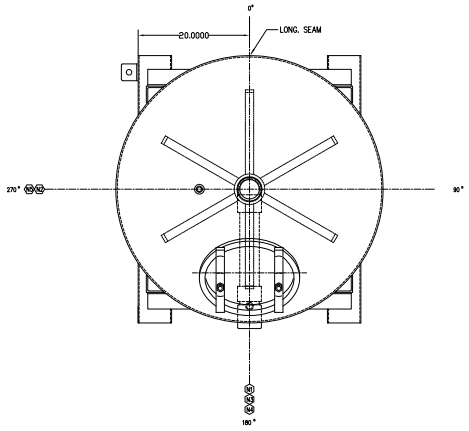
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Rev No	Revision note	Date	Signature	Checked



ELEVATION VIEW
NOT TRUE ORIENTATION



PLAN VIEW
TRUE ORIENTATION

NOZZLE SCHEDULE

ID	Description	Service
N1	12" x 16" ELLIPTICAL MANWAY w/COVER	Upper bed access with Cover (SA-36), Bolts, Neoprene Gasket
N2	3" MNPT 3000# Coupling	Process Inlet
N3	3" MNPT 3000# Coupling	Process Outlet
N4	1" 150# Thrd Tank Flange	Drain w/1/2" Ball Valve
N5	1/4" 150# Thrd Tank Flange	VENT
N6		
N7		

COATINGS SCHEDULE

Surface	Surface Preparation	Product Specification
Internal - 1	SSPC-SP6	SW Macropoxy 646 6-8 mils DFT
Internal - 2	Inspect	n/a
External - 1	SSPC-SP6	SW Kem Bond Primer 2-4 mils DFT
External - 2	n/a	SW Shercryl (Blue) 2-4 mils DFT
External - 3	n/a	n/a

NOTES

Item	Details
Construction	Non-Code Design Pressure: 75 PSIG @ 140 DEG F.
Mtris Vessel	Shell: SA-36 Heads: SA-36 Pipe: SA-53 (see nozzle detail for others)
Mtris Interls	Hub, Laterals (.012" Slot), Diffuser, Hose: PVC Gaskets: Neoprene Hardware: Plated
n/a	n/a
n/a	n/a
Media	Reactivated Vapor Phase Carbon

Designed by	Approved by	Customer	Job Number	Date	Scale/Unit
D Shreves	E Patterson	Newterra	4289JB	December 13, 2012	NTS / Inch

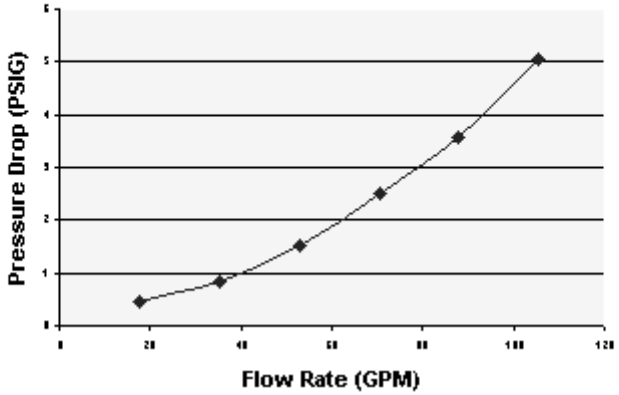
tetraSOLV FILTRATION
1624 ABRAHAM DRIVE
ANDERSON, INDIANA 46013
Ph: (765) 643-3941
Fx: (765) 643-3949

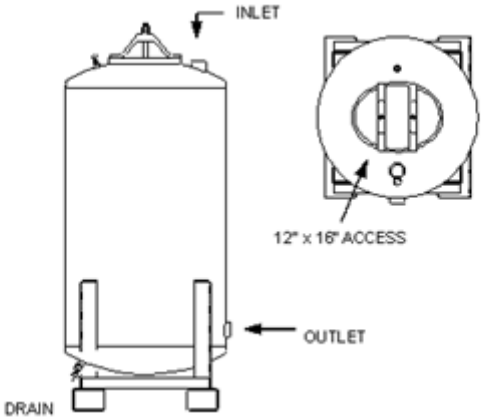
HPAF-2000 Media Filter

Drawing# M-1 / R1

HPAF-2000
High Pressure Aqueous Vessel

PRESSURE DROP GRAPH
*(As Filled - 8*30 GAC)*





HPAF-2000 SPECIFICATIONS			
Overall Height	8'6"	Vessel/Internal Piping Materials	CS (SA-36) / SCH 40 PVC
Diameter	48"	Internal Coating	Polyamide Epoxy Resin
Inlet / Outlet (FNPT)	3"	External Coating	Epoxy Mastic
Drain / Vent (FNPT)	3/4" / 1/2"	Maximum Pressure / Temp	75 PSIG / 140° F
GAC Fill (lbs)	2,000	Cross Sectional Bed Area	12.5 FT^2
Shipping / Operational Weight (lbs)	3,020/6,775	Bed Depth/Volume	5.5 FT / 68.7 FT^3

CARBON ACTIVATED CORP.

Activated Carbon and Related Services

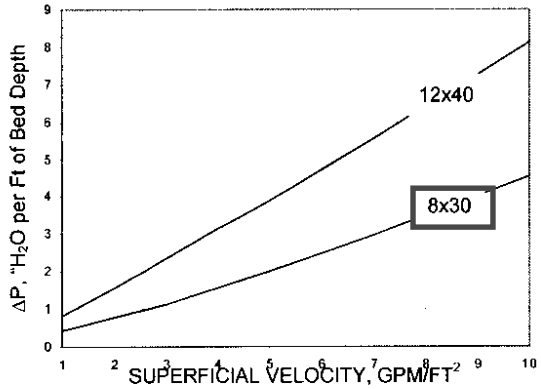
PRODUCT BULLETIN

ACOL – GL 60

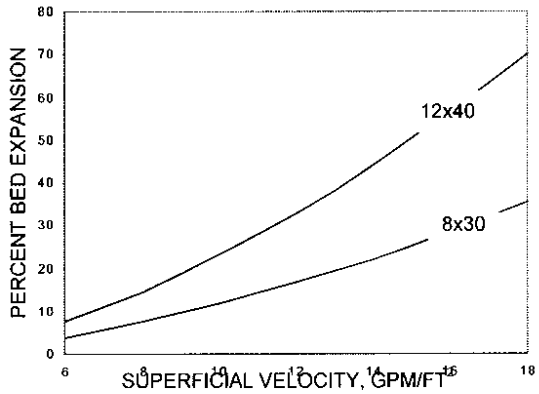
Acid Washed Bituminous Coal Base Carbon

ACOL-GL60 Granular Activated Carbon (GAC) is manufactured from select grades of Bituminous Coal and acid washed to yield a high purity and low ash content. ***ACOL-GL60*** features a high density, large pore volume and high surface area. It's commonly used for beverage manufacture, dialysis, potable water, and a variety of food grade applications. ***ACOL-GL60*** meets AWWA Standard B-600-74, ANSI/NSF Standard 61 and Food Chemicals Codex Standards for drinking water applications.

DOWNFLOW PRESSURE DROP



UPFLOW BED EXPANSION



TYPICAL PHYSICAL PROPERTIES / SPECIFICATIONS

Total Surface Area (BET), m^2/g		950 - 1000
Iodine Number, min.		950 - 1000
Apparent Density (ASTM 2854), g/cc		0.44 – 0.46
	lb/ft^3	27 - 29
Density, BWD	lb/ft^3	23 - 25
Abrasion No., min.		85
Particle Sizes:		8 x 30
		12x40
		20x50
Ash, max.		8%
Moisture as packed, max.		2%

NSF

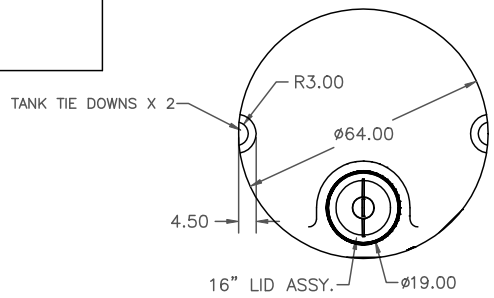
STANDARD PACKAGING:
55lb or 27.5lb POLYLINED POLYPROPYLENE BAGS. 200lb FIBER DRUMS. 1100lb SUPERSACKS.

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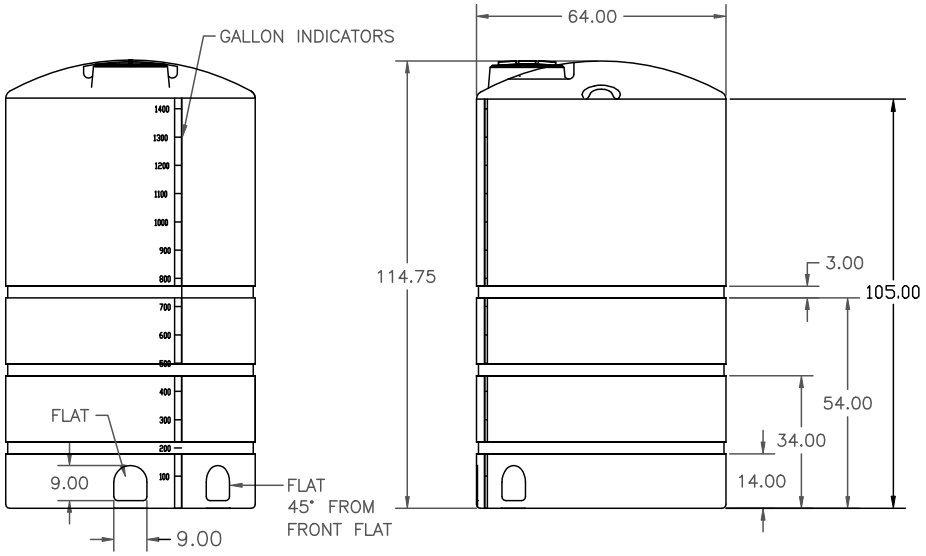
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VT1500-64



1. HEAVY DUTY POLYETHYLENE CONSTRUCTION
2. 1 PIECE ROTATIONALLY MOLDED
3. TRANSLUCENT
4. FDA APPROVED RESIN
5. CALIBRATED IN GALLONS
6. THREE YEAR WARRANTY
7. UV STABILIZED



REV	DESCRIPTION	DATE	APPRD

DRAWN / DATE: DHJ 01/02/03

APPRD. / DATE: ADH 11/19/07

MATERIAL: HDPE OR EQUIVALENT REFERENCE MATERIAL DATA SHEET FOR SPECIFIC PROPERTIES.

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M

NOTES:
1. BLUE, YELLOW, WHITE, OR BLACK COLOR
2. SHOT WEIGHT 335 LBS.
3. NOM. WALL .340

ACE ROTO-MOLD
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4018 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION: 1500 GALLON VERTICAL TANK

SCALE: N.S.

PART NO.: VT1500-64

VERTICAL TANKS - DOME TOP *Syphon tube included with tanks 300 gallon or greater*

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
VT0010-12†	10 GAL	9	12 X 25	8"	3/4"	2.0
VT0020-16†	20 GAL	15	16 X 28	8"	3/4"	2.0
VT0025-18†	25 GAL	14	18 X 30	5"	3/4"	2.0
VT0040-18†	40 GAL	19	18 X 43	5"	3/4"	2.0
VT0055-20†	55 GAL	23	20 X 47	5"	1"	2.0
VT0065-23†	65 GAL	27	23 X 42	5"	1"	2.0
VT0110-32	110 GAL	42	32 X 41	5"	2" TOP	2.0
VT0135-23	135 GAL	47	23 X 82	16"	1"	2.0
VT0300-42	300 GAL	74	42 X 55	8"	2"	2.0
VT0405-52	405 GAL	92	52 X 48	8"	2"	2.0
VT0425-42	425 GAL	102	42 X 75	8"	2"	2.0
VT0505-46	505 GAL	120	46 X 80	16"	2"	2.0
VT0550-52	550 GAL	118	52 X 66	8"	2"	2.0
VT0600-46	600 GAL	132	46 X 91	16"	2"	2.0
VT0625-64	625 GAL	102	64 X 50	8"	2"	2.0
VT0800-46	800 GAL	177	46 X 118	16"	2"	1.7
VT0900-46	900 GAL	222	46 X 132	16"	2"	1.7
VT1000-64	1000 GAL	252	64 X 81	16"	2"	1.7
VT1050-86	1050 GAL	192	86 X 54	16"	2"	1.7
VT1200-64	1200 GAL	277	64 X 97	16"	2"	1.7
VT1350-86	1350 GAL	230	86 X 65	16"	2"	1.7
VT1500-64	1500 GAL	337	64 X 115	16"	2"	1.7
VT1500-86	1500 GAL	252	86 X 69	16"	2"	1.7
VT1525-64	1525 GAL	352	64 X 122	16"	2"	1.7
VT1650-86	1650 GAL	280	86 X 74	16"	2"	1.7
VT2000-64	2000 GAL	467	64 X 156	16"	2"	1.7
VT2000-90	2000 GAL	377	90 X 84	16"	2"	1.7
VT2050-86	2050 GAL	402	86 X 93	16"	2"	1.7
VT2150-102	2150 GAL	417	102 X 71	16"	2"	1.7
VT2500-90	2500 GAL	422	90 X 103	16"	2"	1.7
VT3000-90	3000 GAL	552	90 X 120	16"	2"	1.7
VT3100-102*	3100 GAL	552	102 X 103	16"	2"	1.7
VT3400-102*	3400 GAL	587	102 X 107	16"	2"	1.7
VT4000-96*	4000 GAL	902	96 X 140	16"	2"	1.7
VT4200-96*	4200 GAL	952	96 X 148	16"	2"	1.7
VT4995-142*	4995 GAL	952	142 X 90	16"	3"	1.7
VT5000-102*	5000 GAL	1302	102 X 156	16"	3"	1.7
VT5150-102*	5150 GAL	1352	102 X 161	16"	3"	1.7
VT6250-102*	6250 GAL	1552	102 X 194	16"	3"	1.7
VT6500-120*	6500 GAL	1502	120 X 152	16"	3"	1.7
VT7000-142*	7000 GAL	1752	142 X 125	16"	3"	1.7
VT7800-120*	7800 GAL	1902	120 X 176	16"	3"	1.7
VT8000-120*	8000 GAL	1932	120 X 180	16"	3"	1.7
VT9150-120*	9150 GAL	2202	120 X 203	16"	3"	1.7
VT9500-120*	9500 GAL	2352	120 X 213	16"	3"	1.7
VT10500-2500*	10,500 GAL	2502	142 X 177	16"	3"	1.6
VT10500-2800*	10,500 GAL	2802	142 X 177	16"	3"	1.8
VT12500-142*	12,500 GAL	3402	142 X 208	16"	3"	1.7

† INDICATES CAN BE SHIPPED VIA UPS/FED EX
* HEAVY DUTY FITTING



VT1050-86

VT2050-86



WATER ONLY TANKS *Additional water only tanks available*

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	LID	FITTING	SPEC. GRAVITY
WO2500-VT	2500 GAL	392	96 X 92	16"	2"	1.0
WO3000-VT	3000 GAL	487	96 X 109	16"	2"	1.0



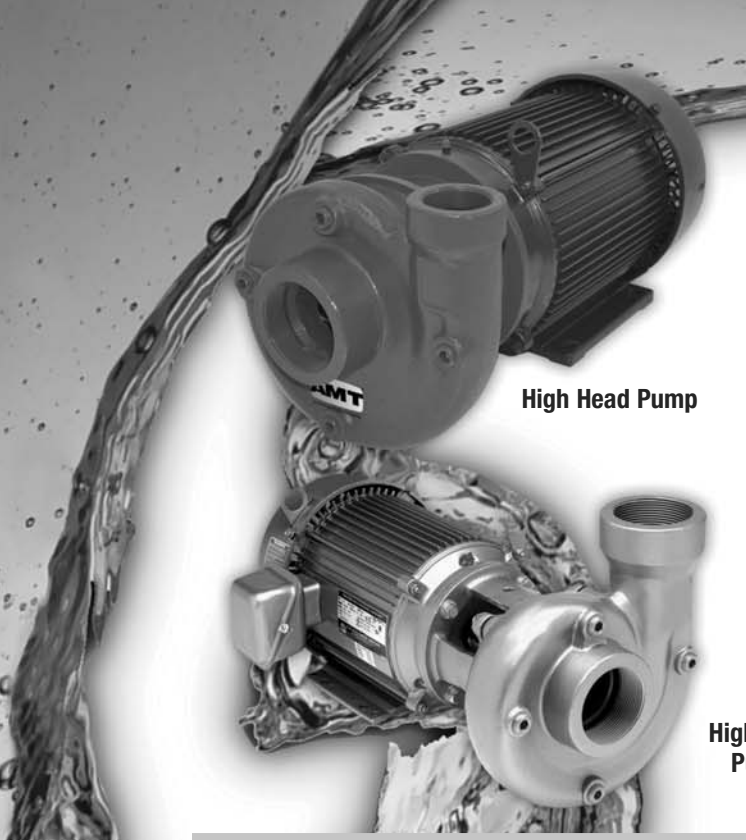
WO2500-VT

WO3000-VT

Water Only Vertical Tanks

Water tanks are free standing for indoor or outdoor stationary applications. Tanks are manufactured from FDA compliant high-density polyethylene with UV inhibitors. They are designed for the storage of chemicals with a specific gravity of 1.0 or less and available in dark green. Contact customer service for additional water only options.

Heavy Duty Straight Centrifugal Pumps

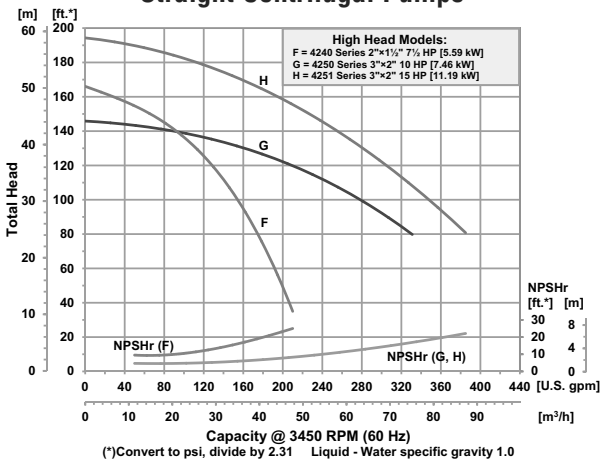


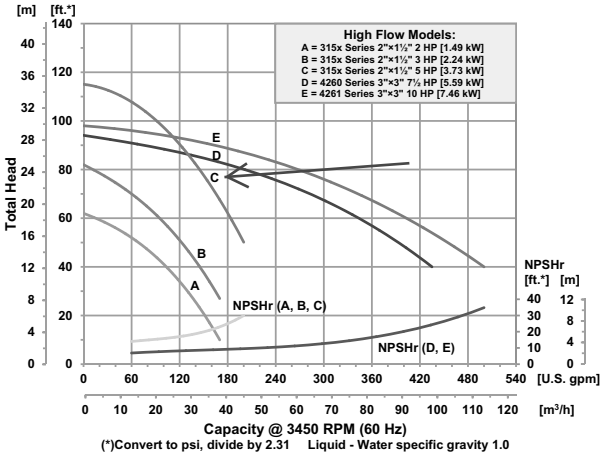
High Head Pump

High Flow Pump

- ***Available in: 300 Series Investment Cast Stainless Steel, Cast Bronze and Cast Iron Construction with Stainless Steel Impeller***
- ***Buna-N Mechanical Seal and O-Ring on Cast Iron Models***
- ***Viton® Mechanical Seal and O-Ring on Stainless Steel and Bronze Models***
- ***Optional Silicon Carbide Seals Available***
- ***Front Drain Plugs Located 90° Apart***
- ***Maximum Head 194 Feet (84 PSI)***
- ***Maximum Flow 500 GPM***
- ***2 HP to 15 HP NEMA Motors, Single and Three Phase***
- ***Optional Mounting Base Available***

Performance of Heavy Duty Straight Centrifugal Pumps





AMT Heavy Duty Solids Handling End Suction Centrifugal pumps are suited for liquid and chemical transfer, heating and cooling, recirculation, booster service, dirty water and other industrial applications. Stainless steel units are especially effective in applications where rust and/or corrosion can develop in systems. Semi-open impeller features self-cleaning ability that makes the unit useful in applications involving up to 1/8" diameter solids and muddy or dirty liquids, as well as clean, clear fluids. Discharge position can be adjusted in 90° increments with vent and drain plugs for all positions. Type 21 mechanical seal and O-ring casing seal. Pumps are close coupled to Totally Enclosed Fan Cooled (TEFC) motors. **Pumps are not self-priming and require flooded suction.**

AMT®
A Gorman-Rupp Company

400 Spring Street • Royersford, PA 19468 USA

www.amtpump.com • 888-amt-pump (268-7867)

For use with nonflammable liquids compatible with pump component materials. Viton® and Teflon® are registered trademarks of E. I. Dupont.

Pump Dimensional & Specification Data

Model ‡	Curve	HP	PH	Frame	ENC	Voltage @ 60 Hz +	Full Load Amps	SUC*	DIS*	A**	B**	C**	D**	E	F**	G	J**	K	L**	W**	H	‡ Ship Wt. (Lbs.)
3156			1	56J		115/230	22/11			5.4 [13.8]	5.0 [12.7]	8.5 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	17.4 [44.2]	10.6 [26.9]	9.6 [24.4]	78
3150	A	2	3	145JM	TEFC	230/460	6/3	2	1½	6.1 [15.5]	3.5 [8.9]	10.7 [27.1]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	2.7 [7.0]	1.3 [3.5]	19.2 [48.7]	11.4 [28.9]	9.6 [24.4]	84
3157			3	56J		230/460	6/3			5.4 [13.8]	3.6 [9.1]	8.5 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	16.9 [42.9]	10.6 [26.9]	9.6 [24.4]	71
315A			1	56J		230	12			5.4 [13.8]	5.0 [12.7]	8.6 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	17.9 [45.4]	10.6 [26.9]	9.6 [24.4]	87
3151	B	3	3	182JM	TEFC	230/460	8/4	2	1½	7.1 [18.0]	6.6 [16.8]	10.9 [27.6]	4.5 [11.4]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	3.7 [9.5]	0.3 [0.9]	20.0 [50.8]	12.8 [32.5]	9.6 [24.4]	137
315B			3	56J		230/460	8/4			5.4 [13.8]	3.6 [9.1]	8.5 [21.8]	3.5 [8.9]	2.5 [6.4]	4.0 [10.2]	4.3 [11.0]	2.4 [6.2]	1.3 [3.5]	17.4 [44.2]	10.6 [26.9]	9.6 [24.4]	75
315E	C	5	1	184JM	TEFC	230	16	2	1½	7.8 [19.9]	6.6 [16.8]	10.8 [27.6]	4.5 [11.4]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	3.7 [9.5]	0.3 [0.9]	24.2 [61.4]	13.9 [35.3]	9.6 [24.4]	143
3152			3	184JM		230/460	17/9			7.1 [18.0]	6.6 [16.8]	10.8 [27.6]	4.5 [11.4]	2.5 [6.4]	4.0 [10.2]	4.4 [11.3]	3.7 [9.5]	0.3 [0.9]	21.7 [55.1]	12.8 [32.5]	9.6 [24.4]	145
4264	D	7½	1	213JM	TEFC	230	32	3	3	9.0 [22.9]	7.3 [18.7]	12.3 [31.4]	5.2 [13.3]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	4.2 [10.8]	0.2 [0.7]	27.0 [68.6]	16.2 [41.1]	12.0 [30.4]	205
4260			3	184JM		230/460	22/11			7.0 [18.0]	6.6 [16.8]	11.6 [29.5]	4.5 [11.4]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	3.7 [9.5]	1.0 [2.6]	22.5 [57.1]	14.3 [36.3]	12.0 [30.4]	172
4265	E	10	1	215JM	TEFC	230	40	3	3	9.0 [22.9]	6.2 [15.7]	12.3 [31.4]	5.2 [13.3]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	4.2 [10.8]	0.2 [0.7]	27.0 [68.5]	16.2 [41.1]	12.0 [30.4]	213
4261			3	215JM		230/460	26/13			8.1 [20.7]	7.3 [18.7]	12.3 [31.4]	5.2 [13.3]	2.7 [7.0]	4.5 [11.4]	4.7 [12.1]	4.2 [10.8]	0.2 [0.7]	26.0 [66.0]	15.0 [38.1]	12.0 [30.4]	204
4242	F	7½	1	213JM	TEFC	230	32	2	1½	9.0 [22.9]	7.3 [18.7]	11.3 [28.9]	5.2 [13.3]	2.4 [6.2]	3.8 [9.7]	4.4 [11.3]	4.2 [10.8]	N/A	26.0 [66.0]	14.6 [37.1]	11.1 [28.1]	196
4240			3	184JM		230/460	22/11			7.1 [18.0]	6.6 [16.8]	10.6 [27.0]	4.5 [11.4]	2.4 [6.2]	4.5 [11.4]	4.5 [11.4]	3.7 [9.5]	0.1 [0.3]	21.5 [54.6]	12.6 [32.0]	10.5 [30.6]	163
4253	G	10	1	215JM	TEFC	230	40	3	2	9.0 [22.9]	5.5 [14.2]	11.5 [29.3]	5.2 [13.3]	2.7 [7.1]	4.7 [12.1]	5.0 [12.9]	4.2 [10.8]	0.3 [0.9]	26.1 [66.3]	15.9 [40.4]	10.6 [26.9]	217
4250			3	215JM		230/460	26/13			8.1 [20.7]	7.3 [18.7]	11.5 [29.3]	5.2 [13.3]	2.7 [7.1]	4.7 [12.1]	5.0 [12.9]	4.2 [10.8]	0.3 [0.9]	25.2 [64.0]	14.7 [37.3]	10.6 [26.9]	208
4251	H	15	3	215JM	TEFC	230/460	47/24	3	2	8.1 [20.7]	7.3 [18.7]	11.5 [29.3]	5.2 [13.3]	2.7 [7.1]	4.7 [12.1]	5.0 [12.9]	4.2 [10.8]	0.3 [0.9]	25.2 [64.0]	14.7 [37.3]	10.6 [26.9]	218

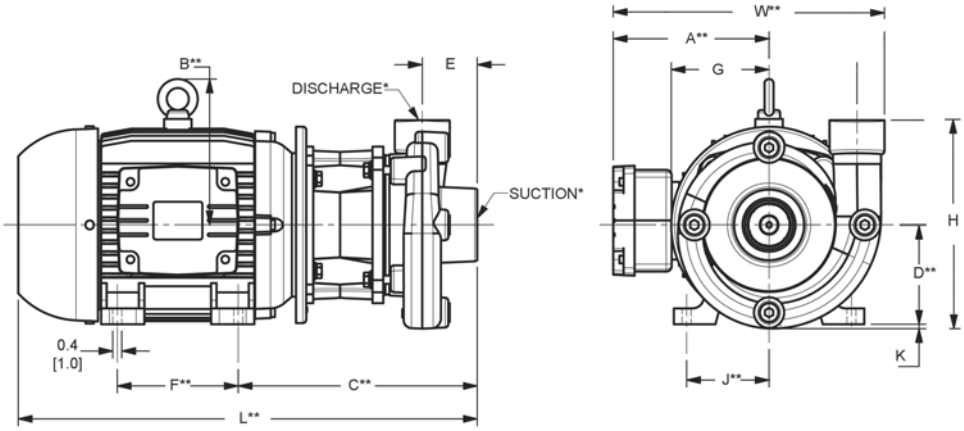
(*) Standard NPT (Female) pipe thread.
(**) This dimension may vary due to motor manufacturer's specifications.
(+) 3-Phase motors can also operate on 50 Hz. (This will change full load amps, service factor and RPM)
NOTE: Dimensions are in inches (centimeters) and have a tolerance of ± 1/4".
NOTE: Electric supply for **ALL** motors must be within ±10% of nameplate voltage rating (e.g. 230V ±10%= 207 to 253).

NOTE: Check Price Book for Specific Pump Construction/Material Availability.
Maximum Solids Handling Capacity: 1/4" Diameter

‡ When Ordering, Add the Correct (-9X) Suffix to Model Number Indicating Material Selection (Ex. 315A-95)

- XCI (-95) Cast Iron Construction with Buna-N Seals
- XB (-94) Cast Bronze Construction with Viton® Seals
- XSS (-98) Cast Stainless Steel Construction with Viton® Seals

(All Models Come Standard with Stainless Steel Impeller)



Standard Features

- Stainless Steel, Bronze and Cast Bronze Construction
- Buna-N or Viton® Mechanical Seal and O-ring, Depending on Model
- Optional Silicon Carbide Mechanical Seals Available
- Stainless Steel Motor Shaft and Hardware
- NEMA TEFC Single and Three Phase Motors, Depending on Model
- Optional Mounting Base Available for 182/184/215 JM Frames
- Self-cleaning Stainless Steel Impeller
- Maximum Working Pressure 150 PSI
- Maximum Temperature
  - Viton® 200° F
  - Buna-N 180° F
- Optional Seal Wash Port and Hose Available on All Models
- Pedestal Version Models Available for Frame Models 145/182/184JM
- QSP – Quick Ship Pump for Many Models

Hazardous Duty/Xplosion Proof motors available from stock ranging from 1 to 10 HP; *CALL FOR QUOTATION & LEAD TIME!*

AMT A Gorman-Rupp Company

Manufacturer of AMT & IPT Pumps
400 Spring Street • Royersford, PA 19468 USA
www.amtpump.com • 888-amt-pump (268-7867)

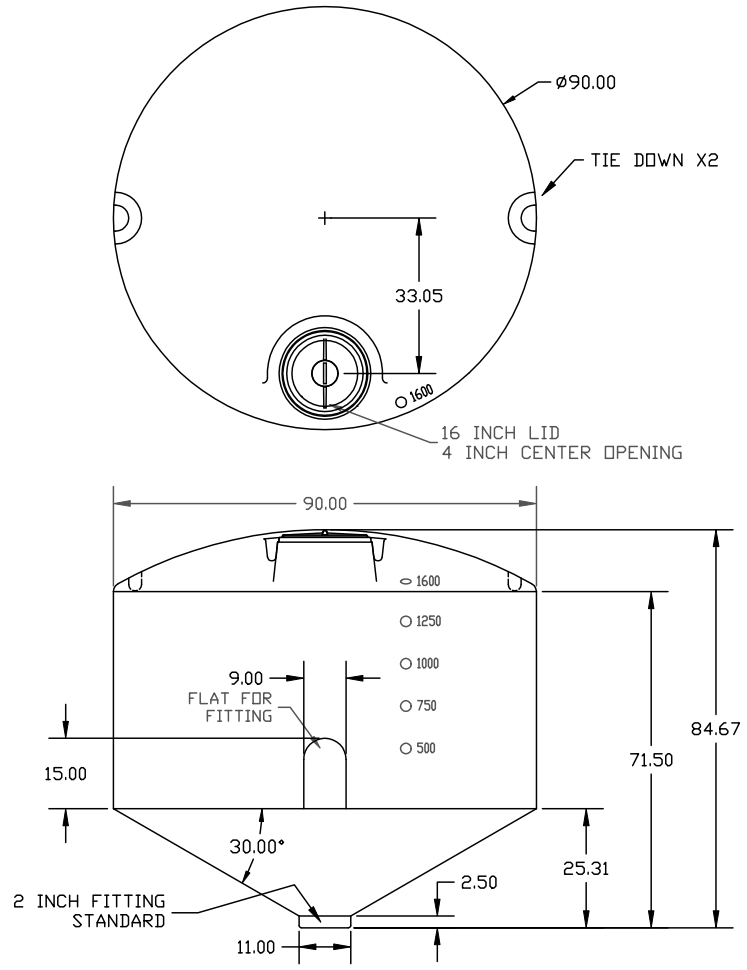
The Gorman-Rupp Company reserves the right to discontinue any model or change specifications at any time without incurring any obligation.
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IPT PUMPS BY GORMAN-RUPP® 1212

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CB1600-90 D



REV	DESCRIPTION	DATE	APPRD
D	ISOLATED STAND AND TANK	6/6/06	NVE
C	ADDED HEIGHT DIMENSIONS	4/11/06	
B	CHANGE SUMP	3/9/06	
A	CHANGE DIM BASE	4/9/03	

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

DRAWN / DATE
DHJ 3/10/03

APPRD. / DATE
REH 4/18/07

THIRD ANGLE PROJECTION
ANSI 14.5M

MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET FOR SPECIFIC PROPERTIES.

NOTES:
1. NOM. WALL @ .326
2. SHOT WEIGHT 284 LBS.

ACE ROTO-MOLD
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4010 HWY. 60 BLVD, BOX 425, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION
1600 GALLON CONE BOTTOM TANK

SCALE
N.S.

PART NO.
CB1600-90

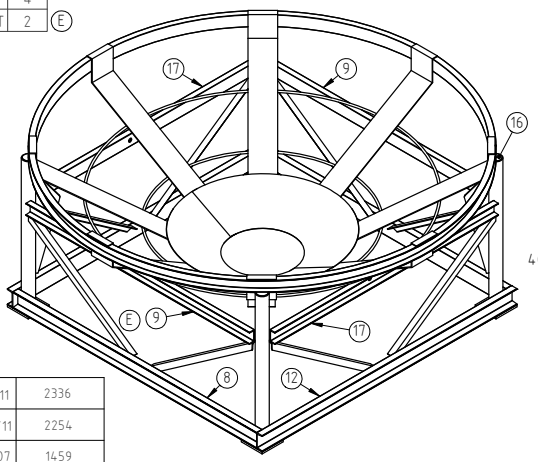
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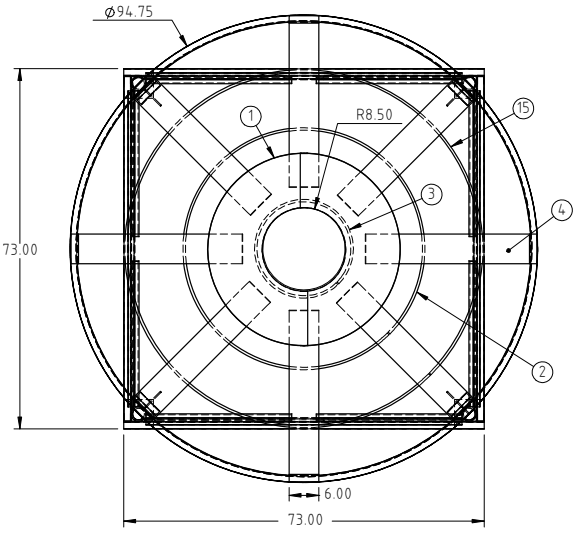
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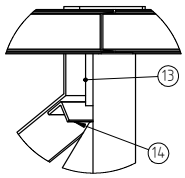
CB090-30ST

F

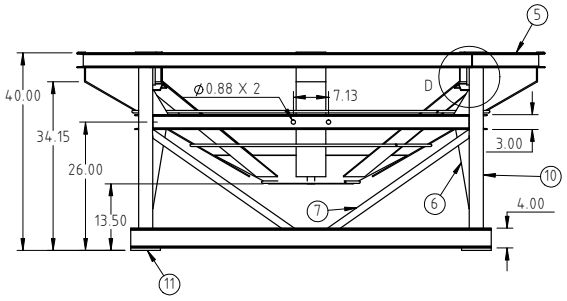
KEY	PART NUMBER	DESCRIPTION	QTY.	
1	CB090-30ST-1	PANBASE	2	
2	CB090-30ST-2	MIDDLE RING	1	
3	CB090-30ST-3	LOWEST RING	1	
4	CB090-30ST-4	BENT SUPPORT STRAP	8	
5	CB090-30ST-5	CHANNEL RING	1	
6	12118	GUSSET	4	D
7	CB090-30ST-7	ANGLE BRACING	8	F
8	CB090-30ST-8	BASE CHANNEL (SHORT)	2	
9	CB090-30ST-9	CHANNEL BRACE	2	
10	CB090-30ST-10	LEG PIPE	4	
11	CB090-30ST-11	LEG BASE	4	
12	CB090-30ST-12	BASE CHANNEL	2	
13	CB090-30ST-13	ROD FILLER	8	
14	CB090-30ST-14	ANGLE BRACING (SHORT)	4	
15	CB090-30ST-15	TOP RING	1	
16	CB090-30ST-16	LEG PLUG	4	
17	CB090-30ST-17	CHANNEL BRACE-POWDER COAT	2	E







DETAIL D
SCALE 1 : 10



REV	DESCRIPTION	BY / DATE	CCN
F	ANGLE DETAIL ADDED TO PRINT	ADH 12/8/11	2336
E	HOLES FOR POWDER COATING ADDED TO TWO LEGS COMPONENT TABLE/DRAWING TEMPLATE UPDATED	ADH 7/22/11	2254
D	PART NUMBER CORRECTED	ADH 9/18/07	1459
C	S-14GA UPDATED TO SJCB090 P.B.	GWC 3/8/07	
B	TOLERANCE WAS 1% @ 68° F	GWC 3/8/07	
A	ISOLATED STAND, ADDED B.O.M.	NVE 6/6/06	

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED

POLYETHYLENE
±1% @ 68° F

METAL
DECIMAL ± .125"
FRACTION ± 1/4"
ANGLE ± 1°

THIRD ANGLE PROJECTION
ANSI 14.5M

DRAWN / DATE: ADH 7/2/07

APPRD. / DATE: REH 7/18/07

SHOT WEIGHT:

SHIPPING WEIGHT: 640.00 LBS

FINISH: POWDER COATING, BLACK TILE, 40012

MATERIAL

NOTES:

Den Hartog
INDUSTRIES, INC.
Ace Roto-Mold Injection Molding Blow Molding Sowjoy

4010 HOSPERS DRIVE S. BOX 425, HOSPERS, IOWA 51238-0421

DESCRIPTION: CONE BOTTOM STAND FOR 30°, 90ø TANK

SCALE: N.S.

PART NO.: CB090-30ST

CONE BOTTOM TANKS - FLAT TOP

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	OVERALL HEIGHT (INCLUDING STAND)	LID	FITTING	SPEC. GRAVITY
CB0200-42	200 GAL – 45°	77	42 X 55	67"	12"	2"	2.0
CBFD240-42	240 GAL – 45° FULL DRAIN	77	42 X 59	69"	12"	2"	1.7
CB0345-52	345 GAL – 45°	102	52 X 58	70"	12"	2"	2.0
CB0350-42	350 GAL – 45°	120	42 X 81	93"	12"	2"	2.0
CB0500-52	500 GAL – 45°	132	52 X 81	92"	12"	2"	2.0
CB0850-90	850 GAL – 15°	212	90 X 56	67"	16"	2"	1.7
CB1150-90	1150 GAL – 15°	242	90 X 67	78"	16"	2"	1.7
CB1550-90	1550 GAL – 30°	286	90 X 88	97"	16"	2"	1.7
CB2450-90	2450 GAL – 15°	437	90 X 114	125"	16"	2"	1.7
CB2550-90	2550 GAL – 30°	502	90 X 126	134"	16"	2"	1.7

CONE BOTTOM TANKS - DOME TOP

PART #	CAPACITY	WEIGHT	DIMENSIONS (DIA X HEIGHT)	OVERALL HEIGHT (INCLUDING STAND)	LID	FITTING	SPEC. GRAVITY
CB0300-42	300 GAL – 45°	102	42 X 67	79"	16"	2"	2.0
CB0800-86	800 GAL – 15°	182	86 X 48	58"	16"	2"	1.7
CB1000-64	1000 GAL – 45°	252	64 X 98	112"	16"	2"	1.7
CB1000-90	1000 GAL – 15°	212	90 X 54	64"	16"	2"	1.7
CB1200-90	1200 GAL – 15°	242	90 X 62	74"	16"	2"	1.7
CB1300-90	1300 GAL – 15°	262	90 X 65	75"	16"	2"	1.7
CB1490-64	1490 GAL – 45°	342	64 X 132	146"	16"	2"	1.7
CB1500-96	1500 GAL - 30°	252	96 X 80	92″	16″	2″	1.7
CB1600-90	1600 GAL – 30°	286	90 X 85	94"	16"	2"	1.7
CB1700-86	1700 GAL – 15°	286	86 X 85	96"	16"	2"	1.7
CB2000-96	2000 GAL - 30°	292	96 X 96	108″	16″	2″	1.7
CB2495-90	2495 GAL – 30°	487	90 X 119	129"	16"	2"	1.7
CB2500-90	2500 GAL – 15°	437	90 X 111	122"	16"	2"	1.7
CB2600-90	2600 GAL – 30°	502	90 X 123	132"	16"	2"	1.7
CB2600-86	2600 GAL – 45°	502	86 X 146	158"	16"	2"	1.7
CB3000-90	3000 GAL – 15°	552	90 X 128	138"	16"	2"	1.7
CB3000-96	3000 GAL – 30°	552	96 X 125	137"	16"	2"	1.7
CB4200-122	4200 GAL – 15°	1102	122 x 113	126"	16"	3"	1.7
CB4600-102	4600 GAL – 15°	1202	102 X 155	166"	16"	2"	1.7
CB4900-102	4900 GAL – 15°	1302	102 X 159	170"	16"	2"	1.7
CB6000-122	6000 GAL – 15°	1602	122 x 150	162"	16"	3"	1.7
CB6900-122	6900 GAL – 15°	1702	122 X 168	178"	16"	3"	1.7
CB8250-122	8250 GAL – 15°	2102	122 X 195	206"	16"	3"	1.7

CB4900-102



CONE BOTTOM STANDS

PART #	DESCRIPTION	WEIGHT	DIMENSIONS (DIA X HEIGHT)	CLEARANCE
CB036-45ST	150 GAL – 45°	63	64 X 61	12"
CB042-45ST	200, 300 OR 350 GAL – 45°	82	41 X 34	11"
CBFD042-45ST	240 GAL FULL DRAIN – 45°	82	42 X 42	10"
CB052-45ST	345 OR 500 GAL – 45°	174	55 X 41	13"
CB064-45ST	1000 OR 1490 GAL – 45°	320	64 X 61	14"
CB086-15ST	800 OR 1700 GAL – 15°	360	86 X 23	11"
CB086-45ST	2600 GAL – 45°	580	86 X 49	12"
CB090-15ST	850, 1000, 1150, 1200, 1300, 2450, 2500 OR 3000 GAL – 15°	380	90 X 24	11"
CB090-30ST	1550, 1600, 2550 OR 2600 GAL 300	640	90 X 40	9"
CB096-30ST	1500, 2000, 3000 GAL – 30°	553	96 X 38	12"
CB102-15ST	4600 OR 4900 GAL – 15°	640	102 X 25	11"
CB122-15ST	4200, 6000, 6900 OR 8250 GAL – 15°	1020	122 X 27	10"

TECHNICAL BROCHURE
BNPE R2



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F R

Casing Rotation, Optional
R = 3 o'clock L = 9 o'clock
B = 6 o'clock
NOTE: Rotation when viewed from suction end of pump. Standard discharge position is 12 o'clock.

Rotación de la cubierta, opcional
R = 3 hora L = 9 hora
B = 6 hora
NOTA: *Rotación cuando está visto del extremo de la succión de la bomba. La posición estándar de la descarga es las 12.*

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	Pump Size, *Tamaño de la bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

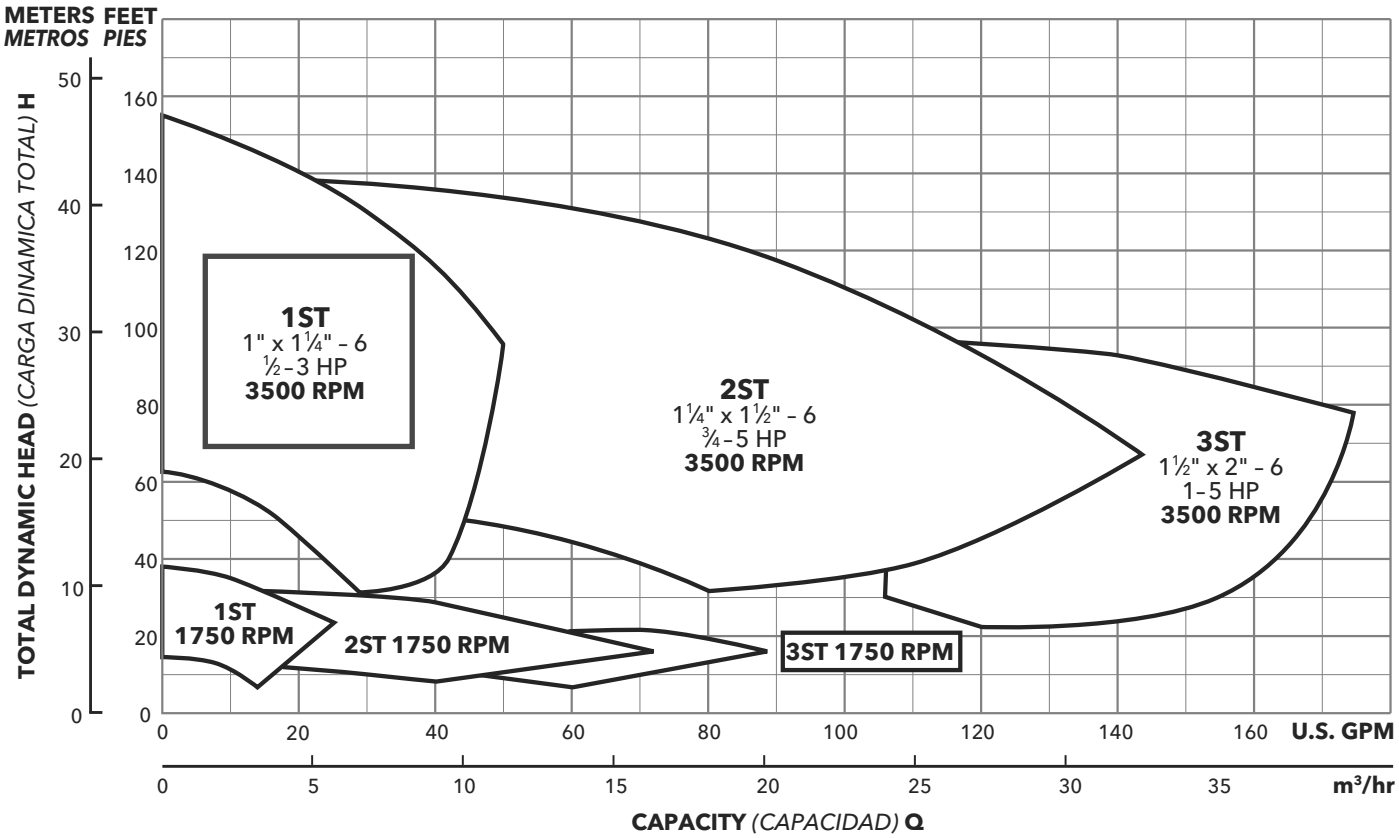
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

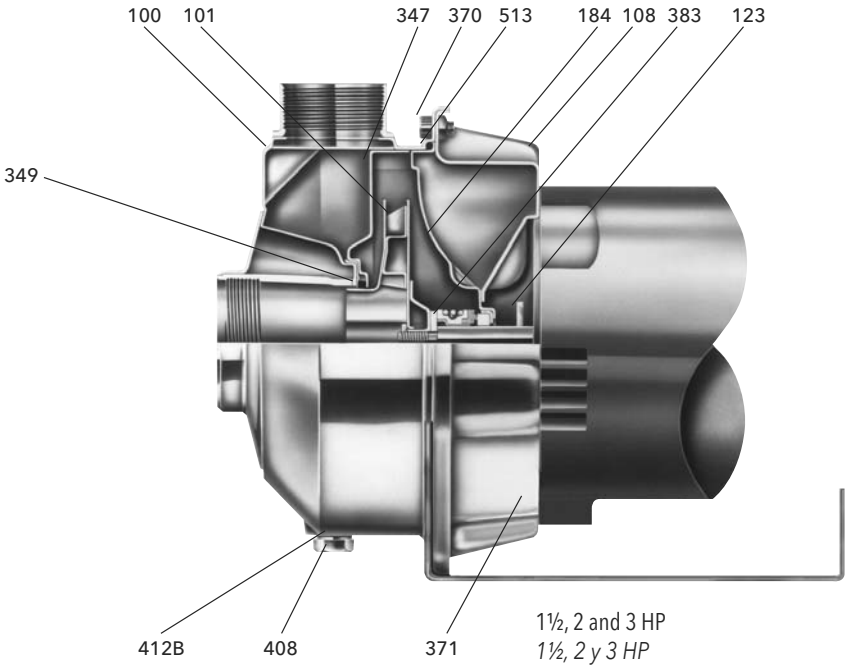
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

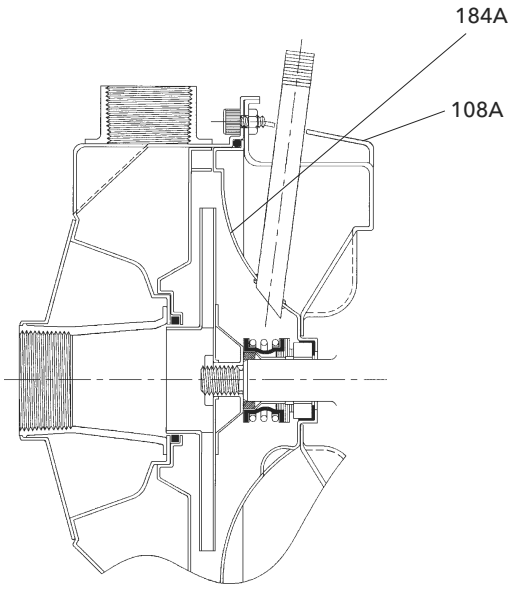
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

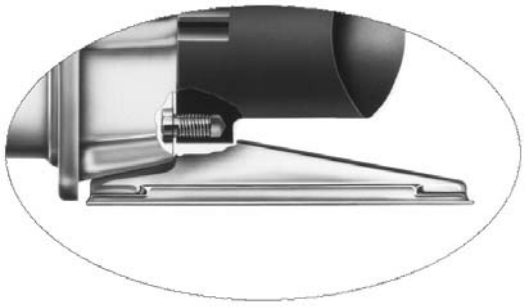


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370 *able*	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxid-*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408 *able*	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxid-*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

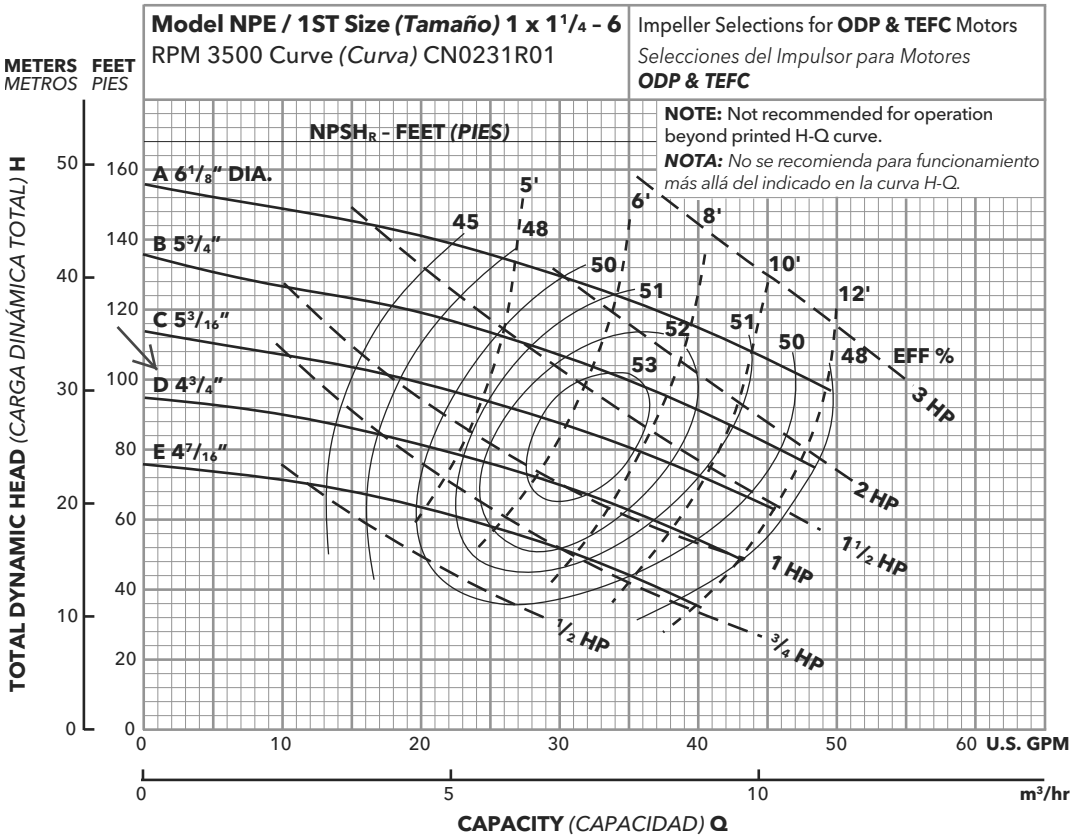


½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

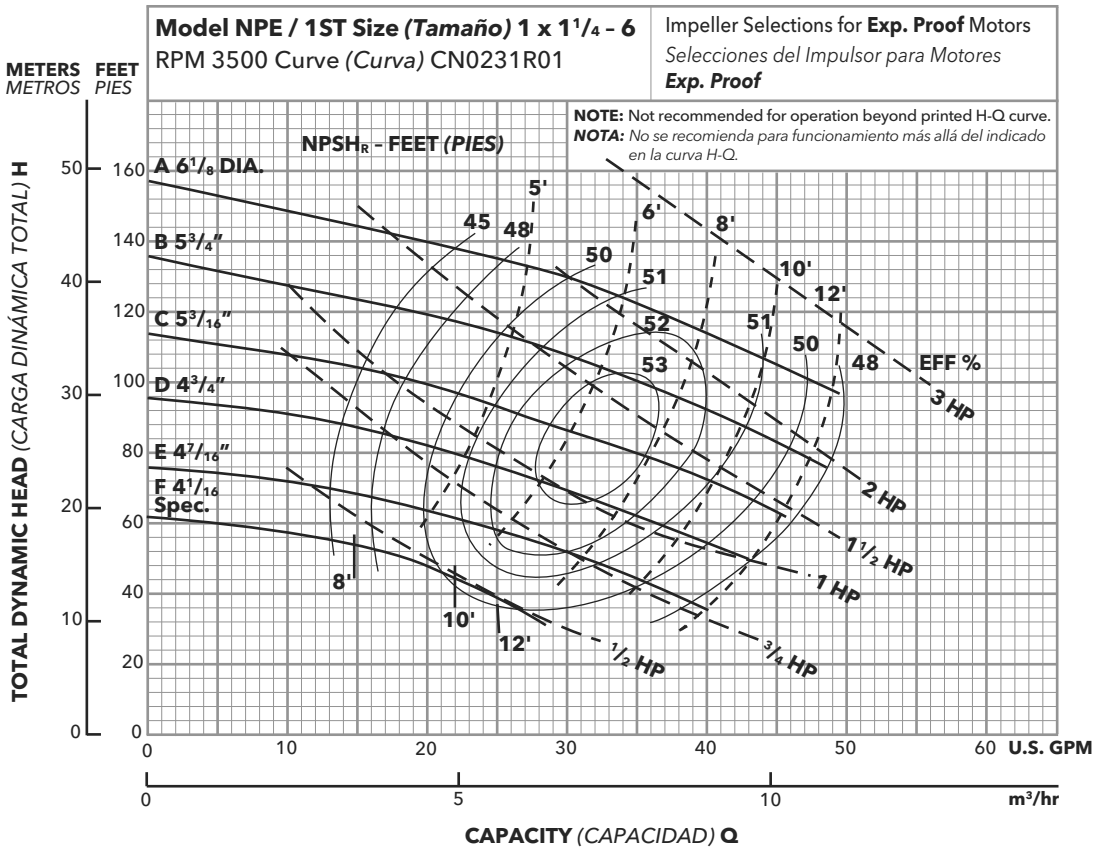
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4 7/16"
D	¾	4¾
C	1	5 3/16
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*



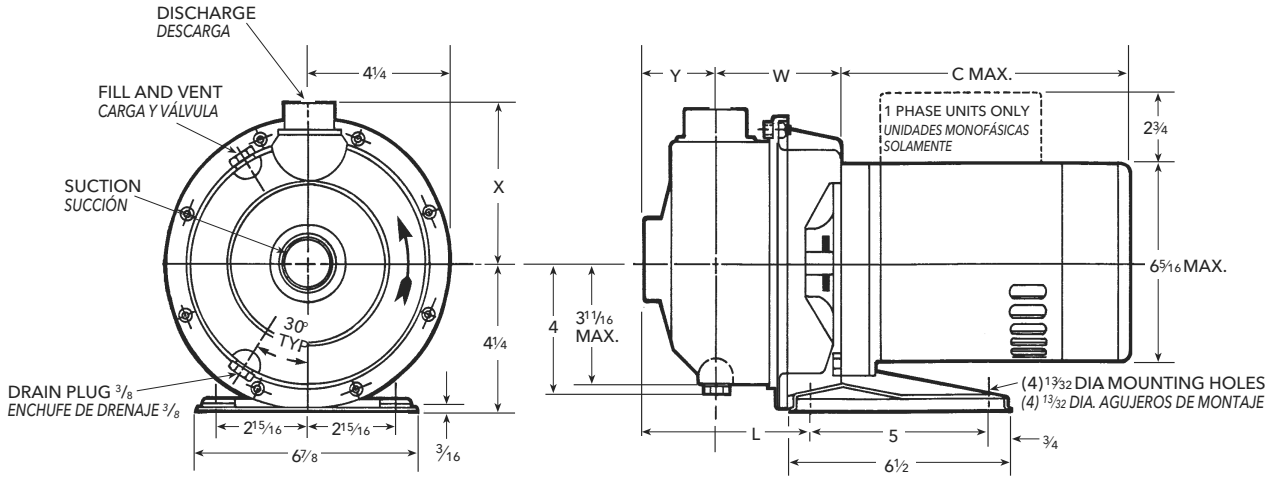
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4 1/16" spec.
E	¾	4 7/16
D	1	4¾
C	1½	5 3/16
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

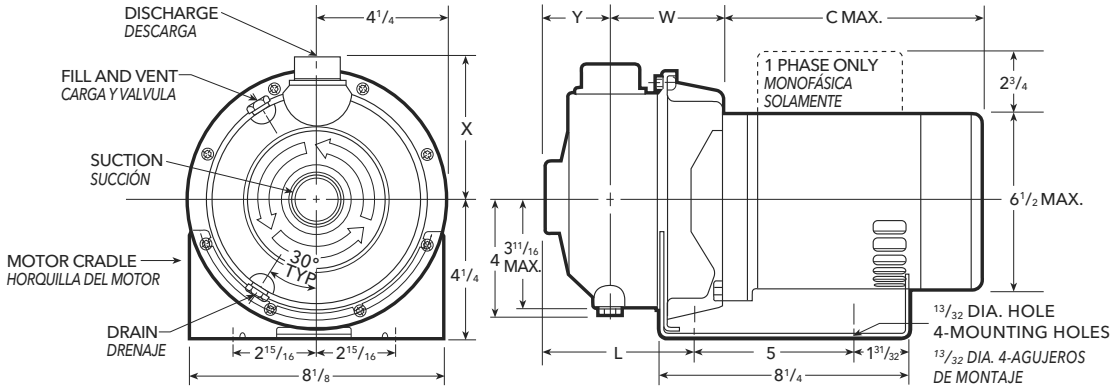
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121 ° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón* 56	140	180
1ST	1¼	1	12 15/16	6 7/16	3 5/16	4⅜	2	22½	4 9/16		6 7/16
2ST	1½	1¼	13½	7	3¾	4½	2 1/8	23	5⅛		7
3ST	2	1½				4⅝					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6⅞	3⅛	22⅜	2⅜	1	30	1"
182T 184T	10	26	7¼	3¾	24	2¾	⅞	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM Single Phase, *Monofásicos* ODP	TEFC	Three Phase, *Trifásicos* ODP	TEFC	C Max.	Wt. Max., *Peso Máx.*
56	½ – 1½	½ – 1½	½ – 1	½ – 1	13	45
143T	–	–	1½	1½	13⅜	45
145T	2	2	1½ – 3	1½ – 2	14¼	52
182T	3	3	5	3	16⅝	63
184T	5	5	–	5	18⅛	112

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

AMT
A Subsidiary of The Gorman-Rupp Company ™

NEW FOR 2007
90° ROTATABLE BASE ON ALL MODELS

Self-Priming Diaphragm Pumps

- ***Sand Cast Aluminum** Construction for Portability and Durability*
- ***Thermoplastic Rubber Diaphragm***
- ***2" to 3" NPT Suction and Discharge Sizes***
- ***1-5/8" Diameter Solids Handling Capability***
- ***Modular Component Design Permits Easy Maintenance and Cleanout***
- ***Engine Driven Models: Choice of Honda and Briggs & Stratton Gas or Yanmar Diesel Engines***
- ***Delivers up to 90 GPM***
- ***Maximum Temperature 180°F***

The AMT line of 2" and 3" Diaphragm pumps features 2-stage, 44 to 1 gear reduction with a large diameter output gear and heavy duty ball bearing construction. Often referred to as Mud Pumps or Sludge Pumps, diaphragm pumps are designed to pump mud, slurry, sewage, and thick liquids that have the ability to flow. AMT Diaphragm pumps are available with a choice of drivers to meet your application requirements: Briggs & Stratton or Honda gasoline engines, Yanmar Diesel, and 115 VAC electric motor with weatherproof cord and switch. Built-in molded polyurethane flapper/check valve assures self-priming to 20 ft. after initial prime. Heavy duty gear box is designed to operate pumps at 40 strokes per minute for Electric Motor Models and 60 strokes per minute for Engine-Driven Models. Each unit includes a 2" or 3" NPT steel suction strainer, two NPT nipples, and a wheel kit with 10" semi-pneumatic transport wheels for portability. Models 336E-K6, 336G-K6, 335G-K6, and 335E-K6, are kits provided less motor or engine. Pumps are designed for use with non-flammable liquids which are compatible with pump component materials. ***Suction and discharge port size cannot be reduced.***



Model 335D-96*

*shown with 90° rotatable base

INDUSTRIAL DUTY



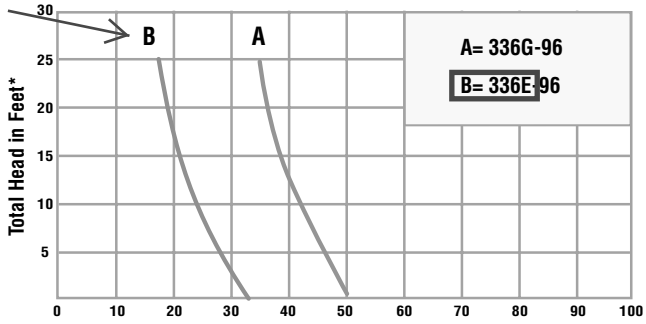
Model 335H-96*

*handle not shown



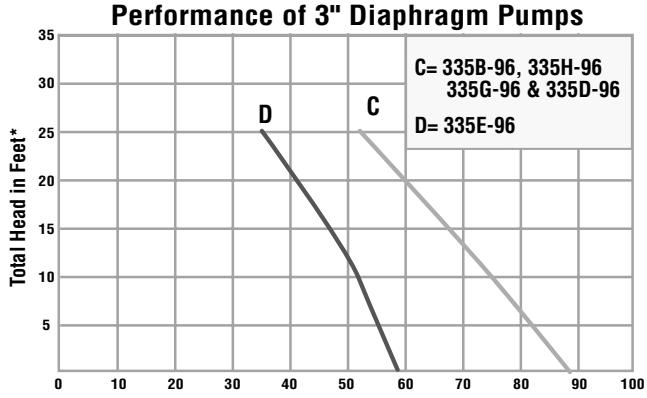
Model 335E-96

Performance of 2" Diaphragm Pumps



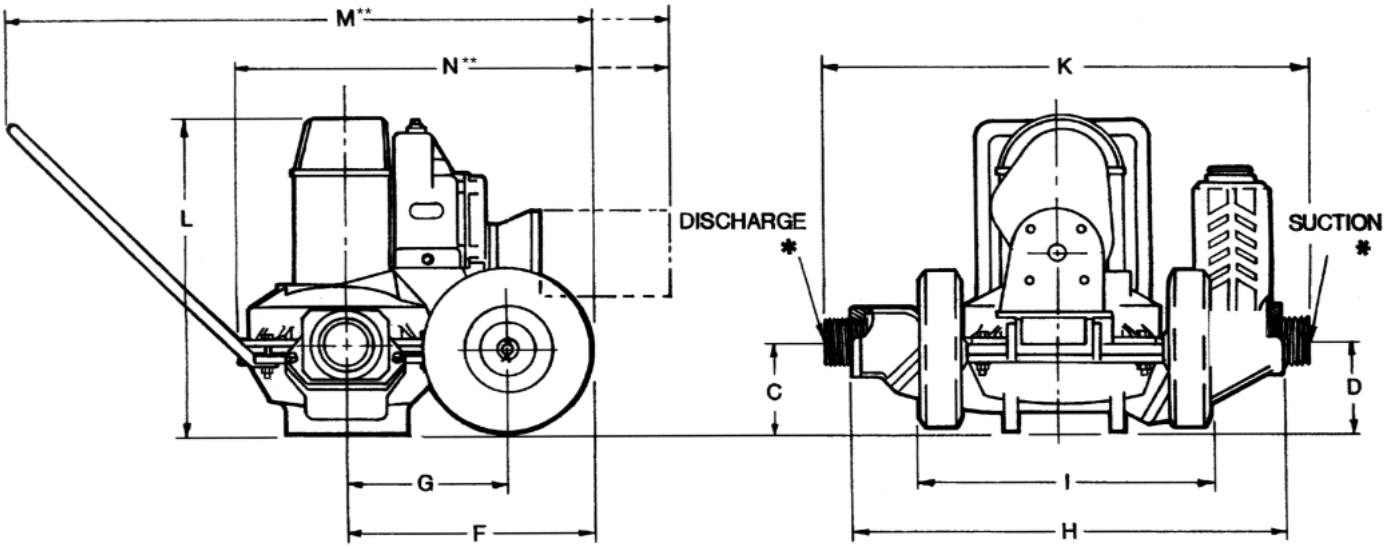
* Convert to PSI, divide by 2.31 Liquid-Water specific gravity 1.0

Performance of 3" Diaphragm Pumps



* Convert to PSI, divide by 2.31 Liquid-Water specific gravity 1.0

Diaphragm Pumps

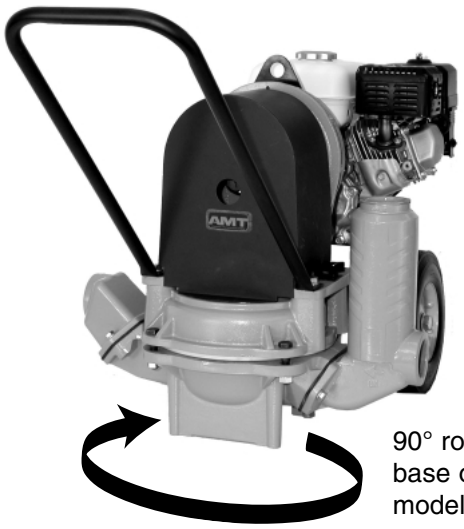


Model #	Curve	Driver	SUC*	DIS*	C	D	F	G	H	I	K	L	M**	N**	Shpg. Wt.
336G-96	A	HONDA GX120	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	39.2	25.0	125 lbs.
336E-96	B	1.5 HP Elec. Motor	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	41.1	26.8	131 lbs.
335G-96	C	HONDA GX120	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	42.0	46.0	175 lbs.
335E-96	D	1.5 HP Elec. Motor	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	43.5	27.5	186 lbs.
335B-96	C	B&S CP550	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	41.5	25.5	181 lbs.
335H-96	C	HONDA GX160	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	41.5	25.5	182 lbs.
335D-96	C	YANMAR DIESEL L48	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	43.0	27.0	203 lbs.
336G-K6	A	Kit, Less Engine	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	N/A	N/A	95 lbs.
336E-K6	B	Kit, Less Motor	2"	2"	7.3	5.6	17.8	12.8	22.2	18.1	25.7	23.2	N/A	N/A	95 lbs.
335G-K6	C	Kit, Less Engine	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	N/A	N/A	146 lbs.
335E-K6	D	Kit, Less Motor	3"	3"	6.2	6.3	14.5	9.5	26.5	17.9	30.0	22.0	N/A	N/A	146 lbs.

(*) Standard NPT (female) pipe thread.
(**) This dimension may vary due to motor or engine manufacturer's specifications.
NOTE: Dimensions have a tolerance of ±1/8".

Standard Features for AMT Diaphram Pumps

- Engine Driven Models - Choice of Honda, Briggs & Stratton Gas or Yanmar Diesel Engines
- 2" to 3" NPT Port Sizes
- Models 336E-96/335E-96 – 1.5 HP single phase, 115/230 Volt motor with manual reset overload includes 20 foot 115 VAC power cord and weather-proof on/off switch
- Models 336G-K6/335G-K6 – Kit, furnished less engine. For use with gasoline or diesel engines with .75" keyed shaft (SAE J609a Mounting Flange)
- Model 336E-K6/335E-K6 – Kit, furnished less motor. For use with electric motor (1725 RPM) or air motor with a minimum of 1.5 HP. 56C Mounting Flange required.



90° rotatable base on all models

WARNING: Do not use in explosive atmosphere or for pumping volatile flammable liquids.

See price book page 13

The Gorman-Rupp Company reserves the right to discontinue any model or change specifications at any time without incurring any obligation.

Model 8 Bag Filter Housings Sizes #1 & #2

Strainers or Bag Filters: Your Choice!

Model 8 strainer/filter housings are made in 2 sizes and can serve as basket strainers (for particle retention down to 74 micron size) or as bag filters (for particle retention down to 1 micron size). In all cases, covers are easily removed without special tools.

Features

- Low pressure drops
- Permanently-piped housings
- Covers are O-ring sealed
- Carbon steel or stainless steel (304 or 316) and aluminum construction for housings
- Easy to clean!
- Adjustable-height legs, standard
- O-Ring seals: Buna N, EPR, Viton®, teflon®
- Duplex unites are available
- Pipe sizes 3/4 thru 4-inch, NPT or flanged
- Two basket depths: 15 or 30 inches (nominal)

Options

- Sanitary connections
- Different outlet connections
- Extra-length legs
- Liquid displacers for easier servicing



Model shown in Stainless Steel



Model shown in Carbon Steel

Choosing A Basket Strainer or Bag Filter

Choose between straining (removing particles down to 74 micron size) or filtering a fluid (removing particles down to 1 micron size). This will direct you to choose the correct basket when ordering.

Operation

Unfiltered liquide enters the housing above the bag or basket and passes down through them. Solids are contained inside the bag or basket, where they're easily and completely removed when the unit is serviced.

Fluid bypass around the basket is prevented because the outside diameter of the filter bag seals radially against the housing inside diameter. A single cover gasket is used to seal the opening, and covers can be installed and removed without tools.

Model 8 Pressure Drop Data

Basket strainer and bag filters are usually selected so that the pressure drop does not exceed 2 psi, when they are clean. Higher pressure drops may be tolerated, when contaminant loading is low. Bag change out should occur at 15 psid.

The pressure drop data is accurate for all housings with strainer or bag filter baskets. When bag filters are added, total pressure drop becomes the sum of the pressure drop as determined by the steps below.

	Viscosity, cps								
	1 (H_2O)	50	100	200	400	600	800	1000	2000
All unlined baskets	.65	.85	1.00	1.10	1.20	1.40	1.50	1.60	1.80
40-mesh lined	.73	.95	1.20	1.40	1.50	1.80	1.90	2.00	2.30
60-mesh lined	.77	1.00	1.30	1.60	1.70	2.10	2.20	2.30	2.80
80-mesh lined	.93	1.20	1.50	1.90	2.10	2.40	2.60	2.80	3.50
100-mesh lined	1.00	1.30	1.60	2.20	2.40	2.70	3.00	3.30	4.40
200-mesh lined	1.30	1.70	2.10	3.00	3.40	3.80	4.40	5.00	6.80

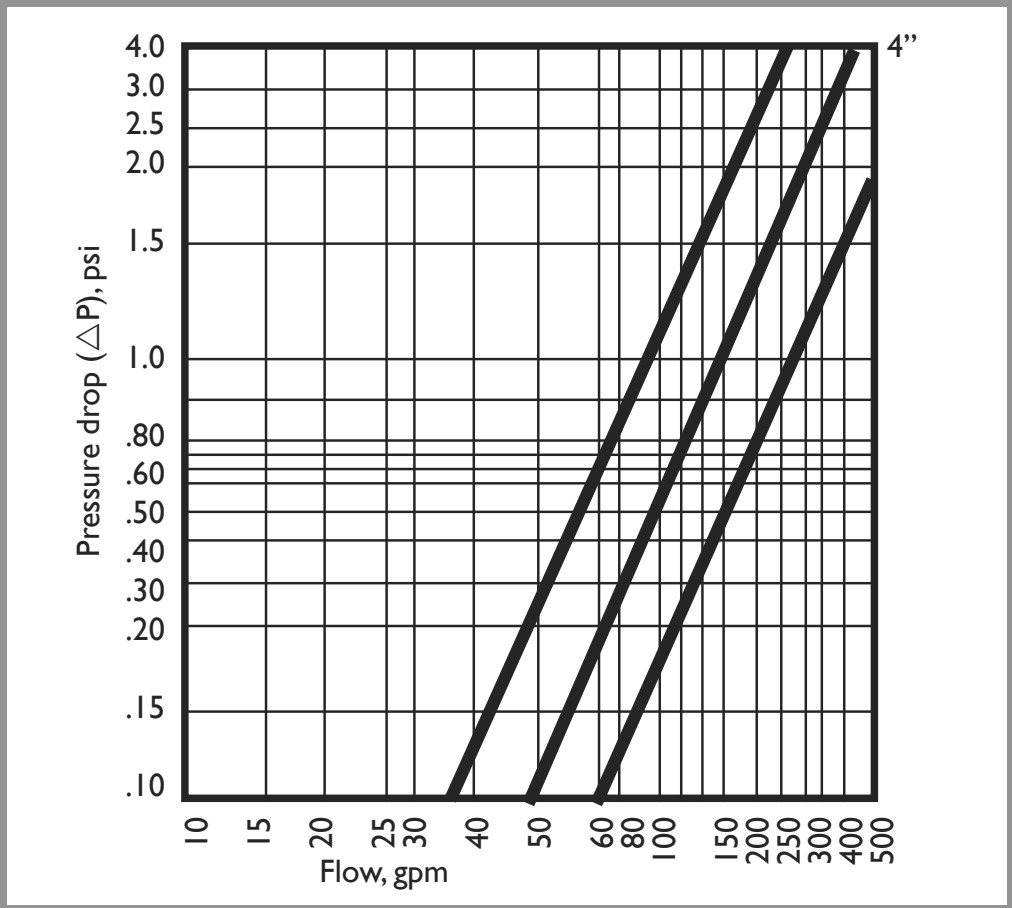
Follow these easy steps:

1) Using the desired pipe size and approximate flow rate, determine the basic pressure drop from the appropriate graph.
2) Multiply the pressure drop obtained in step 1 by the viscosity correction factor found in the accompanying table. This is the adjusted (clean) pressure drop for all baskets, without filter bags.
3) Add the pressure drop for the bag filter.

Basket Data

Depth Nominal (inches)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)	Bag Size No.
15	6.7	2.3	500	1
30	6.7	4.4	1000	2

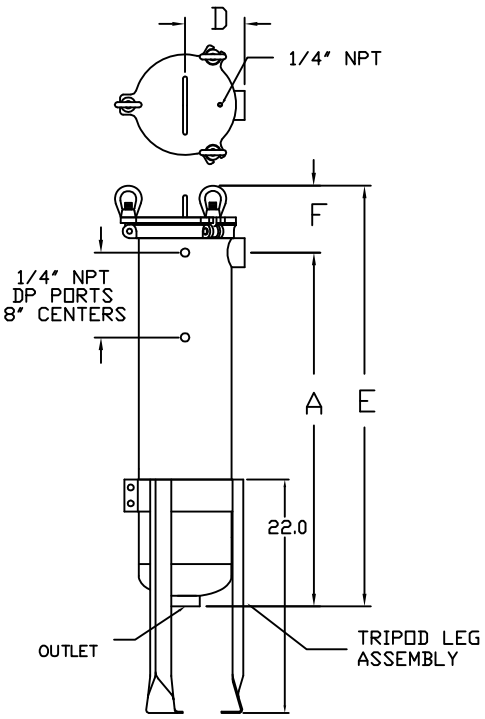
Model 8 — For flow rates to 220 gpm*



* Based on housing only. Fluid viscosity, bag filter used, and expected dirt loading should be considered when sizing a filter.

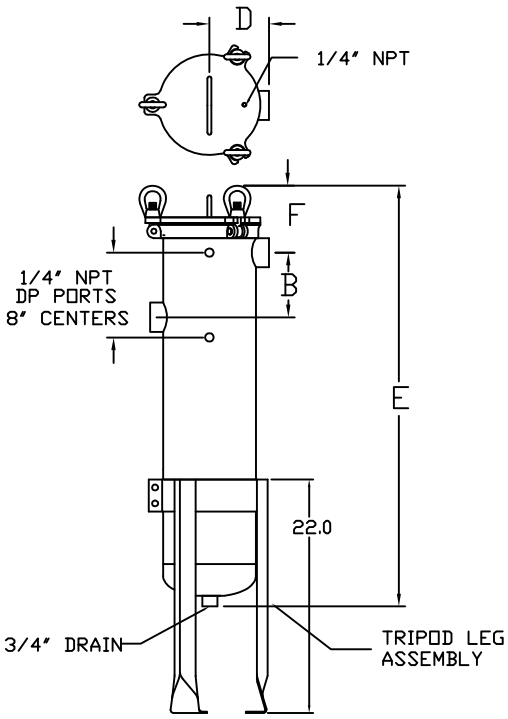
Model 8: Sizes #1 & #2 — Available in four styles and four materials

Carbon Steel



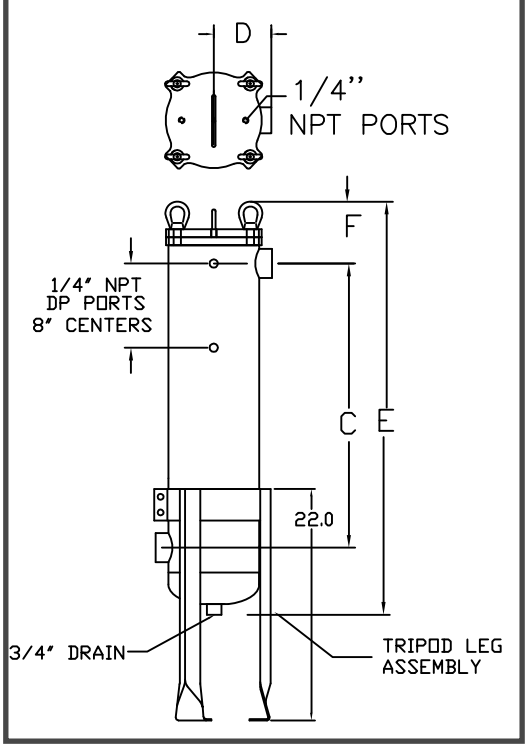
Style 1
Bottom Outlet

304-316 Stainless Steel



Style 2
Side Outlet Top

Aluminum



Style 2B
Side Outlet Bottom

Carbon Steel
304-316 Stainless Steel
Aluminum

Standard Features
- Hinged Eye Bolt Cover (CS & SS)
- Eye Bolt Cover (Aluminum)
- 304 Stainless Basket
- Buna Seal
- 1/4" NPT Gauge Port
- Adjustable C.S. Legs

Options
- 316 Stainless Basket
- DP Ports
- O-Ring Seal Materials
- 304, 316 Adjustable Legs
- Style 3 90 Elbow
- Flange Connections
- Sanitary Connections

#1

SIZE 8-15

Pipe Size In NPT	A	B	C	D	E	F
0.75	30.5	5.6	13	5.3	24.3	5.6
1.00	30.5	5.6	13	5.3	24.5	5.7
1.25	30.5	5.6	13	5.3	24.9	5.9
1.50	30.5	5.6	13	5.3	25.6	6.1
2.00	30.5	6.1	13	5.3	25.7	6.3
3.00	30.5	7.3	13	5.3	26.8	6.9
4.00	30.5	8.3	13	5.3	27.9	7.4

#2

SIZE 8-30

Pipe Size In NPT	A	B	C	D	E	F
0.75	34.5	5.6	27	5.3	38.3	5.6
1.00	34.5	5.6	27	5.3	38.5	5.7
1.25	34.5	5.6	27	5.3	38.9	5.9
1.50	34.5	5.6	27	5.3	39.6	6.1
2.00	34.5	6.1	27	5.3	39.7	6.3
3.00	34.5	7.3	27	5.3	40.8	6.9
4.00	34.5	8.3	27	5.3	41.9	7.4

How To Order Model 8: Size #1 & #2 Filter Bag Housings

HOUSING OPTIONS

EXAMPLE: 8 - 30 - 2P - 1 - 150 - CS - BS - PB - 200 - D - DP

Model #
#8 - 8

Housing Size
15 inch -15
30 inch -30

Pipe Size NPT / Flange
1" Female NPT -1P
1 1/4" Female NPT - 1 1/4P
1 1/2" Female NPT - 1 1/2P
2" Female NPT - 2P
3" Female NPT - 3P
1" 150 Class ANSI Flange -1F
1 1/4" 150 Class ANSI Flange - 1 1/4F
1 1/2" 150 Class ANSI Flange -1 1/2F
2" 150 Class ANSI Flange - 2F
3" 150 Class ANSI Flange - 3F

Outlet Style
Bottom - 1
Side - 2
Side Bottom - 2B
90 Degree Elbow - 3

Pressure Rating
150 PSI(Flanged or NPT)

Housing Material
Aluminum - AL
Carbon Steel - CS
304 Stainless Steel - 4S
316 Stainless Steel - 6S

DP Ports
DP

Displacer
Displacer - D

Mesh Sizes
20,30,40,50,60,70,80
100,150,200

Basket Type
Standard Basket - PB
Mesh Lined - BM
Perforated Basket - P
1/4,3/16,9/64,3/32,1/16

Basket Seal
Buna Seal - BS
Ethylene Propylene(EPR) - ES
Teflon Encapsulated Viton -TS
Solid Teflon - ST
Viton - VS

* Aluminum Housings only available with Eye Bolt Covers
* Carbon Steel & Stainless Housing only available with Hinged Eye Bolt Covers
* All Filter Bag Housings come with Carbon Steel Legs & Standard 304 SS Basket
* 304 Stainless & 316 Stainless Legs are available & 316 SS Baskets are available

Data Sheet

ROYTRONIC EXCEL™ Series AD
Electronic Metering Pumps

Model AD 2 5 1 - 8 3 8 S I

Model Code Configuration

Drive

Control Code

2 - Dual Manual Control
Stroke frequency and length manually adjustable, LCD display, low level indication (remote input). Display configurable to indicate theoretical pump flow.

8 - Pulse/Analog Input w/ Dual Manual Control
Pulse or 4-20 mA signal input controls frequency, LCD display, manual stroke length control, frequency manually adjustable when in local control, pulse multiply/divide functions, 24 V output for remote device. Includes dual low level float switch input. Display configurable to indicate theoretical pump flow.

9 - Pulse/Analog Input w/Dual Manual Control & Enhanced Controls
Advanced Features - Pulse or 4/20 mA signal input controls frequency, graphical display, manual stroke length control, Frequency manually adjustable when in local control, Pulse multiply/divide functions, 24 V output for remote device, dual low level float switch input, Remote on/off signal input. Outputs include: 4-20 mA, pulse, & Alarm. Remote internal/external mode input. Display configurable to indicate theoretical pump flow.

Output Code with FastPrime™ Liquid End

Max Capacity	Max Pressure
1 - 0.21 GPH (0.8 l/h)	250 psi (17.2 Bar)
4 - 0.5 GPH (1.9 l/h)	250 psi (17.2 Bar)
5 - 1.0 GPH (3.8 l/h)	110 psi (7.6 Bar)
6 - 2.0 GPH (7.6 l/h)	50 psi (3.4 Bar)

Voltage Code

1 – 110-120V US Plug
2 – 220-240V US Plug
3 – 220-240V DIN Plug
5 – 220-240V UK Plug
6 – 220-240V Aust/NZ Plug
7 – 220-240V Swiss Plug
8 – 110-120V No Plug

Liquid End

Liquid End Code

See Accompanying Pages for Options

Liquifram™ Size Code

1 – 0.2 in²
2 – 0.4 in²
3 – 0.8 in²
4 – 1.6 in²

Material Code

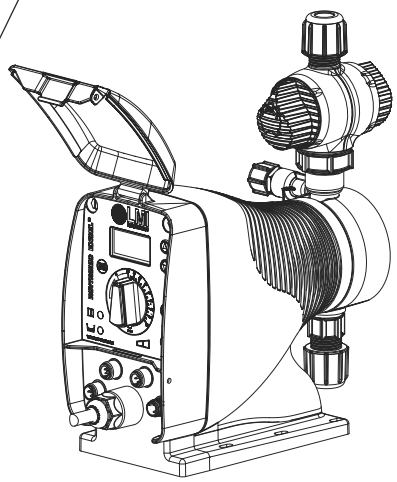
See Accompanying Pages for Options

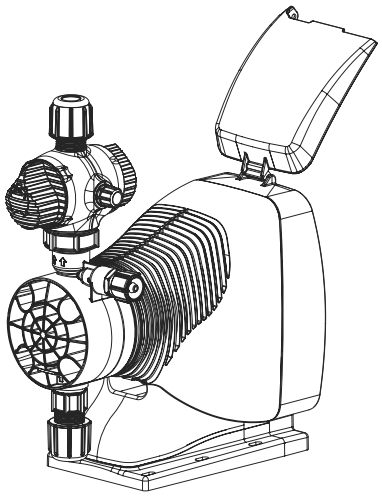
Head/Valve Code

S – FastPrime™ Head + 4FV
N – FastPrime™ Head
H – AutoPrime™ Head + 4FV
A – AutoPrime™ Head
V – High Viscosity Head
P – High Viscosity with Ported Head

Connection Code

I – Inch Tube connections with tubing
M – Metric Tube connection without tubing
U – Inch Tube connection with Black UV resistant suction/discharge tubing
P – 1/2" NPT - 1/2" BSP Pipe (SS 1/4" NPT)





Certified to NSF/ANSI 61

Certified to NSF/ANSI Standard 50

Specifications

Series	Strokes Per Minute (Adjustable) Min	Max	Stroke Length (Adjustable) Recommended Minimum	Average Input Power @ Max Speed and Pressure	Max. Shipping Weight
AD 2X* AD 8X* AD 9X*	1	120	20%	25 watts	10 lbs (4.75 kg)

* where X = output code

LMI MILTON ROY

201 Ivyland Road
Ivyland, PA 18974 USA
TEL: (215) 293-0401
FAX: (800) 327-7563
http://www.lmipumps.com

2039.B 6/2011

Standard FastPrime™ Liquid End Configuration Data & Materials of Construction

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD91 ■ AD81 ■ AD21 ■	910SI†	1	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	915SI†	1	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	918SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	919SI†	1	Acrylic/PVDF	PTFE	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	917NP	1	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	812SI†	1	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	813SI†	1	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	818SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	718SI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD94 ■ AD84 ■ AD24 ■	920SI†	2	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	925SI†	2	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	928SI†	2	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	929SI†	2	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	927NP	2	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	822SI†	2	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	823SI†	2	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 1/4" O.D.
	828SI†	2	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	728SI†	2	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 1/4" O.D.
	624VI*	2	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	626VI	2	Acrylic/PP	316ss	Fluorofilm™	Viton®/ Polyprel®	—	PE.5"O.D. Vinyl.938"O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD95 ■ AD85 ■ AD25 ■	930SI†	3	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	935SI†	3	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	938SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	939SI†	3	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	937NP	3	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	832SI†	3	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	833SI†	3	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	838SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	738SI†	3	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	634VI*	3	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	636VI	3	Acrylic/PP	316ss	Fluorofilm™	Viton®/ Polyprel®	—	PE.5"O.D. Vinyl.938"O.D.

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquifram™	Seat/O-Ring	Accs. Valve	Tubing & Connections Discharge & Suction
AD96 ■ AD86 ■ AD26 ■	940SI†	4	Acrylic/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	945SI†	4	PP/PP	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	948SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	949SI†	4	Acrylic/PVDF	PTFE	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	947NP	4	316ss/316ss	316ss	Fluorofilm™	316ss/PTFE	—	1/4" NPT
	842SI†	4	PVDF/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	843SI†	4	PVDF/PVDF	Ceramic	Fluorofilm™	PTFE	4FV	PE 3/8" O.D.
	848SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	748SI†	4	PVC/PVC	Ceramic	Fluorofilm™	Polyprel®	4FV	PE 3/8" O.D.
	644VI*	4	PP/PP	316ss	Fluorofilm™	PTFE	—	PE.5"O.D. Vinyl.938"O.D.
	646VI	4	Acrylic/PP	316ss	Fluorofilm™	Viton®/ Polyprel®	—	PE.5"O.D. Vinyl.938"O.D.

Output Information with FastPrime™ Liquid End

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
ADX1	0.002	0.21	0.01	0.8	0.132	13.2	0.011	0.11	250 psi (17.2 Bar)
ADX4	0.005	0.5	0.02	1.9	0.315	31.5	0.013	0.13	250 psi (17.2 Bar)
ADX5	0.01	1.0	0.04	3.8	0.630	63.0	0.026	0.26	110 psi (7.6 Bar)
ADX6	0.02	2.0	0.08	7.6	1.260	126.0	0.053	0.53	50 psi (3.4 Bar)

(Where X = Control Code 2,8,9).

AutoPrime™ Liquid End Configuration Data & Materials of Construction

Drive Assembly	Liquid End	Size Code	Materials of Construction: Head/Fittings	Balls	Liquiframe™	Seat/O-Ring	Accs. Valve	Tubing & Connections
AD91 ■ AD81 ■ AD21 ■	910HI†	1	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	918HI†	1	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
AD94 ■ AD84 ■ AD24 ■	920HI†	2	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
	928HI†	2	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 1/4" O.D.
AD95 ■ AD85 ■ AD25 ■	930HI†	3	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
	938HI†	3	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
AD96 ■ AD86 ■ AD26 ■	940HI†	4	Acrylic/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.
	948HI†	4	PVC/PVC	Ceramic	Fluorofilm™	PTFE/Polyprel®	4FV	PE 3/8" O.D.

Output Information with AutoPrime™ Liquid End — Estimated

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
ADX1	0.0015	0.15	0.006	0.6	0.095	9.5	0.0008	0.079	150 psi (10.3 Bar)
ADX4	0.0033	0.33	0.012	1.2	0.21	20.8	0.0017	0.17	150 psi (10.3 Bar)
ADX5	0.008	0.8	0.030	3.0	0.50	50.5	0.0042	0.42	110 psi (7.6 Bar)
ADX6	0.018	1.8	0.068	6.8	1.14	113.6	0.0095	0.95	50 psi (3.4 Bar)

(Where X = Control Code 2,8,9).

AUTOPRIME™ liquid ends have 3 check valves: suction on the bottom; discharge on the front; autoprime bleed on the top. By design, a repeatable portion of the process fluid continuously bleeds through the top check valve to be returned to the chemical supply. The result is the assurance that any gas in the head is automatically relieved thus eliminating air-binding. Depending on application, output may be reduced up to 50%. Variables include supplier piping, stroke length and speed setting. Maximum pressure is 150 psi (10.3 Bar) for AX1, AX4, 110 psi (7.6 Bar) for AX5, 50 psi (3.4 Bar) for AX6 models. (Where X = control codes 0,1,3,7,8).

■ See front page for voltage code specifications.

† To specify black, UV resistant tubing, change 'I' to 'U'. To specify head only and no 4FV, change S to N for FastPrime or change H to A for AutoPrime. To specify 1/2" NPT Male, change "I" to "P".

* To specify Ported Head, change "V" to "P".

4FV indicates that the pump is equipped with an LMI Four Function Valve. This diaphragm type, anti-syphon/pressure relief valve is installed on the pump head. It provides anti-syphon protection and aids priming, even under pressure.

Fluorofilm™ is a copolymer of PTFE and PFA. Polyprel® is an elastomeric PTFE copolymer.

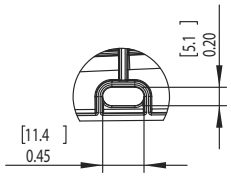
Polyprel is a registered trademark of the Milton Roy Company.

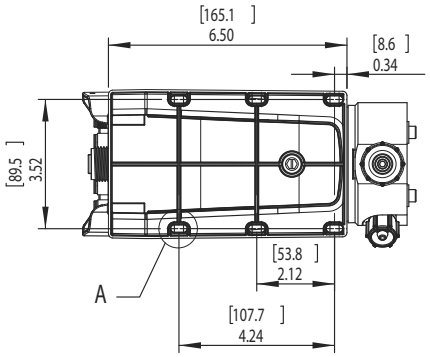
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Viton® is a registered trademark of E.I. DuPont Company.

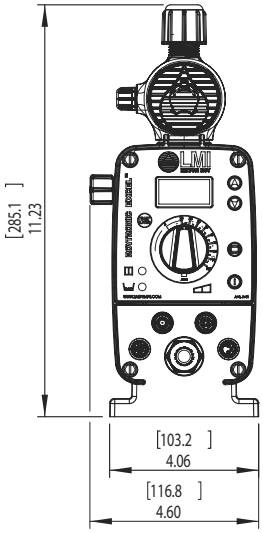
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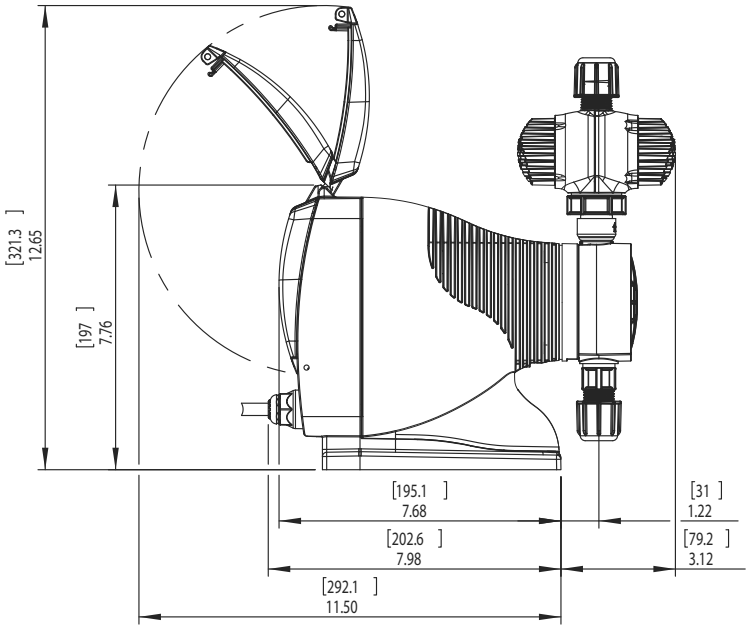
VIEW A



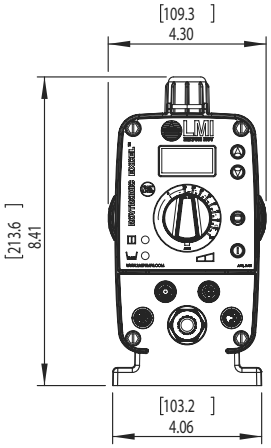


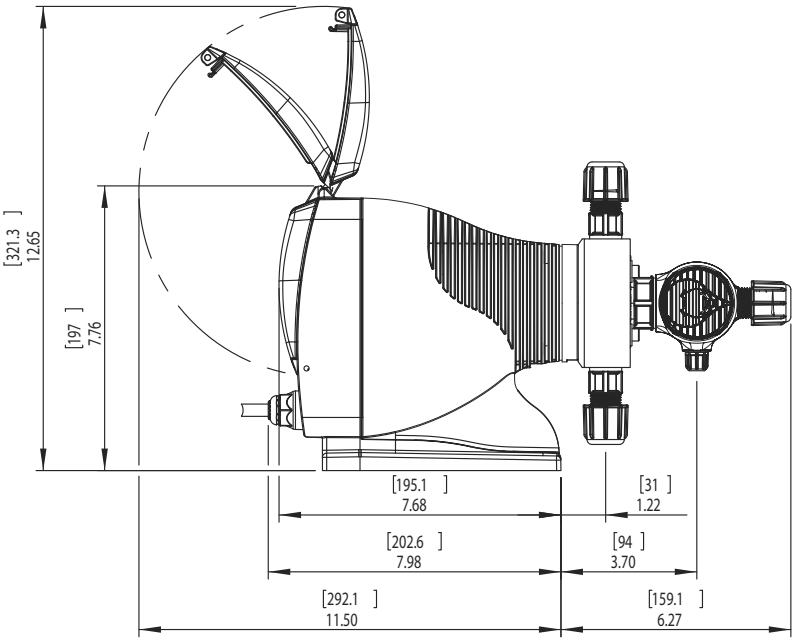
FASTPRIME LIQUID ENDS





AUTOPRIME LIQUID ENDS





NOTE: ALL DIMENSIONS ARE IN INCHES [MM]. DIMENSIONS SHOWN ARE FOR LARGEST LIQUID END.
DIMENSIONS WILL VARY DEPENDING ON LIQUID END SELECTED.

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Specifications Subject to Change

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Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.

ZOELLER® PUMP COMPANY

Zoeller Family of Water Solutions™

SECTION: 2.15.020
FM2778
0515
Supersedes
0315

TECHNICAL DATA SHEET

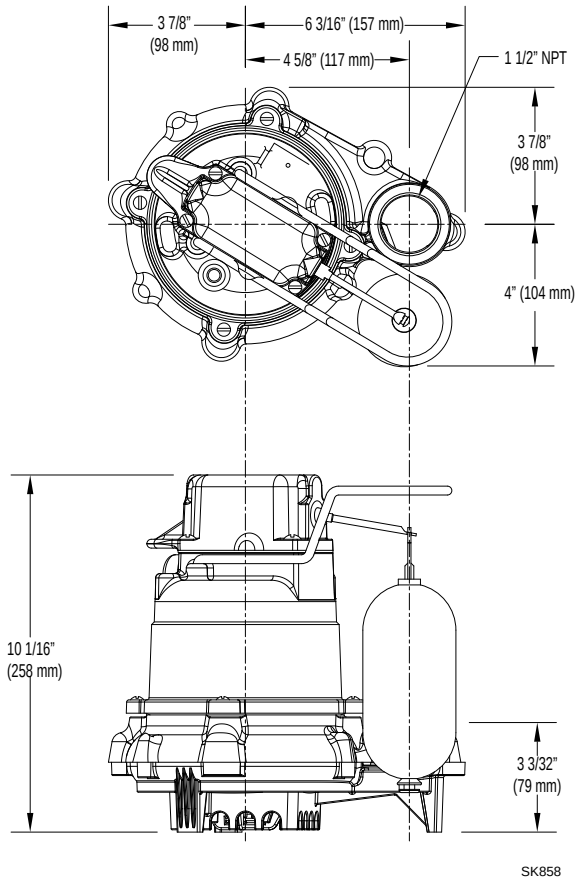
MIGHTY-MATE SERIES

Cast Iron Models 53, 57 and Bronze Models 55, 59
Submersible Effluent / Dewatering Pumps

PRODUCT SPECIFICATIONS

MOTOR	Horse Power	3/10
	Voltage	115 or 230
	Phase	1 Ph
	Hertz	60 Hz
	RPM	1550
	Type	Shaded pole
	Insulation	Class B
	Amps	4.8 - 9.7
PUMP	Operation	Automatic or nonautomatic
	Auto On/Off Points	7-1/4" (18.4 cm) / 3" (7.6 cm)
	Discharge Size	1-1/2" NPT
	Solids Handling	1/2" (12 mm) spherical solids
	Cord Length	9' (3 m) automatic, 15' (5 m) nonautomatic
	Cord Type	UL listed, 3-wire, grounded plug
	Max. Head	19.25' (5.9 m)
	Max. Flow Rate	43 GPM (163 LPM)
	Max. Operating Temp.	130° F (54° C)
	Cooling	Oil filled
	Motor Protection	Auto reset thermal overload
MATERIALS	Cap	Cast iron or bronze
	Motor Housing	Cast iron or bronze
	Pump Housing	Cast iron or bronze
	Base	Cast iron, bronze or engineered thermoplastic
	Upper Bearing	Sleeve bearing
	Lower Bearing	Sleeve bearing
	Mechanical Seals	Carbon and ceramic
	Impeller Type	Non-clogging vortex
	Impeller	Plastic, cast iron or bronze
	Hardware	Stainless steel
	Motor Shaft	AISI 1215 cold rolled steel
	Gasket	Neoprene

NOTE: See model comparison chart for specific details.



Tested to Standard UL778 and Certified to CSA Standard C22.2 No. 108

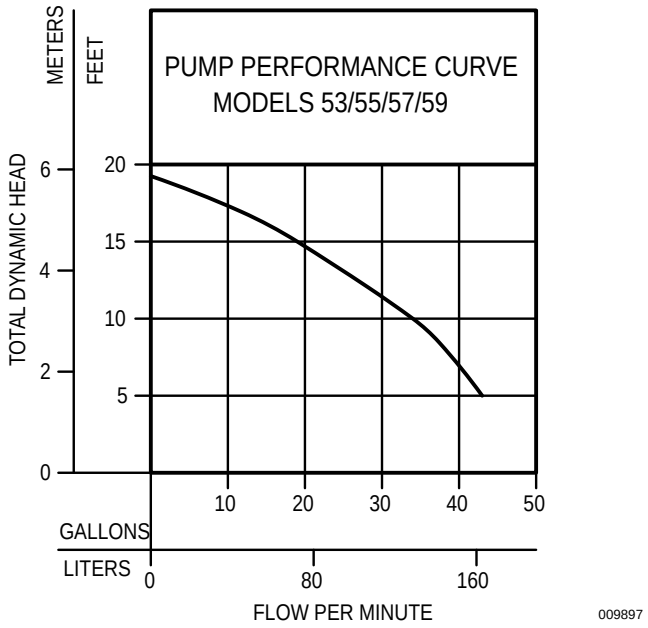
SSPMA

POWDER COATED TOUGH

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TOTAL DYNAMIC HEAD FLOW PER MINUTE

MODEL		53/55/57/59	
Feet	Meters	Gal.	Liters
5	1.5	43	163
10	3.0	34	129
15	4.6	19	72
Shut-off Head:		19.25 ft.(5.9m)	



Model	MODEL COMPARISON										
	Seal	Mode	Volts	Ph	Amps	HP	Hz	Lbs	Kg	Simplex	Duplex
M53/M55	Single	Auto	115	1	9.7	3/10	60	23	10	1	---
N53/N55	Single	Non	115	1	9.7	3/10	60	23	10	2	3 & 4
* BN53	Single	Auto	115	1	9.7	3/10	60	25	11	*	---
* BE53/BE57	Single	Auto	230	1	4.8	3/10	60	24 / 30	11 / 13	*	---
D53	Single	Auto	230	1	4.8	3/10	60	23	10	1	---
E53/E55	Single	Non	230	1	4.8	3/10	60	22	10	2	3 & 4
M57/M59	Single	Auto	115	1	9.7	3/10	60	29 / 33	13 / 15	1	---
N57/N59	Single	Non	115	1	9.7	3/10	60	28 / 29	12 / 13	2	3 & 4
* BN57	Single	Auto	115	1	9.7	3/10	60	30	13	*	---
D57/D59	Single	Auto	230	1	4.8	3/10	60	30 / 33	13 / 15	1	---
E57/E59	Single	Non	230	1	4.8	3/10	60	28 / 29	12 / 13	2	3 & 4
E59	Single	Non	230	1	4.8	3/10	60	29	13	2	3 & 4

* Single piggyback switch included.

SPECIAL MODEL FEATURES

Additional cord lengths are available in 15' (5 m), 25' (8 m) and 35' (11 m). 50' (15 m) cord lengths available for 230 V units only.

BE and BN models include a piggyback variable level pump switch.

Model 53: cast iron switch case, motor and pump housing, a plastic impeller and base. Model 57: all cast iron construction with a cast iron impeller. Model 55: bronze switch case, motor and pump housing, a plastic impeller and base. Model 59: bronze construction with a bronze impeller.

Optional pump stand (P/N 10-2421).

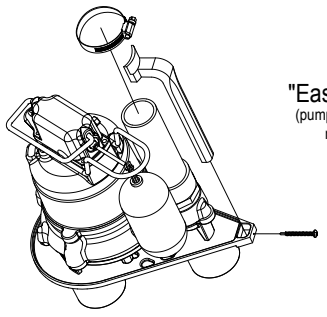
SELECTION GUIDE

1. Integral float-operated mechanical switch, no external control required.
2. Single piggyback variable level float switch or double piggyback variable level float switch. Refer to FM0477.
3. See FM0712 for correct model of Electrical Alternator.
4. Variable level control switch 10-0743 used as a control activator with electrical alternator (3) or (4) float system.

OPTIONAL PUMP STAND P/N 10-2421

- Reduces potential clogging by debris
- Replaces rocks or bricks under the pump
- Made of durable, noncorrosive ABS
- Raises pump 2" (5 cm) off bottom of basin
- Provides the ability to raise intake by adding sections of 1½" or 2" (DN40 or DN50) PVC piping
- Attaches securely to pump
- Accommodates sump, dewatering and effluent applications

NOTE: Make sure float is free from obstruction.



"Easy assembly"
(pump & discharge pipe not included.)

⚠ CAUTION All installation of controls, protection devices and wiring should be done by a qualified licensed electrician. All electrical and safety codes should be followed including the most recent National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

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TW Series Three-Way True Union Ball Valves

1/2" TO 6" PVC AND CPVC

KEY FEATURES

- PVC and CPVC
- Position Indicator
- Easily Actuated
- PTFE Seats
- FPM or EPDM O-Rings
- Double O-Ring Stem Seal

OPTIONS

- Lockouts Available
- Pneumatic and Electric Actuators
- Cross-Flow Ball
- NT Ball
- TP Ball

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

ACTUATED VALVE



SELECTION CHART

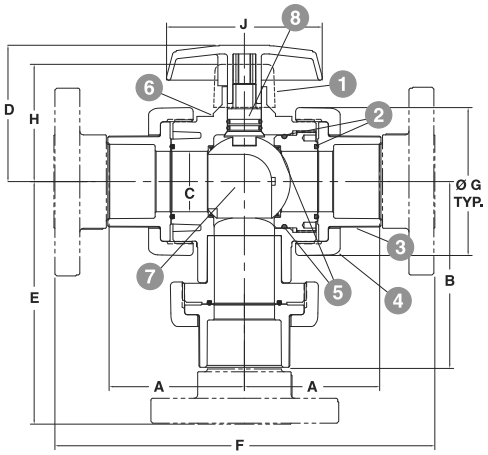
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/2" – 4" (DN15 – DN100)	PVC or CPVC	Socket, Threaded or Flanged	FPM or EPDM	150 PSI @ 70°F Non-Shock
6" * (DN150)		Flanged		

* 4" valve venturied to 6"

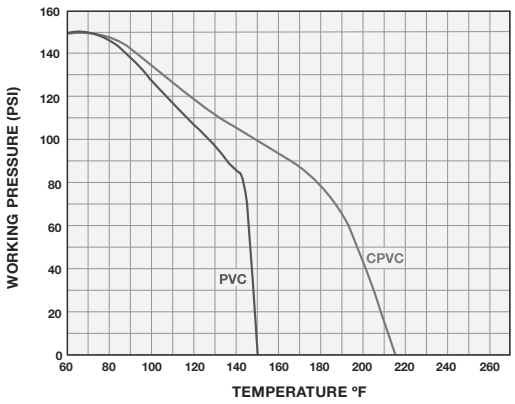
TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Actuation Mount
2. O-Ring Seals
3. End Connector
4. Assembly Nut
5. PTFE Seats
6. Body
7. Ball
8. Stem



OPERATING TEMPERATURE / PRESSURE



DIMENSIONS – INCHES / MILLIMETERS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in / mm	G in / mm	H in / mm	J in / mm
1/2 / 15	2.30 / 58	3.29 / 84	0.50 / 13	2.94 / 75	3.87 / 98	6.72 / 171	2.25 / 57	2.53 / 64	3.50 / 89
3/4 / 20	2.56 / 65	3.57 / 91	0.75 / 19	2.97 / 75	4.60 / 117	7.50 / 191	2.63 / 67	2.82 / 72	3.50 / 89
1 / 25	2.98 / 76	4.14 / 105	1.00 / 25	3.21 / 82	4.77 / 121	8.50 / 216	3.00 / 76	3.08 / 78	4.00 / 102
1-1/4 / 32	4.39 / 112	5.94 / 151	2.00 / 51	3.63 / 92	5.19 / 132	11.54 / 293	4.00 / 102	3.50 / 89	4.00 / 102
1-1/2 / 40	4.39 / 109	5.87 / 149	2.00 / 51	3.63 / 92	6.00 / 152	11.85 / 301	4.00 / 102	3.50 / 89	4.00 / 102
2 / 50	4.38 / 111	6.00 / 152	2.00 / 51	4.31 / 109	6.75 / 171	12.25 / 311	4.75 / 121	3.95 / 100	5.00 / 127
2-1/2 / 63	5.90 / 150	7.59 / 193	3.00 / 76	7.02 / 178	8.68 / 220	15.92 / 404	6.40 / 163	5.88 / 149	10.50 / 267
3 / 80	5.90 / 150	7.59 / 193	3.00 / 76	7.02 / 178	8.72 / 221	16.00 / 406	6.40 / 163	5.88 / 149	10.50 / 267
4 / 100	7.00 / 178	9.33 / 237	4.00 / 102	8.02 / 204	10.44 / 265	18.88 / 480	8.56 / 217	8.88 / 226	10.50 / 267
6 / 150	N/A	N/A	4.00 / 102	8.02 / 204	11.25 / 286	20.25 / 514	8.56 / 217	8.88 / 226	10.50 / 267

Dimensions are subject to change without notice – consult factory for installation information

Cv VALUES

SIZE in / DN	Cv VALUES GPM	SIZE in / DN	Cv VALUES GPM
1/2 / 15	3.0	2 / 50	58.0
3/4 / 20	7.0	3 / 80	190.0
1 / 25	10.0	4 / 100	450.0
1-1/2 / 40	30.0	6 / 150	340.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

FLOW SCHEMATICS – TOP VIEW

FLOW AT	NT OR TN BALL	FLOW AT	CROSS FLOW BALL
0°	Port A  Port B	0°	Port A  Port B
45° *No Deadhead*	Port A  Port B	90°	Port A  Port B
90°	Port A  Port B	180°	Port A  Port B
FLOW AT	TW BALL	FLOW AT	TP BALL
0°	Port A  Port B	0°	Port A  Port B
90° *Center-Off*	Port A  Port B	90°	Port A  Port B
180°	Port A  Port B		

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AE SERIES ELECTRIC ACTUATORS

AE Series electric actuators provide a highly reliable solution for your electric actuation requirements. With torque ranges from 300 in-lbs to over 5200 in-lbs, including optional handwheel overrides, fast acting solutions, as well as extra limit switches, LED position indication, internal space heaters, and modulation capability, the AE Series is designed to exceed your expectations.

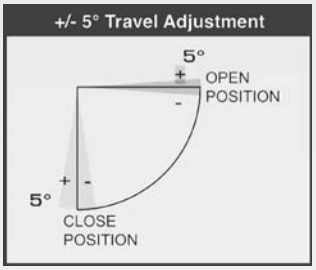


On/Off Control

- Multiple voltages available
- Fast acting and extended duty models available
- Easy wiring and setup
- Manual override standard

Proportional Control

- Selectable input/output signal (4-20mA, 0-10V, 0-5V)
- Available in 120VAC or 220VAC
- Easy Travel and sensitivity adjustment
- Manual override standard



Features:

- Compact design & direct ISO 5211 valve mounting
- Easy field wiring, setup and adjustment
- Multiple voltage options available (AC/DC)
- Open and close directions ±5° travel adjustment
- Standard manual override, hand wheel on larger models
- Standard auxiliary limit switches for open/close feedback
- Standard Open/Close LEDs for easy visual indication
- Standard internal space heater & thermal overload protection
- Selectable input/output signal on modulating models
- Optional 180° rotation for on/off models only up to AE03

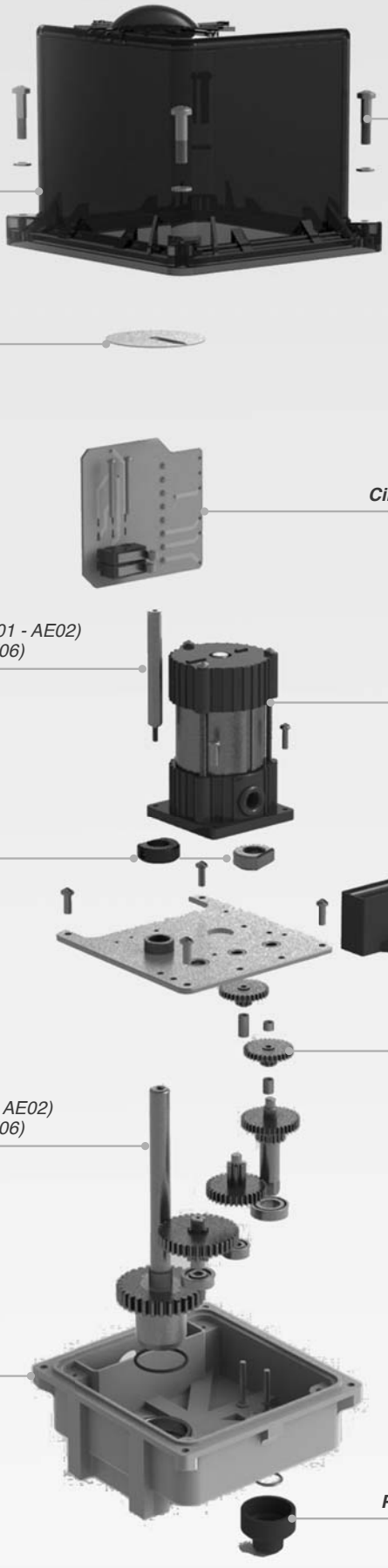
Configurations:

- Standard On/Off Control
  (120VAC, 220VAC, + more AC options)
- Extended Duty On/Off Control*
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Fast Acting On/Off Control
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Modulating Control
  (120VAC, 220VAC)

SPECIFICATIONS	
Rotation	90 Degrees ±5° Adjustment
Housing	Aluminum Alloy Base, Polycarbonate Cover
Gears	Heavy duty sintered metal
Back-Drive Resistance Method	High gearing ratio + back-drive resistant motor
Ambient Temp. Range	14°F to 140°F
Relative Humidity Range	30% to 95%
Enclosure Protection Rating	IP67 (Water and dust proof)
Switches	SPDT Mechanical Switches (2 Auxiliary)
Power Supply Voltage (AC/DC)	120VAC, 220VAC, 24VAC/DC dual voltage
3-Phase AC Power Supply Voltage	220VAC, 380VAC, 480VAC
Modulating Input Signal (Selectable)	4-20mA, 0-10V, 0-5V
Modulating Output Signal (Selectable)	4-20mA, 0-10V, 0-5V
Torque Range	75 to 5,290 in-lbs
Valve Mounting	ISO 5211
Manual Override	Included (hand wheel on larger sizes)

*100% Duty Cycle according to IEC60034-S4 duty type.

AE SERIES EXPLODED VIEW



Cover Screws *- Stainless steel*

Cover *- Polycarbonate*

Indicator *- Aluminum*

Circuit Board with Limit Switches *- FR*

Standoff *- Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Motor

Cams *- Metal*

Gears *- Sintered metal*

Shaft *- Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Lower Box *- Aluminum*

Protection for Manual Lever *- Rubber*

*** NOTE: AE01/AE02 shown.**

PART NUMBER BUILDER

1 Model [ ] - 2 Voltage [ ]

1 Select desired model

Torques shown in inch-lbs.

Standard On/Off Models

Model No.	Torque	Duty	Cycle	Description
AE01-XXXVAC-YY	301	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE02-XXXVAC-YY	434	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03-XXXVAC-YY	1478	50%	8s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03H-XXXVAC-YY	1797	50%	10s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE04H-XXXVAC-YY	3292	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE05H-XXXVAC-YY	4355	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE06H-XXXVAC-YY	5293	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override

Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. Torques shown in inch-lbs.

100% Duty Cycle On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01A-XXXVAC	283	100%	16s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-XXXVAC	443	100%	36s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-XXXVAC	867	100%	65s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override

100% Duty Cycle Models - DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01A-24VAC/24VDC	310	100%	11s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-24VAC/24VDC	443	100%	12s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03A-24VAC/24VDC	1239	100%	8s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-24VAC/24VDC	1381	100%	10s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override
AE04HA-24VAC/24VDC	2434	100%	27s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override

Fast Acting On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01FA-M1-XXXVAC	78	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-XXXVAC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-M2-XXXVAC	885	100%	5s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Fast Acting On/Off Models - 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01FA-M1-24VAC/24VDC	89	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-24VAC/24VDC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-24VAC/24VDC	443	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Modulating Models - 120VAC/240VAC

Model No.	Torque	Duty*	Board	Description
AEM01A-XXXVAC	221	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M1-XXXVAC	319	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M2-XXXVAC	443	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM03HA-M1-XXXVAC	1478	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM03HA-M2-XXXVAC	1797	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM04HA-XXXVAC	2673	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM05HA-XXXVAC	4355	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM06HA-XXXVAC	5293	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA

**Note - No load cycle time.
*Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.
Fast Acting models rated 100% duty in 30 min.

Torques shown in inch-lbs.

2 Select desired voltage

120 VAC	240 VAC	240-3PH VAC	380-3PH VAC	480-3PH VAC
√	√	-	-	-
√	√	-	-	-
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√
√	√
√	√
√	√
√	√
√	√

*12 VDC available as special order only.

Standard On/Off Models - For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.
Extended Duty Cycle On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage.
Modulating Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.
Fast Acting On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

TECHNICAL DATA

Standard On/Off Control Series, 120VAC/240VAC & 240VAC/380VAC/480VAC-3PHASE

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01-XXXVAC-YY	301	34	3.7	1.7	25%	10W	10s	0.7A	0.38A
AE02-XXXVAC-YY	434	49	4.0	1.8	25%	15W	10s	0.9A	0.5A
AE03-XXXVAC-YY	1478	167	9.7	4.4	50%	25W	8s	1.2A	0.72A
AE03H-XXXVAC-YY	1797	203	17.4	7.9	50%	25W	10s	1.2A	0.72A
AE04H-XXXVAC-YY	3292	372	19.0	8.6	50%	25W	30s	1.2A	0.72A
AE05H-XXXVAC-YY	4355	492	19.4	8.8	50%	40W	30s	2.0A	0.75A
AE06H-XXXVAC-YY	5293	598	20.1	9.1	50%	60W	30s	2.4A	0.8A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.

100% Duty Cycle On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01A-XXXVAC	283	32	3.7	1.7	100%	25W	16s	0.3A	0.15A
AE02A-XXXVAC	443	50	4.0	1.8	100%	25W	36s	0.2A	0.10A
AE03HA-XXXVAC	867	98	19.4	8.8	100%	25W	65s	0.2A	0.10A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage.

100% Duty Cycle On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01A-24VAC/24VDC	310	35	4.4	2	100%	7W	11s	1.5A	1.5A
AE02A-24VAC/24VDC	443	50	4.9	2.2	100%	7W	12s	1.5A	1.5A
AE03A-24VAC/24VDC	1239	140	9.7	4.4	100%	25W	8s	3.0A	3.0A
AE03HA-24VAC/24VDC	1381	156	17.4	7.9	100%	25W	10s	3.0A	3.0A
AE04HA-24VAC/24VDC	2434	275	19.0	8.6	100%	25W	27s	3.0A	3.0A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.

MODULATING Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Deg. Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AEM01A-XXXVAC-AMD	221	25	4.9	2.2	100%	25W	16s	0.2A	0.10A
AEM02A-M1-XXXVAC-AMD	319	36	5.5	2.5	100%	25W	16s	0.3A	0.15A
AEM02A-M2-XXXVAC-AMD	443	50	5.5	2.5	100%	25W	35s	0.2A	0.10A
AEM03A-M1-XXXVAC-AMD	885	100	7.1	3.2	100%	25W	36s	0.3A	0.15A
AEM03HA-M1-XXXVAC-BMD	1478	167	10.6	4.8	100%	25W	8s	1.2A	0.72A
AEM03HA-M2-XXXVAC-BMD	1797	203	18.3	8.3	100%	25W	10s	1.2A	0.72A
AEM04HA-XXXVAC-BMD	2673	302	19.8	9	100%	25W	30s	1.2A	0.72A
AEM05HA-XXXVAC-BMD	4355	492	20.3	9.2	100%	40W	30s	2.0A	0.75A
AEM06HA-XXXVAC-BMD	5293	598	20.9	9.5	100%	60W	30s	2.4A	0.80A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

FAST ACTING On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01FA-M1-XXXVAC	78	8.8	3.7	1.7	100%	15W	1s	0.7A	0.38A
AE01FA-M2-XXXVAC	221	25	3.7	1.7	100%	15W	3s	0.8A	0.60A
AE03FA-M2-XXXVAC	885	100	9.7	4.4	100%	25W	5s	1.2A	0.72A

Note - 100% duty in 30 min. Torques shown in inch-lbs. For "XXX", choose either 120 or 240 for required voltage.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

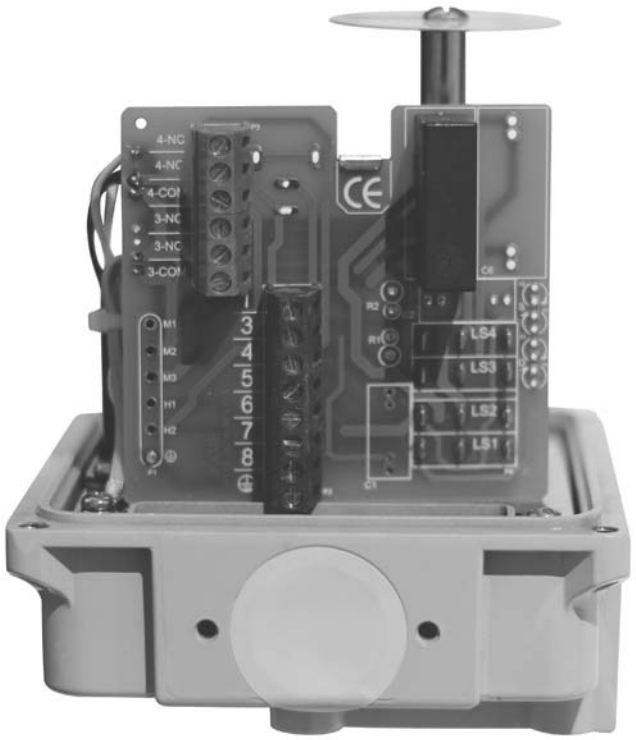
FAST ACTING On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

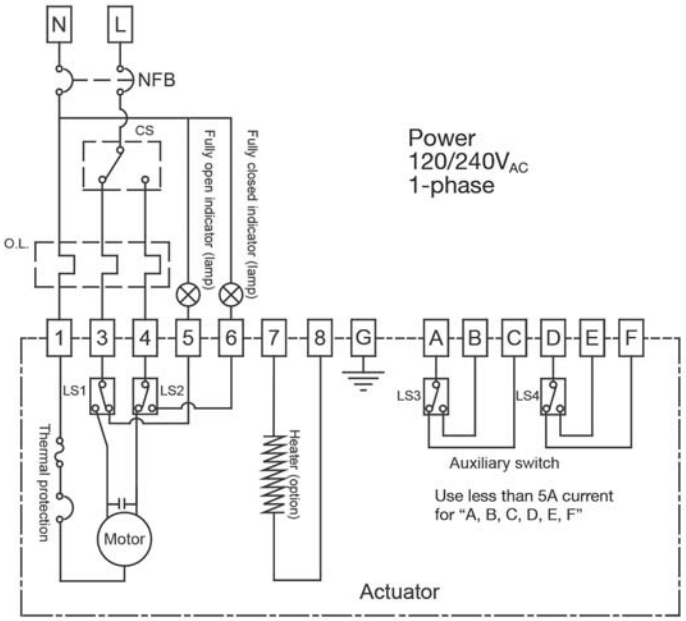
Model No. - Voltage	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01FA-M1-24VAC/24VDC	89	10	3.7	1.7	100%	7W	1s	2.0A	2.0A
AE01FA-M2-24VAC/24VDC	221	25	3.7	1.7	100%	7W	3s	1.6A	1.6A
AE03FA-24VAC/24VDC	443	50	9.7	4.4	100%	25W	3s	3.5A	3.5A

Note - 100% duty in 30 min. 1) Power is consumption at "no load". 2) Amps are based on "full load" at rated torque.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

ON/OFF TYPE FOR 120/240 VAC

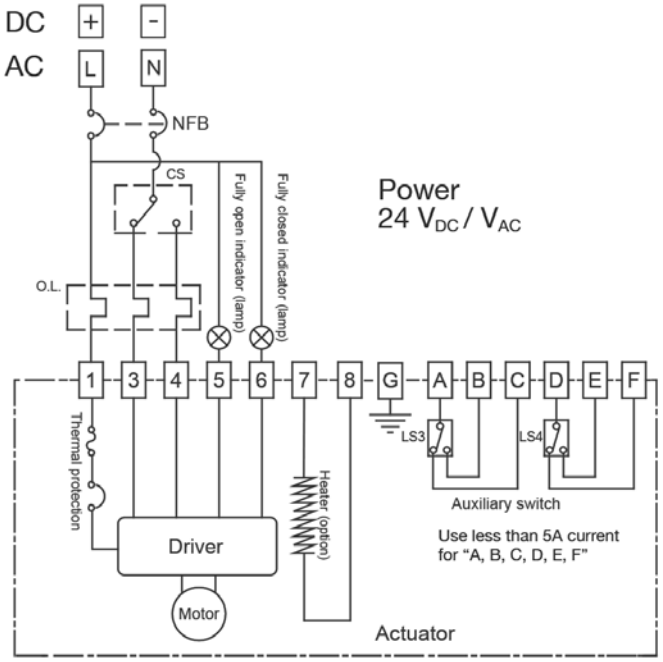
Single Phase



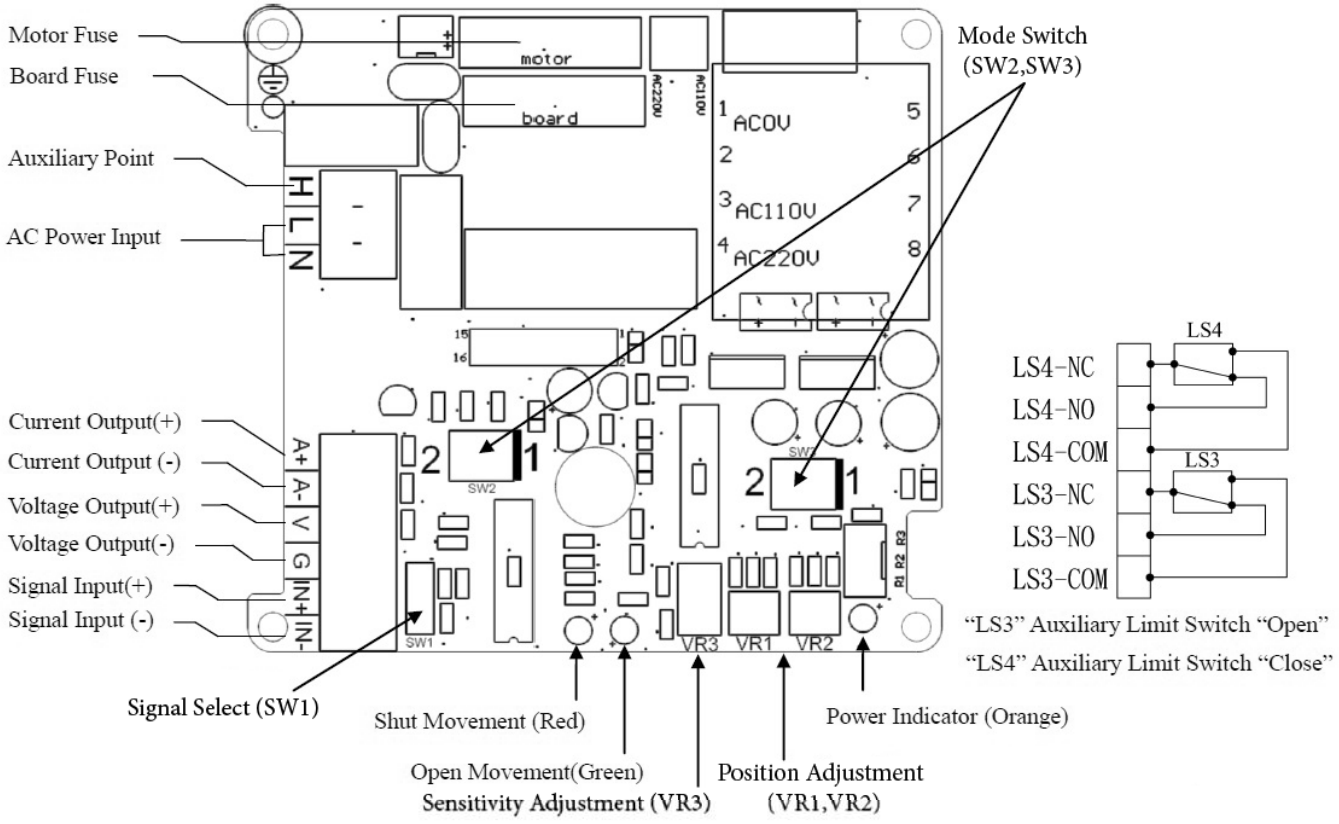


ON/OFF TYPE FOR 24VDC/VAC

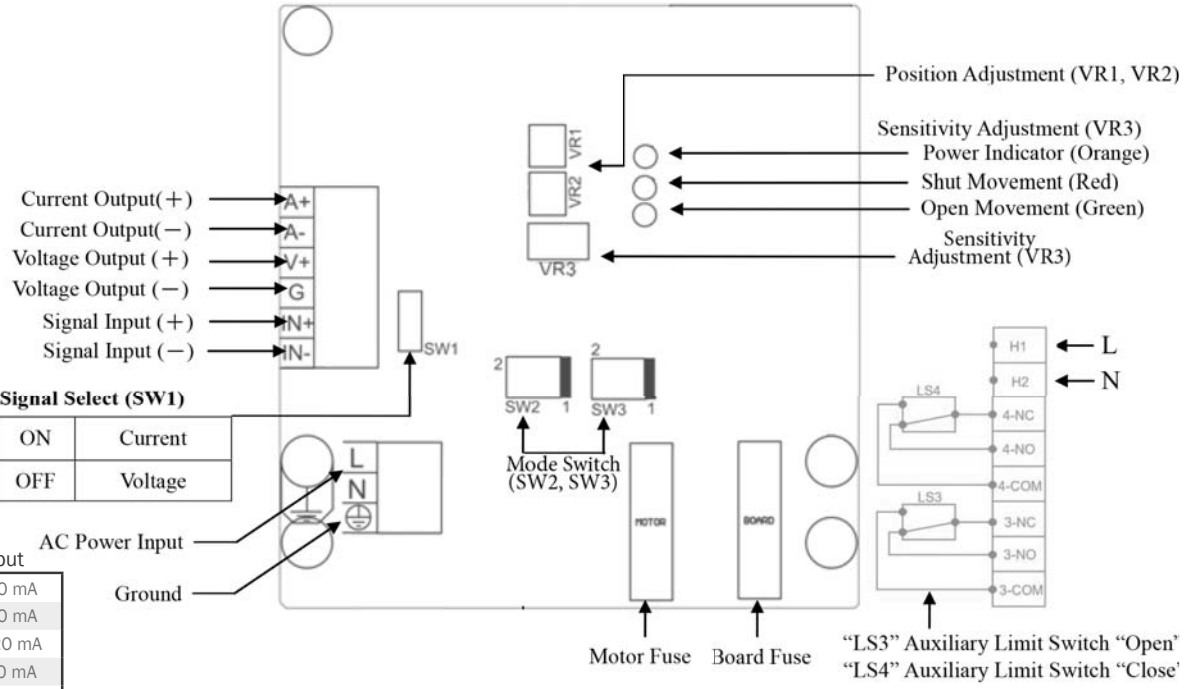




AMD BOARD



BMD BOARD



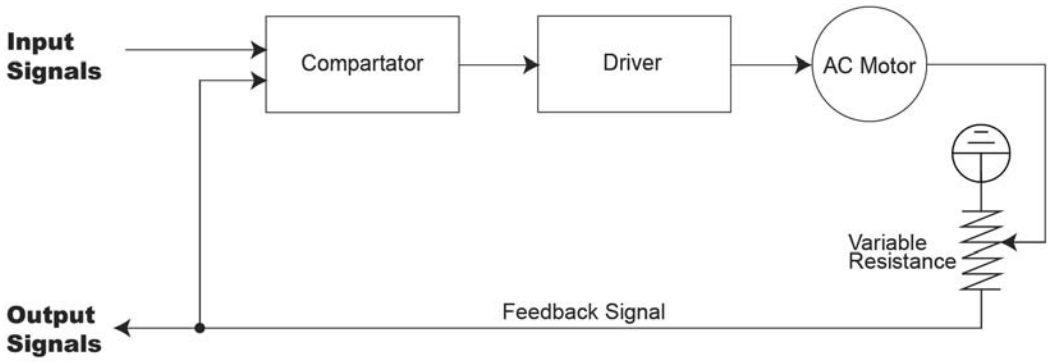
Signal Input	Signal Output
4 ~ 20 mA	2 ~ 10 V, 4~20 mA
2 ~ 10 V	2 ~ 10 V, 4~20 mA
0 ~ 10 V	0 ~ 10 V, 0 ~ 20 mA
1 ~ 5 V	1 ~ 5 V, 2 ~ 10 mA
0 ~ 5 V	0 ~ 5 V, 0 ~ 10 mA

Note - When using current signal, external resistant is under 500 Ω.

Differences between AMD and BMD:

BMD units should be used for higher torques and faster operating speeds. AMD units provide power usage efficiencies and should be used when power savings are a concern.

SIGNAL FLOW OF MODULATION TYPE

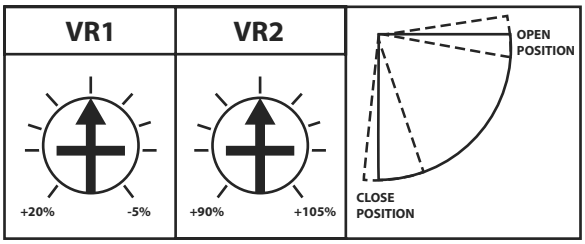


SWITCH & ADJUSTMENT SETTINGS

SW1 Input Signal Selection

	ON	OFF (1)
	Current Input Signal	Voltage Input Signal
SW1	4 ~ 20 mA	2~10 V 0~10 V 1~5 V 0~5 V

VR1 & VR2 Position Adjustment



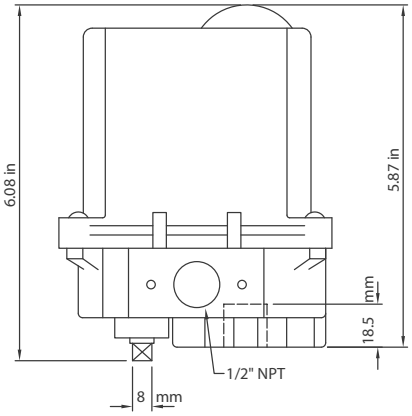
SW2 & SW3 Operation Selection

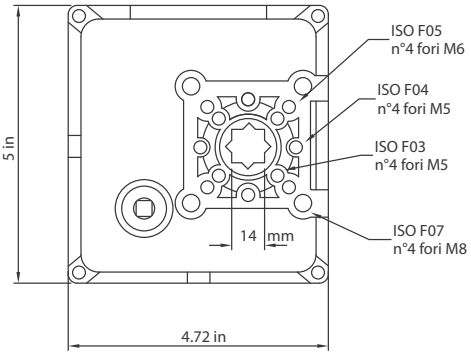
		SW2	
		1	2
SW3	1	MODE A Valve is fully closed when the input signal is 4mA, 2V, 1V, or 0V	X
	2	X	MODE B Valve is fully opened when the input signal is 4mA, 2V, 1V, or 0V

VR3 Sensitivity Adjustment

Rotation	Result
Clockwise	 Increase sensitivity
Counter-clockwise	 Decrease sensitivity

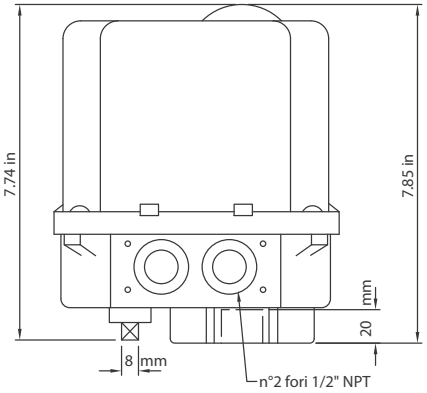
AE01 - AE02

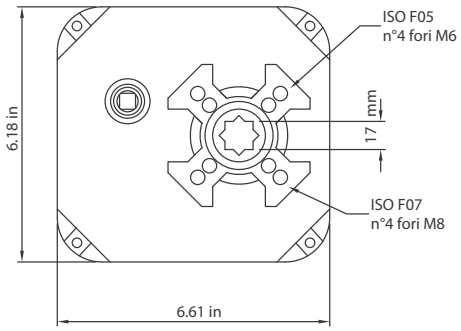






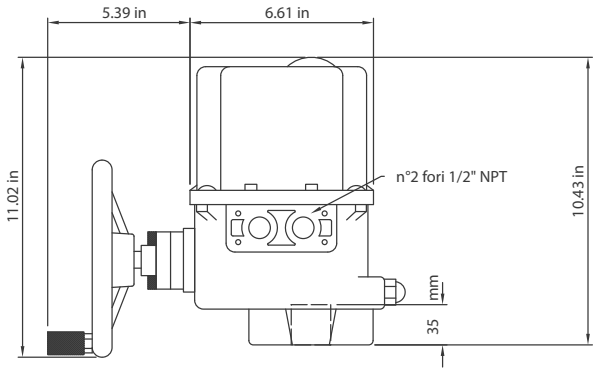
AE03

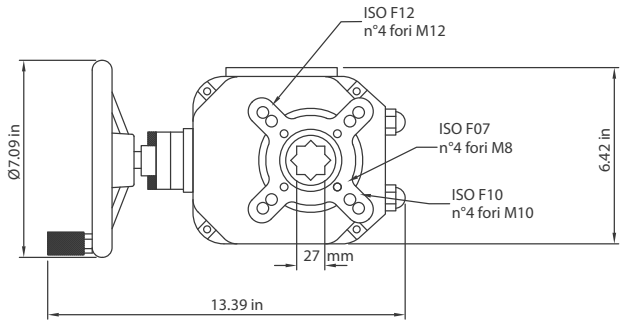






AE03H - AE06H



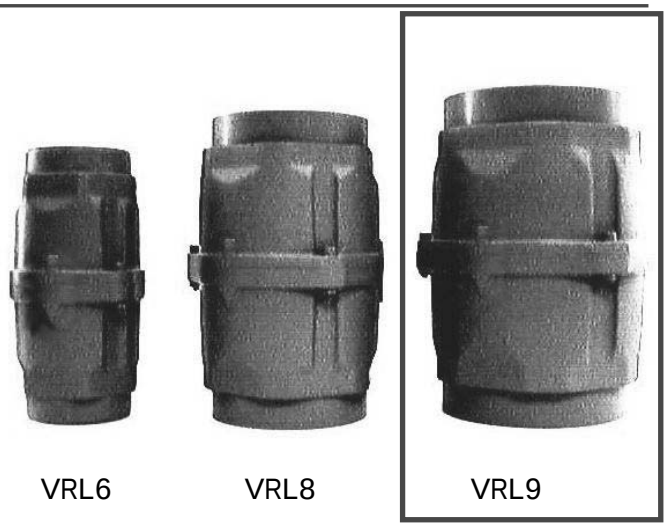




Safety Valves

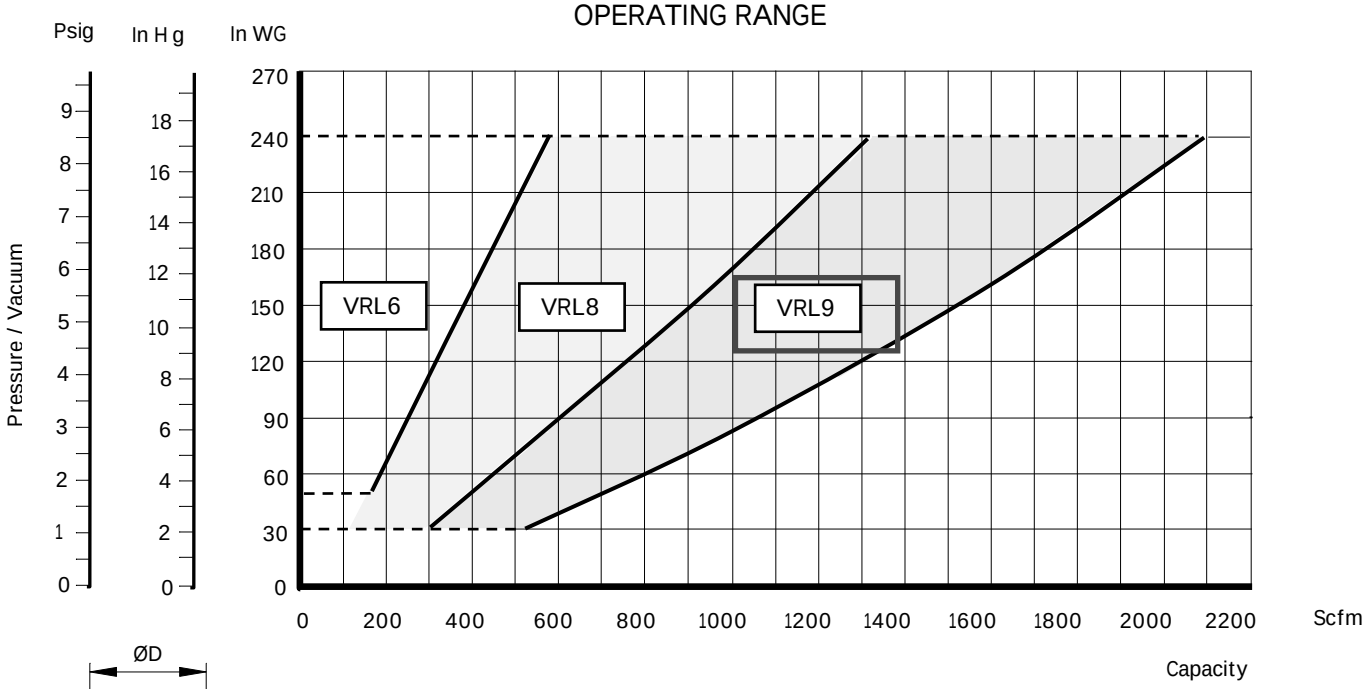
SN 1733 -5 1/1

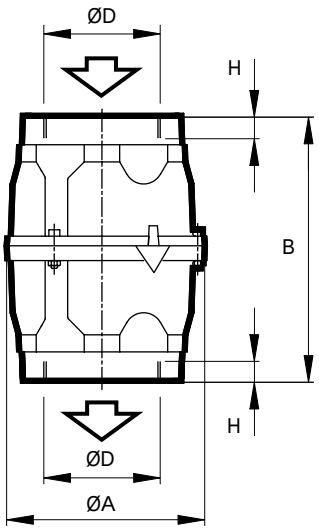
The VRL valves are designed to protect blowers and / or motors from over pressurization or excess vacuum. When there is over pressurization, the valve opens and discharges to the outside. When there is excess in vacuum, the valve opens and takes flow from outside.
The valves have been designed for low pressure / low vacuum, with minimal difference between the initial value at which the valve begins to open and its fully opened position. The valves are supplied with 2 different springs to maximize their efficiency.
These compact valves, made of aluminum alloy, are both easy to install and calibrate. The valves are designed to operate in a wide range of capacities. The VRL can be plumbed to divert excess primary flow through a secondary external outlet when working in pressure conditions or to pipe in a secondary flow when working in vacuum.
Maximum efficiency is achieved by keeping operating values (flow versus pressure or vacuum) within the operating range (shaded area on graph). Capacity refers to air having a density equal to 0.075 lbs./cu.ft .



VRL6 VRL8 VRL9

OPERATING RANGE





OVERALL DIMENSIONS

TYPE	ND	D	A	B	H	WEIGHT (Lbs)
VRL6	2”	2” NPT	4.02	6.90	0.47	1.9
VRL8	3”	3” NPT	5.31	7.48	0.59	4.2
VRL9	4”	4” NPT	6.30	8.11	0.71	5.7

- Dimensions in inches.
- Specifications subject to change without prior notice.



NSF

Sizes 1/4" – 2"

TB Series
True Union Ball Valves

1/4" TO 2" PVC AND CPVC

KEY FEATURES

- PVC and CPVC
- Full Port Design
- Reversible PTFE Seats
- Double O-Ring Stem Seals
- Easily Actuated
- NSF / ANSI 61 Listed

OPTIONS

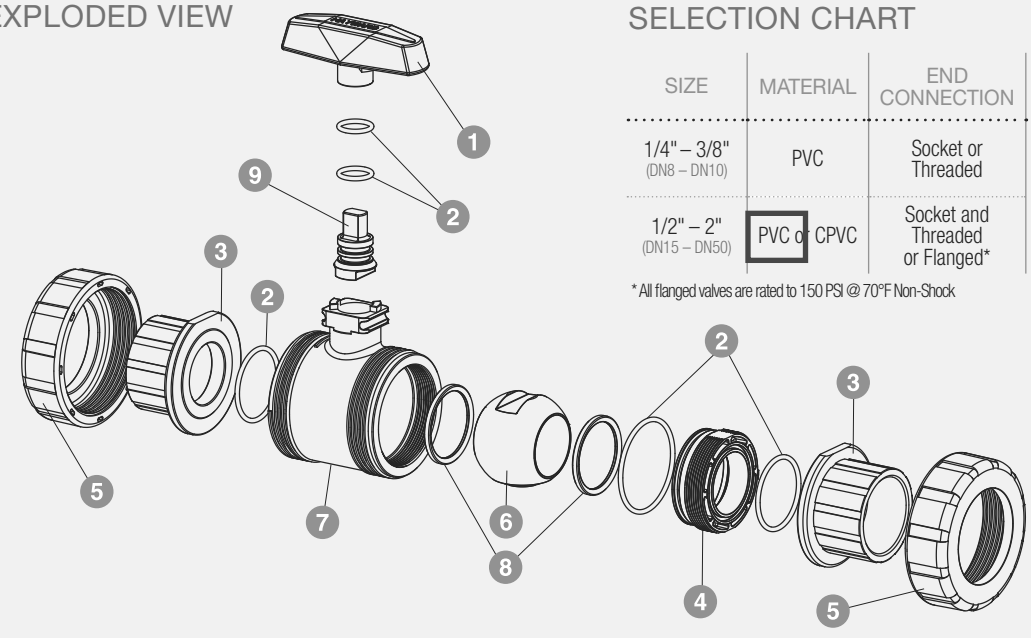
- Lockouts Available
- 2" Square Operating Nut
- Stem Extensions
- Pneumatic and Electric Actuated
- Spring Return Handle

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

EXPLODED VIEW



SELECTION CHART

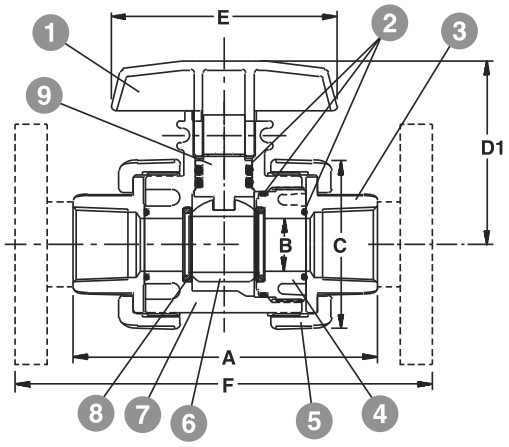
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/4" – 3/8" (DN8 – DN10)	PVC	Socket or Threaded	FPM or EPDM	250 PSI @ 70°F Non-Shock
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded or Flanged*		

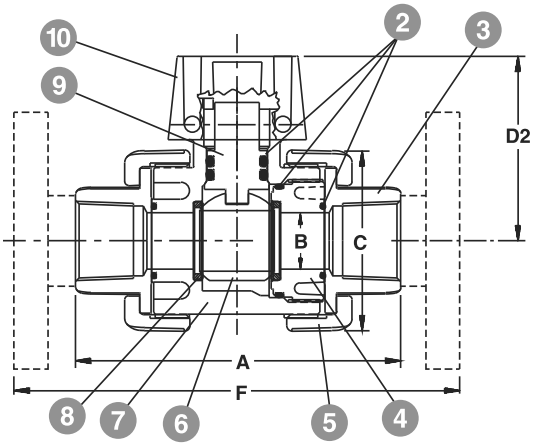
* All flanged valves are rated to 150 PSI @ 70°F Non-Shock

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Handle
2. O-Ring Seals
3. End Connector
4. Seal Retainer
5. Union Nut
6. Ball
7. Body
8. PTFE Seat
9. Stem
10. Actuator Mounting Pad





DIMENSIONS – INCHES / MILLIMETERS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D1 in / mm	D2 in / mm	E in / mm	F in / mm	WEIGHT lbs / kg SOC / THD	WEIGHT lbs / kg FLANGED
1/4 / 8	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
3/8 / 10	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
1/2 / 15*	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	6.75 / 171	.75 / .34	1.00 / .45
3/4 / 20*	4.85 / 123	.75 / 19	2.63 / 67	3.02 / 77	2.81 / 71	3.50 / 89	7.13 / 181	.75 / .34	1.00 / .45
1 / 25*	5.44 / 138	.93 / 24	3.00 / 76	3.26 / 83	3.05 / 77	4.00 / 102	8.09 / 205	1.15 / .52	2.15 / .98
1-1/4 / 32*	6.30 / 160	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.19 / 233	2.15 / .98	3.50 / 1.59
1-1/2 / 40*	6.85 / 174	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.88 / 251	2.15 / .98	3.75 / 1.70
2 / 50*	8.00 / 203	1.94 / 49	4.75 / 121	4.43 / 113	4.00 / 102	5.00 / 127	11.4 / 290	3.80 / 1.72	6.30 / 2.86

Dimensions are subject to change without notice – consult factory for installation information

* Metric End Connections Available In: BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Cv VALUES

SIZE in / DN	Cv VALUES GPM	SIZE in / DN	Cv VALUES GPM
1/4 / 8	1.0	1 / 25	29.0
3/8 / 10	2.8	1-1/4 / 32	75.0
1/2 / 15	8.0	1-1/2 / 40	90.0
3/4 / 20	16.0	2 / 50	150.0

PRESSURE LOSS CALCULATION FORMULA

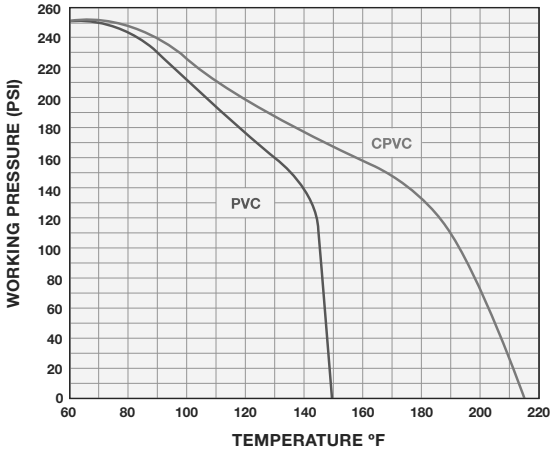
$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop

Q = Flow in GPM

Cv = Flow Coefficient

OPERATING TEMPERATURE / PRESSURE



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AE SERIES ELECTRIC ACTUATORS

AE Series electric actuators provide a highly reliable solution for your electric actuation requirements. With torque ranges from 300 in-lbs to over 5200 in-lbs, including optional handwheel overrides, fast acting solutions, as well as extra limit switches, LED position indication, internal space heaters, and modulation capability, the AE Series is designed to exceed your expectations.

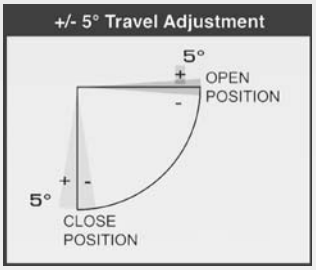


On/Off Control

- Multiple voltages available
- Fast acting and extended duty models available
- Easy wiring and setup
- Manual override standard

Proportional Control

- Selectable input/output signal (4-20mA, 0-10V, 0-5V)
- Available in 120VAC or 220VAC
- Easy Travel and sensitivity adjustment
- Manual override standard



Features:

- Compact design & direct ISO 5211 valve mounting
- Easy field wiring, setup and adjustment
- Multiple voltage options available (AC/DC)
- Open and close directions ±5° travel adjustment
- Standard manual override, hand wheel on larger models
- Standard auxiliary limit switches for open/close feedback
- Standard Open/Close LEDs for easy visual indication
- Standard internal space heater & thermal overload protection
- Selectable input/output signal on modulating models
- Optional 180° rotation for on/off models only up to AE03

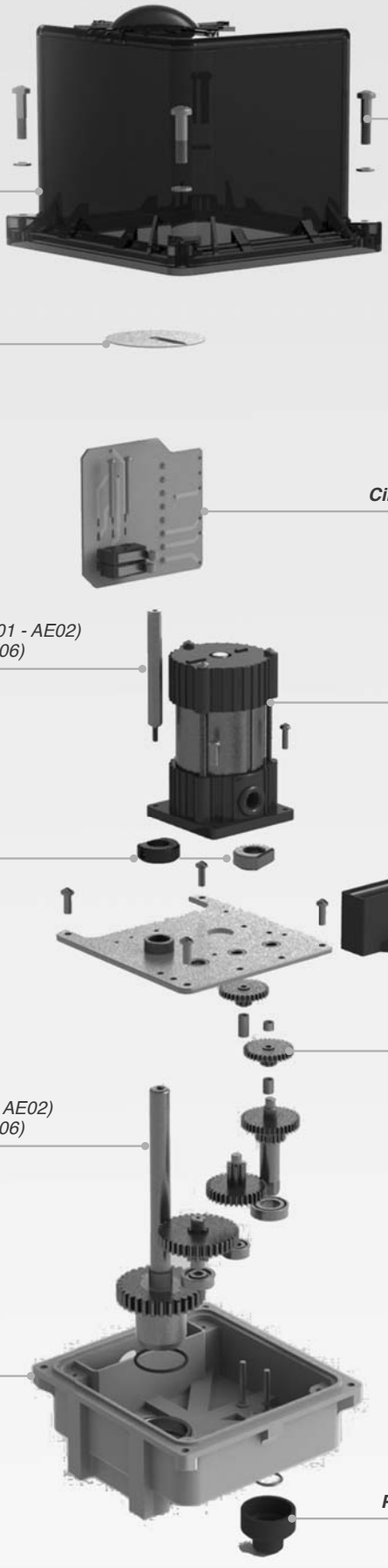
Configurations:

- Standard On/Off Control
  (120VAC, 220VAC, + more AC options)
- Extended Duty On/Off Control*
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Fast Acting On/Off Control
  (120VAC, 220VAC, 24VAC/DC Dual Voltage)
- Modulating Control
  (120VAC, 220VAC)

SPECIFICATIONS	
Rotation	90 Degrees ±5° Adjustment
Housing	Aluminum Alloy Base, Polycarbonate Cover
Gears	Heavy duty sintered metal
Back-Drive Resistance Method	High gearing ratio + back-drive resistant motor
Ambient Temp. Range	14°F to 140°F
Relative Humidity Range	30% to 95%
Enclosure Protection Rating	IP67 (Water and dust proof)
Switches	SPDT Mechanical Switches (2 Auxiliary)
Power Supply Voltage (AC/DC)	120VAC, 220VAC, 24VAC/DC dual voltage
3-Phase AC Power Supply Voltage	220VAC, 380VAC, 480VAC
Modulating Input Signal (Selectable)	4-20mA, 0-10V, 0-5V
Modulating Output Signal (Selectable)	4-20mA, 0-10V, 0-5V
Torque Range	75 to 5,290 in-lbs
Valve Mounting	ISO 5211
Manual Override	Included (hand wheel on larger sizes)

*100% Duty Cycle according to IEC60034-S4 duty type.

AE SERIES EXPLODED VIEW



Cover Screws *- Stainless steel*

Cover *- Polycarbonate*

Indicator *- Aluminum*

Circuit Board with Limit Switches *- FR*

Standoff *- Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Motor

Cams *- Metal*

Gears *- Sintered metal*

Shaft *- Stainless Steel (AE01 - AE02)*
Plated Steel (AE03 - AE06)

Lower Box *- Aluminum*

Protection for Manual Lever *- Rubber*

*** NOTE: AE01/AE02 shown.**

PART NUMBER BUILDER

1 Model [ ] - 2 Voltage [ ]

1 Select desired model

Torques shown in inch-lbs.

Standard On/Off Models

Model No.	Torque	Duty	Cycle	Description
AE01-XXXVAC-YY	301	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE02-XXXVAC-YY	434	25%	10s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03-XXXVAC-YY	1478	50%	8s	Standard On/Off Electric Quarter-Turn Actuator, Manual Override
AE03H-XXXVAC-YY	1797	50%	10s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE04H-XXXVAC-YY	3292	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE05H-XXXVAC-YY	4355	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override
AE06H-XXXVAC-YY	5293	50%	30s	Standard On/Off Electric Quarter-Turn Actuator, with HW Override

Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. Torques shown in inch-lbs.

100% Duty Cycle On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01A-XXXVAC	283	100%	16s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-XXXVAC	443	100%	36s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-XXXVAC	867	100%	65s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override

100% Duty Cycle Models - DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01A-24VAC/24VDC	310	100%	11s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE02A-24VAC/24VDC	443	100%	12s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03A-24VAC/24VDC	1239	100%	8s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, Manual Override
AE03HA-24VAC/24VDC	1381	100%	10s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override
AE04HA-24VAC/24VDC	2434	100%	27s	100% Duty Cycle On/Off Electric Quarter-Turn Actuator, with HW Override

Fast Acting On/Off Models - 120VAC/240VAC

Model No.	Torque	Duty*	Cycle	Description
AE01FA-M1-XXXVAC	78	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-XXXVAC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-M2-XXXVAC	885	100%	5s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Fast Acting On/Off Models - 24VAC/24VDC

Model No.	Torque	Duty*	Cycle**	Description
AE01FA-M1-24VAC/24VDC	89	100%	1s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE01FA-M2-24VAC/24VDC	221	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override
AE03FA-24VAC/24VDC	443	100%	3s	Fast Acting On/Off Electric Quarter-Turn Actuator, Manual Override

Modulating Models - 120VAC/240VAC

Model No.	Torque	Duty*	Board	Description
AEM01A-XXXVAC	221	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M1-XXXVAC	319	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM02A-M2-XXXVAC	443	100%	AMD	Modulating Electric Quarter-Turn Actuator, Manual Override, 0-10V/4-20mA
AEM03HA-M1-XXXVAC	1478	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM03HA-M2-XXXVAC	1797	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM04HA-XXXVAC	2673	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM05HA-XXXVAC	4355	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA
AEM06HA-XXXVAC	5293	100%	BMD	Modulating Electric Quarter-Turn Actuator, w/ HW Override, 0-10V/4-20mA

**Note - No load cycle time.
*Note - The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.
Fast Acting models rated 100% duty in 30 min.

Torques shown in inch-lbs.

2 Select desired voltage

120 VAC	240 VAC	240-3PH VAC	380-3PH VAC	480-3PH VAC
√	√	-	-	-
√	√	-	-	-
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√
√	√	√	√	√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√

24VAC/ 24VDC
√
√
√

120 VAC	240 VAC
√	√
√	√
√	√
√	√
√	√
√	√
√	√
√	√

*12 VDC available as special order only.

Standard On/Off Models - For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.
Extended Duty Cycle On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage.
Modulating Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.
Fast Acting On/Off Models - 120VAC/240VAC - For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

TECHNICAL DATA

Standard On/Off Control Series, 120VAC/240VAC & 240VAC/380VAC/480VAC-3PHASE

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01-XXXVAC-YY	301	34	3.7	1.7	25%	10W	10s	0.7A	0.38A
AE02-XXXVAC-YY	434	49	4.0	1.8	25%	15W	10s	0.9A	0.5A
AE03-XXXVAC-YY	1478	167	9.7	4.4	50%	25W	8s	1.2A	0.72A
AE03H-XXXVAC-YY	1797	203	17.4	7.9	50%	25W	10s	1.2A	0.72A
AE04H-XXXVAC-YY	3292	372	19.0	8.6	50%	25W	30s	1.2A	0.72A
AE05H-XXXVAC-YY	4355	492	19.4	8.8	50%	40W	30s	2.0A	0.75A
AE06H-XXXVAC-YY	5293	598	20.1	9.1	50%	60W	30s	2.4A	0.8A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXXVAC-YY", choose either 120, 240, 240-3PH, 380-3PH, or 480-3PH for required voltage. Only use "-YY" for 3 Phase Voltage Option.

100% Duty Cycle On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01A-XXXVAC	283	32	3.7	1.7	100%	25W	16s	0.3A	0.15A
AE02A-XXXVAC	443	50	4.0	1.8	100%	25W	36s	0.2A	0.10A
AE03HA-XXXVAC	867	98	19.4	8.8	100%	25W	65s	0.2A	0.10A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage.

100% Duty Cycle On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01A-24VAC/24VDC	310	35	4.4	2	100%	7W	11s	1.5A	1.5A
AE02A-24VAC/24VDC	443	50	4.9	2.2	100%	7W	12s	1.5A	1.5A
AE03A-24VAC/24VDC	1239	140	9.7	4.4	100%	25W	8s	3.0A	3.0A
AE03HA-24VAC/24VDC	1381	156	17.4	7.9	100%	25W	10s	3.0A	3.0A
AE04HA-24VAC/24VDC	2434	275	19.0	8.6	100%	25W	27s	3.0A	3.0A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type.

MODULATING Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Deg. Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AEM01A-XXXVAC-AMD	221	25	4.9	2.2	100%	25W	16s	0.2A	0.10A
AEM02A-M1-XXXVAC-AMD	319	36	5.5	2.5	100%	25W	16s	0.3A	0.15A
AEM02A-M2-XXXVAC-AMD	443	50	5.5	2.5	100%	25W	35s	0.2A	0.10A
AEM03A-M1-XXXVAC-AMD	885	100	7.1	3.2	100%	25W	36s	0.3A	0.15A
AEM03HA-M1-XXXVAC-BMD	1478	167	10.6	4.8	100%	25W	8s	1.2A	0.72A
AEM03HA-M2-XXXVAC-BMD	1797	203	18.3	8.3	100%	25W	10s	1.2A	0.72A
AEM04HA-XXXVAC-BMD	2673	302	19.8	9	100%	25W	30s	1.2A	0.72A
AEM05HA-XXXVAC-BMD	4355	492	20.3	9.2	100%	40W	30s	2.0A	0.75A
AEM06HA-XXXVAC-BMD	5293	598	20.9	9.5	100%	60W	30s	2.4A	0.80A

Note - "H" in the part number indicates hand-wheel manual override. The definition of DUTY CYCLE is in accordance with IEC60034-S4 duty type. For "XXX", choose either 120 or 240 for required voltage. M1 motors are synchronous type motors providing relatively high electrical efficiency, M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

FAST ACTING On/Off Control Series, 120VAC/240VAC

Model No.	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	90 Degree Cycle Time	Amps 120VAC @ 60Hz[2]	Amps 240VAC @ 60Hz[2]
AE01FA-M1-XXXVAC	78	8.8	3.7	1.7	100%	15W	1s	0.7A	0.38A
AE01FA-M2-XXXVAC	221	25	3.7	1.7	100%	15W	3s	0.8A	0.60A
AE03FA-M2-XXXVAC	885	100	9.7	4.4	100%	25W	5s	1.2A	0.72A

Note - 100% duty in 30 min. Torques shown in inch-lbs. For "XXX", choose either 120 or 240 for required voltage.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

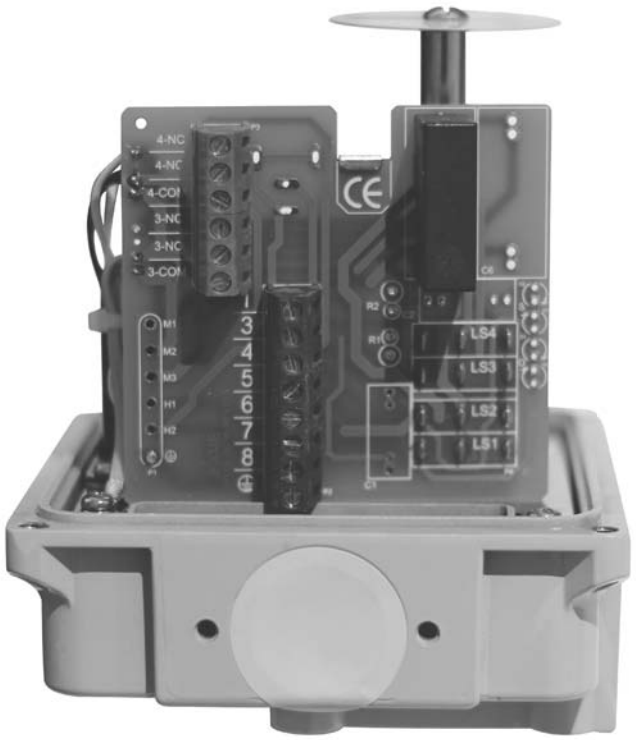
FAST ACTING On/Off Control Series, DUAL VOLTAGE 24VAC/24VDC

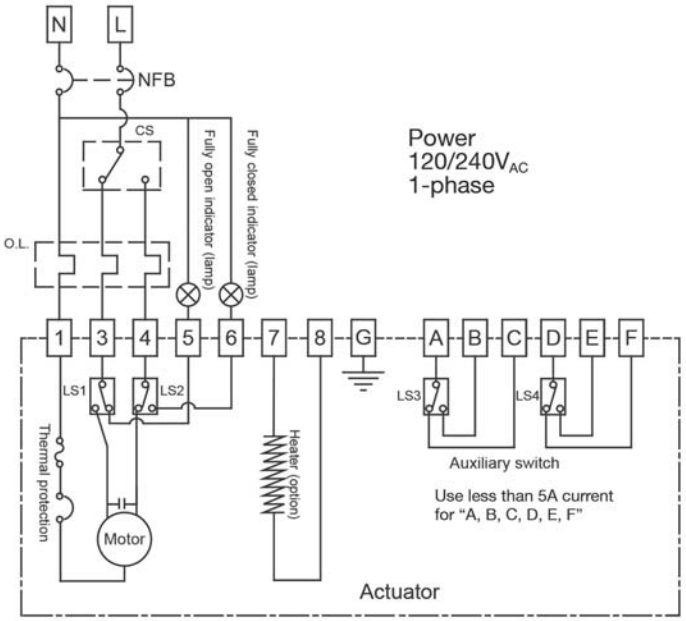
Model No. - Voltage	Torque (in-lbs)	Torque (NM)	Weight (lbs)	Weight (Kg)	Duty	Power[1]	Cycle Time	24VAC @ 60 Hz[2]	24VDC Direct[2]
AE01FA-M1-24VAC/24VDC	89	10	3.7	1.7	100%	7W	1s	2.0A	2.0A
AE01FA-M2-24VAC/24VDC	221	25	3.7	1.7	100%	7W	3s	1.6A	1.6A
AE03FA-24VAC/24VDC	443	50	9.7	4.4	100%	25W	3s	3.5A	3.5A

Note - 100% duty in 30 min. 1) Power is consumption at "no load". 2) Amps are based on "full load" at rated torque.
M1 motors are synchronous type motors providing relatively high electrical efficiency,
M2 motors are inductive type motors and provide higher torque and speed in the same motor size.

ON/OFF TYPE FOR 120/240 VAC

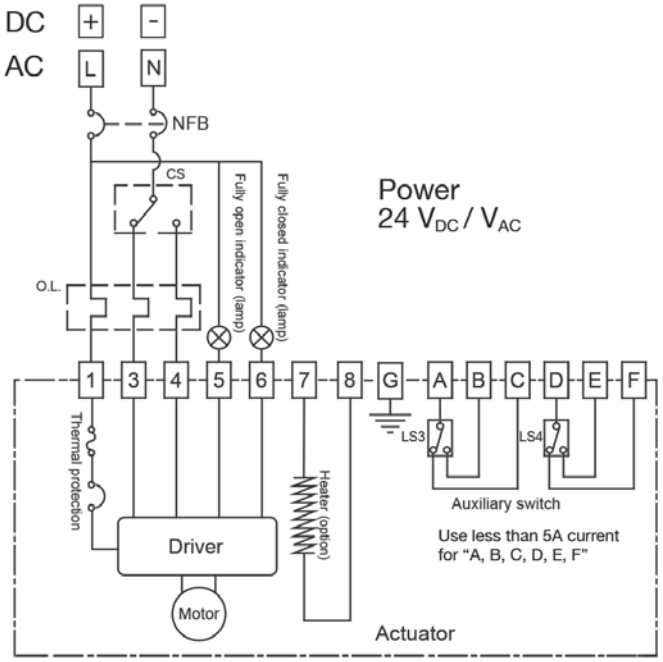
Single Phase



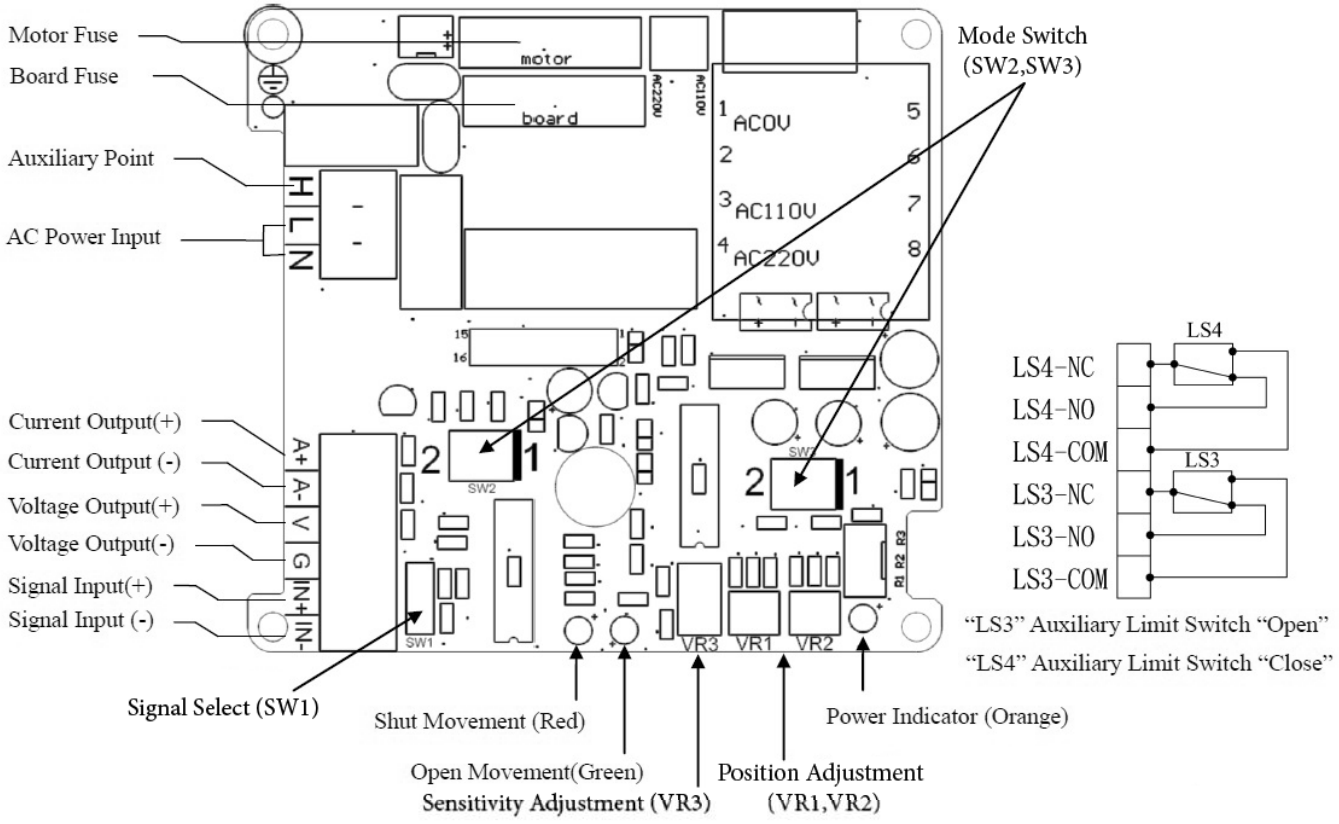


ON/OFF TYPE FOR 24VDC/VAC

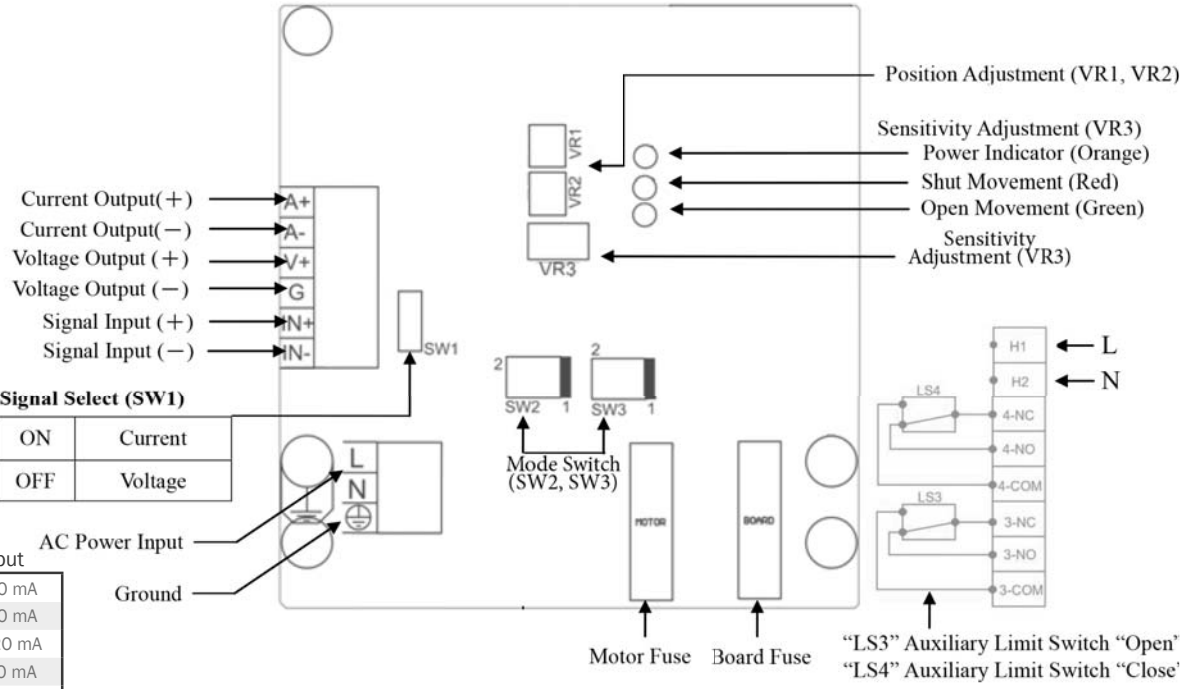




AMD BOARD



BMD BOARD



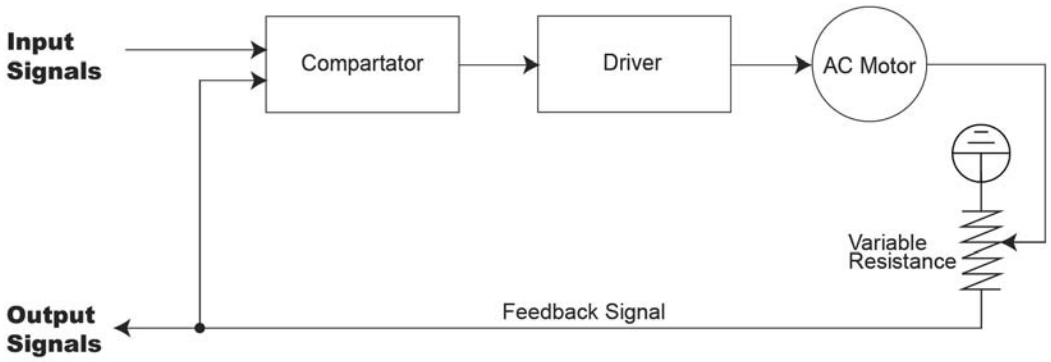
Signal Input	Signal Output
4 ~ 20 mA	2 ~ 10 V, 4~20 mA
2 ~ 10 V	2 ~ 10 V, 4~20 mA
0 ~ 10 V	0 ~ 10 V, 0 ~ 20 mA
1 ~ 5 V	1 ~ 5 V, 2 ~ 10 mA
0 ~ 5 V	0 ~ 5 V, 0 ~ 10 mA

Note - When using current signal, external resistant is under 500 Ω.

Differences between AMD and BMD:

BMD units should be used for higher torques and faster operating speeds. AMD units provide power usage efficiencies and should be used when power savings are a concern.

SIGNAL FLOW OF MODULATION TYPE

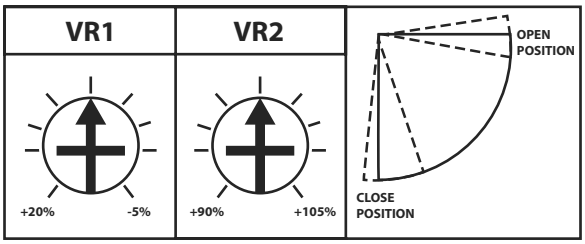


SWITCH & ADJUSTMENT SETTINGS

SW1 Input Signal Selection

	ON	OFF (1)
	Current Input Signal	Voltage Input Signal
SW1	4 ~ 20 mA	2~10 V 0~10 V 1~5 V 0~5 V

VR1 & VR2 Position Adjustment



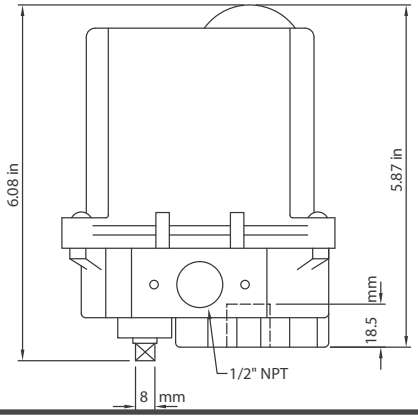
SW2 & SW3 Operation Selection

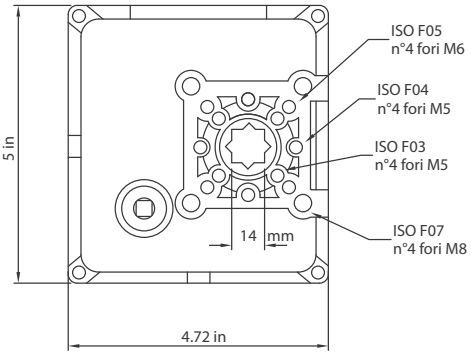
		SW2	
		1	2
SW3	1	MODE A Valve is fully closed when the input signal is 4mA, 2V, 1V, or 0V	X
	2	X	MODE B Valve is fully opened when the input signal is 4mA, 2V, 1V, or 0V

VR3 Sensitivity Adjustment

Rotation	Result
Clockwise	 Increase sensitivity
Counter-clockwise	 Decrease sensitivity

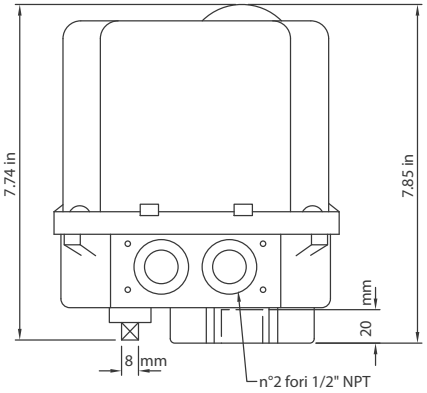
AE01 - AE02

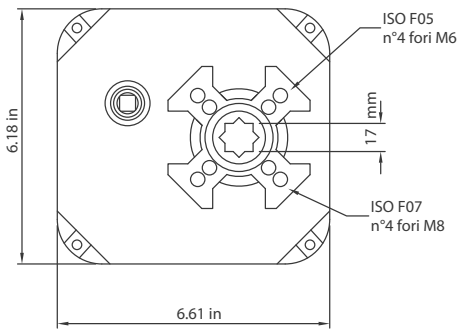






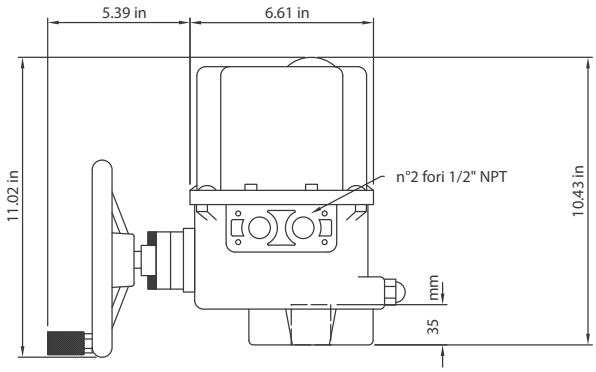
AE03

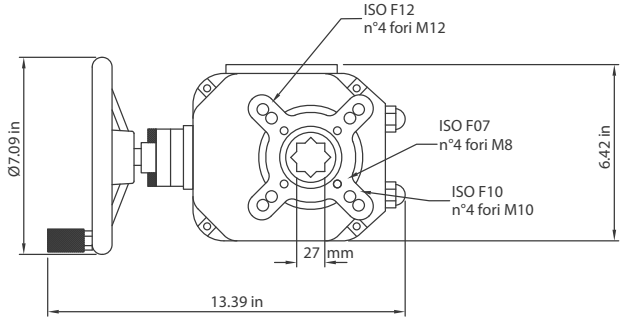






AE03H - AE06H







Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

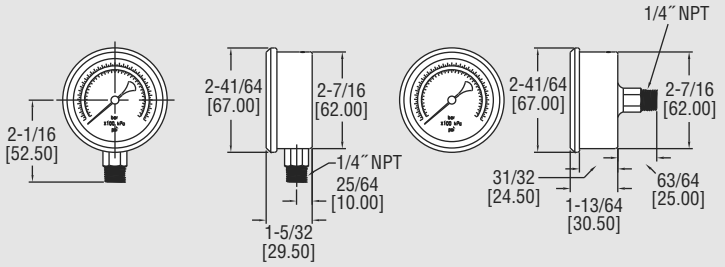
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

English

+GF+

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

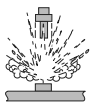
Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

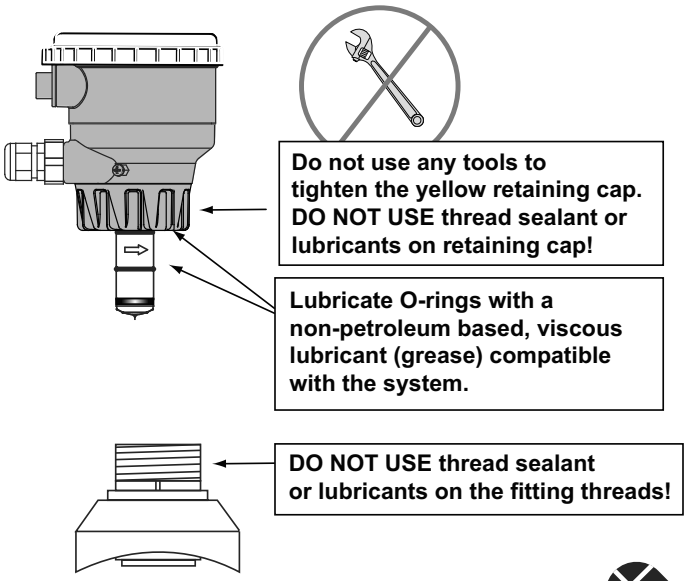
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

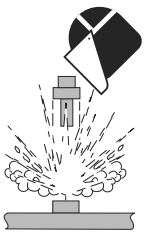
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

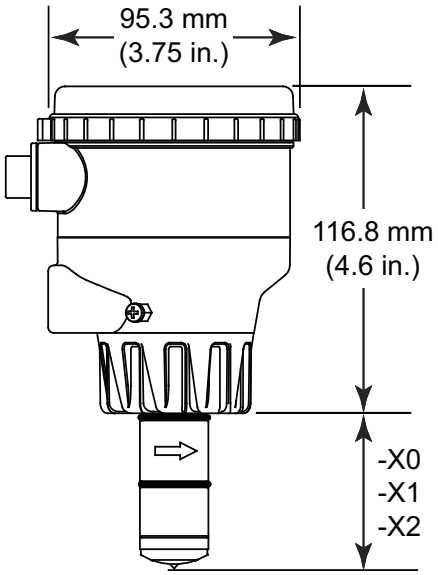


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary.....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance....300 Ω
Loop Accuracy.....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

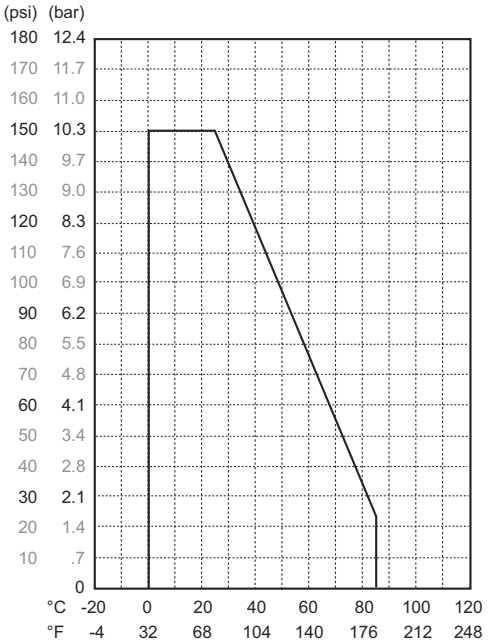
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant

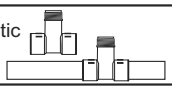
China RoHS (visit gfsignet.com for details)

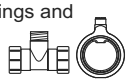
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

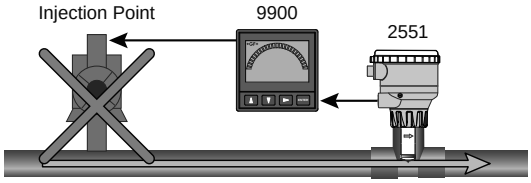
Pipe Fittings

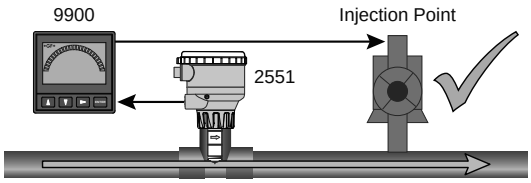
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

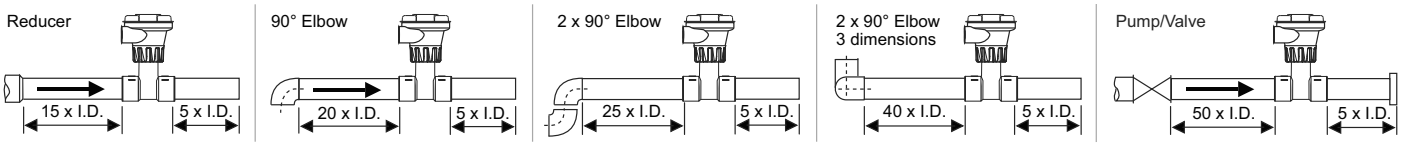
Selecting a Location



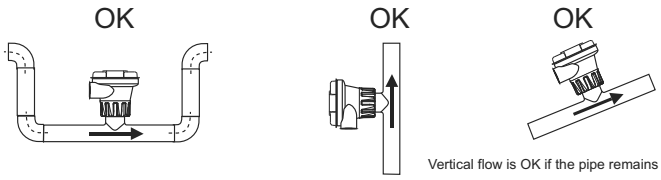


- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

Select a location with sufficient distance of straight pipe immediately upstream of the sensor.

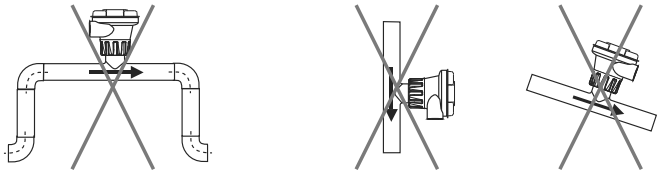


Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.



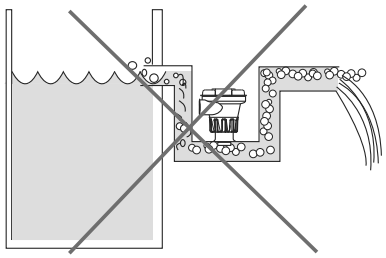
Vertical flow is OK if the pipe remains full at all times.

These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

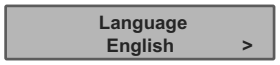
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



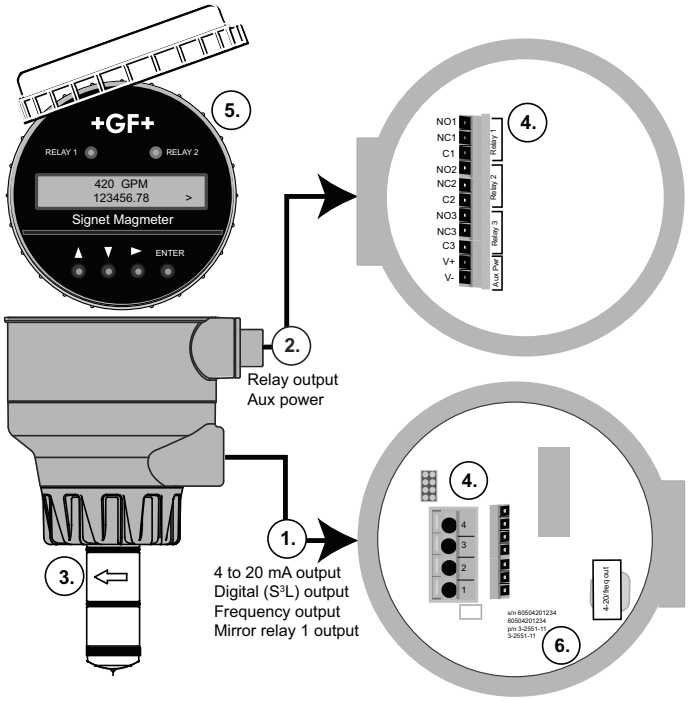
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

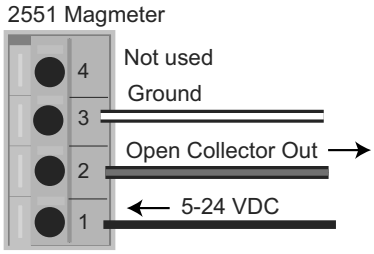


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

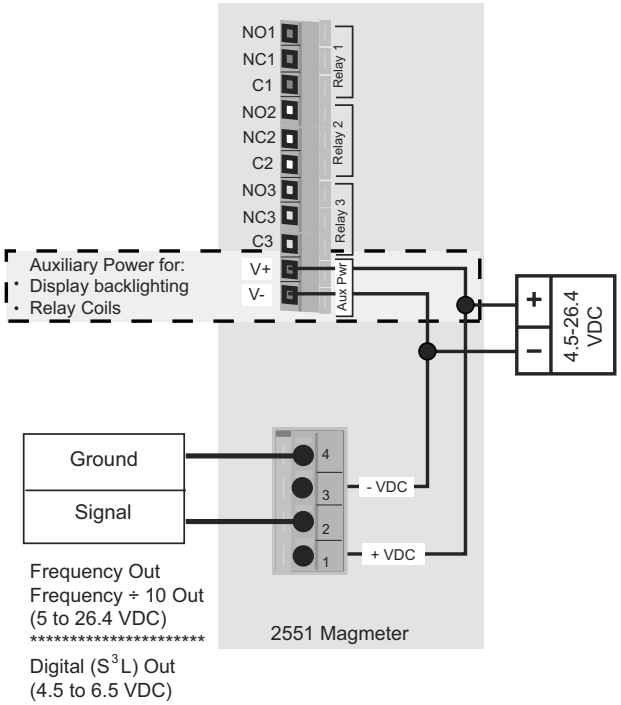
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

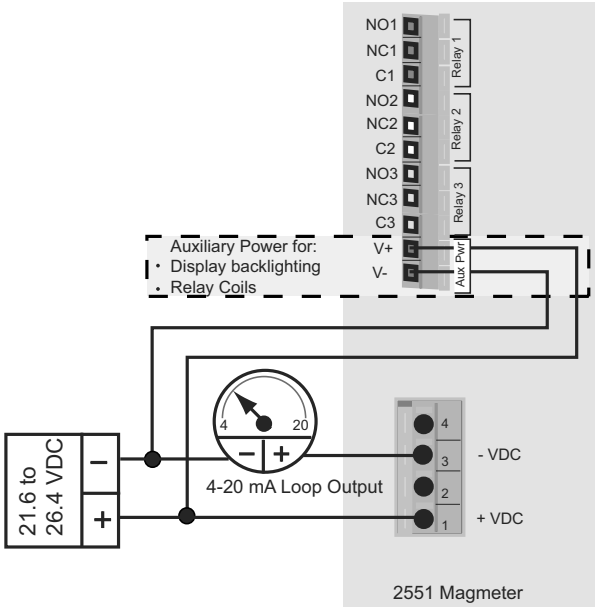
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

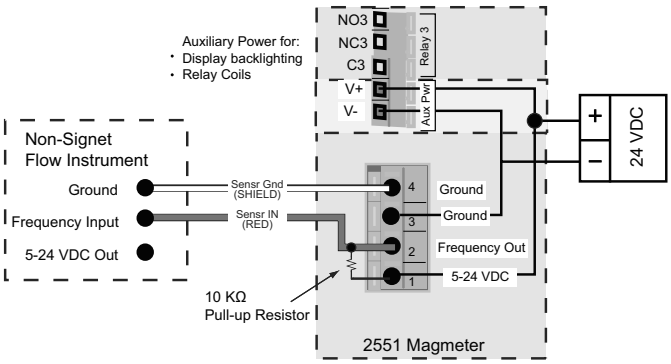
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

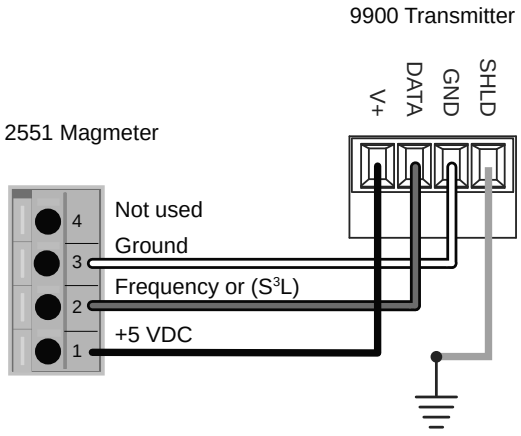


Wiring to Signet Flow Instruments

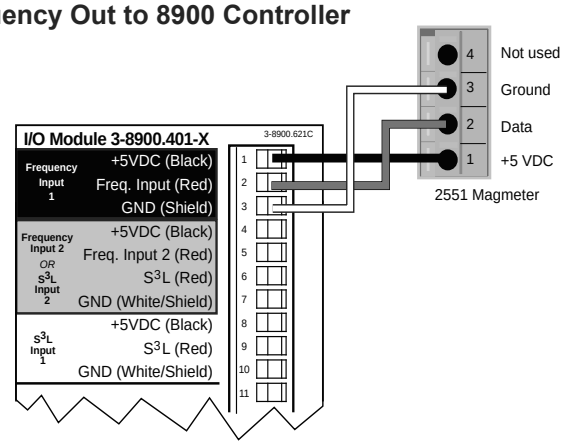
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S^3L) output.

Frequency and Digital (S^3L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

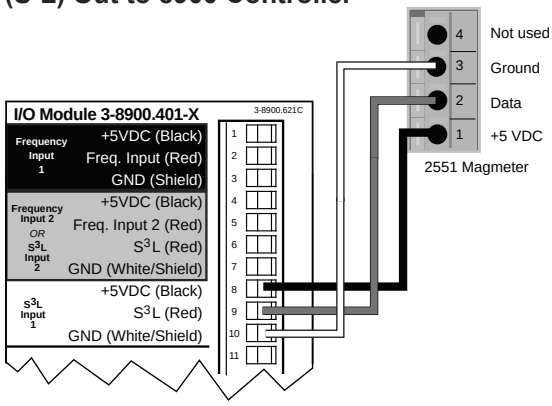
2551 Frequency or Digital (S^3L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S^3L) Out to 8900 Controller



Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

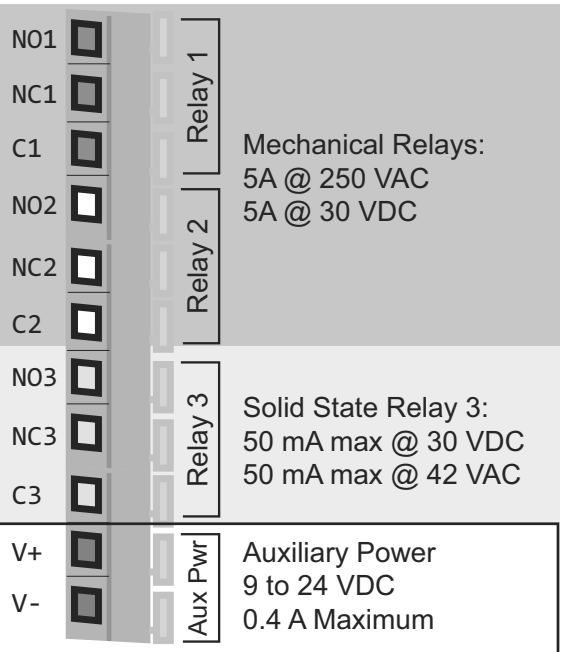
When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.



Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

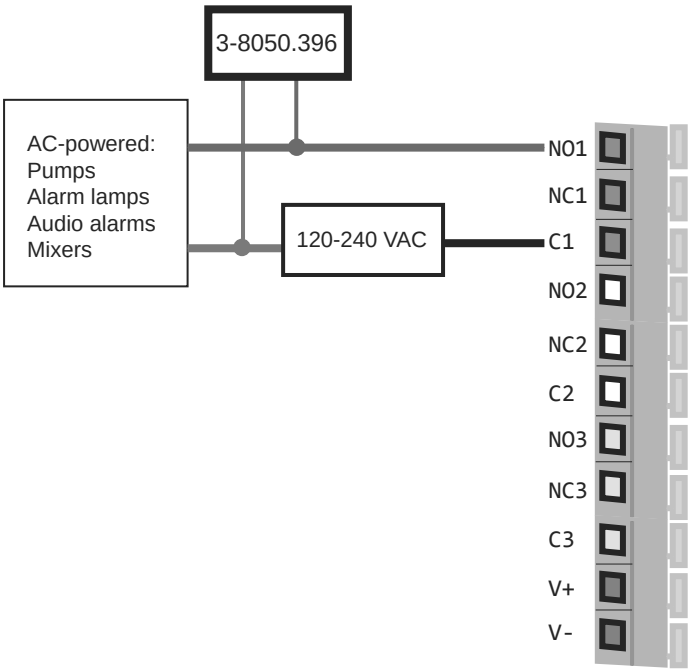
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.



Navigating the Menus



Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

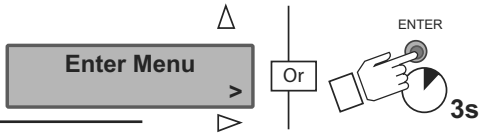
- All menu instructions in this manual assume that the instrument is showing this display.

2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

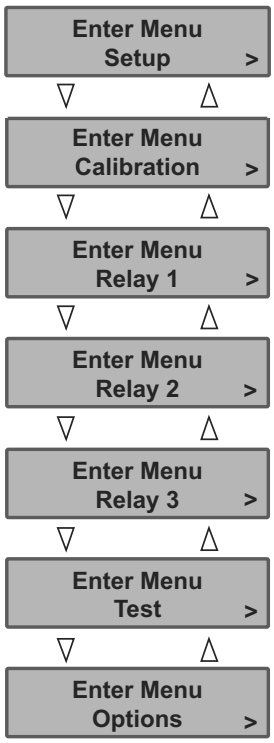
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.



Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



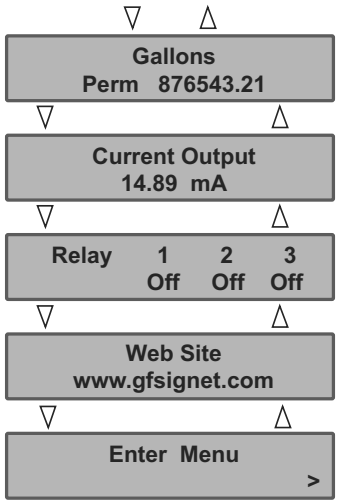
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

Relay States shown for units with a relay board.

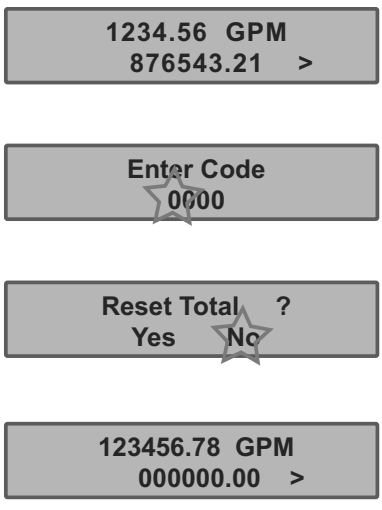
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

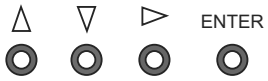


The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..

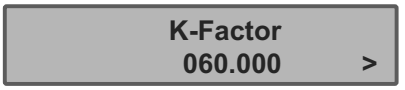


Use the keypad to navigate through each setting.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.



Pipe Size: Select the pipe size that is nearest to the nominal pipe size.



Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot) μ (micro) _ (blank)
- - (dash) / (slash) 3 (for cubic units)

The last character selects the timebase for the flow rate measurement.
Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)



Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

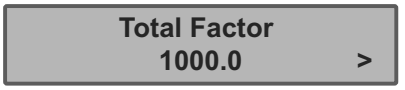


Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.



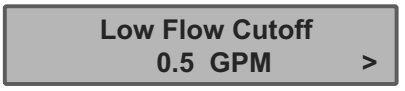
Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)



Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.



Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.



Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.



Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.



Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

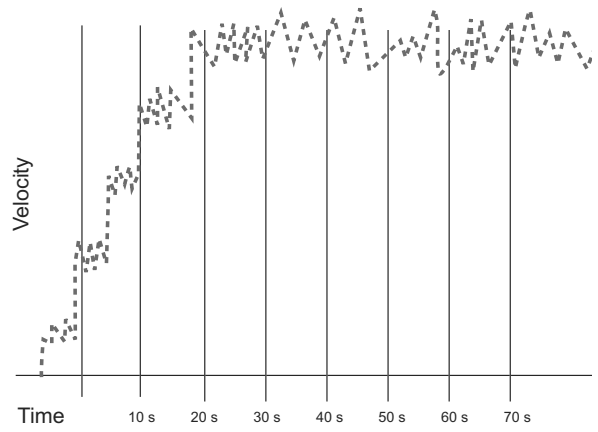
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

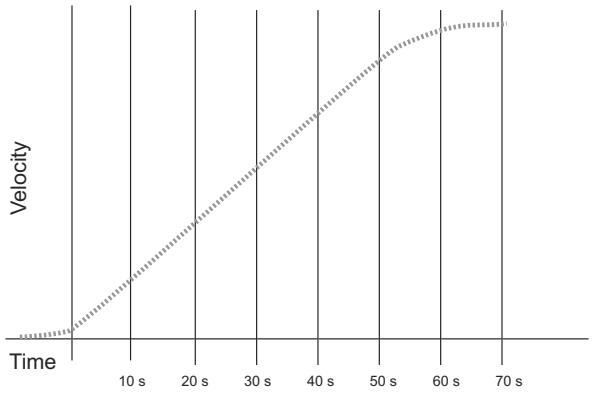
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



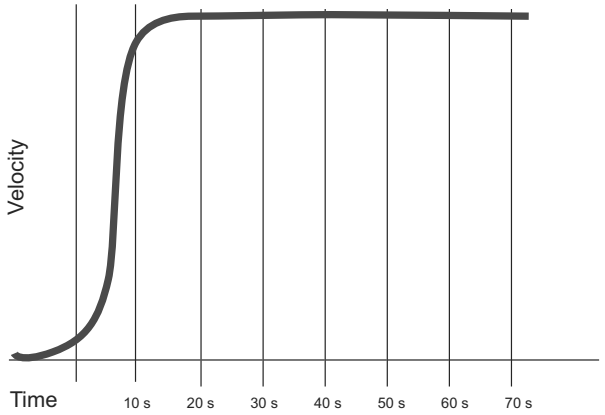
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



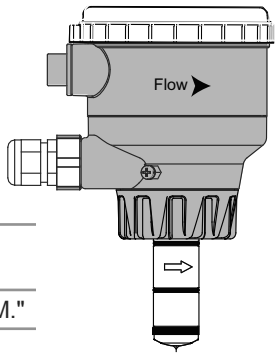
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

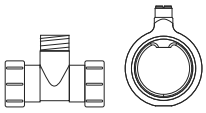
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

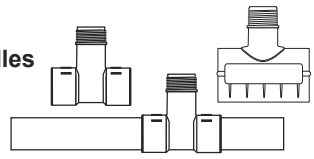
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

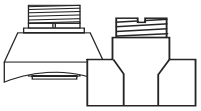
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

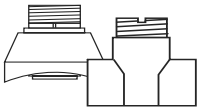
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



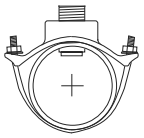
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

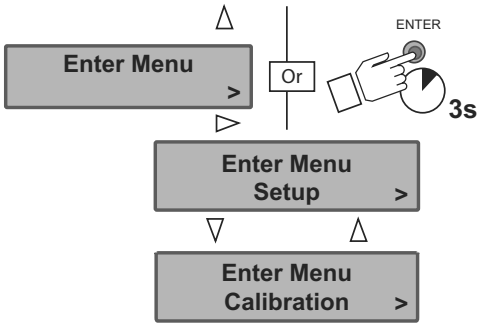
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

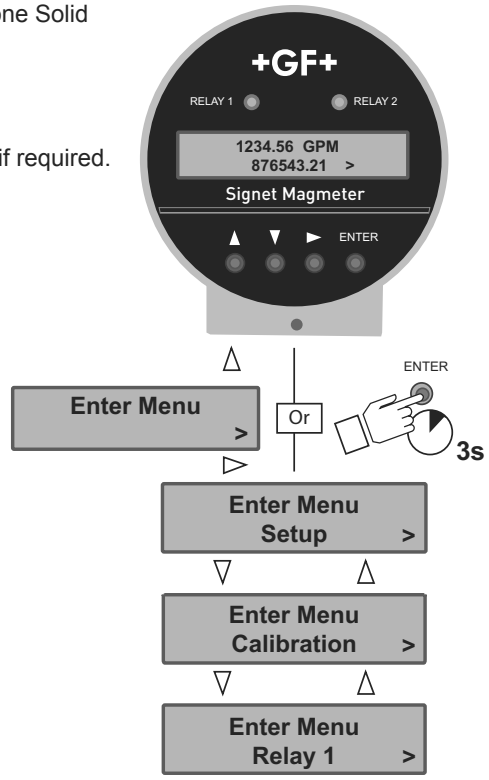
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

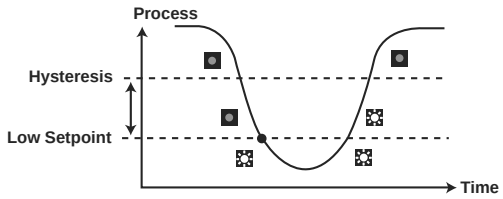
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

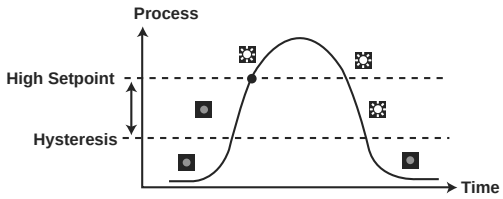
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

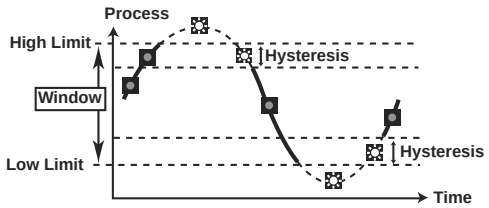
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

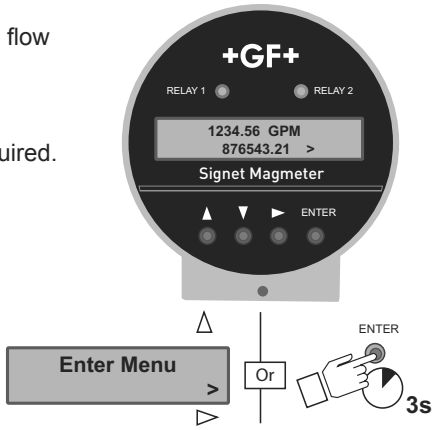


Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated



NOTE: The Security Code must be entered before modifying the relay menu.



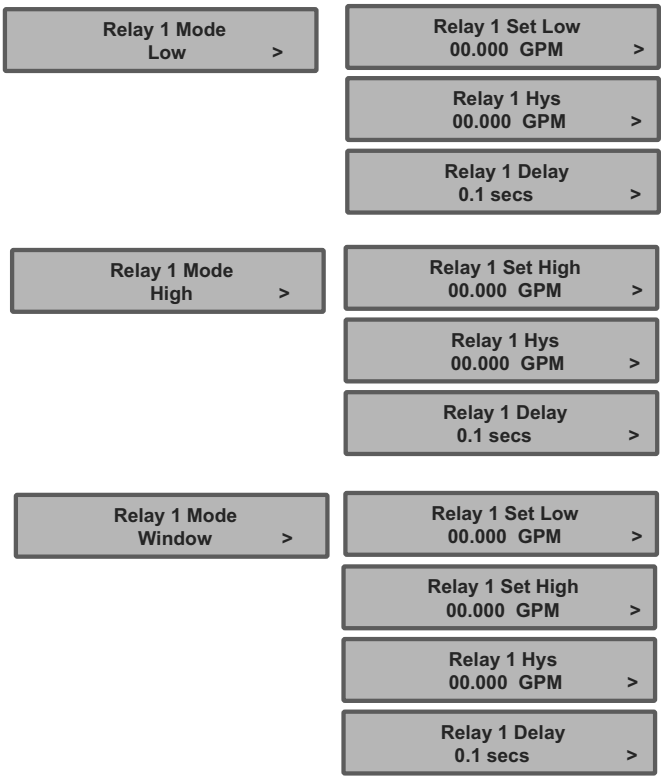
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S^3L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The (**S^3L) Digital** output mode switches the 2551 to the Signet serial data output called (S^3L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

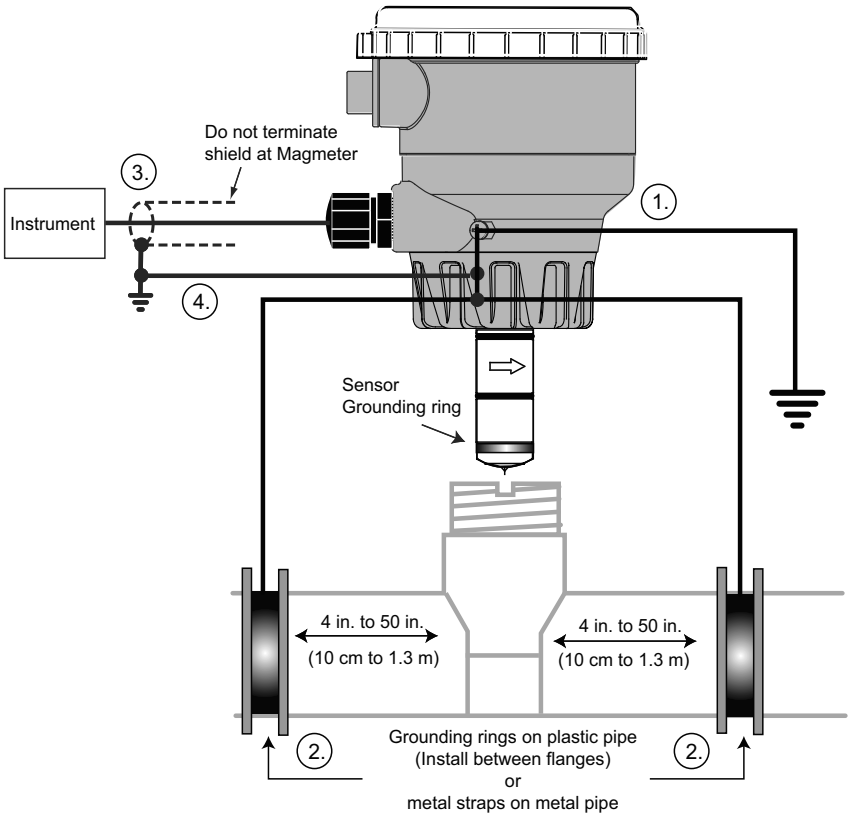
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

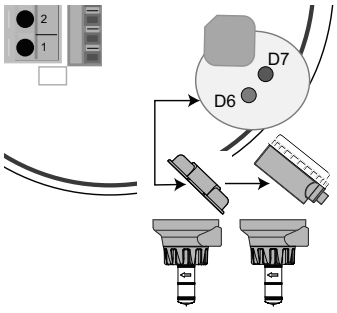
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

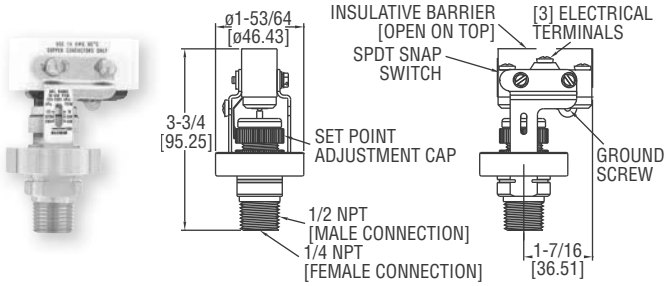
+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

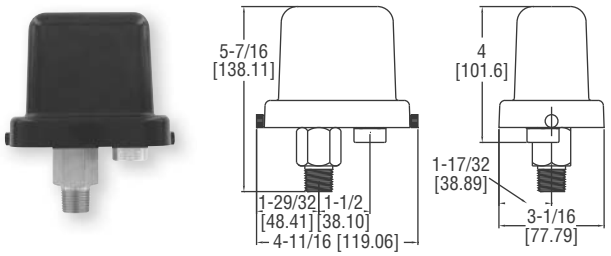
3-2551.090-1 Rev. M 04/15 English
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LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS
- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS
- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
~~A1F-O-SS-1-1~~	~~3 to 15 (0.14 to 1.03)~~	~~3 (0.14)~~	~~3 (0.21)~~
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
~~**A1F-O-SS-1-3**~~	~~8 to 225 (0.55 to 15.5)~~	~~8 (0.55)~~	~~25 (1.7)~~
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

Note: Optional enclosure factory installed. To order, change O to PC.

Example: A1F-PC-SS-1-1

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

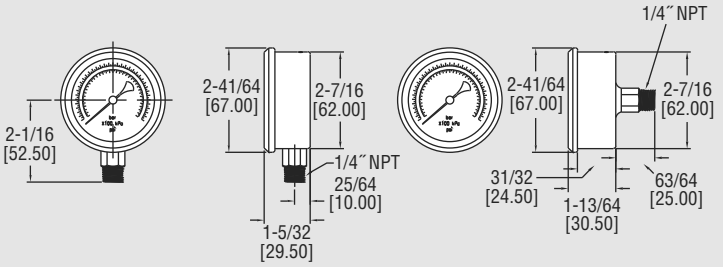
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	**SGZ-D10622N**	0 to 160 psi
SGZ-D10322N	0 to 30 psi	**SGZ-D10722N**	0 to 200 psi
SGZ-D10422N	0 to 60 psi	**SGZ-D11022N**	0 to 300 psi
SGZ-D10522N	0 to 100 psi	**SGZ-D11122N**	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

English

+GF+

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

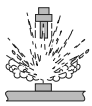
Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

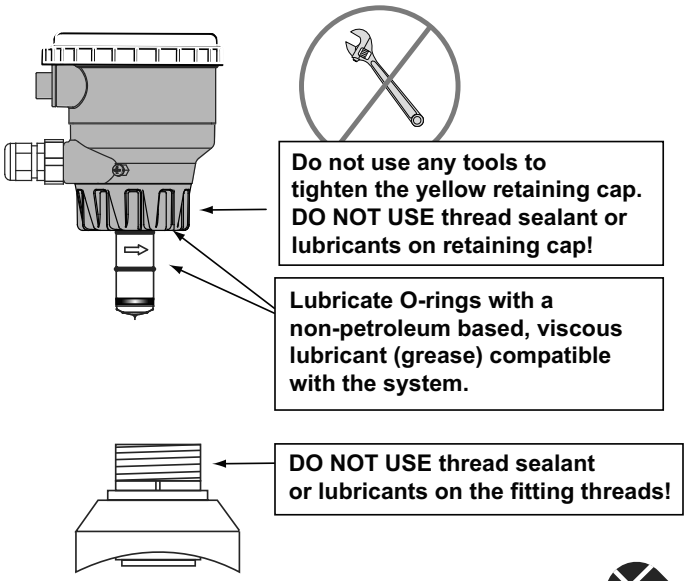
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

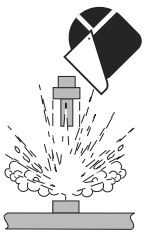
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

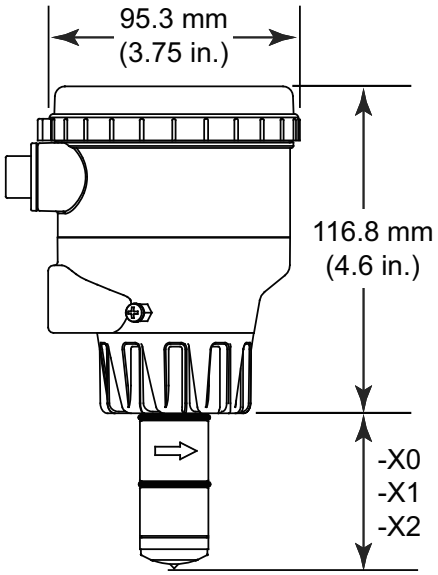


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary.....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance....300 Ω
Loop Accuracy.....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

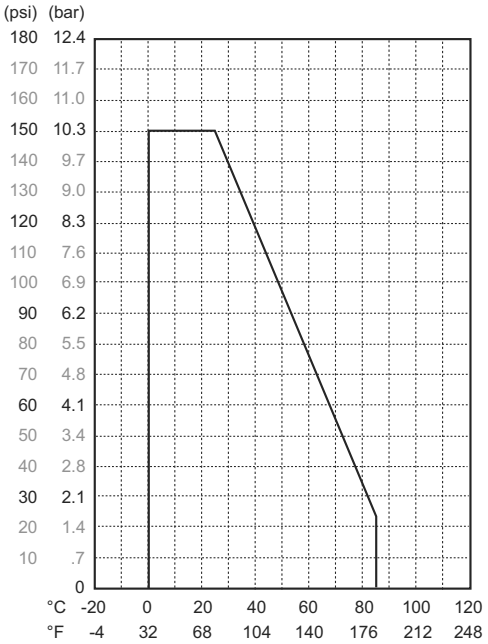
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant

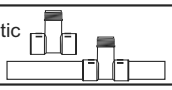
China RoHS (visit gfsignet.com for details)

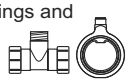
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

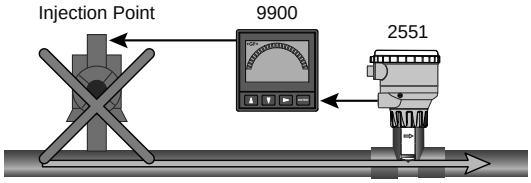
Pipe Fittings

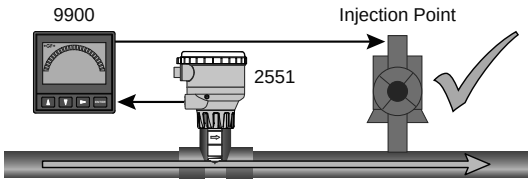
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

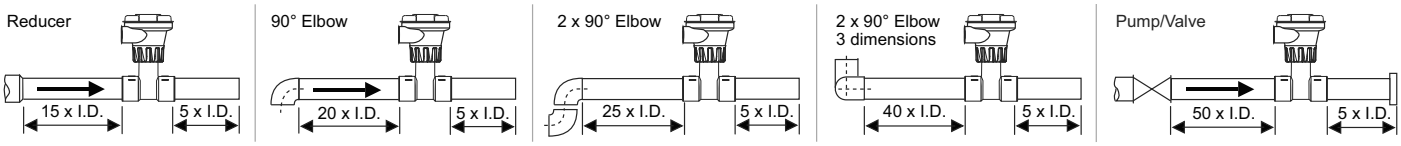
Selecting a Location



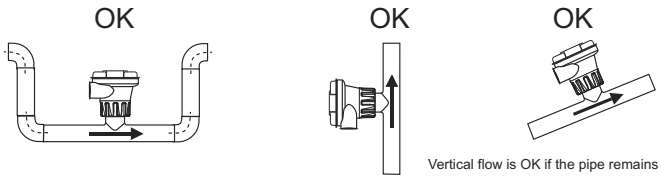


- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

Select a location with sufficient distance of straight pipe immediately upstream of the sensor.

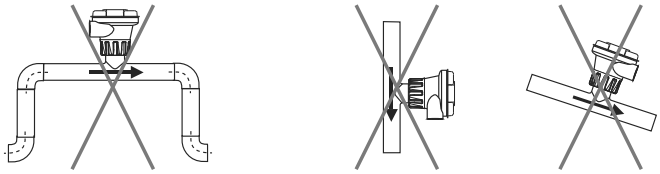


Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.



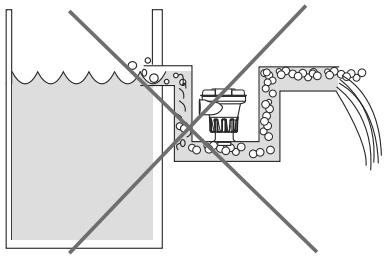
Vertical flow is OK if the pipe remains full at all times.

These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

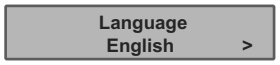
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



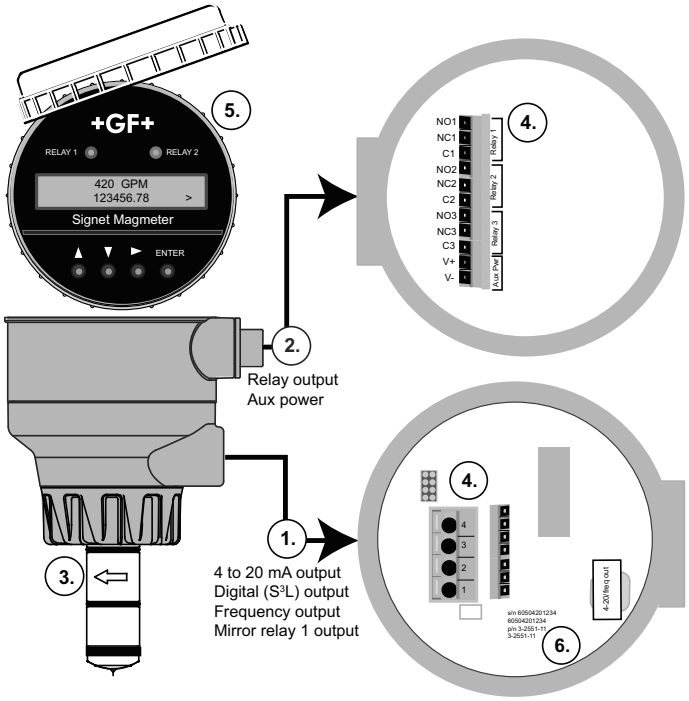
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

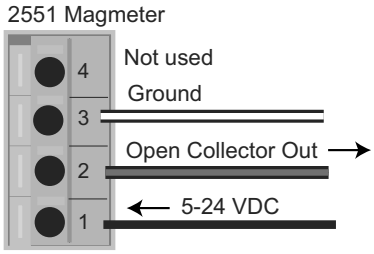


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

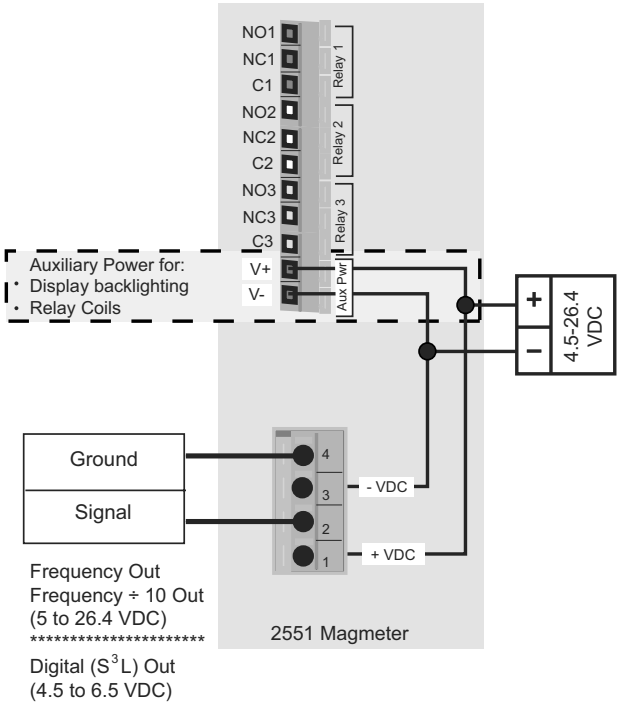
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

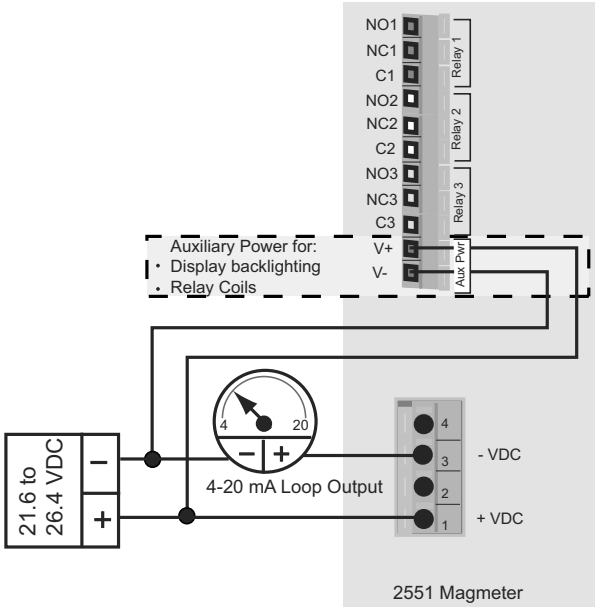
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

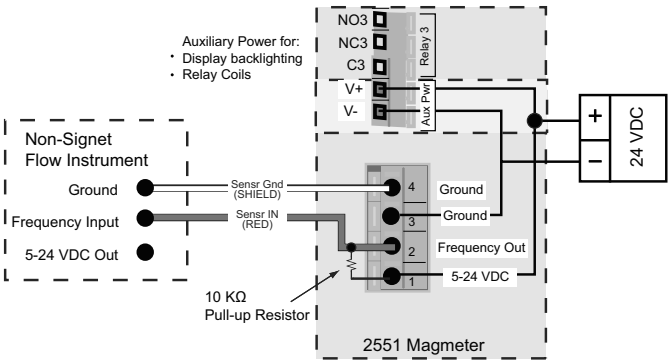
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

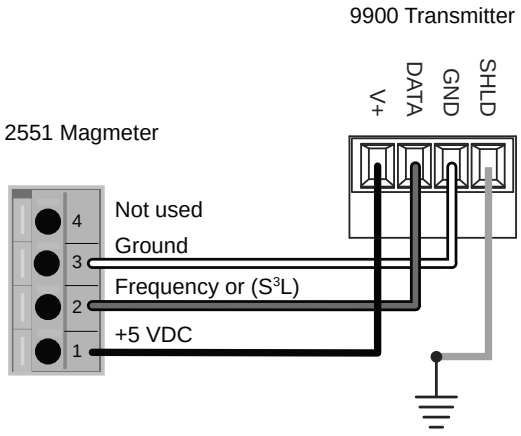


Wiring to Signet Flow Instruments

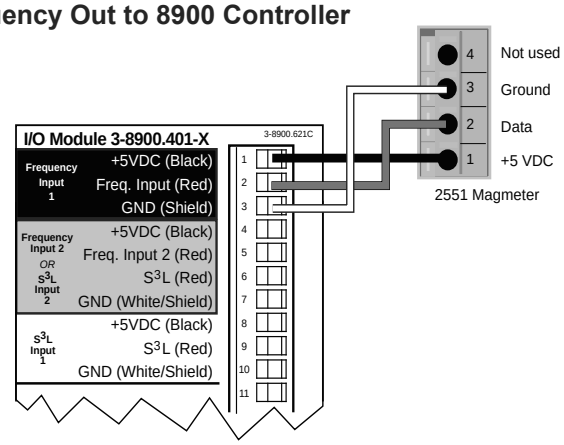
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S^3L) output.

Frequency and Digital (S^3L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

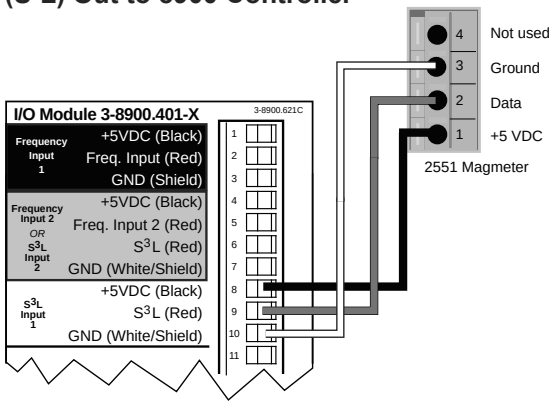
2551 Frequency or Digital (S^3L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S^3L) Out to 8900 Controller



Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

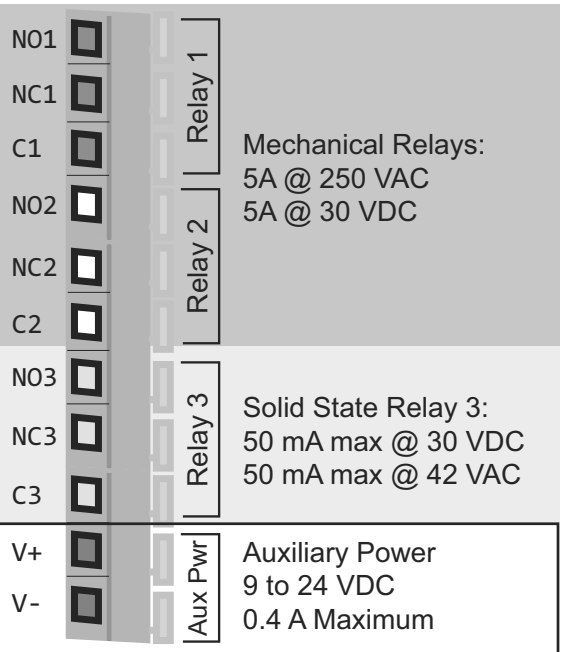
When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.



Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

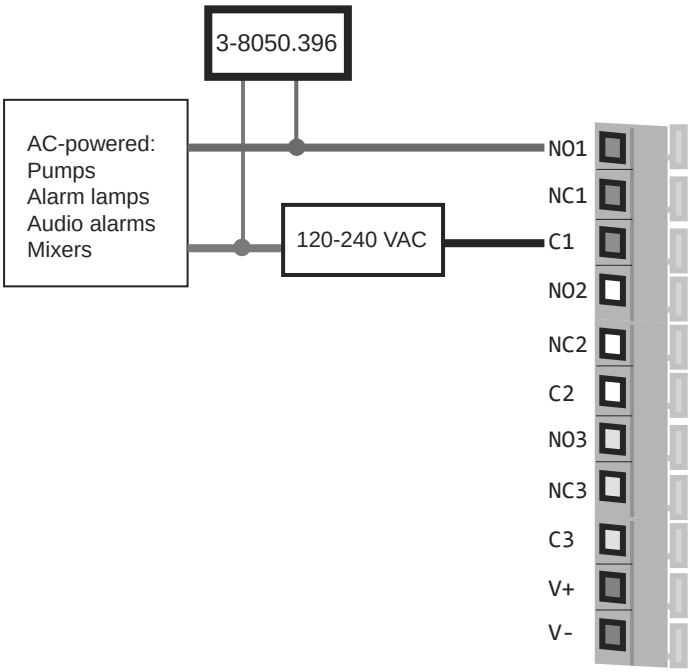
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.



Navigating the Menus



Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

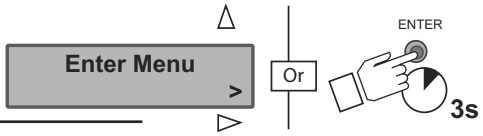
- All menu instructions in this manual assume that the instrument is showing this display.

2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

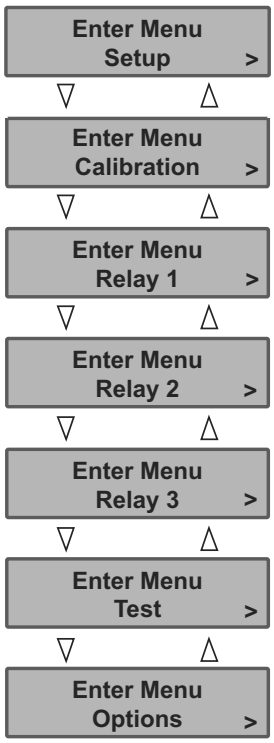
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.



Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



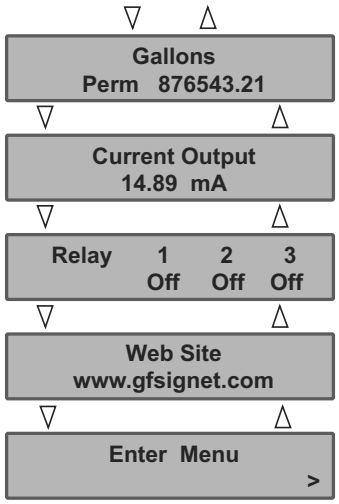
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

Relay States shown for units with a relay board.

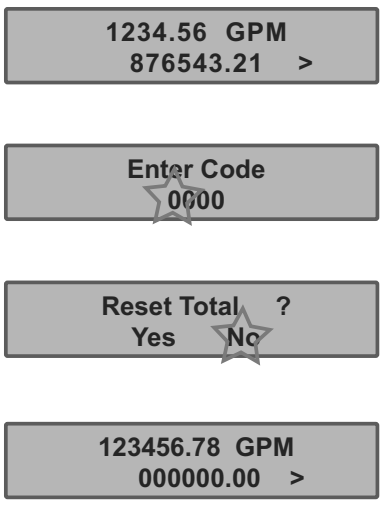
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

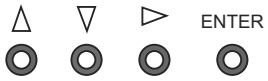


The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..

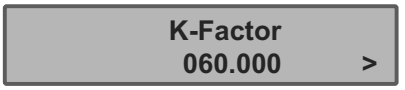


Use the keypad to navigate through each setting.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.



Pipe Size: Select the pipe size that is nearest to the nominal pipe size.



Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot) μ (micro) _ (blank)
- - (dash) / (slash) 3 (for cubic units)

The last character selects the timebase for the flow rate measurement.
Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)



Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

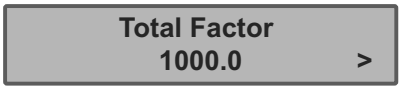


Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.



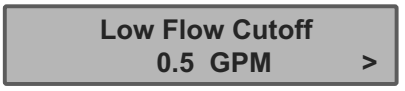
Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)



Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.



Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.



Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.



Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.



Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

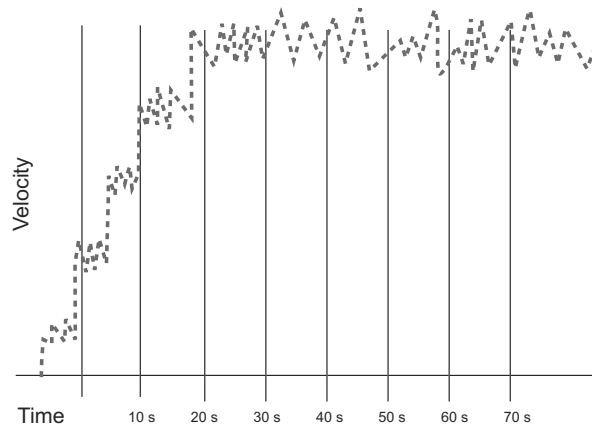
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

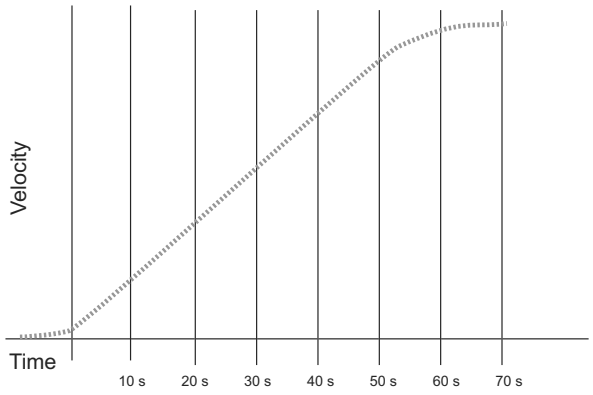
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



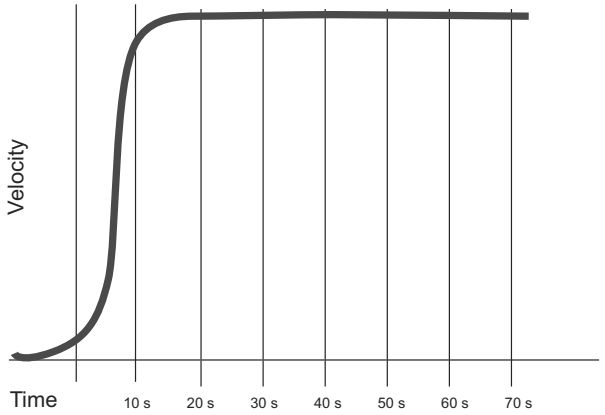
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



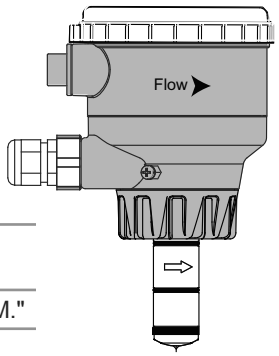
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

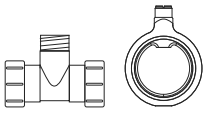
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

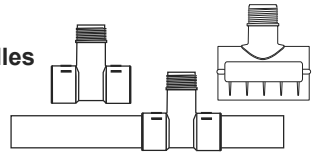
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

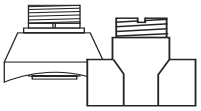
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

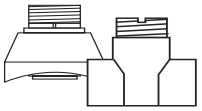
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



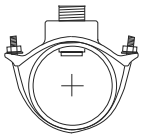
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

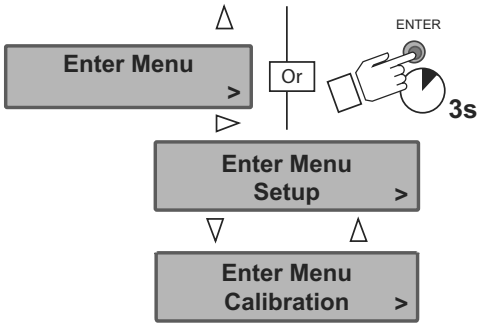
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

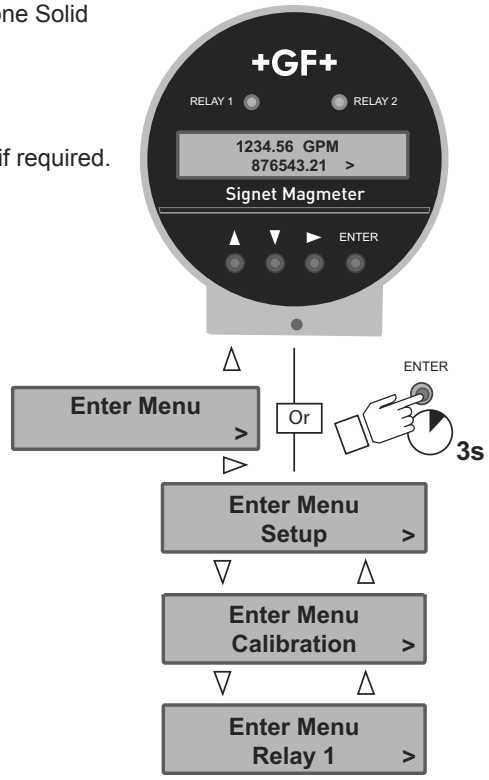
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

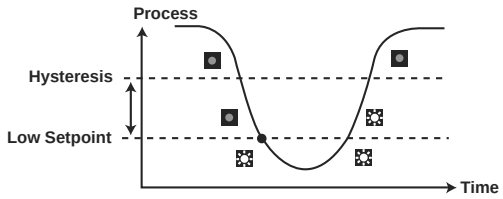
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

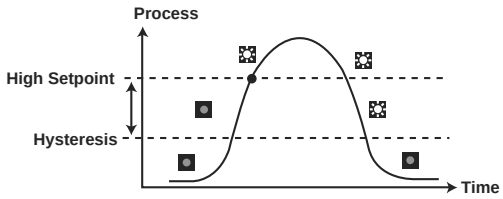
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

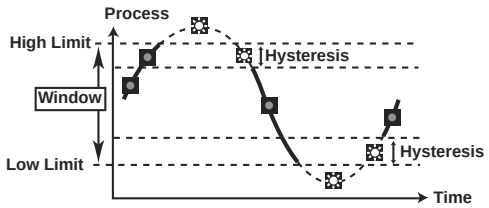
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

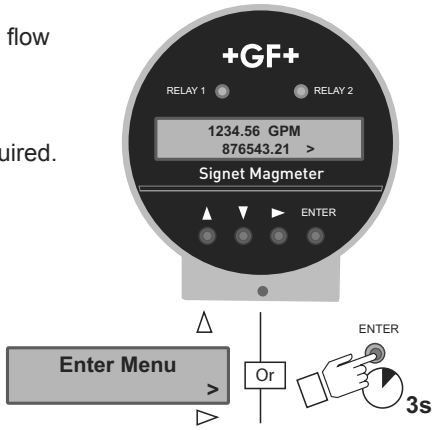


Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated



NOTE: The Security Code must be entered before modifying the relay menu.



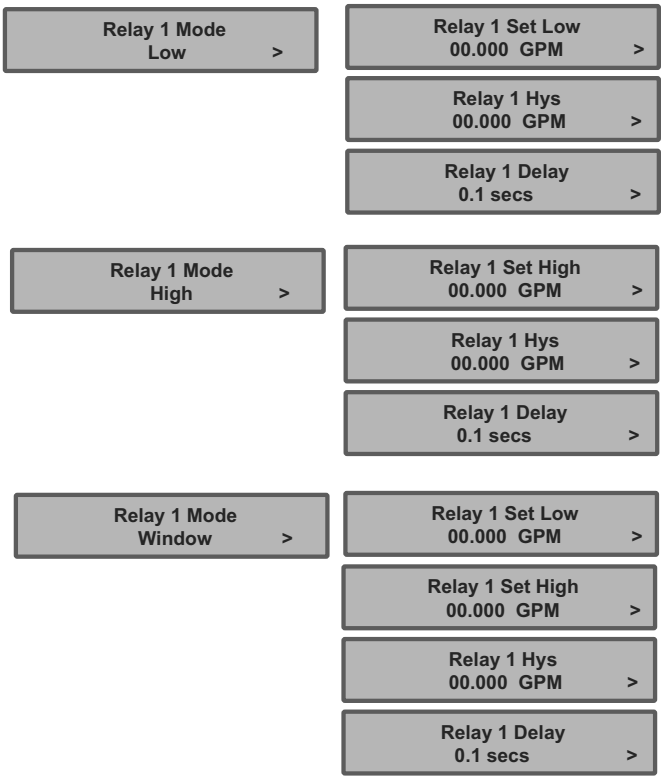
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S^3L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The (**S^3L) Digital** output mode switches the 2551 to the Signet serial data output called (S^3L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

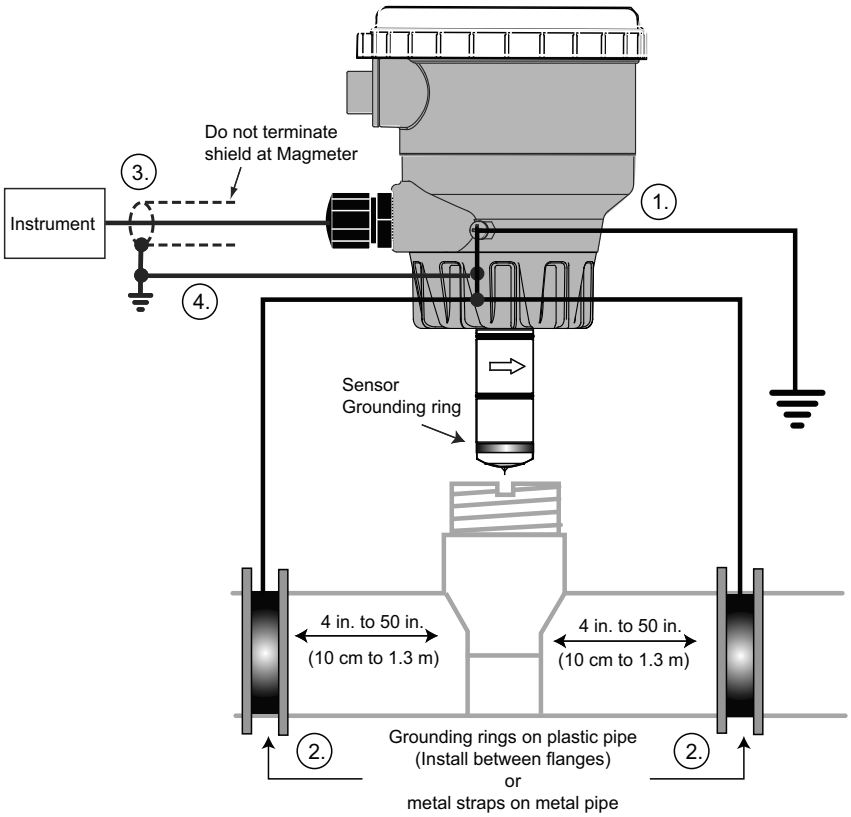
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

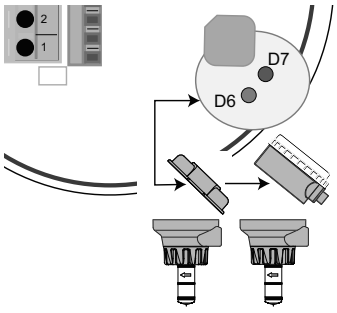
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

3-2551.090-1 Rev. M 04/15 English
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EchoSpan® LU80/81/83/84 Ultrasonic Level Transmitter

Application

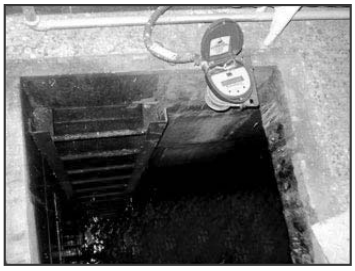


The general purpose ultrasonic level transmitter provides continuous level measurement up to 32.8' (10m) with a 4-20 mA signal output, and is configured via its integral push button display module. This non-contact liquid level sensor is ideally suited for corrosive, ultrapure, sticky or dirty liquids, and is broadly selected for bulk storage, day tank, lift station and process tank level applications.

Features

- Offered in 4 measurement ranges from 9.8' (3m) to 32.8' (10m)
- Configuration is simple via integral push button display module
- LCD display indicates level in inches, centimeters and percentages
- Narrow 2" or 3" beam width for applications with limited measurement space
- Fail-safe intelligence and diagnostic feedback for simple troubleshooting
- PVDF transducer and NEMA 4X polycarbonate enclosure for corrosive liquids
- Automatic temperature compensation for accurate measurement

Success



North American thermoelectric power plants use 225M gallons of water per day in their steam turbines and cooling towers. Most US plants are located in the Coastal and upper Mid West states with easy access to abundant ocean or lake resources. These facilities have lots of sumps that collect and pump transfer water into treatment for reuse or release to the environment. But sumps capture much more than water including grease, oil, chemical and trash, that coats everything in the pit. Here, an EchoSpan ultrasonic level transmitter is installed over the sump man-way. The patented digital signal processing technology features an industry leading 3" beam width that enables installation in close proximity to the ladder and side wall.

Compatible Products

DataLoop™
Level Indicator



DataView™
Level Controller



Commander™
Multi-Tank Level Controller



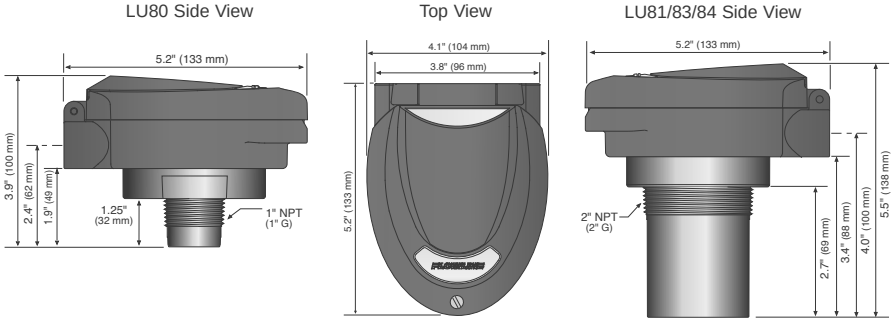
DataPoint™
Level Controller



Specifications

Range:	LU80: 4” to 9.8’ (10cm to 3m) LU81: 8” to 18.0’ (20cm to 5.5m) LU83: 8” to 26.2’ (20cm to 8m) LU84: 12” to 32.8’ (30cm to 10m)
Accuracy:	± 0.2% of range
Resolution:	LU80: 0.019” (0.5mm) LU81/83: 0.039” (1mm) LU84: 0.078” (2mm)
Dead band:	LU80: 4” (10cm) LU81/83: 8” (20cm) LU84: 12” (30cm)
Beam width:	LU80: 2” (5cm) LU81/83/84: 3” (7.6cm)
Configuration:	Push button
Memory:	Non-volatile
Display type:	LCD, 6-digit
Display units:	Inch, cm and percent
Supply voltage:	12-28 VDC
Loop resist.:	500 Ohms @ 24 VDC
Signal output:	4-20 mA, two-wire
Signal invert:	4-20 mA, 20-4 mA
Signal fail-safe:	4mA, 20mA, 21mA, 22mA or hold last
Process temp.:	F: -7° to 140° C: -20° to 60°
Temp. comp.:	Automatic
Ambient temp.:	F: -40° to 160° C: -40° to 71°
Pressure:	MWP = 30 psi (2 bar)
Enclosure rating:	NEMA 4X (IP65)
Encl. material:	Polycarbonate
Encl. hardware:	Brass & stainless
Enclosure vent:	Water tight membrane
Conduit entrance:	Dual, 1/2” NPT
Trans. material:	PVDF
Process mount:	LU80: 1” NPT (1” G) LU81/83/84: 2” NPT (2” G)
Mount gasket:	Viton®
Classification:	General purpose
Compliance:	CE, RoHS

Dimensions



Fittings

For optimum performance, install the level sensor using the below recommended or direct equivalent fittings.



P/N	Description
LM52-1400	2” NPT x 1” NPT (Sch. 40)
LM52-2400	3” NPT x 2” NPT (Sch. 40)
LM52-2800	3” NPT x 2” NPT (Sch. 80)
LM52-3800	4” NPT x 2” NPT (Sch. 80)



LM52-1410	2” Socket x 1” NPT (Sch. 40)
LM52-2410	3” Socket x 2” NPT (Sch. 40)
LM52-3410	4” Socket x 2” NPT (Sch. 40)
LM52-2810	3” Socket x 2” NPT (Sch. 80)
LM52-3810	4” Socket x 2” NPT (Sch. 80)



LM52-2890	2” NPT Bulkhead Fitting, PVC



LM50-1001-1	1” NPT Bracket, Polypropylene
LM50-1001	2” NPT Bracket, Polypropylene

Ordering

LU8[ ]-51[ ]1

Sensor range

0	*3m (9.8’)*
1	*5.5m (18.0')*
3	*8m (26.2')*
4	*10m (32.8')*

Process mount (1)

0	*NPT (US)*
6	*G (Metric)*

Notes

1) Install the level sensor using Flowline installation fittings or equivalents.

MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

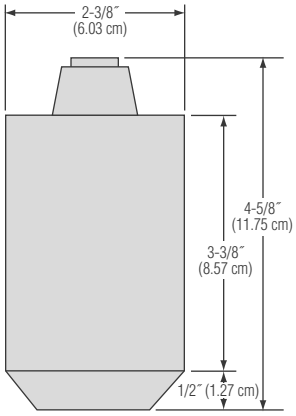


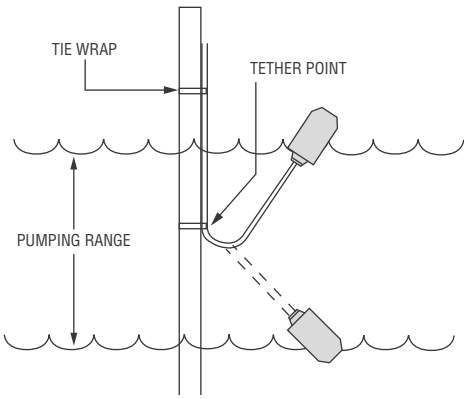
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

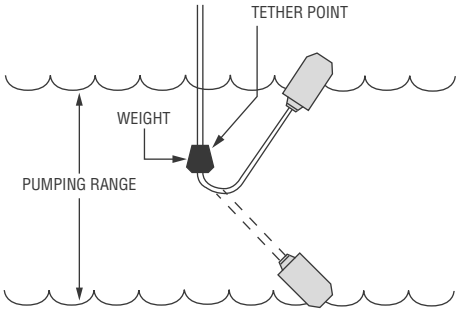
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

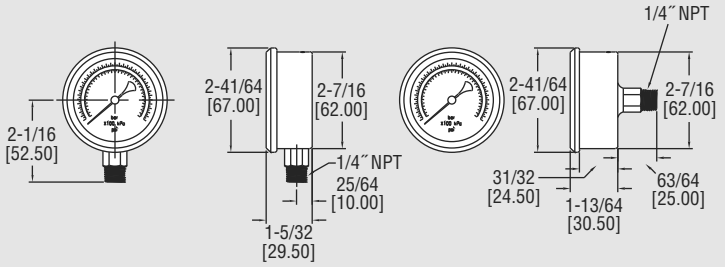
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	**SGZ-D10622N**	0 to 160 psi
SGZ-D10322N	0 to 30 psi	**SGZ-D10722N**	0 to 200 psi
SGZ-D10422N	0 to 60 psi	**SGZ-D11022N**	0 to 300 psi
SGZ-D10522N	0 to 100 psi	**SGZ-D11122N**	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

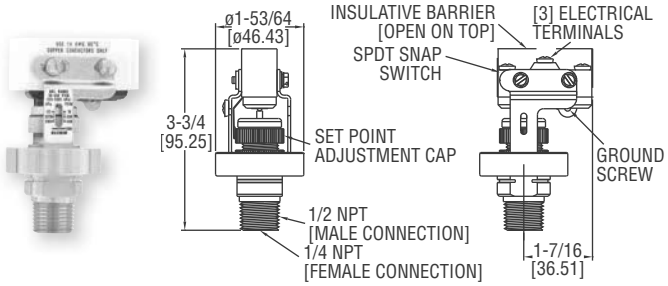
OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

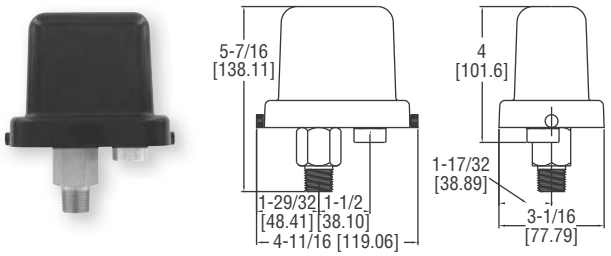
ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS
- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS
- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

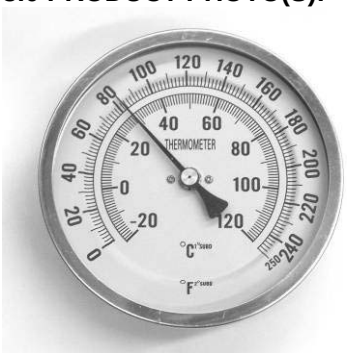
Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
A1F-O-SS-1-1	2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
A1F-O-SS-1-3	8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

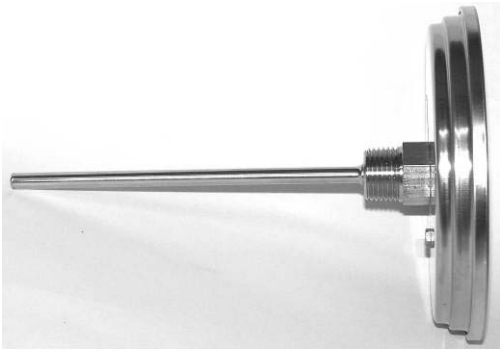
Note: Optional enclosure factory installed. To order, change O to PC.
Example: A1F-PC-SS-1-1

GRAINGER® FOR THE ONES WHO GET IT DONE GRAINGER INTERNATIONAL, INC. GLOBAL SOURCING DIVISION	-- GGS TECHNICAL SPECIFICATION --			
	SPECIFICATION NUMBER: 1NFY4_TSRev1.doc	AUTHOR: Hoskinson	TITLE: ENG	REL. DATE: 5/25/07
	GGS MODEL NUMBER(s): 1NFY4	DESCRIPTION: Industrial thermometer	REVISION #: 1	REV. DATE: 8/10/07

1.0 BRAND:	No brand
2.0 PRODUCT DESCRIPTION:	Bimetal Industrial Thermometer

3.0 PRODUCT PHOTO(S):





4.0 PRODUCT REQUIREMENTS:

4.1 Features & Performance	**Requirement**
Temperature scale(s)	°F: 0 to 250 °C: -20 to 120
Connection location/type	Back; 1/2 inch NPT
Dial size (inches)	3
Stem length (inches)	2 1/2
Stem diameter (inches)	1/4 In
Rotated degrees	N/A
Angled degrees	N/A
Full scale accuracy	≤40°F: ±1.5% 41 to 200°F: ±1% ≥201°F: ±1.5%
Calibration	External Adjustment

4.2 Materials & Construction	**Requirement**
Case	Stainless Steel Hermetically Sealed to Prevent Icing/Fogging Inside
Stem	Stainless Steel
Coil dampening	Silicone for Superior Time Response and Vibration Dampening
Dial face	Glass

4.3 Finish / Color	**Requirement**
All Surface Finishes	a) Surface finishes must be uniform and continuous. The surface finish must not exhibit any visual defects such as blisters, rust, corrosion, scratches, peeling, bubbles, and/or cracking. b) All exposed surfaces must be free of burrs and sharp edges. c) All applied finishes must adhere to the surface and show no signs of delamination or peeling.
Finish	Stainless Steel

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This specification is based on the manufacturers design and is to be used as a Quality Control document.

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Series SGX & SGF

2.5″ Stainless Steel Low Pressure Gages

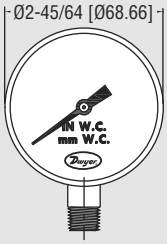
Brass or 316 SS Wetted Parts

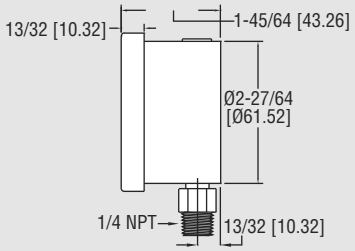


SGX



SGF





The Series SGX/SGF Gages have dual English/metric scales with ±1.6% full-scale accuracy. The Series SGX/SGF gages are designed with 304 SS housing and brass or 316 SS wetted parts. Units can withstand ambient temperatures up to 149°F (65°C) and process temperatures up to 212°F (100°C). Ranges of vacuum, compound and pressures to 235 in w.c. are available. Included on the dial is a convenient zero adjustment screw which allows the user to easily re-zero the needle.

APPLICATIONS

- Pneumatic
- Draft measurement
- Filter monitoring
- Liquid level

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: SGX: Brass; SGF: 316/316L SS.
Housing: 304 SS.
Lens: Glass.
Accuracy: ±1.6% full-scale on positive pressure ranges 15 in w.c. and greater; ±2.5% full scale on all other ranges.
Pressure Limit: Full-scale value.

Temperature Limits:
Ambient: -13 to 149°F (-25 to 65°C);
Process: 212°F max. (100°C max.).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 4.6 oz (0.13 kg).

Brass Gages		316SS Gages	
Model	**Range**	**Model**	**Range**
SGX-D7122N	-10-0 in w.c. (-250-0 mm)	**SGF-D7122N**	-10-0 in w.c. (-250-0 mm)
SGX-D7322N	-25-0 in w.c. (-600-0 mm)	**SGF-D7322N**	-25-0 in w.c. (-600-0 mm)
SGX-D7522N	-60-0 in w.c. (-1600-0 mm)	**SGF-D7522N**	-60-0 in w.c. (-1600-0 mm)
SGX-D7722N	-100-0 in w.c. (-2500-0 mm)	**SGF-D7722N**	-100-0 in w.c. (-2500-0 mm)
SGX-D8022N	0-10 in w.c. (0-250 mm)	**SGF-D8022N**	0-10 in w.c. (0-250 mm)
SGX-D8122N	0-15 in w.c. (0-400 mm)	**SGF-D8122N**	0-15 in w.c. (0-400 mm)
SGX-D8222N	0-25 in w.c. (0-600 mm)	**SGF-D8222N**	0-25 in w.c. (0-600 mm)
SGX-D8322N	0-40 in w.c. (0-1000 mm)	**SGF-D8322N**	0-40 in w.c. (0-1000 mm)
SGX-D8422N	0-60 in w.c. (0-1600 mm)	**SGF-D8422N**	0-60 in w.c. (0-1600 mm)
SGX-D8722N	0-160 in w.c. (0-4000 mm)	**SGF-D8622N**	0-100 in w.c. (0-2500 mm)
SGX-D8922N	-4-0-6 in w.c. (-100-0-150 mm)	**SGF-D8722N**	0-160 in w.c. (0-4000 mm)
SGX-D9122N	-8-0-16 in w.c. (-200-0-400 mm)		
SGX-D9722N	-80-0-160 in w.c. (-2000-0-4000 mm)		

OPTION

For NIST traceable calibration certificate, use order code NISTCAL-PG1.

FPI SENSORS INTERNATIONAL

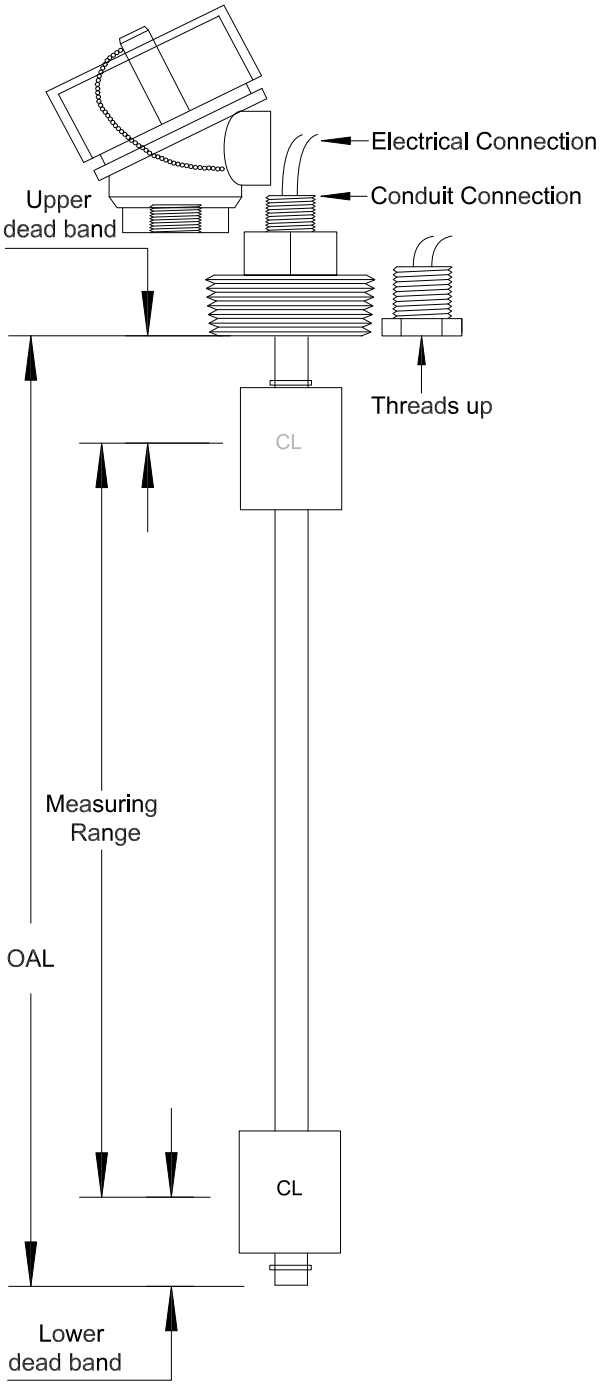
A HIGHER LEVEL OF SATISFACTION

Continuous Level (4-20ma) Configurator – Build to Order

We excel in LOW COST » HIGH QUALITY » 72 HOUR MFG TIME

FPI SENSORS INTERNATIONAL — WE SHIP IN 72 HOURS — CUSTOM ORDERS

MANY OTHER VARIATIONS AND OPTIONS ARE AVAILABLE



HOUSING:
❑ Nema 4X & Explosion Proof ☑ Watertight ❑ NA

ELECTRICAL CONNECTION:
❑ Wire ☑ Cable ❑ Connector (specify) _____

WIRING: Red Wire = Signal
Black Wire = Negative voltage
(Loop powered 10-30 VDC)

CONDUIT CONNECTION:
☑ ½" NPT ❑ Other _____ ❑ NA

FITTING AND STEM MATERIAL:
❑ SS ❑ Brass

FITTING SIZE (NPT):
❑ ¼" ❑ ½" ❑ ¾" ❑ 1" ❑ 1¼" ❑ 1½" ☑ 2"
❑ Flange _____ ❑ Other _____

THREAD ORIENTATION:
☑ Threads down *(threads from outside of the tank)*
❑ Threads up *(threads from inside of the tank)*

LEAD LENGTH: _____"

FLOAT MATERIAL:
☑ SS ❑ Buna

MEASURING RANGE: _____"
(4" – 96", 1-inch increments only)

UPPER DEAD BAND: _____" (1" minimum)

LOWER DEAD BAND: _____" (1" minimum)

OPERATIONAL INDEPENDENT ALARM SWITCH(S):

ALARM:	OPERATION:	SPECIFIC GRAVITY:
#1 _____"	❑ N.O. ❑ N.C.	☑ .60sg ❑ .93sg
#2 _____"	❑ N.O. ❑ N.C.	☑ .60sg ❑ .93sg

If alarm point is outside of the measuring range, dead band dimensions will be affected. If alarm point is inside the measuring range, contact factory for details.

OPTIONS:
☑ Centering Disk
❑ Thermocouple _____
❑ Temp Switch ❑ N.O. or ❑ N.C.
❑ Field Adjustable Length
❑ Thermistor _____
_____ °F set point

RESOLUTION: ¼" increments

ACCURACY: +/-2% of measuring range

MAXIMUM OPERATING PRESSURE: 200 PSI

OPERATING TEMPERATURE RANGE: -20°F – 250°F

1.800.852.9984

www.FPIsensors.com

info@FPIsensors.com

Fax 651.681.1888

MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

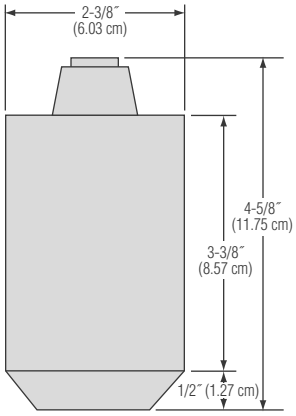


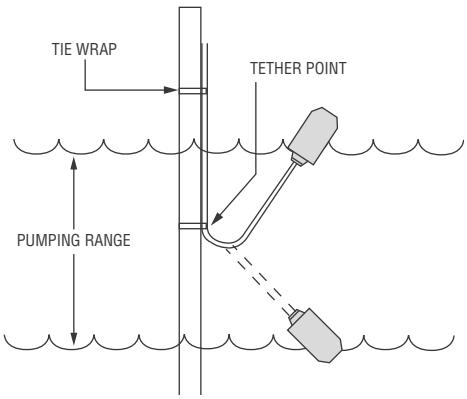
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

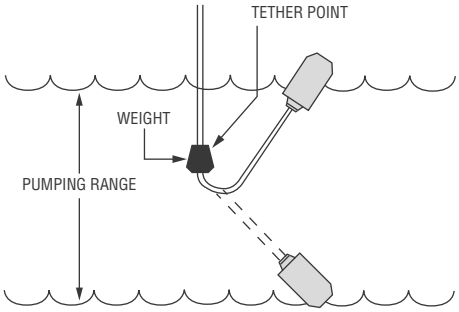
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

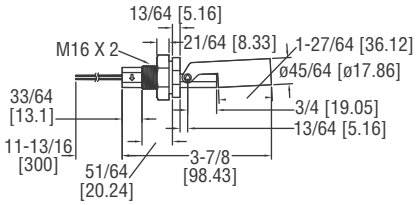
LEVEL SWITCHES - HORIZONTAL/SPECIALTY

Low Cost, Hermetically Sealed Contacts

HORIZONTAL

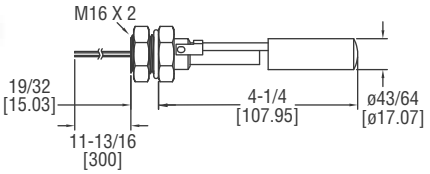


F6-HPS-11



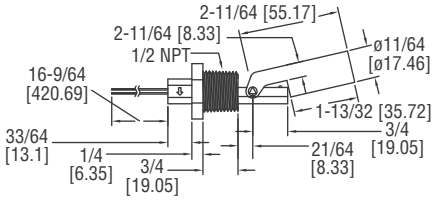


F6-MHS



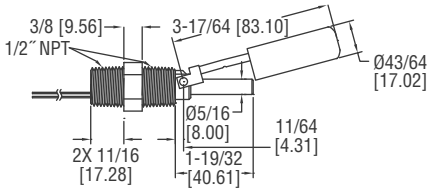


F6-HPS-21



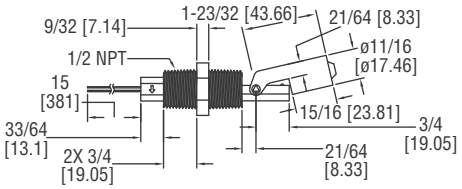


F6-MHS2



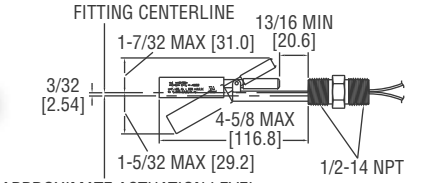


F6-HPS-31

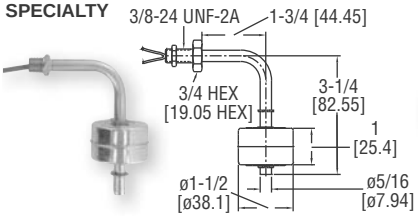




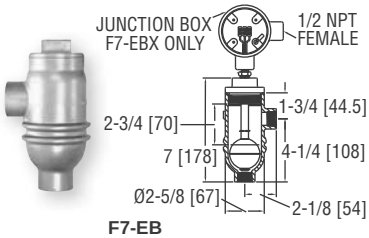
F6-HSS



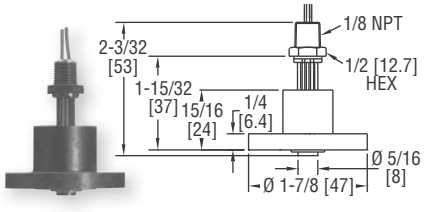
SPECIALTY



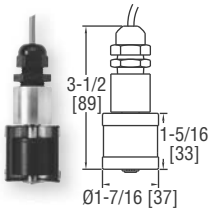
F7-SS6



F7-EB



F7-LL



F7-WBB

The **SERIES F6 & F7** Horizontal and Specialty Float Switches are designed to mount through the walls of tanks or other vessels and unique applications to provide point level indication.

FEATURES/BENEFITS
- Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float arm and can be easily adapted to open or close a circuit on rising or falling levels

APPLICATIONS
- Water level monitoring
- Oil level control
- Chemical level indication
- Sumps
- Stand pipes
- Tank level control

MODEL CHART

Model	Applications	Material Float/Stem	Temperature Limits	Pressure Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg	Weight oz (g)
F6-HPS-11	Water, oils, chemicals	Polypropylene/ polypropylene	176°F (80°C)	116 psig (8 bar)	0.60	20 VA: 0.08 A @ 240 VAC	20 AWG, 11.8˝ (30 cm)	M16 x 2	1.23 (38)
F6-HPS-21	Water, oils, chemicals	Polypropylene/ polypropylene	176°F (80°C)	116 psig (8 bar)	0.60	20 VA: 0.08 A @ 240 VAC	20 AWG, 11.8˝ (30 cm)	1/2˝ NPT	1.23 (38)
F6-HPS-31	Water, oils, chemicals	Polypropylene/ polypropylene	176°F (80°C)	116 psig (8 bar)	0.60	20 VA: 0.08 A @ 240 VAC	20 AWG, 11.8˝ (30 cm)	1/2˝ NPT	1.41 (40)
F6-MHS	Corrosives	304 SS/304 SS	257°F (125°C)	218 psig (15 bar)	0.85	20 VA: 0.08 A @ 240 VAC	22 AWG, 11.8˝ (30 cm)	M16 x 2	3.35 (95)
F6-MHS2	Water, oils, chemicals	304 SS/304 SS	257°F (125°C)	363 psig (25 bar)	0.85	70 VA: 0.7 A @ 250 VAC	22 AWG, 11.8˝ (30 cm)	1/2˝ NPT	4.8 (136)
F7-HSS†	High temp/pressure, corrosive, expl.	316 SS/316 SS	392°F (200°C)	300 psig (20.7 bar)	0.60	30 VA: 0.14 A @ 220 VAC	22 AWG, 24˝ (61 cm)	1/2˝ NPT (int/ext)	3 (94)

Model	Style/Applications	Material Float/Stem	Temperature Limits	Pressure Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg	Weight oz (g)
F7-SS6	Bent stem/liquids with metal particles	316 SS/316 SS	300°F (149°C)	100 psig (7 bar)	0.70	20 VA: 0.08 A @ 220 VAC N.O. operation	22 AWG, 24˝ (61 cm)	3/8˝-24˝ UNF-2A	2 (58)
F7-SS6B	Bent stem/liquids with metal particles	316 SS/316 SS	300°F (149°C)	100 psig (7 bar)	0.70	20 VA: 0.08 A @ 220 VAC N.C. operation	22 AWG, 24˝ (61 cm)	3/8˝-24˝ UNF-2A	2 (58)
F7-EB‡**	Non-intrusive bottle type/ Outside tank mounting	Brass/316 SS (Brass housing)	300°F (149°C)	500 psig (34 bar)	0.75	20 VA: 0.08 A @ 240 VAC	18 AWG, 24˝ (61 cm)	3/4˝ NPT female	5 lb 5 oz (2.4 kg)
F7-LL	Vertical/detect levels as low as 5/8˝	Polysulfone/ Buna-N	180°F (82°C)	50 psig (3 bar)	–	20 VA: 0.08 A @ 240 VAC	22 AWG, 72˝ (182 cm)	1/8˝ NPT male	2 (58)
F7-WBB	25´ cable, slosh shield/ Sumps, stand pipes	Brass/Buna-N	180°F (82°C)	150 psig (10 bar)	0.45	20 VA: 0.08 A @ 240 VAC	22 AWG, 25´ (7.6 m)	–	10.8 (310)

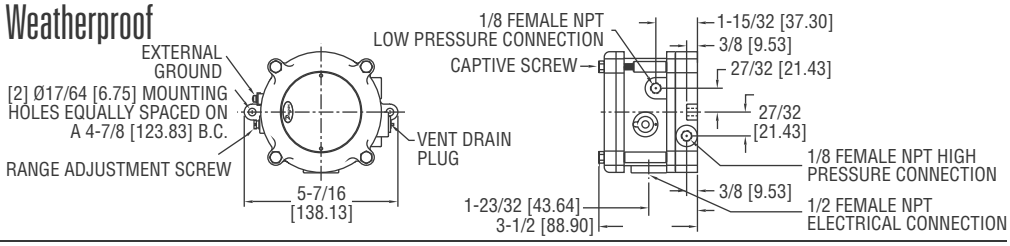
† F7-HSS is rated explosion-proof for Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III.
‡ Explosion proof model available with DPDT switch. **Example:** F7-EBX
** Model available with normally closed switch. **Example:** F7-EBNC

Dwyer

EXPLOSION-PROOF DIFFERENTIAL PRESSURE SWITCH

Compact, Low Cost, Explosion-proof and Weatherproof





SERIES 1950 Explosion-proof Differential Pressure Switch combines the best features of the popular Dwyer® Series 1900 Pressure Switch with an integral explosion-proof and weatherproof housing, making it an exceptional value for either application. It is CE, UL and CSA listed, FM approved for use in Class I, Div 1, Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres NEMA 7 & 9. Rain tight NEMA 3 (IP54), weatherproof features include a drain plug and O-ring seal in cover. Electrical connections are easily made by removing front cover. For convenience the set point adjustment screw is located on the outside of the housing. Twelve models offer set points from .03 to 20 in w.c. (0.0075 to 5 kPa) and from .5 to 60 psi (0.035 to 3.5 bar). The unit is very light and compact - about half the weight and bulk of other explosion-proof or weatherproof switches with separate enclosures.
CAUTION: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

FEATURES/BENEFITS
- Explosion-proof and weatherproof housing provides device protection for outdoor use or harsh environment operation
- External set point screw provides easy access that simplifies making adjustments without opening or disassembling enclosure
- Easily accessible electrical connection simplifies the installation

APPLICATIONS
• HVAC applications • Process applications • All-weather applications

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits: Continuous: 1950's - 45 in w.c. (0.11 bar); 1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar). Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: NEMA 3 (IP54), NEMA 7 & 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, CSA, FM, UL.

MODEL CHART

Model	Range, psid	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model*	Range*	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model	Range, in w.c.	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point
1950P-2-2F	0.5 to 2	0.3	0.3	**1950P-50-2F**	15 to 50	1.0	1.5	**1950-1-2F**	.4 to 1.6	.15	.20
1950P-8-2F	1.5 to 8	1.0	1.0	**1950-02-2S**	.03 to .10	.025	.05	**1950-5-2F**	1.4 to 5.5	.30	.40
1950P-15-2F	3 to 15	0.9	0.9	**1950-00-2F**	.07 to .15	.04	.05	**1950-10-2F**	3 to 11	.40	.50
1950P-25-2F	4 to 25	0.7	0.7	**1950-0-2F**	.15 to .50	.10	.15	**1950-20-2F**	4 to 20	.40	.60

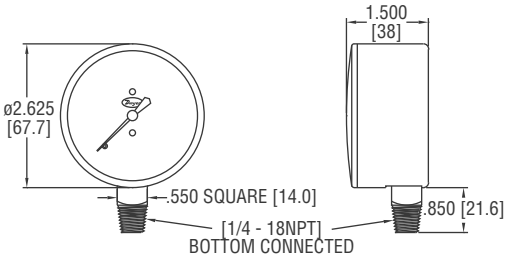
*P=PSID range models. Other ranges in w.c.

Caution: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

2.5″ LOW PRESSURE GAGE

1.5% Full-Scale Accuracy in a 2.5″ Gage





Our **SERIES LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

FEATURES/BENEFITS
- Low pressure gage provides a selection to meet specific applications
- Specified with high ambient and process temperature ratings mean more robust uses and longer service-life
- High accuracy gage for applications requiring more precise measurement is a concern

APPLICATIONS
- Air flow indication
- Liquid level
- Draft measurement

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% FS.
Pressure Limit: 100% of range scale.
Temperature Limits: Process: -40 to 160°F (-40 to 70°C); Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

OPTION	
Use order code:	**Description**
NISTCAL-PG1	NIST traceable calibration certificate

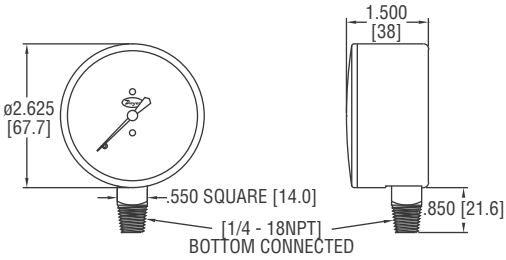
MODEL CHART

Model	Range	Model	Range
LPG4-D7122N	-10 to 0 in w.c. (-2.5 to 0 kPa)	**LPG4-D8322N**	0 to 40 in w.c. (0 to 10 kPa)
LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	**LPG4-D8422N**	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	**LPG4-D8522N**	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	**LPG4-D8622N**	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	**LPG4-D8722N**	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	**LPG4-D8922N**	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	**LPG4-D9022N**	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	**LPG4-D9122N**	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	**LPG4-D9222N**	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	**LPG4-D9322N**	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	**LPG4-D9422N**	-30 to 0 to 50 in w.c. (-7.5 to 0 to 12.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	**LPG4-D9522N**	-40 to 0 to 60 in w.c. (-10 to 0 to 15.0 kPa)

2.5″ LOW PRESSURE GAGE

1.5% Full-Scale Accuracy in a 2.5″ Gage





Our **SERIES LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

FEATURES/BENEFITS
- Low pressure gage provides a selection to meet specific applications
- Specified with high ambient and process temperature ratings mean more robust uses and longer service-life
- High accuracy gage for applications requiring more precise measurement is a concern

APPLICATIONS
- Air flow indication
- Liquid level
- Draft measurement

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% FS.
Pressure Limit: 100% of range scale.
Temperature Limits: Process: -40 to 160°F (-40 to 70°C); Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

OPTION	
Use order code:	**Description**
NISTCAL-PG1	NIST traceable calibration certificate

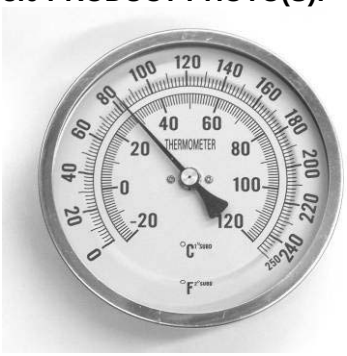
MODEL CHART

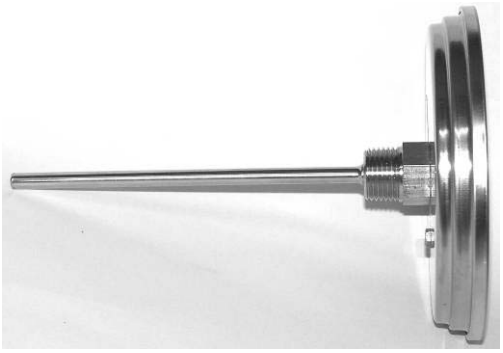
Model	Range	Model	Range
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LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	**LPG4-D8422N**	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	**LPG4-D8522N**	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	**LPG4-D8622N**	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	**LPG4-D8722N**	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	**LPG4-D8922N**	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	**LPG4-D9022N**	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	**LPG4-D9122N**	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	**LPG4-D9222N**	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	**LPG4-D9322N**	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	**LPG4-D9422N**	-30 to 0 to 50 in w.c. (-7.5 to 0 to 12.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	**LPG4-D9522N**	-40 to 0 to 60 in w.c. (-10 to 0 to 15.0 kPa)

GRAINGER® FOR THE ONES WHO GET IT DONE GRAINGER INTERNATIONAL, INC. GLOBAL SOURCING DIVISION	-- GGS TECHNICAL SPECIFICATION --			
	SPECIFICATION NUMBER: 1NFY4_TSRev1.doc	AUTHOR: Hoskinson	TITLE: ENG	REL. DATE: 5/25/07
	GGS MODEL NUMBER(s): 1NFY4	DESCRIPTION: Industrial thermometer	REVISION #: 1	REV. DATE: 8/10/07

1.0 BRAND:	No brand
2.0 PRODUCT DESCRIPTION:	Bimetal Industrial Thermometer

3.0 PRODUCT PHOTO(S):





4.0 PRODUCT REQUIREMENTS:

4.1 Features & Performance	**Requirement**
Temperature scale(s)	°F: 0 to 250 °C: -20 to 120
Connection location/type	Back; 1/2 inch NPT
Dial size (inches)	3
Stem length (inches)	2 1/2
Stem diameter (inches)	1/4 In
Rotated degrees	N/A
Angled degrees	N/A
Full scale accuracy	≤40°F: ±1.5% 41 to 200°F: ±1% ≥201°F: ±1.5%
Calibration	External Adjustment

4.2 Materials & Construction	**Requirement**
Case	Stainless Steel Hermetically Sealed to Prevent Icing/Fogging Inside
Stem	Stainless Steel
Coil dampening	Silicone for Superior Time Response and Vibration Dampening
Dial face	Glass

4.3 Finish / Color	**Requirement**
All Surface Finishes	a) Surface finishes must be uniform and continuous. The surface finish must not exhibit any visual defects such as blisters, rust, corrosion, scratches, peeling, bubbles, and/or cracking. b) All exposed surfaces must be free of burrs and sharp edges. c) All applied finishes must adhere to the surface and show no signs of delamination or peeling.
Finish	Stainless Steel

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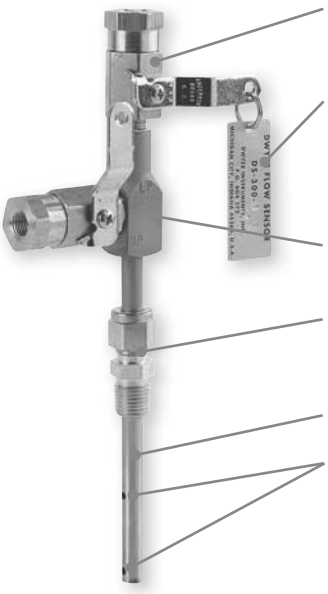
This specification is based on the manufacturers design and is to be used as a Quality Control document.

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Dwyer

IN-LINE FLOW SENSORS

Use with the Dwyer® Differential Pressure Gages or Transmitters



Valves — Standard, brass with TFE seat and Buna-N O-ring

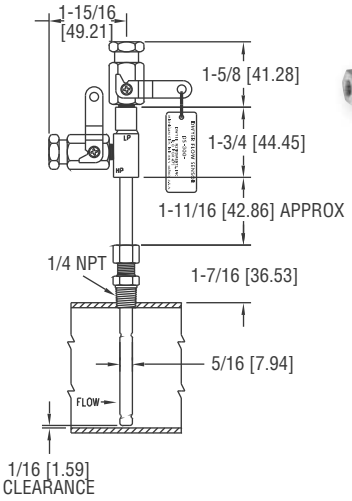
Nameplate — Stainless steel permanently attached with split ring. Includes complete size and model information.

Head — Machined stainless steel.

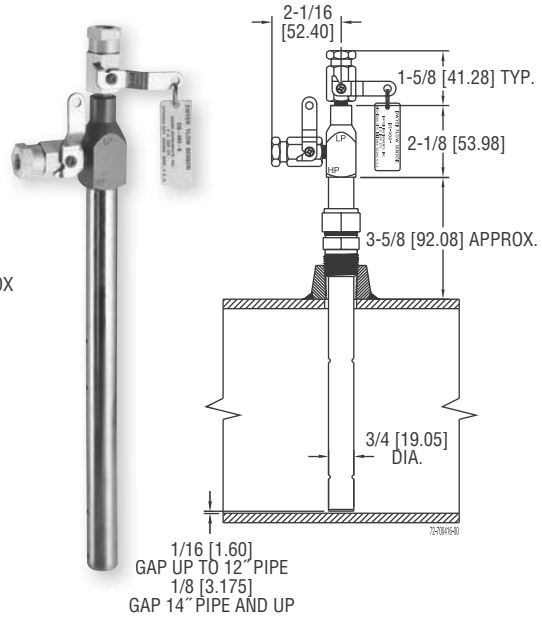
Packing gland — Brass compression fitting.

Sensor tube — 304 SS.

Sensing ports — Multiple upstream and downstream ports sized and positioned to provide effective accurate pressure averaging, even at lower velocities.



Series DS-300



Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches

Series DS-400

The **SERIES DS** In-Line Flow Sensors are two Series of averaging Pitot tubes for compatible gases and liquids that provide accurate and convenient flow rate sensing, for schedule 40 pipe, when purchased with suitable differential pressure gage with appropriate range.

The Series DS-300 Averaging Flow Sensors are designed to be inserted in the pipeline through a compression fitting and available for pipe sizes from 1 to 10″ (2.5 to 25.4 cm). Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® Gage Kit.

The Series DS-400 Averaging Flow Sensors are designed for insertion lengths up to 24″ (61 cm) and include a pair of 1/8″ NPT x 1/4″ SAE 45° flared adapters which are compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. The supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a threaded branch connection (not included).

FEATURES/BENEFITS

- Multiple sensing point measurement and built-in averaging capability eliminates the need for “traversing” the flowing stream with single point velocity pressure measurement saving time
- Extremely reliable, proven technology, Pitot tubes, have been used in flow measurement for years
- All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing with 1/8″ female NPT valve assembly process connections.
- Furnished with instrument shut-off valves on both pressure connections with 1/8″ female NPT connections rated at 200 psig (13.7 bar) and 200°F (93.3°C)
- Where valves are not required, they can be omitted at reduced cost
- The Series DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water
- Economical flow indication when used with appropriate differential pressure gage
- Rugged construction yields, non-clogging, stable design

APPLICATIONS

- Remediation
- Natural, flare, flue, stack gas
- Boiler feedwater
- Cooling water
- Superheated, saturated, or geothermal steam
- Combustion or compressed air
- Oil flow monitoring

IN-LINE FLOW SENSORS

Use with the Dwyer® Differential Pressure Gages or Transmitters

HOW TO ORDER

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2″ pipe would be a Model No. DS-300-2″.

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

MODEL CHART

Model	Description	Model	Description
DS-300-1″	1″ pipe size	**DS-400-6″**	6″ pipe size
DS-300-1-1/4″	1-1/4″ pipe size	**DS-400-8″**	8″ pipe size
DS-300-1-1/2″	1-1/2″ pipe size	**DS-400-10″**	10″ pipe size
DS-300-2″	2″ pipe size	**DS-400-12″**	12″ pipe size
DS-300-2-1/2″	2-1/2″ pipe size	**DS-400-14″**	14″ pipe size
DS-300-3″	3″ pipe size	**DS-400-16″**	16″ pipe size
DS-300-4″	4″ pipe size	**DS-400-18″**	18″ pipe size
DS-300-6″	6″ pipe size	**DS-400-20″**	20″ pipe size
DS-300-8	8″ pipe size	**DS-400-24″**	24″ pipe size
DS-300-10″	10″ pipe size		

OPTION

To order add suffix:	Description
-LV	DS-300 or DS-400 Less Valves

RANGE CHART

Gage Range (in w.c.)	Media @ 70°F	Full Range Flows by Pipe Size (Approximate)									
		1″	1-1/4″	1-1/2″	2″	2-1/2″	3″	4″	6″	8″	10″
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
2	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
2	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
5	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
5	Air @ 100 PSIG (SCFM)	83.0	142.0	190.0	340.0	610	820	1600	3300	5700	10000
10	Water (GPM)	11.0	19.0	25.5	45.5	67	110	195	450	800	1260
10	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
10	Air @ 100 PSIG (SCFM)	120.0	205.0	275.0	470.0	740	1100	2000	4600	8100	15000
25	Water (GPM)	18.0	32.0	40.5	72.0	108	173	310	720	1250	2000
25	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
25	Air @ 100 PSIG (SCFM)	185.0	325.0	430.0	760.0	1200	1800	3300	7200	13000	22000
50	Water (GPM)	25.0	44.0	57.5	100.0	152	247	435	1000	1800	
50	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
50	Air @ 100 PSIG (SCFM)	260.0	460.0	620.0	1050.0	1700	2600	4600	10000	18500	
100	Water (GPM)	36.5	62.0	82.0	142.0	220	350	620	1500		
100	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
100	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

ACCESSORIES

Model	Description
A-160	Threaded branch connection, 3/8″ NPT, forged steel, 3000 psi
A-161	Brass bushing, 1/4″ x 3/8″
A-471	Portable Kit. For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings.❶
631B	Capsuhelic® Wet/Wet Differential Pressure Transmitter. Low pressure transmitter for use with DS-300/400 flow sensors. Use Series 631B Capsuhelic® Wet/Wet Differential Pressure Transmitter.❷



Capsuhelic® Gage Shown Installed In A-471 Portable Kit



Series 631B

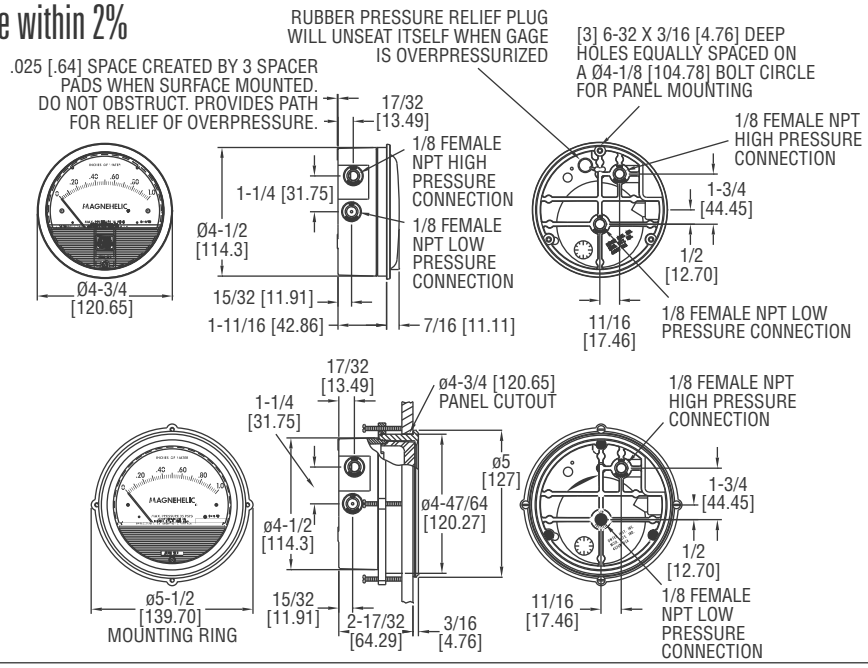
❶See page 15 (Series 4000)
❷See page 60 (Series 631B)

Dwyer

MAGNEHELIC® DIFFERENTIAL PRESSURE GAGES

Indicate Positive, Negative or Differential, Accurate within 2%





Scan here to watch product video

Select the **SERIES 2000** Magnehelic® Gage for high accuracy--guaranteed within 2% of full scale--and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures--either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures.

FEATURES/BENEFITS

- Easy to read gage through undistorted plastic face permits viewing from far away
- Patented design provides quick response to pressure changes means no delay in assessing critical situations
- Durable and rugged housing and high-quality components combine to provide long-service life and minimized down-time

APPLICATIONS

- Filter monitoring
- Air velocity with Dwyer pitot tube
- Blower vacuum monitoring
- Fan pressure indication
- Duct, room or building pressures
- Clean room positive pressure indication

SPECIFICATIONS	
Service: Air and non-combustible, compatible gases (natural gas option available). Note: May be used with hydrogen. Order a Buna-N diaphragm. Pressures must be less than 35 psi. **Wetted Materials:** Consult factory. **Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test. **Accuracy:** ±2% of FS (±3% on -0, -100PA, -125PA, -10MM and ±4% on -00, -60PA, -6MM ranges), throughout range at 70°F (21.1°C). **Pressure Limits:** -20 in Hg to 15 psig† (-0.677 to 1.034 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar). **Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.❶ **Temperature Limits:** 20 to 140°F* (-6.67 to 60°C). -20°F (-28°C) with low temperature option.	**Size:** 4″ (101.6 mm) diameter dial face. **Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations. **Process Connections:** 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back. **Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g). **Standard Accessories:** Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter, and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for three adapters in MP & HP gage accessories.) **Agency Approvals:** Meets the technical requirements of EU Directive 2011/65/EU (RoHS II). Note: -SP models not RoHS approved.
Note: For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.	
*Low temperature models available as special options.	

ACCESSORIES	
Model	**Description**
A-432	Portable kit; combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ ID rubber tubing, standhang bracket and terminal tube with holder
A-605	Air filter gage accessory kit; adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing, two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves
A-605B	Air filter gage accessory kit; air filter kit with two plastic open/close valves, two 4″ steel static tips, plastic tubing and mounting flange
A-605C	Air filter gage accessory kit; air filter kit with two plastic open/close valves, two plastic static tips, plastic tubing and mounting flange



A-432



A-605

❶Over Protection Note: See page 5 (Series 2000)

MAGNEHELIC® DIFFERENTIAL PRESSURE GAGES

Indicate Positive, Negative or Differential, Accurate within 2%

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

OVERPRESSURE PROTECTION
Blowout plug is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.
The blowout plug is not used on models above 180″ of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings of any component.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

MODEL CHART

Model	Range, Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180*	0-180
2250*	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range, PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30
Model	**Range, CM of Water**
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

Model	Range, MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10
Model	**Range, Pa**
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-1000
Zero Center Ranges	
Model	**Range, Pa**
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

Model	Range, in w.c./ Velocity F.P.M.
2000-00AV†••	0-.25/ 300-2000
2000-0AV†•	0-.50/ 500-2800
2001AV	0-1.0/ 500-4000
2002AV	0-2.0/ 1000-5600
2005AV	0-5.0/ 2000-8800
2010AV	0-10/ 2000-12500

Dual Scale English/Metric Models

Model	Range, in w.c.	Range, Pa or kPa
2000-00D†••	0-.25	0-62 Pa
2000-0D†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

†These ranges calibrated for vertical scale position • Accuracy ±3% •• Accuracy ±4% *MP option standard **HP option standard

VELOCITY AND VOLUMETRIC FLOW UNITS
Scales are available on the Magnehelic® that read in velocity units (FPM, m/s) or volumetric flow units (SCFM, m^3/s, m^3/h). Stocked velocity units with dual range scales in inches w.c. and feet per minute are shown above. For other ranges contact the factory.
When ordering volumetric flow scales please specify the maximum flow rate and its corresponding pressure.
Example: 0.5 in w.c. = 16,000 CFM.

ACCESSORIES

Model	Description
A-321	Safety relief valve
A-448	3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-135	Rubber gasket for panel mounting
A-401	Plastic carry case
A-310A	3-way vent valves. In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

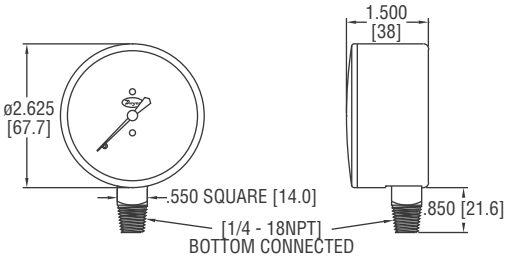


A-310A

2.5″ LOW PRESSURE GAGE

1.5% Full-Scale Accuracy in a 2.5″ Gage





Our **SERIES LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

FEATURES/BENEFITS
- Low pressure gage provides a selection to meet specific applications
- Specified with high ambient and process temperature ratings mean more robust uses and longer service-life
- High accuracy gage for applications requiring more precise measurement is a concern

APPLICATIONS
- Air flow indication
- Liquid level
- Draft measurement

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% FS.
Pressure Limit: 100% of range scale.
Temperature Limits: Process: -40 to 160°F (-40 to 70°C); Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

OPTION	
Use order code:	**Description**
NISTCAL-PG1	NIST traceable calibration certificate

MODEL CHART

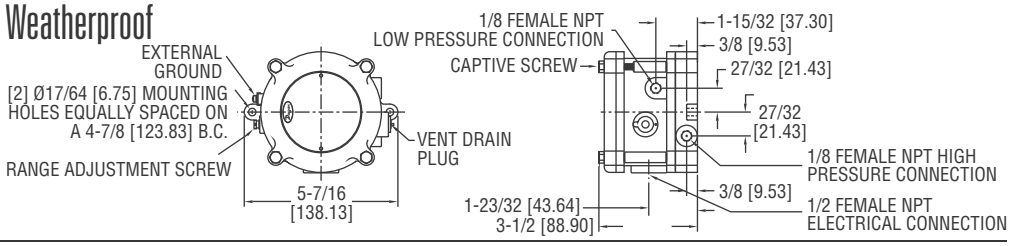
Model	Range	Model	Range
LPG4-D7122N	-10 to 0 in w.c. (-2.5 to 0 kPa)	**LPG4-D8322N**	0 to 40 in w.c. (0 to 10 kPa)
LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	**LPG4-D8422N**	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	**LPG4-D8522N**	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	**LPG4-D8622N**	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	**LPG4-D8722N**	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	**LPG4-D8922N**	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	**LPG4-D9022N**	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	**LPG4-D9122N**	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	**LPG4-D9222N**	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	**LPG4-D9322N**	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	**LPG4-D9422N**	-30 to 0 to 50 in w.c. (-7.5 to 0 to 12.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	**LPG4-D9522N**	-40 to 0 to 60 in w.c. (-10 to 0 to 15.0 kPa)

Dwyer

EXPLOSION-PROOF DIFFERENTIAL PRESSURE SWITCH

Compact, Low Cost, Explosion-proof and Weatherproof





SERIES 1950 Explosion-proof Differential Pressure Switch combines the best features of the popular Dwyer® Series 1900 Pressure Switch with an integral explosion-proof and weatherproof housing, making it an exceptional value for either application. It is CE, UL and CSA listed, FM approved for use in Class I, Div 1, Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres NEMA 7 & 9. Rain tight NEMA 3 (IP54), weatherproof features include a drain plug and O-ring seal in cover. Electrical connections are easily made by removing front cover. For convenience the set point adjustment screw is located on the outside of the housing. Twelve models offer set points from .03 to 20 in w.c. (0.0075 to 5 kPa) and from .5 to 60 psi (0.035 to 3.5 bar). The unit is very light and compact - about half the weight and bulk of other explosion-proof or weatherproof switches with separate enclosures.
CAUTION: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

FEATURES/BENEFITS

- Explosion-proof and weatherproof housing provides device protection for outdoor use or harsh environment operation
- External set point screw provides easy access that simplifies making adjustments without opening or disassembling enclosure
- Easily accessible electrical connection simplifies the installation

APPLICATIONS

• HVAC applications • Process applications • All-weather applications

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits: Continuous: 1950's - 45 in w.c. (0.11 bar); 1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar). Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: NEMA 3 (IP54), NEMA 7 & 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, CSA, FM, UL.

MODEL CHART

Model	Range, psid	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model*	Range*	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point	Model	Range, in w.c.	Approximate Deadband Min. Set Point	Approximate Deadband Max. Set Point
1950P-2-2F	0.5 to 2	0.3	0.3	**1950P-50-2F**	15 to 50	1.0	1.5	**1950-1-2F**	.4 to 1.6	.15	.20
~~**1950P-8-2F**~~	~~1.5 to 8~~	~~1.0~~	~~1.0~~	**1950-02-2S**	.03 to .10	.025	.05	**1950-5-2F**	1.4 to 5.5	.30	.40
1950P-15-2F	3 to 15	0.9	0.9	**1950-00-2F**	.07 to .15	.04	.05	**1950-10-2F**	3 to 11	.40	.50
1950P-25-2F	4 to 25	0.7	0.7	**1950-0-2F**	.15 to .50	.10	.15	**1950-20-2F**	4 to 20	.40	.60

*P=PSID range models. Other ranges in w.c.

Caution: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

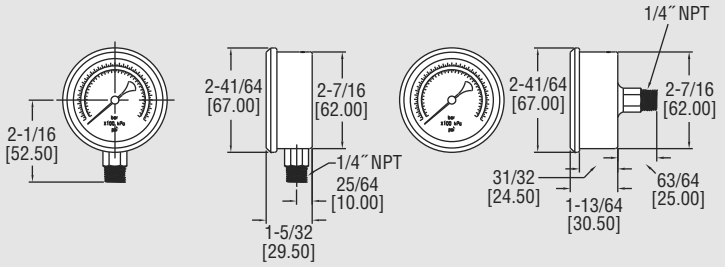
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	**SGZ-D10622N**	0 to 160 psi
SGZ-D10322N	0 to 30 psi	**SGZ-D10722N**	0 to 200 psi
SGZ-D10422N	0 to 60 psi	**SGZ-D11022N**	0 to 300 psi
SGZ-D10522N	0 to 100 psi	**SGZ-D11122N**	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

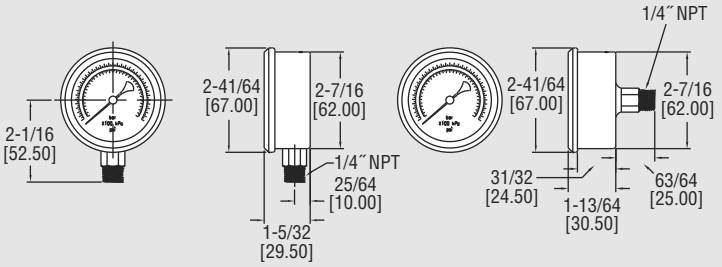
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



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Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	**SGZ-D10622N**	0 to 160 psi
SGZ-D10322N	0 to 30 psi	**SGZ-D10722N**	0 to 200 psi
SGZ-D10422N	0 to 60 psi	**SGZ-D11022N**	0 to 300 psi
SGZ-D10522N	0 to 100 psi	**SGZ-D11122N**	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

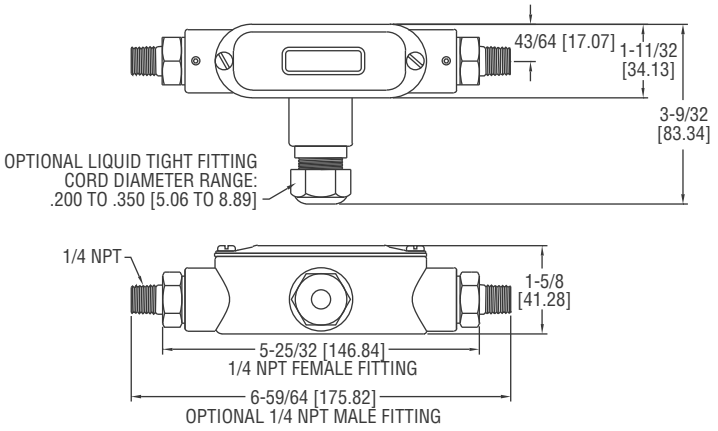
ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

Dwyer

WET/WET DIFFERENTIAL PRESSURE TRANSMITTER

0.5% Accuracy, NEMA 4X (IP66) Enclosure





The **SERIES 629** Differential Pressure Transmitter monitors differential pressure of air and compatible gases and liquids with 0.5% accuracy. The design employs dual pressure sensors converting pressure changes into a standard 4 to 20 mA output signal for two wire circuits. Small internal volume and minimum moving parts result in exceptional response and reliability. Terminal block, zero and span adjustments are easily accessed under the top cover. The Series 629 Differential Pressure Transmitter is designed to meet NEMA 4X (IP66) construction.

FEATURES/BENEFITS

- Versatile, high-accuracy device for liquid or gas supports designs requiring more precise measurements in support of application
- Minimum components provide excellent response and reliability
- Span and zero controls reduce installation and service time
- Terminal block reduces wiring difficulties saving installation time
- Optional LED indicator provides local status to identify operational conditions.
- Optional 3-way valve manifold supports higher line pressures or simplifying removal of transmitter without interrupting process

APPLICATIONS

- Flow elements
- Coils
- Heat exchangers
- Chiller
- Filters
- Pumps

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Without valve: 316, 316L SS. Additional wetted parts with 3-way valve option: Buna-N, silicone grease, PTFE, brass 360, copper, reinforced acetal copolymer.
Accuracy: ±0.5% FS (includes linearity, hysteresis & repeatability).
Temperature Limits: 0 to 200°F (-18 to 93°C).
Compensated Temperature Limits: 0 to 175°F (-18 to 79°C).
Pressure Limits: See chart.
Thermal Effect: 0.02%/°F (0.036%/°C) includes zero & span.
Power Requirements: 13 to 30 VDC (2-wire).
Output Signal: 4 to 20 mA. Optional 0 to 5, 0 to 10 VDC.
Response Time: 50 ms.
Loop Resistance: 0 to 1300 Ω maximum for current output. For voltage outputs, minimum load resistance: 2000 Ω.
Electrical Connections: Terminal block; 1/2″ female NPT conduit.
Process Connections: 1/4″ female NPT.
Enclosure Rating: Designed to meet NEMA 4X (IP66).
Mounting Orientation: Not position sensitive.
Weight: 10.1 oz (286 g).
Agency Approvals: CE.

MODEL CHART - Standard

Model	Range	Pressure Limits	
		Working* Pressure	Over Pressure
629-02-CH-P2-E5-S1	10 psid	20 psi	100 psi
629-03-CH-P2-E5-S1	25 psid	50 psi	250 psi
629-04-CH-P2-E5-S1	50 psid	100 psi	250 psi
629-05-CH-P2-E5-S1	100 psid	200 psi	500 psi

*Pressures exceeding the working pressure limit may cause a calibration shift of up to ±3% of full scale.

MODEL CHART - 3-Way Valve Manifold Assembly

Model	Range	Pressure Limits	
		Working* Pressure	Over Pressure
629-02-CH-P2-E5-S1-3V	10 psid	20 psi	100 psi
629-03-CH-P2-E5-S1-3V	25 psid	50 psi	100 psi
629-04-CH-P2-E5-S1-3V	50 psid	100 psi	100 psi
629-05-CH-P2-E5-S1-3V	100 psid	100 psi	100 psi

*Pressures exceeding the working pressure limit may cause a calibration shift of up to ±3% of full scale.

OPTIONS

To order add suffix:	Description
-LED	4.5 digit LED display
-NIST	NIST traceable calibration certificate

ACCESSORIES

Model	Description
A-131A	3-way brass manifold valve
641-LED	Field-upgradeable LED
A-155	Cable gland with 1/2″ NPT male
BBV-1B	Mini SS 3-valve block manifold
A-228	12″ SS flex hose



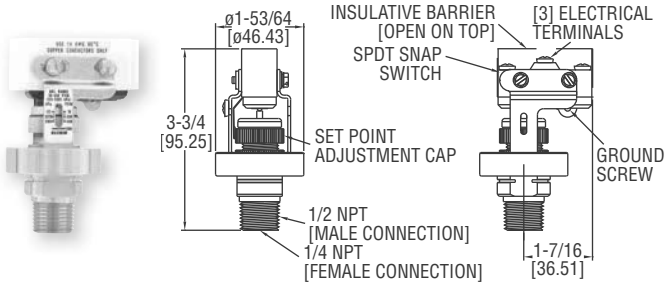
3-way valve assembly with integral bleed screws



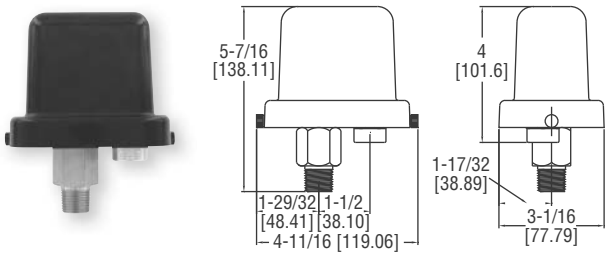
629 shown with optional red LED and cable gland

LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS
- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS
- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
A1F-O-SS-1-1	2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
A1F-O-SS-1-3	8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

Note: Optional enclosure factory installed. To order, change O to PC.
Example: A1F-PC-SS-1-1

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

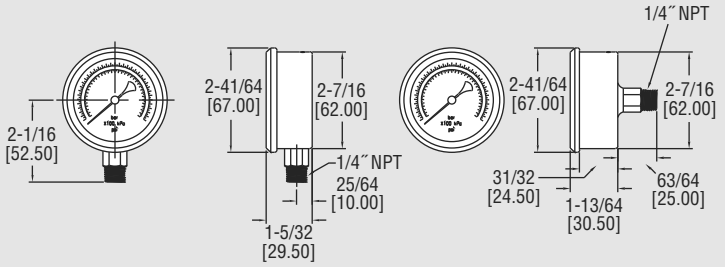
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	**SGZ-D10622N**	0 to 160 psi
SGZ-D10322N	0 to 30 psi	**SGZ-D10722N**	0 to 200 psi
SGZ-D10422N	0 to 60 psi	**SGZ-D11022N**	0 to 300 psi
SGZ-D10522N	0 to 100 psi	**SGZ-D11122N**	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

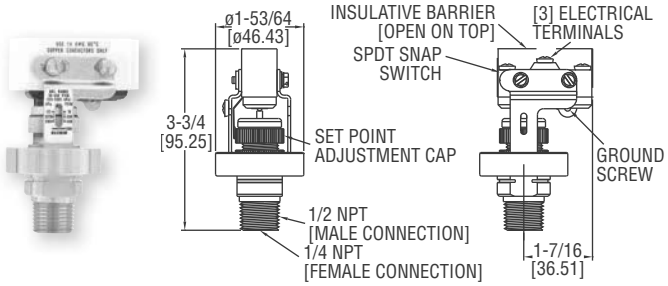
OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

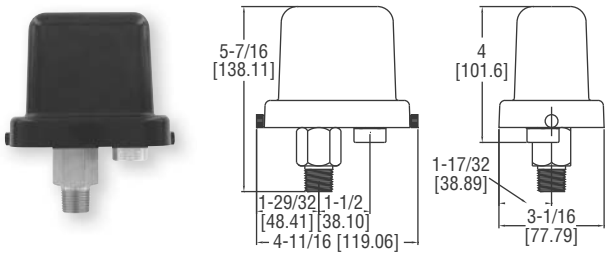
ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

LOW COST OEM PRESSURE SWITCH

Field Installable Weatherproof Enclosure



A1F



A1F with weatherproof enclosure

Low cost and precision made, the **SERIES A1F** Pressure Switch is ideal for OEM industrial applications. Wetted materials of 316 SS and fluorocarbon ensure great chemical compatibility with a wide range of process media. The open case style is perfect for panel mounting applications like pump skids. Weatherproof enclosure is available in polycarbonate offering a low cost weatherproof switch. Superior 15 A contact allows direct control of motors or pumps without the use of external relays, a true cost savings. Features include a convenient indicating scale for quick and easy field adjustment.

FEATURES/BENEFITS
- 15 A contact allows direct control reducing costs and reliability by having to introduce additional contacts and relays
- Case style allows use for panel mounting application with optional weather-proof enclosure for use in outdoor environments
- Field adjustable reduces installation time bring application on-line faster
- Wetted material provides support for wider range of process media

APPLICATIONS
- OEM
- Compressors
- Motor control
- Process equipment
- Pump control

SPECIFICATIONS

Service: Compatible liquids and gases.
Wetted Materials: Pressure chamber: 316 SS; Diaphragm: Fluorocarbon.
Temperature Limit: -40 to 175°F (-40 to 80°C).
Pressure Limits: 750 psig (51 bar).
Enclosure Rating: No rating for open construction. Installed properly within an optional weatherproof enclosure meets NEMA 4X (IP66) standards.
Switch Type: SPDT snap switch.
Electrical Rating: 15 A @ 120/240/480 VAC; 1/8 HP @ 125 VAC; 1/4 HP @ 250 VAC.
Electrical Connection: Screw terminals.
Process Connection: 1/4″ female NPT and 1/2″ male NPT.
Mounting Orientation: Within 20° of vertical.
Set Point Adjustment: Knurled screw cap with indicating scale.
Deadband: Fixed. See deadband chart.
Weight: 10.5 oz (297 g).
Agency Approvals: cUL, UL.

MODEL CHART

Model	Range psg (bar)	Deadband at Min. Range psg (bar)	Deadband at Max. Range psg (bar)
A1F-O-SS-1-1	2 to 15 (0.14 to 1.03)	2 (0.14)	3 (0.21)
A1F-O-SS-1-2	4 to 75 (0.28 to 5.17)	4 (0.27)	15 (1.0)
A1F-O-SS-1-3	8 to 225 (0.55 to 15.5)	8 (0.55)	25 (1.7)
A1F-O-SS-1-4	16 to 450 (1.1 to 31.0)	15 (1.0)	50 (3.5)

Note: Optional enclosure factory installed. To order, change O to PC.
Example: A1F-PC-SS-1-1

English

+GF+

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

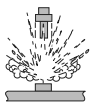
Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

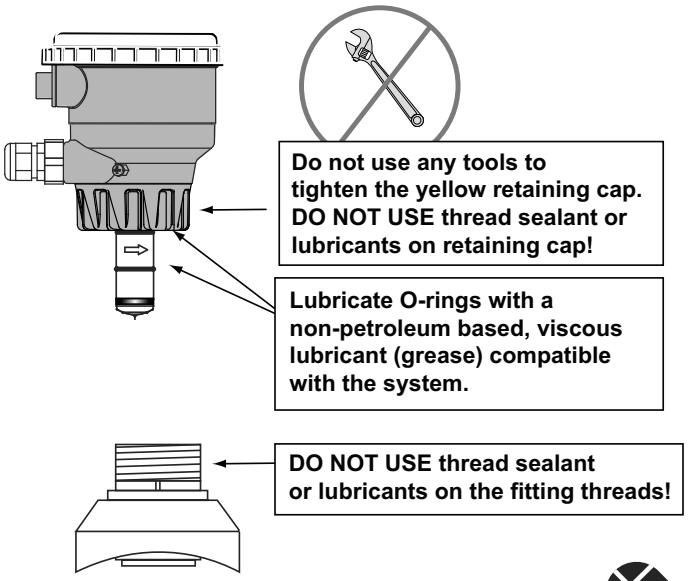
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

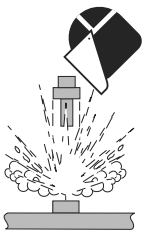
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

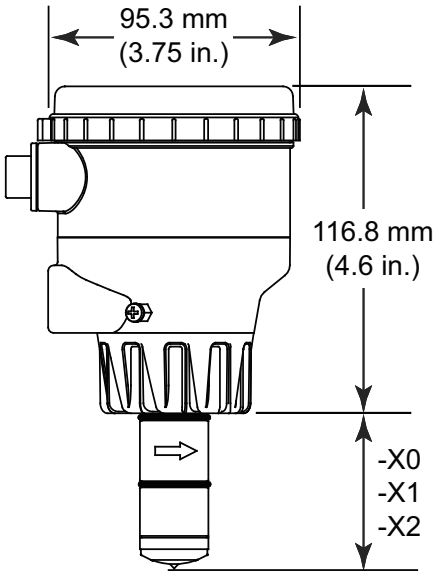


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary.....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance....300 Ω
Loop Accuracy.....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

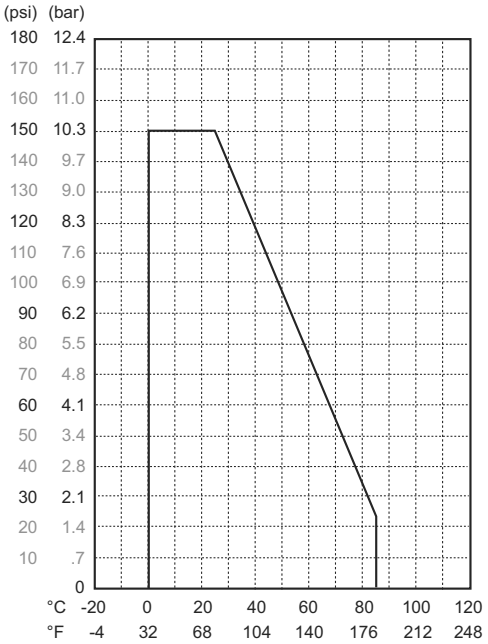
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant

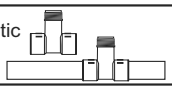
China RoHS (visit gfsignet.com for details)

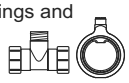
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

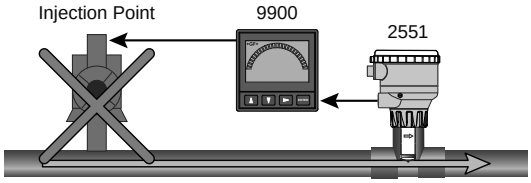
Pipe Fittings

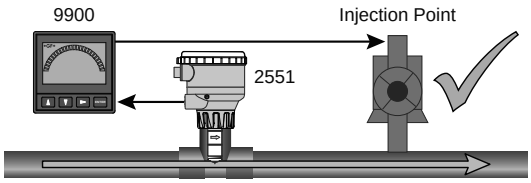
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

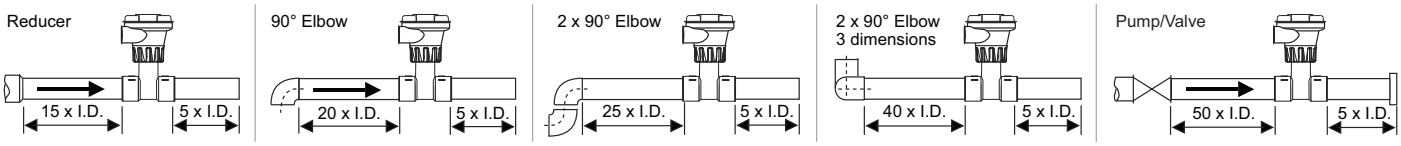
Selecting a Location



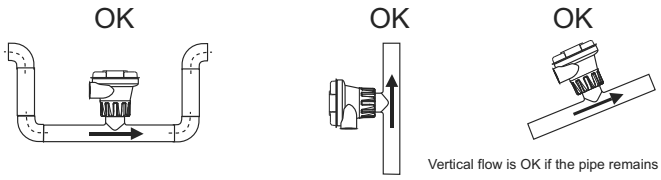


- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

Select a location with sufficient distance of straight pipe immediately upstream of the sensor.

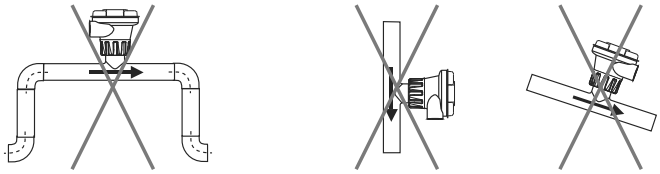


Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.



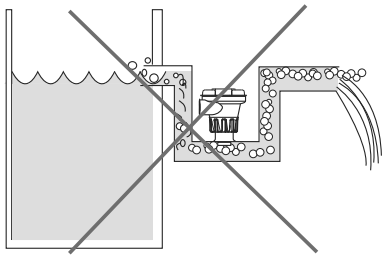
Vertical flow is OK if the pipe remains full at all times.

These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

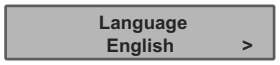
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



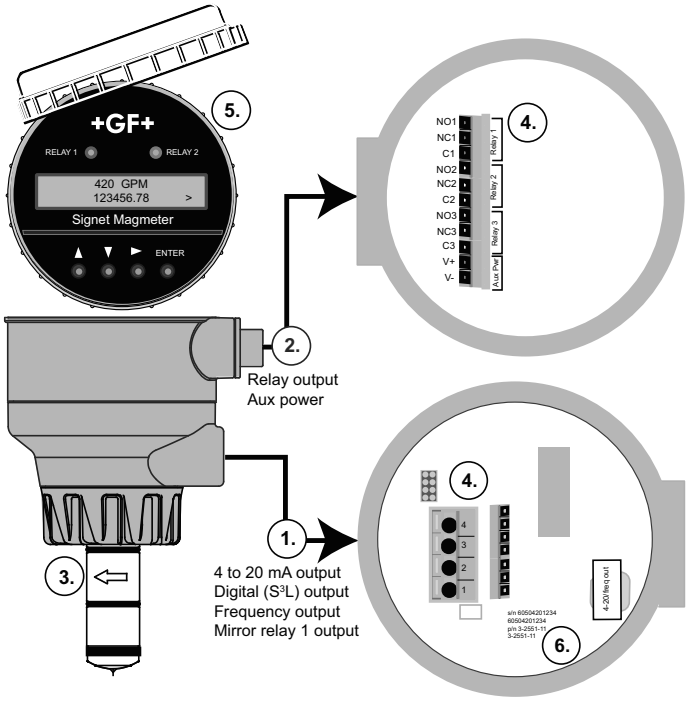
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

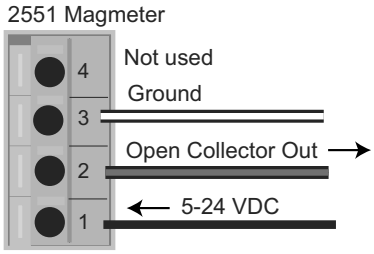


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

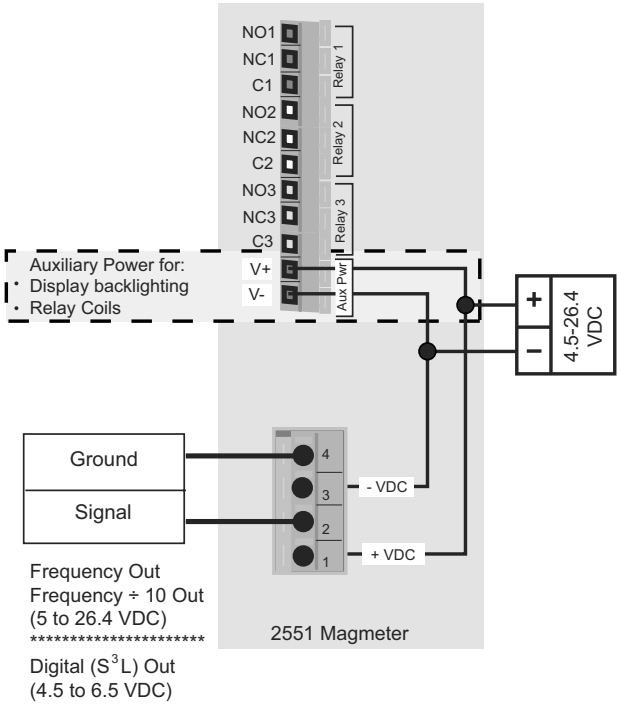
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

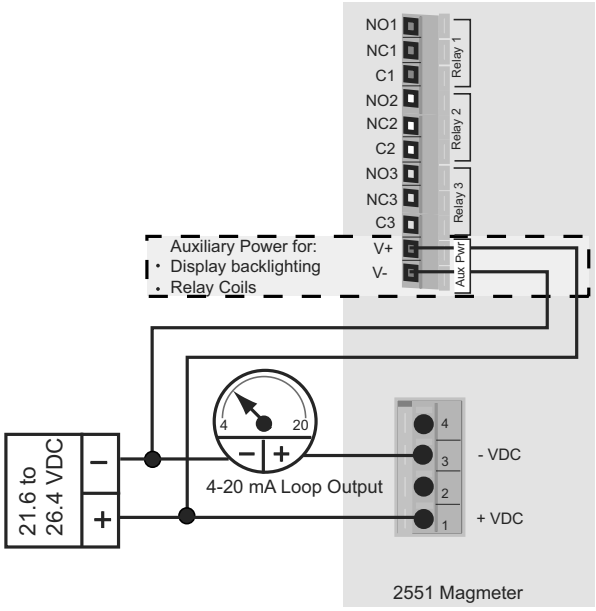
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

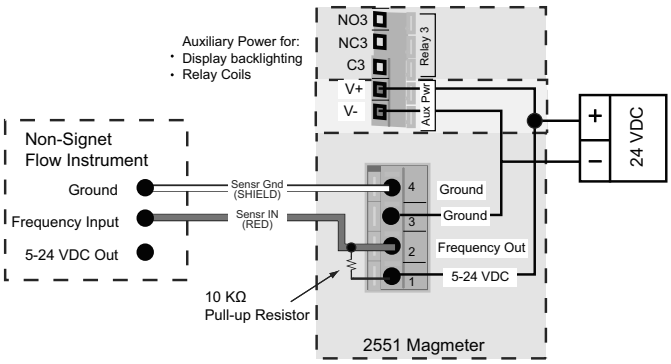
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

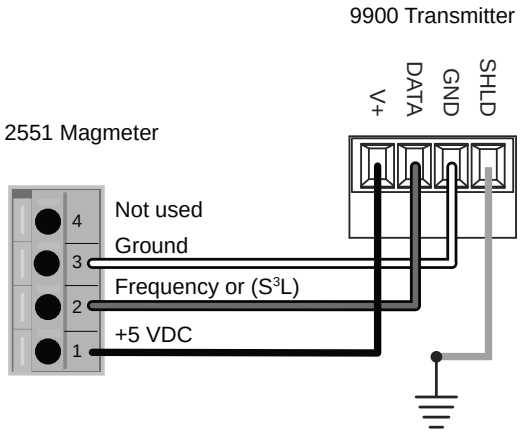


Wiring to Signet Flow Instruments

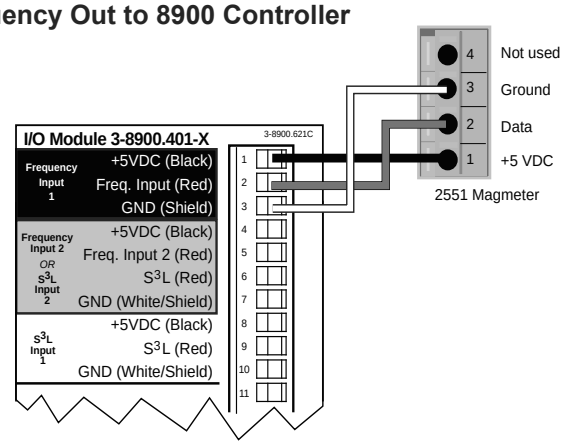
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S^3L) output.

Frequency and Digital (S^3L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

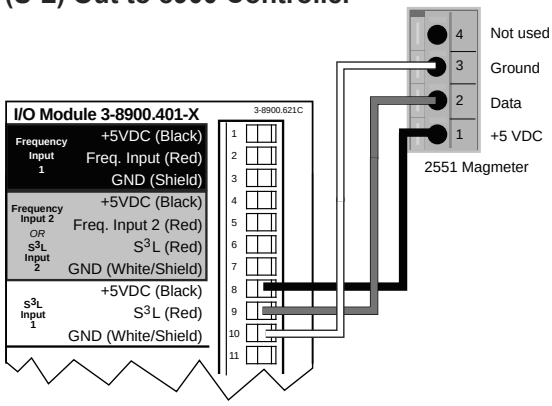
2551 Frequency or Digital (S^3L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S^3L) Out to 8900 Controller



Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

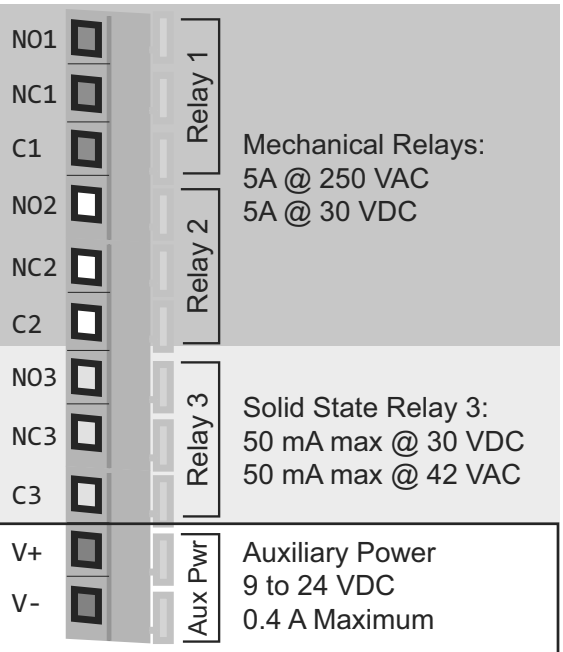
When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.



Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

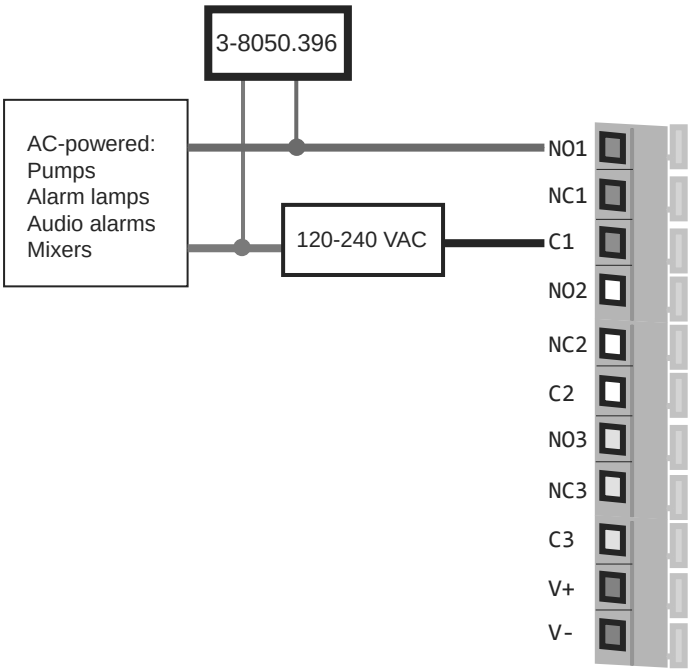
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.



Navigating the Menus



Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

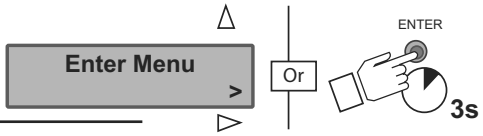
- All menu instructions in this manual assume that the instrument is showing this display.

2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

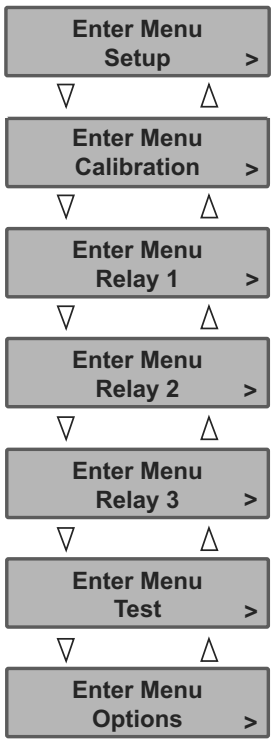
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.



Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



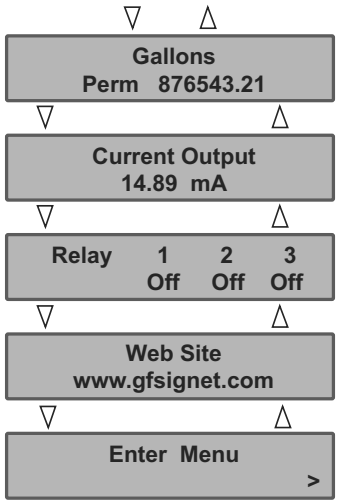
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

Relay States shown for units with a relay board.

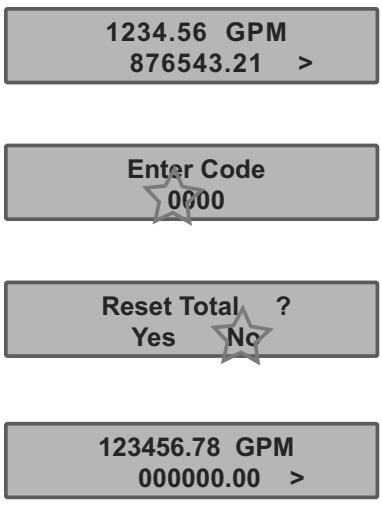
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

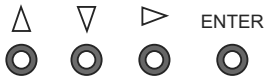


The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..

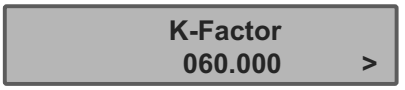


Use the keypad to navigate through each setting.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.



Pipe Size: Select the pipe size that is nearest to the nominal pipe size.



Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot) μ (micro) _ (blank)
- - (dash) / (slash) 3 (for cubic units)

The last character selects the timebase for the flow rate measurement.
Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)



Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

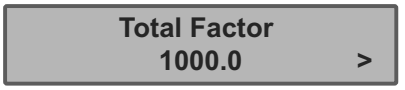


Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.



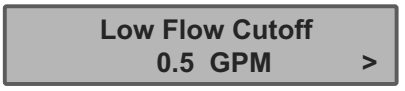
Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)



Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.



Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.



Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.



Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.



Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

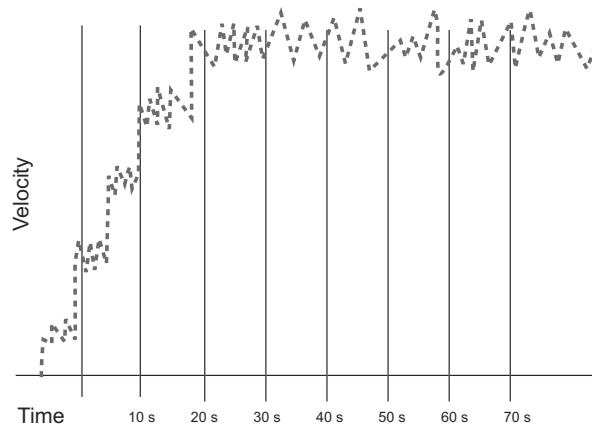
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

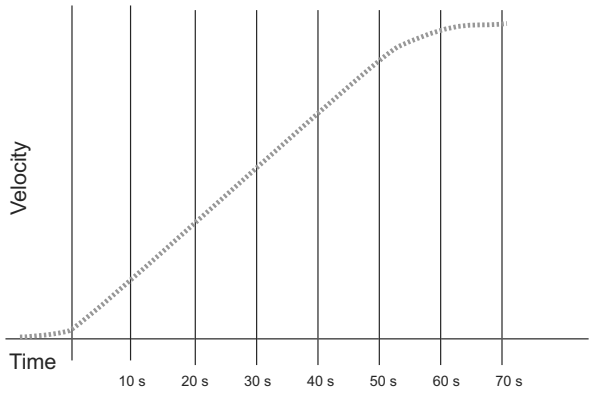
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



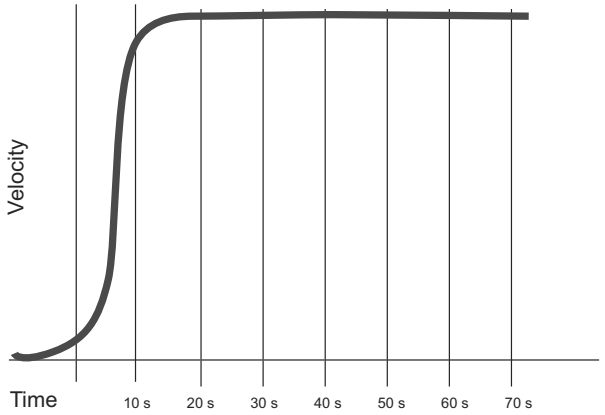
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



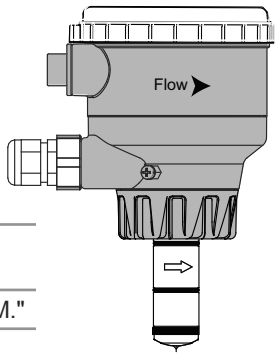
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

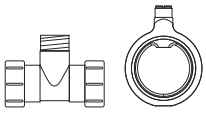
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

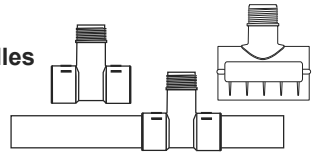
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

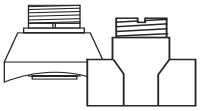
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

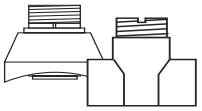
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



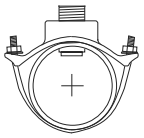
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

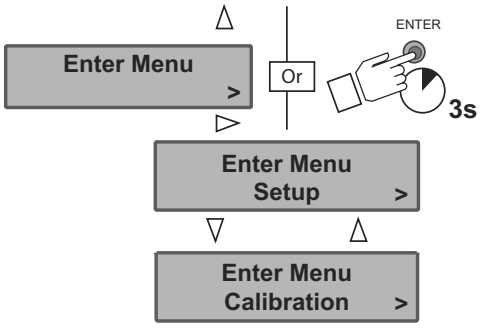
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

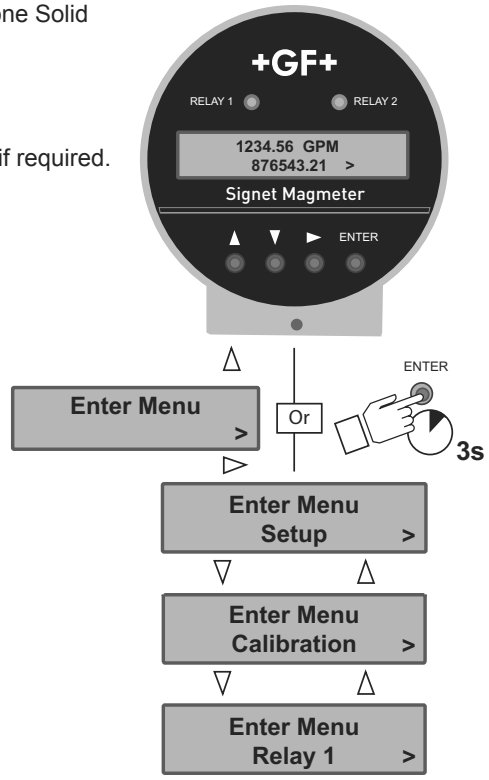
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

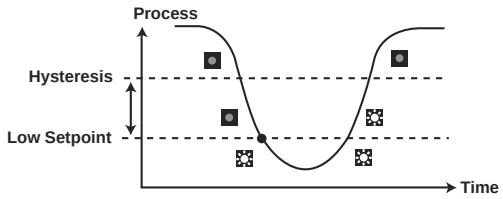
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

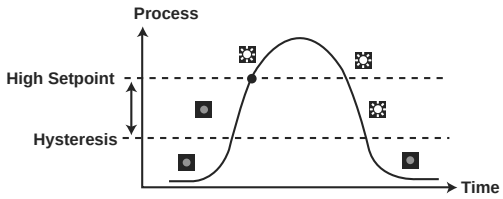
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

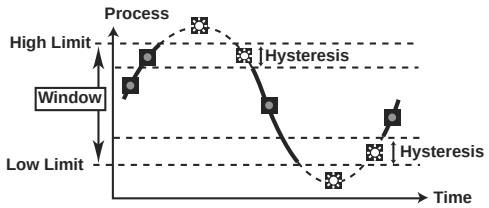
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

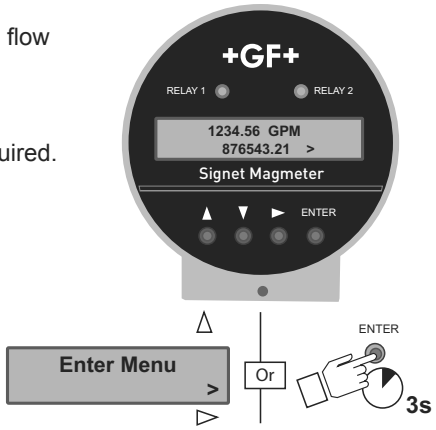


Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated



NOTE: The Security Code must be entered before modifying the relay menu.



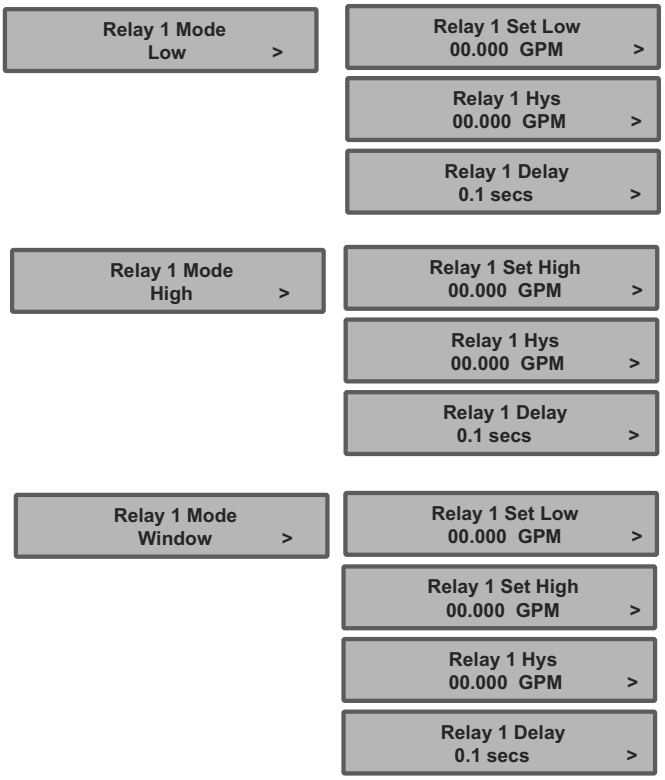
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S^3L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The (**S^3L) Digital** output mode switches the 2551 to the Signet serial data output called (S^3L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

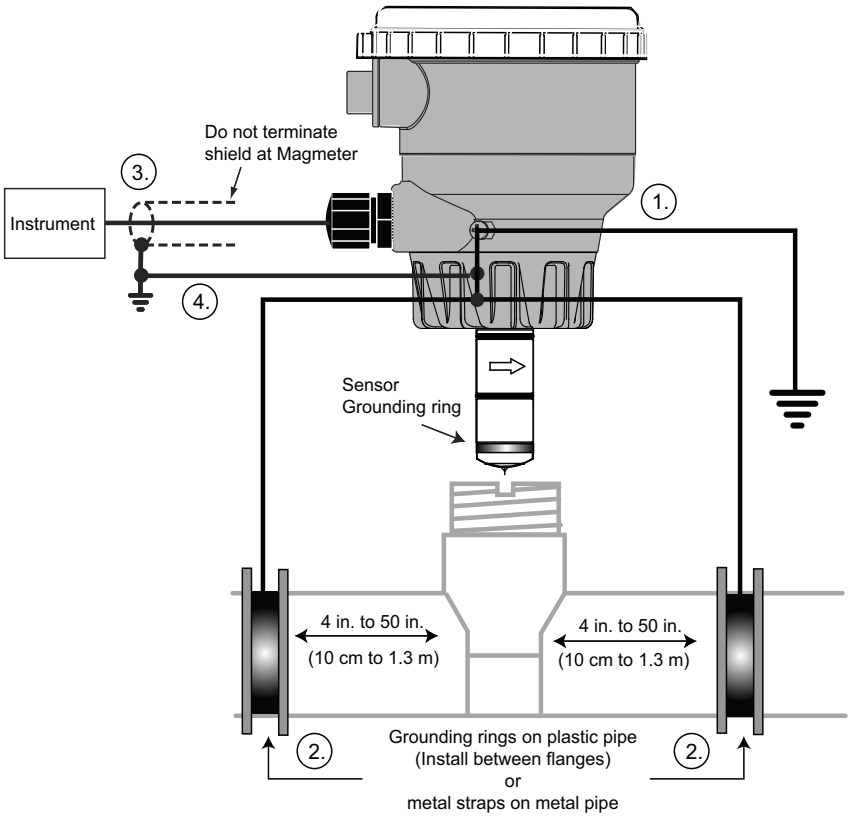
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

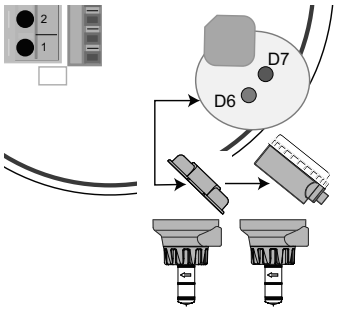
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

3-2551.090-1 Rev. M 04/15 English
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MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

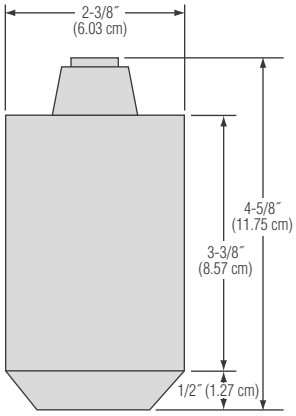


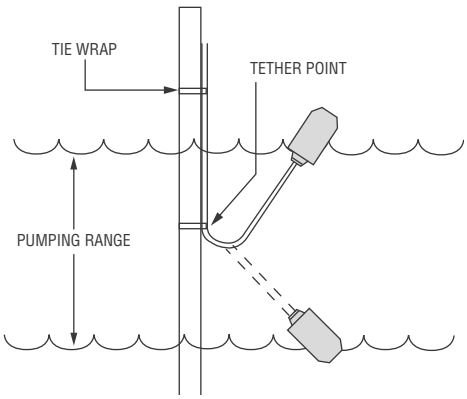
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

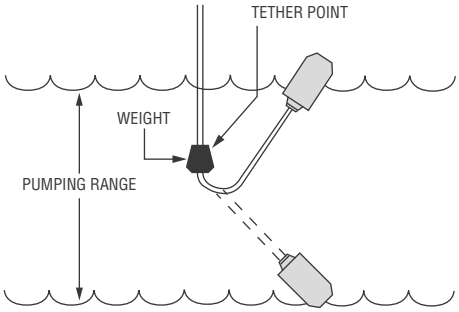
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.



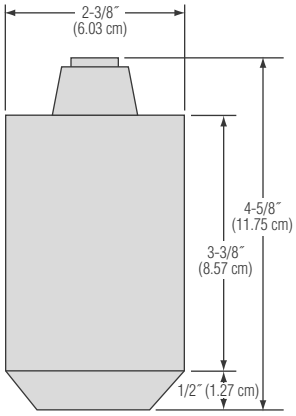
Specifications

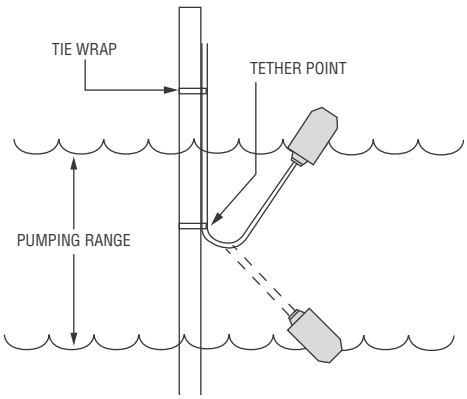
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Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

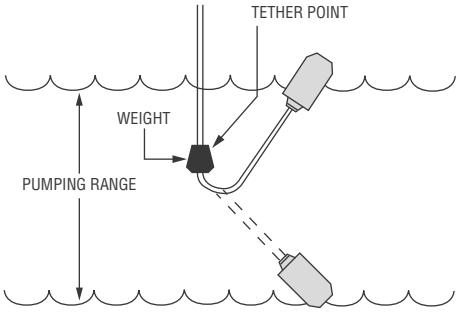
Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

Dimensions







How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

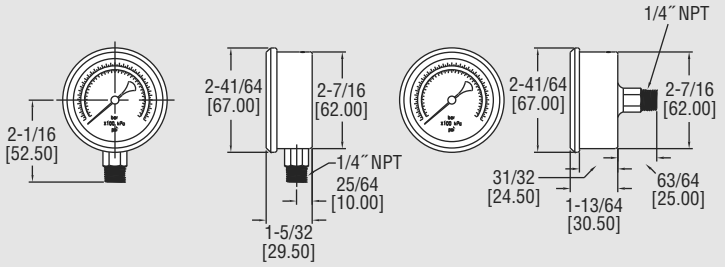
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	SGZ-D10622N	0 to 160 psi
SGZ-D10322N	0 to 30 psi	SGZ-D10722N	0 to 200 psi
SGZ-D10422N	0 to 60 psi	SGZ-D11022N	0 to 300 psi
SGZ-D10522N	0 to 100 psi	SGZ-D11122N	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

English

+GF+

Signet 2551 Display Magmeter

3-2551.090-1 Rev. M 04/15

Operating Instructions





- English
- Deutsch
- Français
- Español
- Italiano
- Português

Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field. Output options include a traditional frequency signal, a serial data (Digital (S^3L)) output, and a 4 to 20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 36 inch diameters.

Select from three different material combinations to match the Magmeter to the application requirements.

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Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

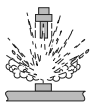
Product Registration

Thank you for purchasing the Signet line of Georg Fischer measurement products.
If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com.** Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), **click here**

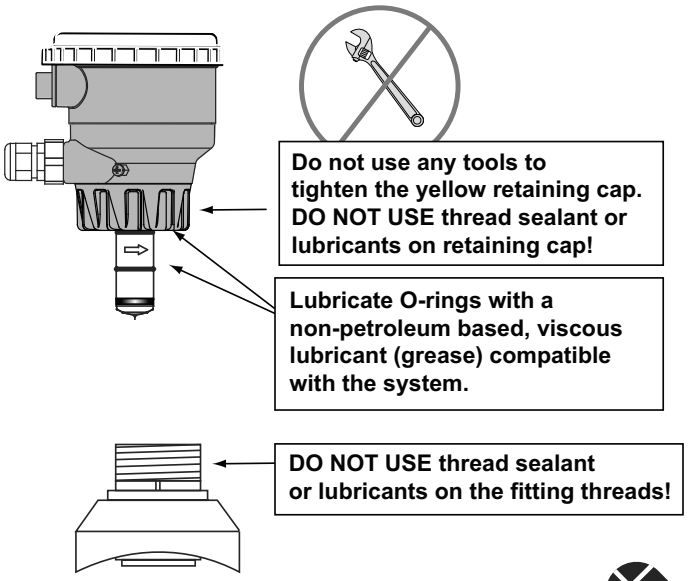
Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature / pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.

	**Caution / Warning / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Electrostatic Discharge (ESD) / Electrocution Danger** Alerts user to risk of potential damage to product by ESD, and/or risk of potential of injury or death via electrocution.
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Signet products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.

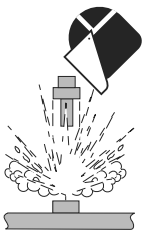
Chemical Compatibility

The retaining nuts of Magmeters are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

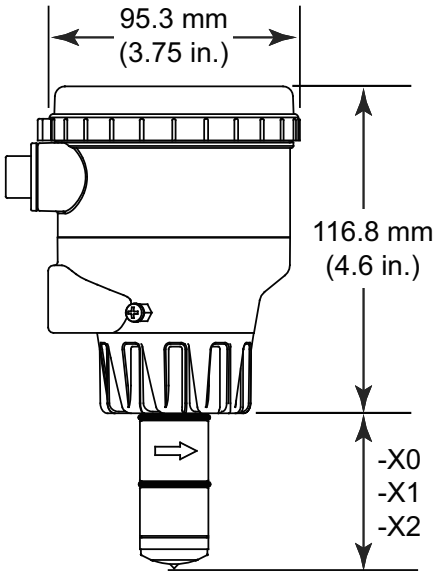


Failure to follow these instructions may result in the sensor being ejected from the pipe!

If leaking is observed from the retaining cap, it indicates defective or worn o-rings on the sensor. Do not attempt to correct by further tightening.



Dimensions



Pipe Range	Insertion Depth
½ in. to 4 in.	-X0 = 58 mm (2.3 in.)
5 in. to 8 in.	-X1 = 91 mm (3.6 in.)
10 in. to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body Material (P, T, or V)

Specifications

General

Pipe size range.....DN15 to DN900 (½ in. to 36 in.)
Flow Range .....Minimum: 0.05 ms (0.15 ft/s)
(Bi-directional) .....Maximum: 10 ms (33 ft/s)
Linearity.....±1% of reading +0.01 ms (0.033 ft/s)
Repeatability.....±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity ...20 µS/cm

Wetted Materials

Sensor body and Electrodes and Grounding ring:
-P0, -P1, -P2 .....Polypropylene and 316L SS
-T0, -T1, -T2.....PVDF and Titanium
-V0, -V1,-V2 .....PVDF and Hastelloy-C
O-rings .....FPM (standard) EPDM, FFPM (optional)

> The user is responsible for determining the chemical suitability of these materials for a specific application.

Power Requirements

4 to 20 mA .....21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
Frequency.....5 to 26.4 VDC, 15 mA max.
Digital.....5 to 6.5 VDC, 15 mA max.
Auxiliary.....9 to 24 VDC, 0.4A max
(only required for units with relays)
Reverse polarity and short circuit protected

Current output (4 to 20 mA)

Max Loop Resistance....300 Ω
Loop Accuracy.....32 µA max. error (25 °C @ 24 VDC)
Temp. drift.....± 1 µA per °C max.
Power supply rejection ...± 1 µA per V
Isolation: .....Low voltage < 48 VAC/DC from electrodes and aux power
Maximum cable .....300 m (1000 ft)
Error condition .....22.1 mA

Frequency output

Output modes.....Freq, Freq÷10, or Mirror Relay 1
Max. Pullup Voltage.....30 VDC
Max. Current Sink.....50 mA, current limited
Maximum cable .....300 m (1000 ft)
Reverse Polarity Protected to -40 V

Digital (S³L) Output

Serial ASCII, TTL level 9600 bps
Compatible with Signet 8900 and 9900
Maximum cable .....Application dependent (See 8900 manual)

Relay Specifications

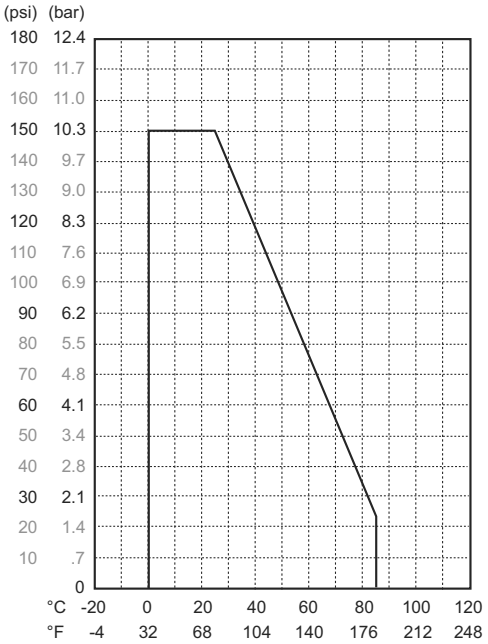
Relay 1 and 2 Type.....Mechanical SPDT
Rating .....5 A @ 30 VDC max.,
5 A @ 250 VAC max.
Relay 3 Type.....Solid State
Rating .....50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis.....Adjustable, plus timer delay
Trigger Delay .....Adjustable (0 to 9999.9 sec.)
Relay Modes.....Off, Low, High, Window, and Proportional Pulse
Relay Source .....Flow Rate, Resettable Totalizer
Error Condition .....Selectable; Fail Open or Fail Closed

Display

Characters.....2 x 16
Contrast.....User-set in four levels
Backlighting .....Requires external 9-24 VDC, 0.4 mA max. (only on relay versions)

Environmental Requirements

Enclosure .....NEMA 4X / IP65 (with cap installed)
Case .....PBT
Display window.....Polyamide
Storage Temperature.....-20 °C to 70 °C (-4 °F to 158 °F)
Relative Humidity.....0 to 95% (non-condensing)
Operating Temperature:
Ambient.....-10 °C to 70 °C (14 °F to 158 °F)
Media .....0 °C to 85 °C (32 °F to 185 °F)
Operating pressure:
Maximum .....10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)



Standards and Approvals

- CE
- UL/CUL (for display versions with relays)
- NSF (3-2551-P versions only)
- RoHS compliant

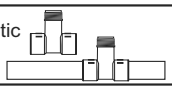
China RoHS (visit gfsignet.com for details)

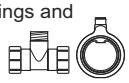
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

Declaration of Conformity according to FCC Part 15
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and,
(2) This device must accept any interference received, including interference that may cause undesired operation.

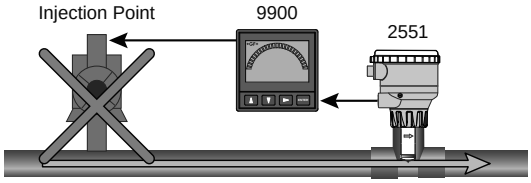
Pipe Fittings

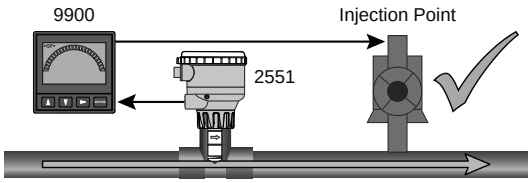
Georg Fischer offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration Tables on pages 12-13.

Type	Description
Plastic tees 	• 0.5 to 2 inch versions • MPVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Clamp-on Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe • Special order 14 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees  FPT	• 1.5 in. to 2 in. PVDF insert
Union Fittings and Wafers 	• For pipes from DN 15 to 50 mm • PP or PVDF

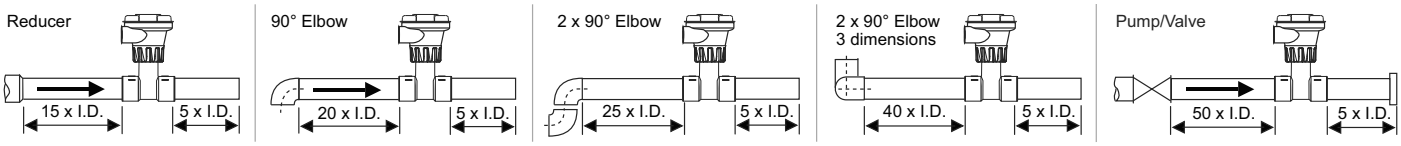
Selecting a Location



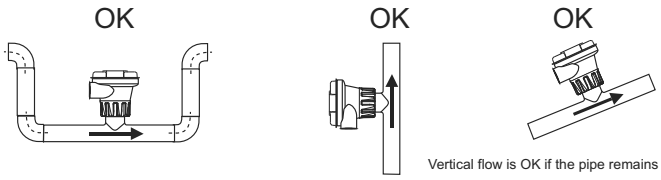


- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.
- Chemical injection systems can temporarily alter the fluid conductivity and cause anomalies in the magmeter measurement.
  To avoid this problem, install the magmeter UPSTREAM of the injection point.

Select a location with sufficient distance of straight pipe immediately upstream of the sensor.

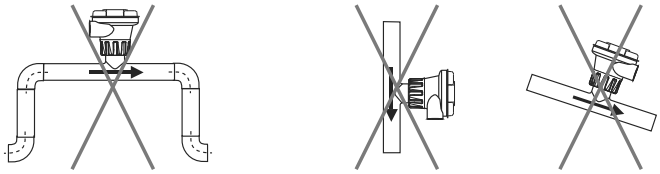


Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.



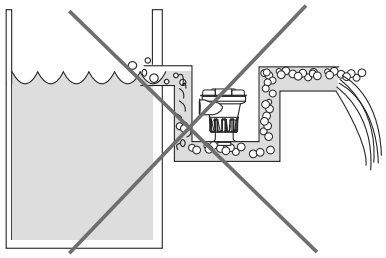
Vertical flow is OK if the pipe remains full at all times.

These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

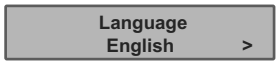
This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.



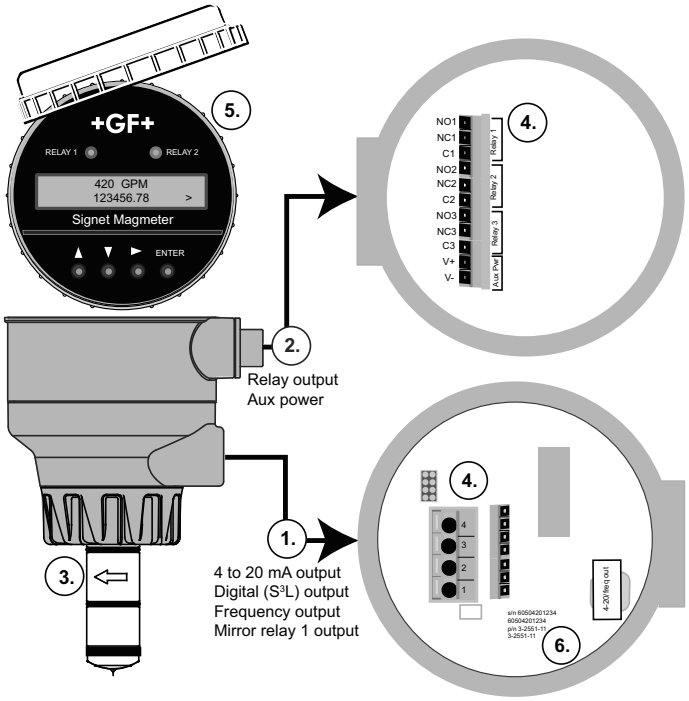
Overview of Magmeter Display

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

1. The lower set of conduit ports provide access to the wiring terminals for:
   - Loop Power
   - Flow Output Signal (current loop, Digital (S^3L), frequency or Mirror Relay 1 output).
2. The upper set of conduit ports provide access to the wiring terminals for:
   - Relay output wiring
   - Auxiliary power for relay coils and display backlight
3. The sensor is marked with a directional arrow to indicate the direction identified as forward flow.
   - An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow.
   - Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
4. The terminals in the magmeter are designed to accomodate 16 to 22 AWG conductors.
5. The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
   - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
   - If the Language option has not been made, new magmeters will always open with the Select Language display.

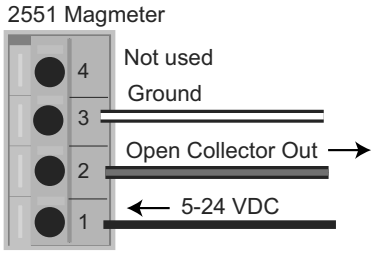


6. The part number, serial number and output type are identified on the electronics module.



Wiring to Mirror Relay 1 Output

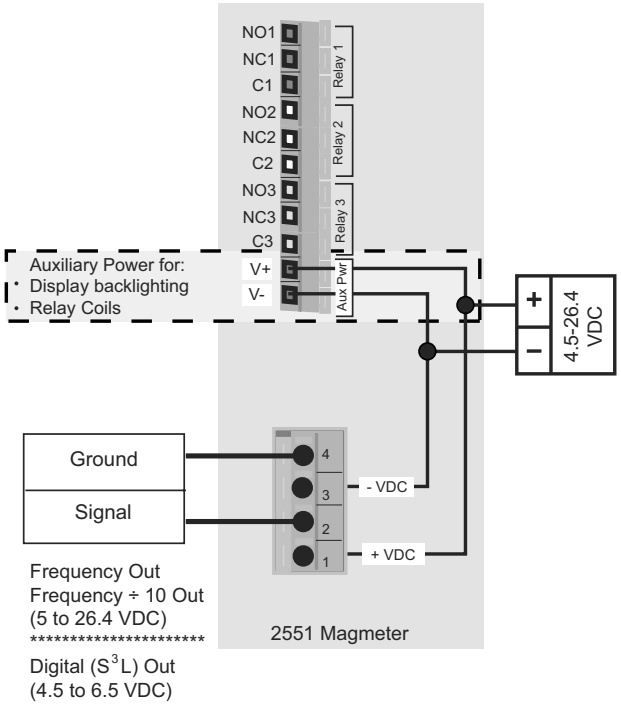
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital (S^3L) output selections. The Open Collector output can be programmed via the Relay 1 menu.



Wiring to Frequency Output

3-2551-21 and 3-2551-41 Magmeters may be programmed in the OPTIONS menu to provide an open collector FREQUENCY output.

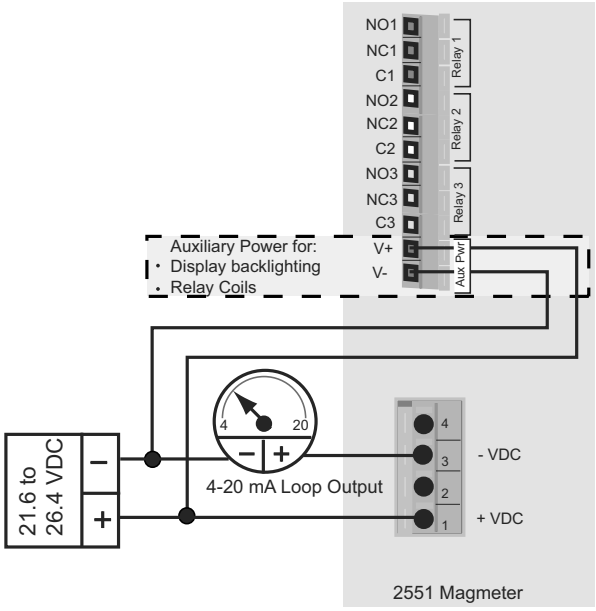
- The maximum frequency output is 1000 Hz (at 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (at 10 meters per second).
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



Wiring to 4 to 20 mA Output

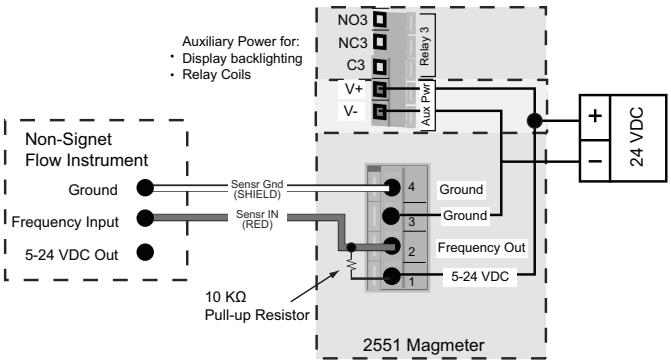
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4 to 20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 to 20 mA = 0 to 5 m/s.
- The 4 to 20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power to the relay coils if included.



Wiring to other manufacturer's Instruments

When using the 2551 in a system with other manufacturer's equipment, a 10 KΩ pull-up resistor (not supplied) may be required to power the open collector output.

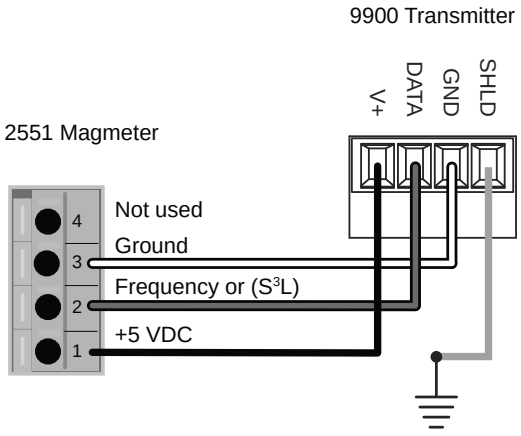


Wiring to Signet Flow Instruments

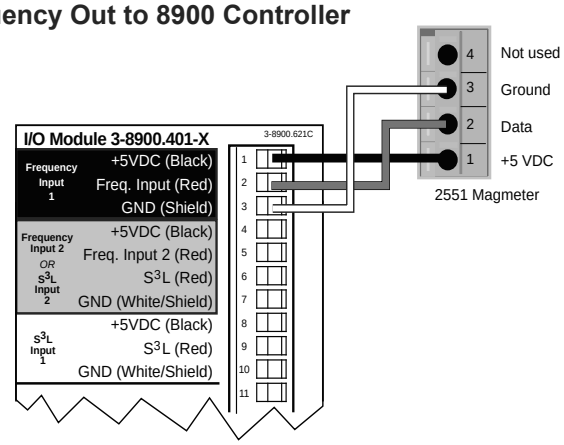
The 3-2551-21 and 3-2551-41 Magmeter can be configured in the OPTIONS menu to provide a Frequency or Digital (S^3L) output.

Frequency and Digital (S^3L) output can be used by Signet 8900 Multi-Parameter Controller and 9900 Transmitter.

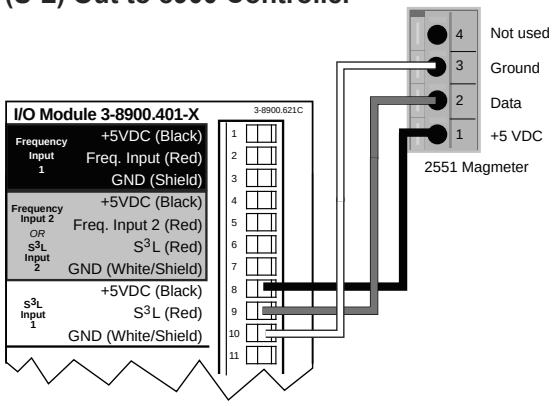
2551 Frequency or Digital (S^3L) Out to 9900 Transmitter



2551 Frequency Out to 8900 Controller



2551 Digital (S^3L) Out to 8900 Controller



Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

Relays 1 and 2 are dry contact relays rated for 5 A maximum current. They are best suited for switching high voltage loads, such as AC powered pumps and valves.

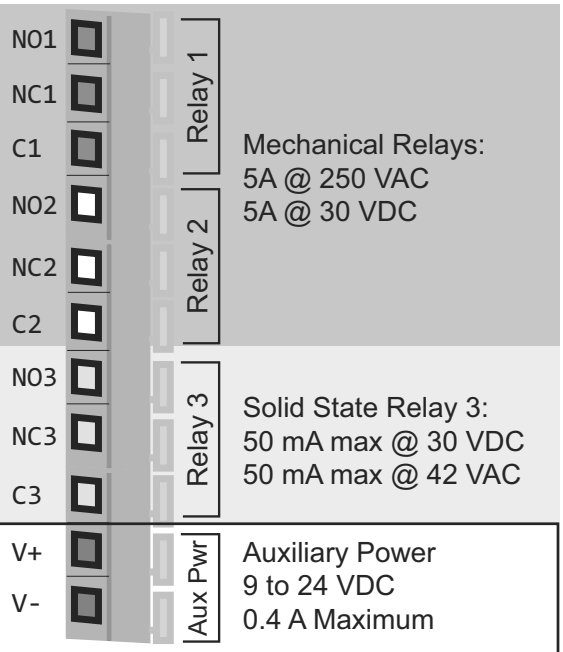
When used to switch inductive loads, the dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)

Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.

Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.



Relay Terminal Legend:
NO: Normally Open
NC: Normally Closed
C: Common

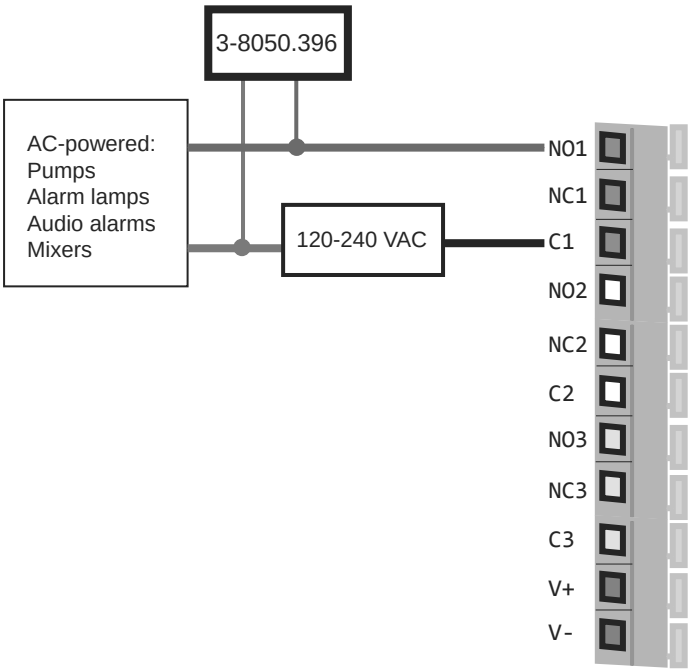
Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends an RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.

Definition:
An ***inductive load*** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized.

Examples of inductive loads include motors, solenoids, and relays.

High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.



Navigating the Menus



Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

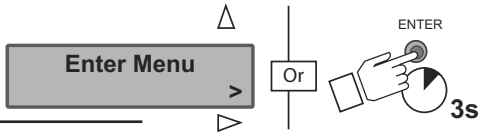
- All menu instructions in this manual assume that the instrument is showing this display.

2551 Menu Directory

The 2551 Magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the ▲ key to scroll to the Enter Menu display, then press the ► key.
2. Press the ENTER key and hold it for about three seconds.



Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-Factor, the totalizer settings, low flow cutoff, and several display characteristics. See page 10 for details related to this menu.

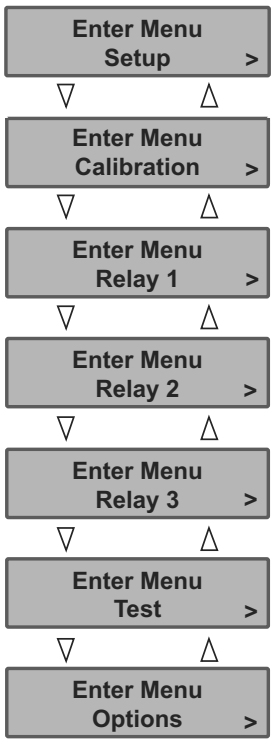
Calibration Menu

This menu provides two different methods for adjusting the calibration. See page 14 for details related to this menu.

□elay Menus

Each of the available relays in the 3-2551-21 and 3-2551-22 are programmed from their own dedicated menu. See page 15 for details related to these menus.

NO□□□Menu items associated with Relays 2 and 3 are suppressed in models without relays.



□est Menu

This menu is used to manually toggle relays or to induce a known value out of the 4 to 20 mA terminals. See page 17 for details related to this menu.

Options Menu

This menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section below). See page 17 for details related to the Options menu.

Keypad Functions

△	Scrolls UP through any menu. If the display shows any flashing character or selection, scrolls UP to the previous value or selection.
▽	Scrolls DOWN through any menu. If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.
△▽	Press the ▲ and ▼ keys together to abandon any unsaved edits and return to the previous display.
▷	Opens the menu currently being displayed. In Edit modes, advances the flashing character. In menus with only two options (Yes or No, On or Off) toggles between selections.
ENTER	Saves a new selection in any menu. From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

Security Code

The 2551 has a security code that can be programmed to any four-digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.



Securiy Code ____ ____ ____ ____

View Menu

The VIEW menu contains all of the basic information available from the Magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See below for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
- A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling ▲ or ▼. These displays will remain in the display for 10 minutes, then the normal operating display will return.



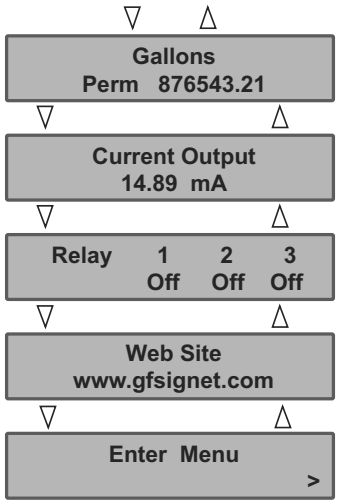
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4 to 20 mA Output models only.

Relay States shown for units with a relay board.

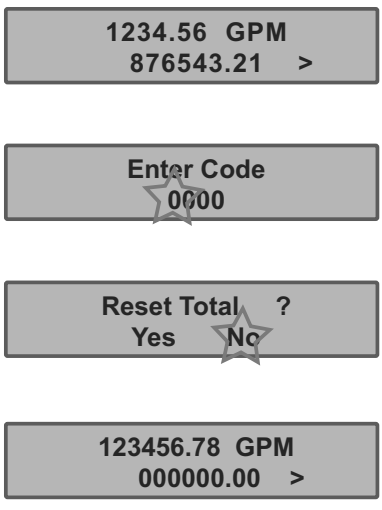
This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See page 10 for details.



Resetting the Resettable Totalizer





1. From the normal operating display, press the ► key.
2. The resettable totalizer can be configured to require the security code before allowing the reset. If the Total Reset is set to "RESET OFF" this display will not appear. See page 17, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to all zeroes and the display will immediately return to the normal operating display.

Setup Menu

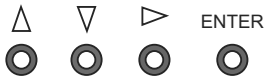


The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See page 17 for details related to the Options menu..

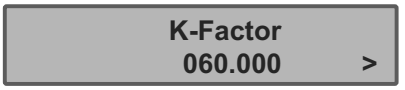


Use the keypad to navigate through each setting.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts on pages 12-13 for values in pulses per U.S. gallon or in pulses per liter. To use other units, convert the published values as appropriate.



Pipe Size: Select the pipe size that is nearest to the nominal pipe size.



Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- • (centered dot) μ (micro) _ (blank)
- - (dash) / (slash) 3 (for cubic units)

The last character selects the timebase for the flow rate measurement.
Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)



Set 4 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 4 mA.

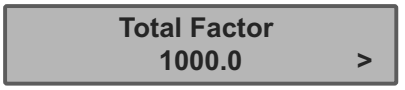


Set 20 mA: (2551-22 and -42 versions only) Set the flow rate where the current output will be 20 mA.

The 4 to 20 mA output may be spanned to monitor forward and reverse flow rates.



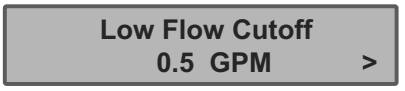
Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (i.e., gallons, liters, etc.)



Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.



Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshhold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.



Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See page 11 for details.



Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation on page 11.



Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal.

  The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

  Short averaging times provide the fastest display and output response to changes in the flow rate.

  Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

  The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 milliseconds (ms).

  Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 ms before the function is enabled.

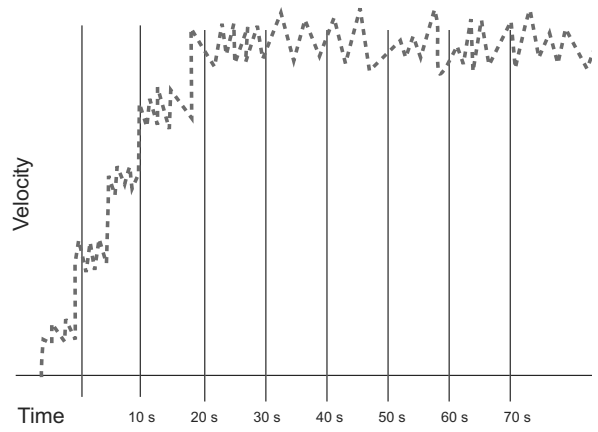
NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero.

CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system, such a change may be undesirable.

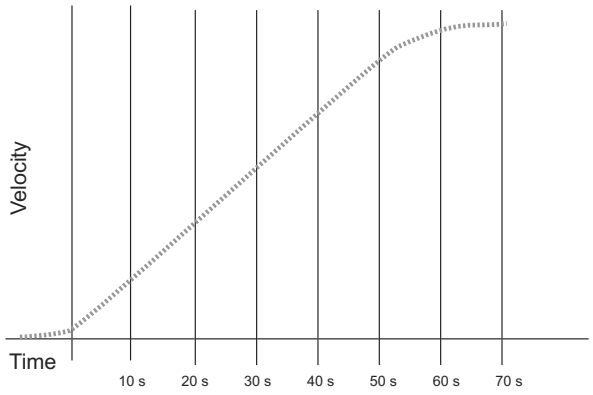
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



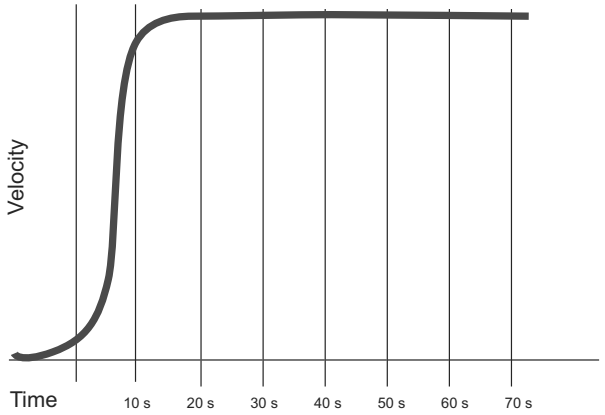
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



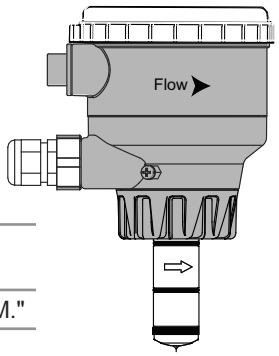
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



Bi-Directional Flow

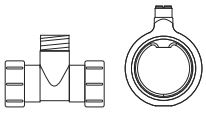
- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display	The "+" sign is suppressed during forward flow. "-123.45 GPM" during reverse flow.
Totalizer Display	The totalizer will count during forward flow conditions only. During reverse flow the totalizer will not increment.
Relay Outputs	May be set to detect reverse flow: "Low Setpoint at -25 GPM."
4 to 20 mA output	May be scaled to span any flow range: For example: "4 to 20 mA = -100 GPM to +100 GPM"
Frequency output, Frequency ÷ 10 output	Reverse flow is processed same as forward flow in the frequency output magmeters.
Digital (S^3L) output	Reverse flow results in 0 flow rate output.

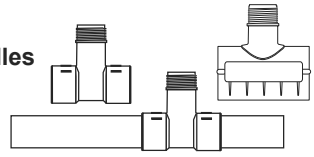
Calibration Data: K-Factors

Polypropylene True Union Tees and Wafers
PVDF True Union Tees,
PVC True Union Tees



Pipe Size (Metric)	Fitting Type	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
PVDF FITTINGS (DIN/ISO, BS, ANSI)			
DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
PVC FITTINGS (DIN/ISO, BS, ANSI)			
DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10

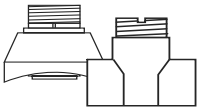
PVC Tees and Clamp-on Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 PVC-U TEES FOR SCH 80 PIPE			
½	MPV8T005	2277.0	601.58
¾	MPV8T007	1407.6	371.90
1	MPV8T010	861.17	227.52
1¼	MPV8T012	464.91	122.83
1½	MPV8T015	331.43	87.56
2	MPV8T020	192.89	50.96
SCH 80 PVC TEES FOR SCH 80 PIPE			
2½	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83
SCH 80 CPVC TEES FOR SCH 80 PIPE			
½	MCPV8T005	2277.0	601.58
¾	MCPV8T007	1407.6	371.90
1	MCPV8T010	861.17	227.52
1¼	MCPV8T012	464.91	122.83
1½	MCPV8T015	331.43	87.56
2	MCPV8T020	192.89	50.96
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 80 PIPE			
2	PV8S020	193.83	51.21
2½	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51
SCH 80 PVC CLAMP-ON SADDLES FOR SCH 40 PIPE			
2	PV8S020	180.01	47.56
2½	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

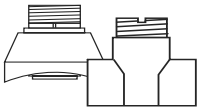
Calibration Data: K-Factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees



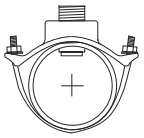
Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
CARBON STEEL TEES ON SCH 40 PIPE			
½	CS4T005	1572.66	415.50
¾	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1¼	CS4T012	377.48	99.73
1½	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35
STAINLESS STEEL TEES ON SCH 40 PIPE			
½	CR4T005	1601.26	423.05
¾	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1¼	CR4T012	279.68	73.89
1½	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE			
2½	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39
CARBON STEEL WELDOLETS ON SCH 40 PIPE			
2½	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39
GALVANIZED IRON TEES ON SCH 40 PIPE			
1	IR4T010	558.50	147.56
1¼	IR4T012	334.45	88.36
1½	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

Bronze and Copper Tees and Brazolets



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
BRONZE TEES ON SCH 40 PIPE			
1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58
COPPER TEES FITTING ON COPPER PIPE SCH K			
½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94
COPPER TEES FITTING ON COPPER PIPE SCH L			
½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE			
2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

Iron Saddles



Pipe Size (In.)	Fitting Type	K-Factor Gallons	K-Factor Liters
SCH 80 IRON SADDLE ON SCH 80 PIPE			
2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49
SCH 80 IRON SADDLE ON SCH 40 PIPE			
2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

Calibration Menu

The K-Factors published in this manual assume that the flow conditions in the pipe are ideal.

Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

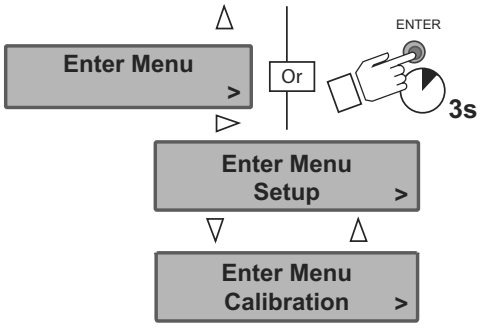
Performing a custom calibration with the magmeter in place will adjust the K-Factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.



NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Volume Method of Calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter To Start	At START, the 2551 begins counting the flow past the sensor.
Press Enter To Stop	At STOP, the 2551 stores the total flow accumulated since the START.
Enter Volume 000000. GPM	Enter the VOLUME that has been pumped past the sensor.
Value must be more than 0.0	This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.
K-Factor 45.6789	Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Rate Method of Calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate 45.6789	The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-Factor based on the new flow rate.
K-Factor Out of Range	This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.
K-Factor 56.7890	Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

Relay Menus

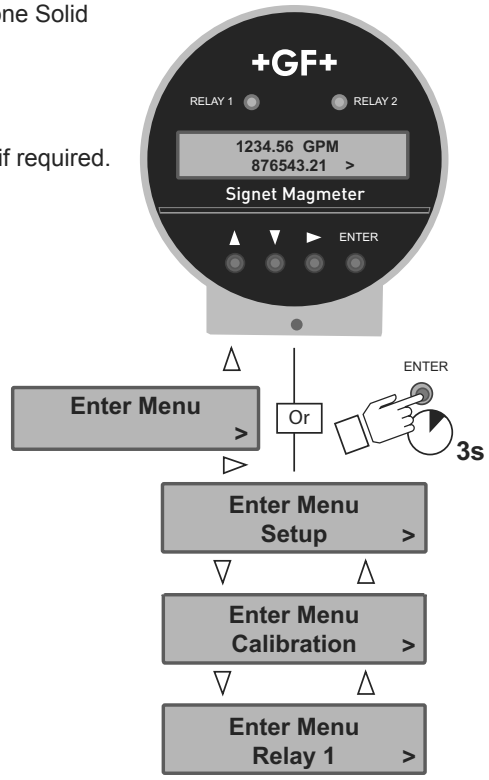
Magmeter models 3-2551-21 and -22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

Off: If a relay is not used, it can be turned Off to prevent contact wear.



NOTE: The Security Code must be entered before modifying the relay menu.

Enter Code
0000

Pulse Relay Mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.

Relay 1 Mode
Pulse >

Relay 1 Volume
0.0000 Gal >

Relay 1 Width
0.1 secs >

Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

Total Relay Mode

Program a relay to activate when the Resettable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in an R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the service representative to replace the filter.

When the totalizer is reset, the relay will be deactivated and the process begins anew.

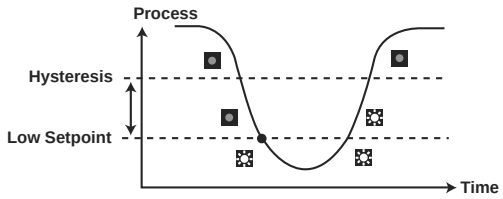
Relay 1 Mode
Total >

Relay 1 Set High
000000 >

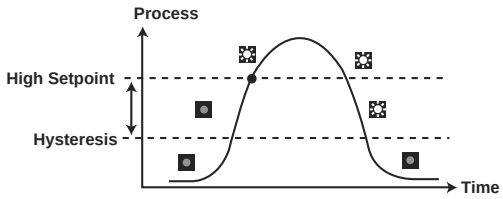
High, Low, or Window Relay Modes

Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

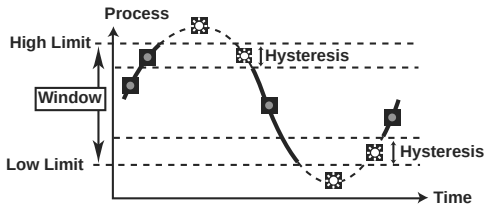
Reverse Flow
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint

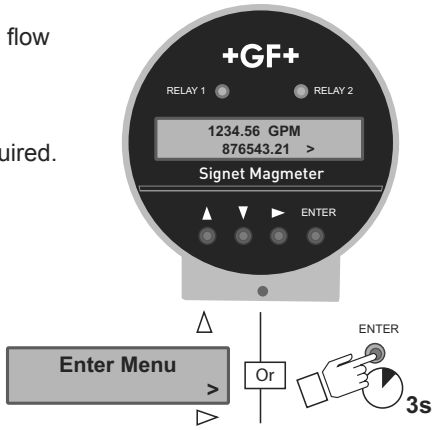


Relay behavior with HIGH Setpoint



Relay behavior with WINDOW Setpoints

Relay activated
Relay deactivated



NOTE: The Security Code must be entered before modifying the relay menu.



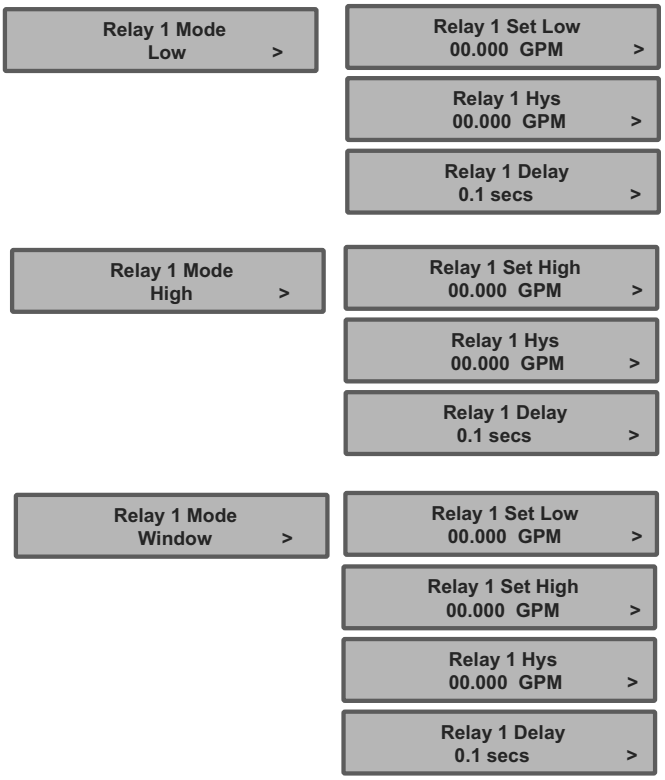
The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low:
Set the flow rate where a Low relay will be activated.

Hysteresis:
Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

Set High:
Set the flow rate where a High relay will be activated.

Delay:
Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.



The menu repeats for Relay 2 and Relay 3.

Test Menus

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power MUST be connected to the 2551 to activate the relays



Test Output
4.20 mA >

Shown for 4 to 20 mA models only (3-2551-XX-22, -42). Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Test Relay 1
Open Closed >

Test Relay 2
Open Closed >

Test Relay 3
Open Closed >

Shown for Relay models Only
Toggle any of these relays ON and OFF to verify that the system is operating properly.

Auxiliary power MUST be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

Options Menus

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Language
English >

Select from English, French, German, Italian, Portuguese or Spanish. This selection will be displayed at first power-up of a new magmeter.

Security Code
****** >**

Security Code can be set to any four digit number. Factory standard setting is 0000.

Contrast
2 >

Set for best view after the magmeter is installed. Larger number means display appears darker.

Total Reset
Lock On >

Lock ON requires the Security Code before resetting the Resetable Totalizer. Lock OFF reset with no security code.

Noise Rejection
60 Hz >

Filters out common 50 or 60 Hz electrical noise.

Flow Decimal
******.** >**

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Total Decimal
********.** >**

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Separator
ddd.d >

Select decimal point or comma for use in numeric displays.

Output Mode
Frequency >

For Frequency/Digital models only: Select Freq output, Freq ÷ 10 output, Mirror Relay 1 output or (S^3L) Digital output.

Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-Powered Flow Totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu. If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1. If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The (**S^3L) Digital** output mode switches the 2551 to the Signet serial data output called (S^3L) (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.

Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe **for 24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use PTFE tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm^2 wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

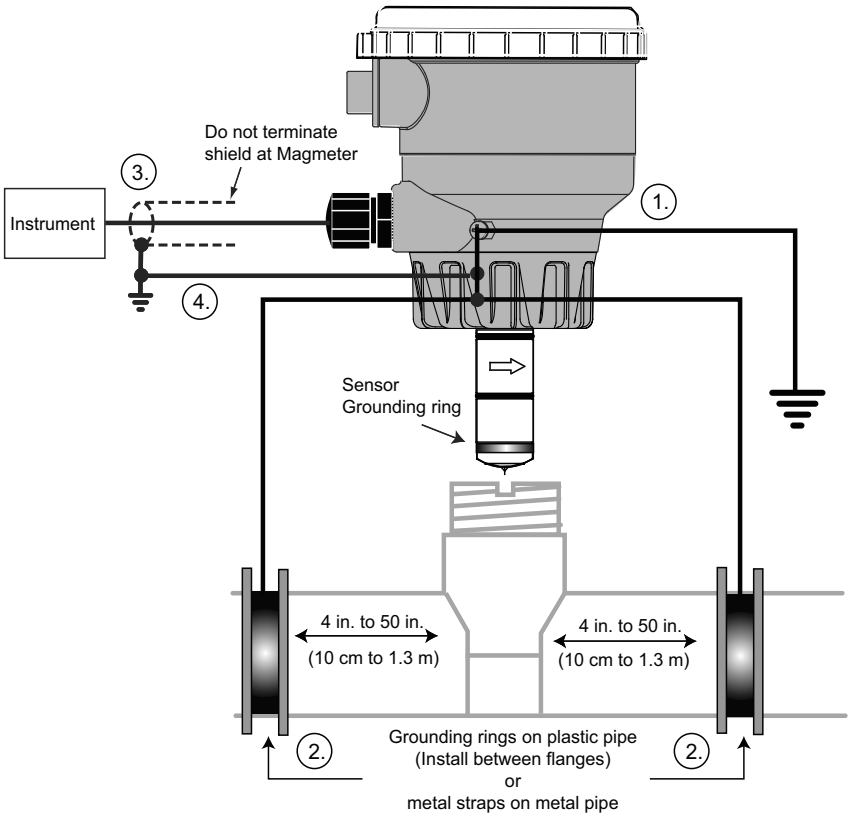
② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

④ Connect an additional wire (minimum AWG 14/1.5 mm^2) from the remote instrument ground to the magmeter ground terminal.



Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

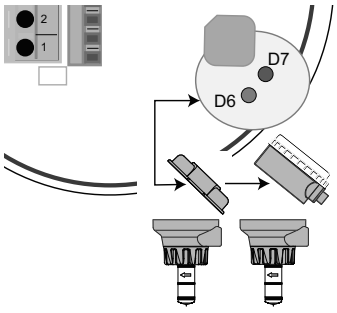
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	Magmeter installed too close to upstream obstruction.	Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter.
	Magmeter located in area exposed to air bubbles/pockets.	Eliminate air bubbles in the pipe.
	Magmeter is installed in pipe backwards.	Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM.
	Electrical noise is interfering with the measurement.	Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the Magmeter to operate properly.
	Electrodes are coated with deposits or chemical oxide layers.	Carefully clean the electrodes. Refer to sensor manual for details.
Output is not 0 when flow is stopped.	Electrodes not adequately conditioned in fluid.	Allow the sensor to sit in full pipe for 24 hours then restart.
	Fluid is moving inside the pipe.	Increase the Low Flow Cutoff. (page 10)
No 4 to 20 mA output.	Loop power not connected correctly.	Connect 24 VDC ±10% connected to loop terminals 1 and 3.
4 to 20 mA current output is incorrect.	4 to 20 mA is not scaled properly.	Check and reset in the Setup Menu.
No Frequency output. No (S^3L) output.	2551 is wrong model.	Frequency / (S^3L) model: 3-2551-21 (w/rlys) or -41 (w/o rlys).
	Incorrect setting in Options Menu.	Select Frequency in the Options menu.
	Wiring is not correct.	Check wiring, make corrections.
	Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	Install 10 kΩ resistor. (page 6)
No flow rate, current output is 22 mA.	The fluid is too clean for Magmeter.	Unsuitable application for Magmeter.
	Electronic component failure.	Return 2551 to factory.
Blank display, no backlighting, no relay LEDs, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (page 7) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification.	Correct the main power deficiency.

Troubleshooting with the RED and BLUE LEDs

No Lights: The power is off or the sensor is not connected
Solid Blue: The power is on but there is no flow in the pipe.
Blinking Blue: Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue: Empty pipe indication (electrodes are not wet.)
Blinking Red: System errors (Electrical noise interference)
Solid Red: Instrument error (defective electronic component)



Reverse flow:
- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S^3L) output: Reverse flow results in 0 flow rate displayed on 8900, or with negative numbers on the 9900.
- 4 to 20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4 to 20 mA = -100 to +100 GPM).

Empty Pipe Detection
- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S^3L) output will be locked to 0 if electrodes are not wet.
- 4 to 20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Ordering Information

Frequency or Digitial (S^3L) output

Mfr. Part No.	Code	Description
3-2551-P0-21	159 001 267	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-21	159 001 436	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-21	159 001 269	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-41	159 001 261	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-41	159 001 433	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-41	159 001 263	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-21	159 001 268	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-21	159 001 437	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-21	159 001 270	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-41	159 001 262	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-41	159 001 434	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-41	159 001 264	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-21	159 001 435	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-21	159 001 454	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-21	159 001 456	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-41	159 001 432	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-41	159 001 460	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-41	159 001 462	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

4 to 20 mA output

Mfr. Part No.	Code	Description
3-2551-P0-22	159 001 273	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T0-22	159 001 439	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V0-22	159 001 275	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P0-42	159 001 279	DN15 to DN100 (½ in. to 4 in.) Polypropylene and 316L SS.
3-2551-T0-42	159 001 442	DN15 to DN100 (½ in. to 4 in.) PVDF and Titanium
3-2551-V0-42	159 001 281	DN15 to DN100 (½ in. to 4 in.) PVDF and Hastelloy-C
3-2551-P1-22	159 001 274	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T1-22	159 001 440	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V1-22	159 001 276	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P1-42	159 001 280	DN125 to DN200 (5 in. to 8 in.) Polypropylene and 316L SS
3-2551-T1-42	159 001 443	DN125 to DN200 (5 in. to 8 in.) PVDF and Titanium
3-2551-V1-42	159 001 282	DN125 to DN200 (5 in. to 8 in.) PVDF and Hastelloy-C
3-2551-P2-22	159 001 438	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS. Two SPDT relays, one solid state relay
3-2551-T2-22	159 001 455	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium. Two SPDT relays, one solid state relay
3-2551-V2-22	159 001 457	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C. Two SPDT relays, one solid state relay
3-2551-P2-42	159 001 441	DN250 to DN900 (10 in. to 36 in.) Polypropylene and 316L SS
3-2551-T2-42	159 001 461	DN250 to DN900 (10 in. to 36 in.) PVDF and Titanium
3-2551-V2-42	159 001 463	DN250 to DN900 (10 in. to 36 in.) PVDF and Hastelloy-C

Replacement Parts and Accessories

1220-0021	198 801 186	O-ring, FPM
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox®
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8050.396	159 000 617	RC Filter kit (for relay protection)
3-8551.521	159 001 378	Clear plastic cap for display

+GF+

Georg Fischer Signet LLC, 3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

3-2551.090-1 Rev. M 04/15 English
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MYEL-40T

Series M
Mechanical Tilt Float Level Switch

- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body

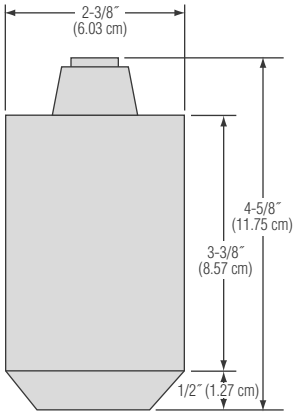


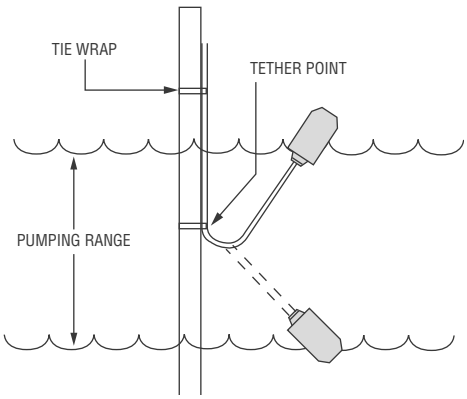
Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

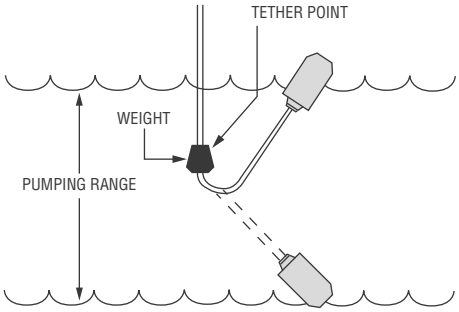
Specifications

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert.

Dimensions







Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

How to Order

Use the **Bold** characters from the chart below to construct a product code.

M XXX XX X

Series
M

Contact Configuration
BLU – SPST, Normally Open, narrow angle[1]
YEL – SPST, Normally Closed, narrow angle[1]
RED – SPST, Normally Open, wide angle[2]
WHI – SPST, Normally Closed, wide angle[2]
GRE – SPDT, Form C, wide angle[2]

Length
40 – 40 feet (12.19 m)

Tether Method
T – Tie
W – Weight

Tether Method	Part Number
Tie Wrap	**7762360**
Weight	**7762381**

Notes:
1. Narrow angle pumping range approximately 2 in. to 8 in.
2. Wide angle pumping range approximately 5 in. to 18 in.

Series SGZ

2.5″ Stainless Steel Industrial Pressure Gage

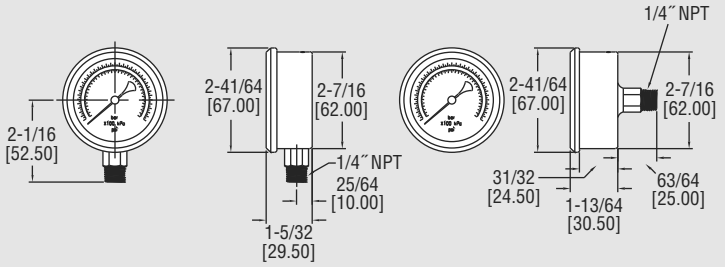
1.5% FS Accuracy, 316 SS Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGZ Bottom



SGZ Back with Accessory Pointers



The Series SGZ Gages have dual psi and bar (x100 kPa) scales with ±1.5% full-scale accuracy. The Series SGZ gages are designed with 304 SS housings and 316 SS wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges in either bottom or back connection configurations. Series SGZ gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

Model	Range	Model	Range
SGZ-D10122N	30″ Hg to 0	**SGZ-D10622N**	0 to 160 psi
SGZ-D10322N	0 to 30 psi	**SGZ-D10722N**	0 to 200 psi
SGZ-D10422N	0 to 60 psi	**SGZ-D11022N**	0 to 300 psi
SGZ-D10522N	0 to 100 psi	**SGZ-D11122N**	0 to 500 psi
		SGZ-D11222N	0 to 1000 psi

Note: To order with glycerin fill add - GF to the end of the model
For back connect, change ending from 22N to 42N

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

SPECIFICATIONS
Service: Compatible gases and liquids.
Wetted Materials: 316 L SS Tube, 316 SS connector.
Housing: 304 SS.
Lens: Polycarbonate.
Accuracy: ±1.5% FS.
Pressure Limit: FS range.
Temperature Limits: -4 to 140°F (-20 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Weight: 4.9 oz (141 g) bottom, 5.8 oz (164 g) back. Add 3.7 oz (104 g) for glycerin fill.

ACCESSORY
A-445D, U-Bracket Mounting Kit for 2.5″ Gage
A-499R, Red Sliding Color Pointer
A-499Y, Yellow Sliding Color Pointer
A-499G, Green Sliding Color Pointer

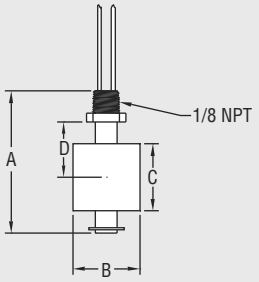
Series
F6 & F7

Level Switches - Vertical

Low Cost, Reliable and Compact, Hermetically Sealed Contacts


F7-SB


F7-ST713



Series F6 & F7 compact level switches combine low cost and reliability with fast, simple installation. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels. Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications.

Dimensions in Inches (mm)

Model	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from Hex①
F7-SB	2.75 (70)	1.38 (35)	1.13 (29)	1.2 (31)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F6-SS	2.17 (55)	1.11 (28)	1.11 (28)	–
F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-K	2.13 (54)	1.0 (25)	1.0 (25)	0.65 (17)
F7-C11	2.06 (52)	1.0 (25)	1.0 (25)	0.56 (14)
F7-C21	2.06 (24)	1.0 (25)	1.0 (25)	0.56 (14)
F7-BB	3.19 (81)	1.88 (48)	1.81 (46)	1.19 (30)
F7-PS	3.38 (86)	1.88 (48)	1.88 (48)	1.25 (32)
F7-PVC	3.44 (87)	1.5 (38)	1.81 (46)	0.75 (19)
F7-T1	3.47 (88)	2.13 (54)	1.94 (49)	0.92 (22)
F7-ST713	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)
F7-ST714	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)

Model	Applications	Material Float/Stem	Temp. Limits	Press. Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg NPT (M)	Weight oz (g)
F7-SB	General purpose	Buna-N & Epoxy/ 316 SS	220°F (105°C)	150 psig 10 bar	0.60	25 VA: 1A @ 220 VAC	22 AWG 18″ (45 cm)	1/8″	2 (58)
F7-SS2	High temp/pressure, corrosives	316 SS (CYC)/ 316 SS	300°F (149°C)	450 psig 31 bar	0.75	25 VA: 1A @ 200 VAC	22 AWG 18″ (45 cm)	1/8″	1.2 (34)
F6-SS	Corrosives	316 SS/ 316 SS	257°F (125°C)	218 psig 15 bar	0.65	20 VA: 0.08A @ 240 VAC	20 AWG 11.8″ (30 cm)	1/8	1.59 (45)
F7-MPP**	Broad chemical compatibility	Polypropylene/ Polypropylene	180°F (82°C)	100 psig 6.89 bar	0.90	10 VA: 0.1A @ 100 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-MPP-NO**	Broad chemical compatibility	Polypropylene/ Polypropylene	176°F (80°C)	100 psig 6.89 bar	0.90	50 VA: 0.2A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-PP	Broad chemical compatibility	Polypropylene & Epoxy/Polypropylene	220°F (105°C)	100 psig 6.89 bar	0.60	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-BT	Oils & Fuels	Buna-N & Epoxy/ PBT*	220°F (105°C)	150 psig 10 bar	0.45	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.7 (20)
F7-K	Food/beverage, corrosives	PVDF/ PVDF	180°F (82°C)	100 psig 6.89 bar	1.00	50 VA: 0.25A @ 150 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C11	General purpose	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C21	Oils & water, general purpose	Buna-N/ 316 SS	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-BB	High viscosity liquids	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-PS	Water-based liquids, complies with FDA	Polysulfone/ Polysulfone†	225°F (107°C)	50 psig 3 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	4 (110)
F7-PVC	Chemical & plating	CPVC/ CPVC	180°F (82°C)	15 psig 1 bar	0.85	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-T1	Viscous, sticky or corrosive liquids	PTFE/ TFE	300°F (149°C)	30 psig 2 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)
F7-ST713	Oils, water & chemicals	316 SS/ 316 SS	300°F (149°C)	750 psig 52 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)

①Distance between hex and liquid (S.G. = 1.0) level at actuation point will vary with specific gravity changes.
*PBT - Polybutylene Terephthalate.
†Incudes 316 SS clip.
‡Spherical floats.
** F7-MPP is normally closed/F7-MPP-NO is normally open

UL Listed

OPTIONAL FITTINGS — For external mounting of vertical models
A-347, 1/8″ x 1-1/4″ NPT carbon steel adapter
A-347-SS, 1/8″ x 1-1/4″ NPT 316 SS adapter
A-348, 1/8″ x 1-1/2″ NPT carbon steel adapter

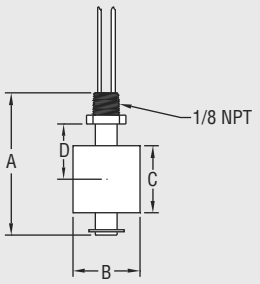
Series F6 & F7

Level Switches - Vertical

Low Cost, Reliable and Compact, Hermetically Sealed Contacts


F7-SB


F7-ST713



Series F6 & F7 compact level switches combine low cost and reliability with fast, simple installation. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels. Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications.

Dimensions in Inches (mm)

Model	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from Hex①
F7-SB	2.75 (70)	1.38 (35)	1.13 (29)	1.2 (31)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F6-SS	2.17 (55)	1.11 (28)	1.11 (28)	–
F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-K	2.13 (54)	1.0 (25)	1.0 (25)	0.65 (17)
F7-C11	2.06 (52)	1.0 (25)	1.0 (25)	0.56 (14)
F7-C21	2.06 (24)	1.0 (25)	1.0 (25)	0.56 (14)
F7-BB	3.19 (81)	1.88 (48)	1.81 (46)	1.19 (30)
F7-PS	3.38 (86)	1.88 (48)	1.88 (48)	1.25 (32)
F7-PVC	3.44 (87)	1.5 (38)	1.81 (46)	0.75 (19)
F7-T1	3.47 (88)	2.13 (54)	1.94 (49)	0.92 (22)
F7-ST713	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)
F7-ST714	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)

Model	Applications	Material Float/Stem	Temp. Limits	Press. Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg NPT (M)	Weight oz (g)
F7-SB	General purpose	Buna-N & Epoxy/ 316 SS	220°F (105°C)	150 psig 10 bar	0.60	25 VA: 1A @ 220 VAC	22 AWG 18″ (45 cm)	1/8″	2 (58)
F7-SS2	High temp/pressure, corrosives	316 SS (CYC)/ 316 SS	300°F (149°C)	450 psig 31 bar	0.75	25 VA: 1A @ 200 VAC	22 AWG 18″ (45 cm)	1/8	1.2 (34)
F6-SS	Corrosives	316 SS/ 316 SS	257°F (125°C)	218 psig 15 bar	0.65	20 VA: 0.08A @ 240 VAC	20 AWG 11.8″ (30 cm)	1/8″	1.59 (45)
F7-MPP**	Broad chemical compatibility	Polypropylene/ Polypropylene	180°F (82°C)	100 psig 6.89 bar	0.90	10 VA: 0.1A @ 100 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-MPP-NO**	Broad chemical compatibility	Polypropylene/ Polypropylene	176°F (80°C)	100 psig 6.89 bar	0.90	50 VA: 0.2A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-PP	Broad chemical compatibility	Polypropylene & Epoxy/Polypropylene	220°F (105°C)	100 psig 6.89 bar	0.60	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-BT	Oils & Fuels	Buna-N & Epoxy/ PBT*	220°F (105°C)	150 psig 10 bar	0.45	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.7 (20)
F7-K	Food/beverage, corrosives	PVDF/ PVDF	180°F (82°C)	100 psig 6.89 bar	1.00	50 VA: 0.25A @ 150 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C11	General purpose	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C21	Oils & water, general purpose	Buna-N/ 316 SS	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-BB	High viscosity liquids	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-PS	Water-based liquids, complies with FDA	Polysulfone/ Polysulfone†	225°F (107°C)	50 psig 3 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	4 (110)
F7-PVC	Chemical & plating	CPVC/ CPVC	180°F (82°C)	15 psig 1 bar	0.85	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-T1	Viscous, sticky or corrosive liquids	PTFE/ TFE	300°F (149°C)	30 psig 2 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)
F7-ST713	Oils, water & chemicals	316 SS/ 316 SS	300°F (149°C)	750 psig 52 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)

①Distance between hex and liquid (S.G. = 1.0) level at actuation point will vary with specific gravity changes.
*PBT - Polybutylene Terephthalate.
†Incudes 316 SS clip.
‡Spherical floats.
** F7-MPP is normally closed/F7-MPP-NO is normally open

UL Listed

OPTIONAL FITTINGS — For external mounting of vertical models
A-347, 1/8″ x 1-1/4″ NPT carbon steel adapter
A-347-SS, 1/8″ x 1-1/4″ NPT 316 SS adapter
A-348, 1/8″ x 1-1/2″ NPT carbon steel adapter

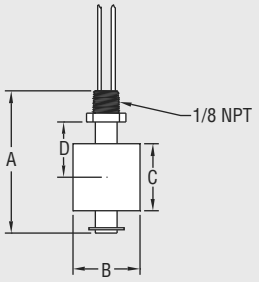
Series F6 & F7

Level Switches - Vertical

Low Cost, Reliable and Compact, Hermetically Sealed Contacts


F7-SB


F7-ST713



Series F6 & F7 compact level switches combine low cost and reliability with fast, simple installation. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels. Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications.

Dimensions in Inches (mm)

Model	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from Hex①
F7-SB	2.75 (70)	1.38 (35)	1.13 (29)	1.2 (31)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F6-SS	2.17 (55)	1.11 (28)	1.11 (28)	–
F7-MPP	1.63 (41)	0.63 (16)	0.63 (16)	0.47 (12)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-K	2.13 (54)	1.0 (25)	1.0 (25)	0.65 (17)
F7-C11	2.06 (52)	1.0 (25)	1.0 (25)	0.56 (14)
F7-C21	2.06 (24)	1.0 (25)	1.0 (25)	0.56 (14)
F7-BB	3.19 (81)	1.88 (48)	1.81 (46)	1.19 (30)
F7-PS	3.38 (86)	1.88 (48)	1.88 (48)	1.25 (32)
F7-PVC	3.44 (87)	1.5 (38)	1.81 (46)	0.75 (19)
F7-T1	3.47 (88)	2.13 (54)	1.94 (49)	0.92 (22)
F7-ST713	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)
F7-ST714	3.38 (86)	2.06 (52)	2.06 (52)	1.09 (28)

Model	Applications	Material Float/Stem	Temp. Limits	Press. Limits	Min. S.G.	Electrical Rating	Wire Leads	Mtg NPT (M)	Weight oz (g)
F7-SB	General purpose	Buna-N & Epoxy/ 316 SS	220°F (105°C)	150 psig 10 bar	0.60	25 VA: 1A @ 220 VAC	22 AWG 18″ (45 cm)	1/8″	2 (58)
F7-SS2	High temp/pressure, corrosives	316 SS (CYC)/ 316 SS	300°F (149°C)	450 psig 31 bar	0.75	25 VA: 1A @ 200 VAC	22 AWG 18″ (45 cm)	1/8	1.2 (34)
F6-SS	Corrosives	316 SS/ 316 SS	257°F (125°C)	218 psig 15 bar	0.65	20 VA: 0.08A @ 240 VAC	20 AWG 11.8″ (30 cm)	1/8″	1.59 (45)
F7-MPP**	Broad chemical compatibility	Polypropylene/ Polypropylene	180°F (82°C)	100 psig 6.89 bar	0.90	10 VA: 0.1A @ 100 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-MPP-NO**	Broad chemical compatibility	Polypropylene/ Polypropylene	176°F (80°C)	100 psig 6.89 bar	0.90	50 VA: 0.2A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-PP	Broad chemical compatibility	Polypropylene & Epoxy/Polypropylene	220°F (105°C)	100 psig 6.89 bar	0.60	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.8 (23)
F7-BT	Oils & Fuels	Buna-N & Epoxy/ PBT*	220°F (105°C)	150 psig 10 bar	0.45	30 VA: 0.14A @ 220 VAC	22 AWG 24″ (61 cm)	1/8″	0.7 (20)
F7-K	Food/beverage, corrosives	PVDF/ PVDF	180°F (82°C)	100 psig 6.89 bar	1.00	50 VA: 0.25A @ 150 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C11	General purpose	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-C21	Oils & water, general purpose	Buna-N/ 316 SS	180°F (82°C)	150 psig 10 bar	0.45	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/8″	1.5 (43)
F7-BB	High viscosity liquids	Buna-N/ Brass	180°F (82°C)	150 psig 10 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-PS	Water-based liquids, complies with FDA	Polysulfone/ Polysulfone†	225°F (107°C)	50 psig 3 bar	0.55	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	4 (110)
F7-PVC	Chemical & plating	CPVC/ CPVC	180°F (82°C)	15 psig 1 bar	0.85	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	5 (140)
F7-T1	Viscous, sticky or corrosive liquids	PTFE/ TFE	300°F (149°C)	30 psig 2 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)
F7-ST713	Oils, water & chemicals	316 SS/ 316 SS	300°F (149°C)	750 psig 52 bar	0.80	20 VA: 0.08A @ 240 VAC	22 AWG 24″ (61 cm)	1/4″	6 (170)

①Distance between hex and liquid (S.G. = 1.0) level at actuation point will vary with specific gravity changes.
*PBT - Polybutylene Terephthalate.
†Incudes 316 SS clip.
‡Spherical floats.
** F7-MPP is normally closed/F7-MPP-NO is normally open

UL Listed

OPTIONAL FITTINGS — For external mounting of vertical models
A-347, 1/8″ x 1-1/4″ NPT carbon steel adapter
A-347-SS, 1/8″ x 1-1/4″ NPT 316 SS adapter
A-348, 1/8″ x 1-1/2″ NPT carbon steel adapter

Direct-Drive Dust-Resistant Wall Exhaust Fan

120 VAC, 12" Diameter



Blade Diameter	12"
Airflow	2,000 cfm
Volume	Not Rated
rpm	1,550
hp	1/5
Amps	1.1
Overall	
Height	17 3/4"
Width	17 3/4"
Depth	5 1/4"
Additional Specifications	Direct-Drive Dust-Resistant Fans 120 Volts AC, Single Phase

Expel stagnant and humid air. Fans must be hardwired. Wall collars and louvers are also available. Direct-drive fans have fewer moving parts than belt-drive fans for less maintenance. Belt-drive fans are quieter and have a longer life span than direct-drive fans because components can be replaced if worn or damaged.

Dust-resistant fans are better suited to damp and dirty environments than standard fans. All have a totally enclosed motor. They have a steel frame. Styles B and C have aluminum blades.

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(609) 259-8900
(609) 259-3575 (fax)
nj.sales@mcmaster.com
Text 58926

Large-Space Ceiling/Wall-Mount Electric Heater

480V AC, Heats Maximum 2280 cu. ft., 17100 Btu/Hour



Voltage	480V AC
Electrical Phase	Three
Maximum Cu. Feet Heated	2,280
Heat Output, Btu/hour.	17,100
Airflow	400 cfm
Watts	5,000
Amps	6.1
Overall	
Height	18"
Width	15"
Depth	7"
Related Products	Heater-Mount Thermostats
	Ceiling-Mount Brackets

No need for gas lines and vent pipes—install these electric heaters in shops, garages, and other large spaces without the hassles of a gas heater installation. Heaters must be hardwired. Adjust the louvers to direct airflow.

Standard—Housing is steel.

Large-Space Ceiling/Wall-Mount Electric Heater

208/240V AC, Single Phase, 34100 Btu/Hour



Voltage	208V AC, 240V AC
Electrical Phase	Single
Maximum Cu. Feet Heated	4,540
Heat Output, Btu/hour.	34,100
Airflow	700 cfm
Watts	10,000
Amps	41.2
Overall	
Height	25"
Width	22"
Depth	7"
Related Products	Heater-Mount Thermostats
	Ceiling-Mount Brackets

No need for gas lines and vent pipes—install these electric heaters in shops, garages, and other large spaces without the hassles of a gas heater installation. Heaters must be hardwired. Adjust the louvers to direct airflow.

Standard—Housing is steel.

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SPDT Heater-Mount Thermostat for Large-Space Ceiling/Wall-Mount Electric Heater



Heater-mount thermostats and wall-mount thermostats adjust from 50° to 90° F. Heater-mount thermosats are SPDT (single pole, double throw), unless noted.

Style A can be wall-mounted and ceiling-mounted. When wall-mounted with the included bracket, heaters evenly warm large spaces. Bracket has 11/32" dia. holes (fasteners not included).

Operating Instructions

1UHH1 thru 1UHH4, 2NNR5 thru 2NNR9, 2NNT1 thru 2NNT5, and 6EDY3 thru 6EDY7

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Line Voltage Thermostats

Description

These Line Voltage Thermostats are designed for reliable use in heating, ventilating, and refrigeration applications. A broad temperature range between -30° and +120°F (-34° and +49°C) allows for a wide range of heating, ventilating, and refrigeration applications. Snap-acting contacts are in a dust protected enclosure. SPDT switches are enclosed and protected.

Specifications

ELECTRICAL RATINGS

AC Voltage	120 V	208 V	240 V	277 V
Models 1UHH1 thru 1UHH4, 2NNR5 thru 2NNR7, 2NNR9, 2NNT1 thru 2NNT4 & 6EDY3 thru 6EDY7:				
Inductive Full Load Amps	16.0	9.2	8.0	–
Locked Rotor Amps	96.0	55.2	48.0	–
Models 2NNR8 & 2NNT5:				
Inductive Full Load Amps	12.0	–	–	–
Locked Rotor Amps	72.0	–	–	–

Resistive Load Amps (not lamp loads):

Models 1UHH1, 1UHH2, 2NNR6, 2NNR7, 2NNR9 & 2NNT3:				
SPST (when connected)	22.0	22.0	22.0	22.0
SPDT (when connected)	16.0	9.2	8.0	7.2
Models 1UHH3, 2NNT1 & 6EDY4:				
SPDT Rating	16.0	9.2	8.0	7.2
Models 1UHH4, 2NNR5 & 2NNT4:				
SPST Rating	22.0	22.0	22.0	22.0
Models 2NNR8 & 2NNT5*:				
SPST Rating	12.0	–	–	–

Pilot Duty . . . . . 125 VA 24/600 VAC

(*) Model numbers 2NNR8 and 2NNT5 include a 6 foot "Piggyback" cord.

NOTE: When used as a two circuit switch, the total load must not exceed 2000 VA.



Figure 1

General Safety Information

⚠ WARNING ***Disconnect all power before installing or servicing this product. If the power disconnect is out of view, lock it in the open position and tag it to prevent unexpected restarting of power. Failure to do so could result in fatal electric shock.***

1. Special attention must be given to any grounding information on this product and to other equipment associated with its installation and use. To ensure a proper ground, the grounding means must be checked by a qualified electrician.
2. Be certain that the electrical ratings of the thermostat conform to the power source and the load(s) being controlled. Loads that exceed the rating of the thermostat should be handled with a suitable rated relay or motor starter.

⚠ WARNING ***Do not depend upon the thermostat as the sole means of disconnecting power when installing or servicing the product it is controlling. Always disconnect power at the main circuit breaker as described above. Failure to do so could result in fatal electric shock.***

3. This thermostat is intended ONLY for permanent installation in accordance with the United States National Electrical Code (NEC), all applicable local codes and ordinances, and all sections of this manual. All wiring should be done by a qualified electrician, using copper wire only.

⚠ WARNING ***These thermostats are intended for general heating, ventilating, and refrigeration ONLY. They must NOT be used in potentially dangerous locations such as flammable, explosive, chemical laden areas or in wet atmospheres.***

⚠ WARNING ***These thermostats are designed for use as operating controls only. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (supervisory alarm systems) that protect against, or warn of control failure.***

ADDITIONAL SPECIFICATIONS

Model Number	Application	Switch	Temperature Range	Temperature Differential*	Sensor	Construction	Housing Rating
1UHH1	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
1UHH2	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
1UHH3	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
1UHH4	Cool Only	SPST	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
2NNR5	Refrigeration	SPST	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Steel	1
2NNR6	Heat/Cool	SPDT	0 to 120°F (-18 to 49°C)	3.5°F	Extended	Polymeric	4X
2NNR7	Heat/Cool	SPDT	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Steel	1
2NNR8	Heat Only	SPST	35 to 95°F (2 to 35°C)	3.5°F	Fixed	Steel	1
2NNR9	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT1	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT2	Cool Only	SPST	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT3	Heat/Cool	SPDT	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Stainless Steel	1
2NNT4	Refrigeration	SPST	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Stainless Steel	1
2NNT5	Heat Only	SPST	35 to 95°F (2 to 35°C)	3.5°F	Fixed	Stainless Steel	1
6EDY3	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5 to 12°F	Fixed	Polymeric	1
6EDY4	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
6EDY5	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
6EDY7	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5 to 12°F	Extended	Steel	1

(*) Temperature between stages on Models 1UHH3, 2NNT1 and 6EDY4 is fixed. The low stage makes contacts R (Red) to Y (Yellow) at the knob setting while the high stage makes contact approximately 3°F above the knob setting.

HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Type 4 Mild Steel Wallmount Enclosure *Eclipse Series*

Hinge Door with Quarter Turn/Handle







Panel Sold Separately

Application

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

Standards

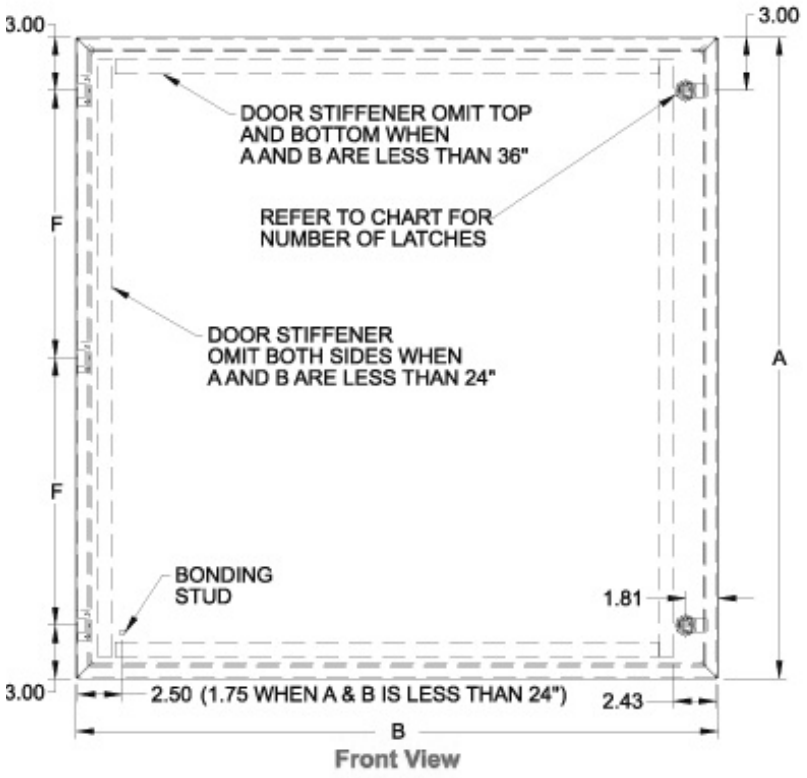
- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
  - NEMA Type 3R, 4, and 12
  - IEC 60529, IP66

Construction

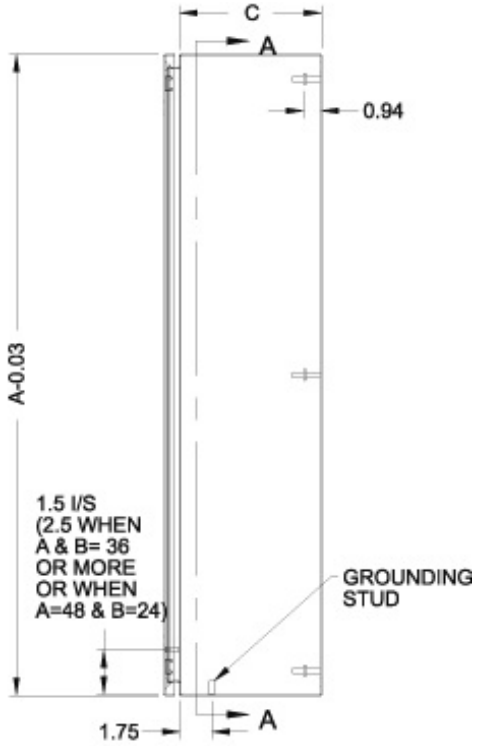
- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

Finish

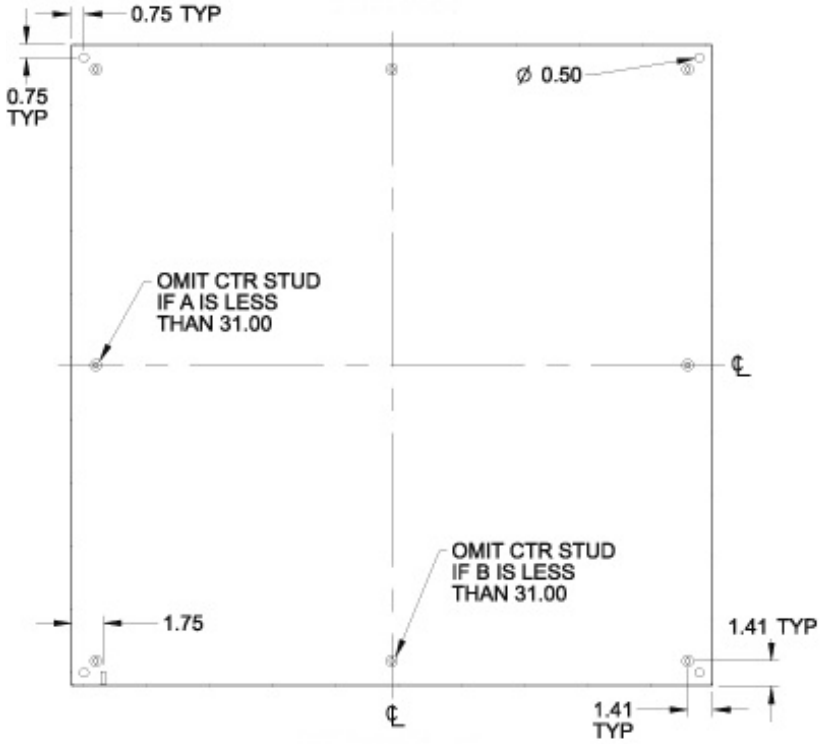
- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).



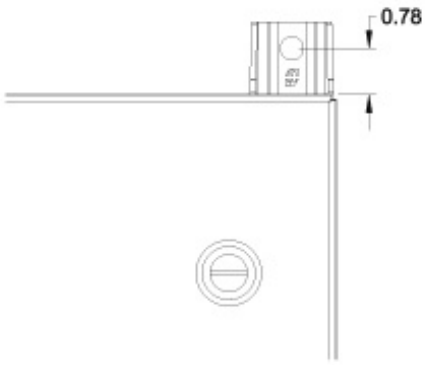
Front View



Side View



SECTION A-A



Mounting Foot Detail

Part No. (ANSI 61 Gray)	Part No. (RAL 7035 Light Gray)	Overall Dimensions A	B	C	Door/Body Gauge	Latches Qty	Type	Opt. Panel Part No.	Panel Size D	E	# Hinges	F	Ship Wt. (lbs)
EN4SD12126GY	**EN4SD12126LG**	12.00	12.00	6.00	16	1	Qtr Turn	**EP1212**	10.20	10.20	2	6.00	12
EN4SD12246GY	**EN4SD12246LG**	12.00	24.00	6.00	16	1	Qtr Turn	**EP1224**	10.20	22.20	2	18.00	24
EN4SD16126GY	**EN4SD16126LG**	16.00	12.00	6.00	16	1	Qtr Turn	**EP1612**	14.20	10.20	2	10.00	16
EN4SD16166GY	**EN4SD16166LG**	16.00	16.00	6.00	16	1	Qtr Turn	**EP1616**	14.20	14.20	2	10.00	19
EN4SD16206GY	**EN4SD16206LG**	16.00	20.00	6.00	16	1	Qtr Turn	**EP1620**	14.20	18.20	2	10.00	22
EN4SD20126GY	**EN4SD20126LG**	20.00	12.00	6.00	16	1	Qtr Turn	**EP2012**	18.20	10.20	2	14.00	20

EN4SD242410GY	**EN4SD242410LG**	24.00	24.00	10.00	14	2	Qtr. Turn	**EP2424**	22.20	22.20	2	18.00	45
EN4SD243010GY	**EN4SD243010LG**	24.00	30.00	10.00	14	2	Qtr. Turn	**EP2430**	22.20	28.20	2	18.00	53
EN4SD302010GY	**EN4SD302010LG**	30.00	20.00	10.00	14	2	Qtr. Turn	**EP3020**	28.20	18.20	3	12.00	47
EN4SD302410GY	**EN4SD302410LG**	30.00	24.00	10.00	14	2	Qtr. Turn	**EP3024**	28.20	22.20	3	12.00	53
EN4SD303010GY	**EN4SD303010LG**	30.00	30.00	10.00	14	2	Qtr. Turn	**EP3030**	28.20	28.20	3	12.00	75
EN4SD362410GY	**EN4SD362410LG**	36.00	24.00	10.00	14	2	Qtr. Turn	**EP3624**	34.20	22.20	3	15.00	70
EN4SD363010GY	**EN4SD363010LG**	36.00	30.00	10.00	14	2	Qtr. Turn	**EP3630**	34.20	28.20	3	15.00	84
EN4SD363610GY	**EN4SD363610LG**	36.00	36.00	10.00	14	2	Qtr. Turn	**EP3636**	34.20	34.20	3	15.00	100
EN4SD423010GY	**EN4SD423010LG**	42.00	30.00	10.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	107
EN4SD423610GY	**EN4SD423610LG**	42.00	36.00	10.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	117
EN4SD482410GY	**EN4SD482410LG**	48.00	24.00	10.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	95
EN4SD483010GY	**EN4SD483010LG**	48.00	30.00	10.00	14	1	3-point	**EP4830**	46.20	28.20	4	14.00	120
EN4SD483610GY	**EN4SD483610LG**	48.00	36.00	10.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	125
EN4SD603610GY	**EN4SD603610LG**	60.00	36.00	10.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	150
EN4SD201612GY	**EN4SD201612LG**	20.00	16.00	12.00	16	1	Qtr Turn	**EP2016**	18.20	14.20	2	14.00	32
EN4SD202012GY	**EN4SD202012LG**	20.00	20.00	12.00	16	1	Qtr Turn	**EP2020**	18.20	18.20	2	14.00	34
EN4SD242012GY	**EN4SD242012LG**	24.00	20.00	12.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	38
EN4SD242412GY	**EN4SD242412LG**	24.00	24.00	12.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	47
EN4SD302412GY	**EN4SD302412LG**	30.00	24.00	12.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	57
EN4SD303012GY	**EN4SD303012LG**	30.00	30.00	12.00	14	2	Qtr Turn	**EP3030**	28.20	28.20	3	12.00	80
EN4SD362412GY	**EN4SD362412LG**	36.00	24.00	12.00	14	2	Qtr Turn	**EP3624**	34.20	22.20	3	15.00	62
EN4SD363012GY	**EN4SD363012LG**	36.00	30.00	12.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	91
EN4SD363612GY	**EN4SD363612LG**	36.00	36.00	12.00	14	2	Qtr Turn	**EP3636**	34.20	34.20	3	15.00	104
EN4SD423012GY	**EN4SD423012LG**	42.00	30.00	12.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	111
EN4SD423612GY	**EN4SD423612LG**	42.00	36.00	12.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	121
EN4SD482412GY	**EN4SD482412LG**	48.00	24.00	12.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	98
EN4SD483612GY	**EN4SD483612LG**	48.00	36.00	12.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603612GY	**EN4SD603612LG**	60.00	36.00	12.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	165
EN4SD723012GY	**EN4SD723012LG**	72.00	30.00	12.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	190
EN4SD723612GY	**EN4SD723612LG**	72.00	36.00	12.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	195
EN4SD242016GY	**EN4SD242016LG**	24.00	20.00	16.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	52
EN4SD242416GY	**EN4SD242416LG**	24.00	24.00	16.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	66
EN4SD302416GY	**EN4SD302416LG**	30.00	24.00	16.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	85
EN4SD363016GY	**EN4SD363016LG**	36.00	30.00	16.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	102
EN4SD423616GY	**EN4SD423616LG**	42.00	36.00	16.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	140
EN4SD483616GY	**EN4SD483616LG**	48.00	36.00	16.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603616GY	**EN4SD603616LG**	60.00	36.00	16.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	200
EN4SD723016GY	**EN4SD723016LG**	72.00	30.00	16.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	215
EN4SD723616GY	**EN4SD723616LG**	72.00	36.00	16.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	217
EN4SD242420GY	**EN4SD242420LG**	24.00	24.00	20.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	70
EN4SD302420GY	**EN4SD302420LG**	30.00	24.00	20.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	82
EN4SD363020GY	**EN4SD363020LG**	36.00	30.00	20.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	117

APC Back-UPS® 350

Best Value Battery Backup & Protection for Home and Home Office Computers

APC's Back-UPS provides enough battery backup power so you can work through short length power outages. It also safeguards your equipment against damaging surges and spikes that travel along utility and phone lines. The Back-UPS series is also "greener" than ever, using an ultra-efficient design that consumes less power during normal operation than any other battery backup in its class, saving you money on your electricity bill. Coupled with all the standard features of the Back-UPS series, the 350 is the perfect unit to protect your productivity from the constant threat of bad power and lost data.





Product Features:

1. **4 "Battery Backup & Surge Protected" Outlets** keep a CPU, monitor and other critical devices running when the power goes out or fluctuates outside safe levels.
2. **3 "Surge Only" Outlets** provide surge protection for your non-critical devices.
3. **Data Line Surge Protection** guards against surges and spikes traveling over an analog phone line (phone, fax, modem, DSL).
4. **Combination Power Button/LED Indicator** provides visual and audible status of unit.
5. **An ultra efficient electrical design**, RoHS compliance and use of all recyclable packaging materials minimize impact on the environment and maximize efficiency.
6. **Building Wiring Fault Indicator** lets you know if there are problems in your building's wiring.
7. **Push Button Circuit Breaker** enables quick recovery from overloads.
8. **Automatic Diagnostic Testing** ensures your unit is ready when you need it.
9. **3 yr Warranty**, $75,000 Equipment Protection Policy, free technical phone and online support

APC by Schneider Electric

Back-UPS 350 Specifications

Model Number	BE350G
Output	
Output Capacity	350 VA / 210 Watts
Output Voltage / Frequency (On utility)	120V / 60Hz
Output Voltage / Frequency (On battery)	115V +/-8%, 60 Hz +/-3Hz
Output Connections	6 total NEMA 5-15R outlets: 3 battery backup & surge 3 surge protection only
Waveform Type	Stepped Approximation to Sine Wave
Input	
Input Voltage / Frequency	120V / 60 Hz +/-1 Hz
Input Connection	5 ft cord with right angle plug (NEMA 5-15P)
Surge Protection	
AC Power Surge Protection	All outlets
Data Line Surge Protection	Analog phone line, RJ-11 (single line, 2-wire). For phone, fax, modem, DSL
Physical	
Unit Dimensions (H x W x D)	3.5” x 6.25” x 11.0”
Unit Weight	8.0 lbs
Shipping Dimensions (H x W x D)	5.0” x 7.75” x 14.25”
Shipping Weight	9.6 lbs
Color	Black
UPC Code	731304258902
Battery	
Battery Type	Maintenance-free, sealed lead-acid battery, leakproof
Management	
Alarms	Visual (LED) and audible alarms
Auto-Shutdown Software	None
Safety	
Certification/Approvals	cUL Listed, FCC Part 15 Class B, FCC Part 68, NOM, UL 1778, UL 497A, UL 498

APC *by Schneider Electric*
132 Fairgrounds Rd
West Kingston, RI 02892
Tel: 800-800-4272
www.apc.com

APC by Schneider Electric

Sierra Wireless AirLink® LS300 Gateway

Small, rugged, and intelligent 3G gateway.

Want to remotely control, monitor, or track the location of field equipment? Need a reliable alternative to landlines when they go down or are not an option in remote or temporary locations?

ONE GATEWAY, MULTIPLE POSSIBILITIES

The AirLink LS300 gateway is the smallest, most compact 3G gateway from Sierra Wireless. Designed to be the next generation, all-in-one successor to the market leading Raven series, the intelligent LS300 gateway comes standard with multiple interfaces (Ethernet, Serial, USB), GPS, and all features that AirLink customers have come to rely on for over 15 years:

- Best-in-class session persistence keep AirLink gateways connected to the cellular network 24/7
- Rugged, military spec design keep AirLink gateways operating in the harshest environments
- AirVantage™ Management Service provides remote device management to centrally configure, deploy, and monitor AirLink gateways over-the-air (OTA)
- Industry-leading warranties and world class support keep AirLink customers coming back

QUICKLY CONFIGURE AND DEPLOY

The comprehensive set of configurable options makes the LS300 quick and easy to deploy in the field. With ALEOS™ embedded intelligence powering AirLink gateways, the LS300 can be deployed in most industrial, enterprise, and transportation applications out-of-the-box.

In addition to configuring connection settings, ALEOS enables users to setup custom security, networking, and routing parameters, GPS location tracking, and events reporting without any programming. With over a decade of experience in real-world deployments, ALEOS has been developed to ease integration and configuration for a wide range of deployment scenarios.

ADD CUSTOM LOGIC WITHOUT ANY EMBEDDED EXPERTISE

ALEOS Application Framework makes it easy to add custom logic to the LS300 gateway for collecting information from connected equipment or optimizing data transfers. This scripting framework allows users to create applications without deep embedded expertise or C/C++ programming skills.



USE CASE EXAMPLES

- Industrial: remotely monitor and control pipelines, meters, pumps, valves in any energy or utility application.
- Enterprise: instantly deploy reliable internet connectivity to remote point-of-sale locations, temporary installations, or retail operations.
- Transportation: track the location and speed of vehicles or heavy equipment and provide reliable internet to a mobile workforce.



SIERRA WIRELESS™ | AirLink®

Sierra Wireless AirLink® LS300 Gateway

Technical Specifications

HSPA+ MODELS

fallback to quad-band GSM/GPRS/EDGE

- HSPA+ North America 800/850/1900/2100 MHz
- HSPA+ EMEA 900/2100 MHz

EV-DO MODELS

fallback to CDMA 1xRTT

- Dual Band EV-DO Rev. A 800/1900 MHz

HOST INTERFACES

- 10/100 Base-T RJ45 Ethernet
- RS-232 Serial Port
- USB V2.0 Micro-B Connector
- 2 SMA Antenna Connectors (RF, GPS/Rx Diversity)
- Support for active antenna

PROTOCOLS

- Network: TCP/IP, UDP/IP, DNS
- Routing: NAT, Host Port Routing, DHCP, PPPoE, VLAN, VRRP
- Application: SMS, Telnet/SSH, SMTP, SNMP, SNTP
- Serial: TCP/UDP PAD Mode, Modbus (ASCII, RTU, Variable), PPP
- GPS: TAIP, NMEA, RAP

INPUT/OUTPUT

- Configurable I/O on power connector
- Input ON Voltage 3.3 to 30 VDC
- Input OFF Voltage 0 to 1.2 VDC
- Output max. switching capability 200mA @ 30VDC

DIMENSIONS

- 3.0 in x 3.5 in x 1.0 in (76 mm x 90 mm x 25 mm)
- 6.7 oz (190G)

POWER CONSUMPTION

All figures in mA @ 12VDC

- HSPA+: Min 219, Peak 624, Idle 104
- CDMA: Min 164, Peak 280, Idle 132
- Low Power Standby Mode: <35

GPS TECHNOLOGY

HSPA+ Models

- Acquisition Time: <3 Sec Hot Start, <45 Sec Cold Start
- Accuracy: <10m
- Tracking Sensitivity: -155 dBm

EV-DO Models

- 12 Channel, Continuous tracking
- Acquisition Time: 9 sec Hot Start, 39 Sec Cold Start
- Accuracy: <3m (50%), <8m (90%)
- Tracking Sensitivity: -160 dBm

EVENTS REPORTING

- Event Types: Digital Input, GPS/AVL, Network Parameters, Data Usage, Timer, Power, Device Temperature
- Report/Action Types: SMS, Email, SNMP Trap, Relay Output, GPS Rap Report, Events Protocol Message to Server

VPN/SECURITY

- IPsec, SSL, and GRE VPN Client
- Up to 5 VPN Tunnels
- IKE Encryption
- Port Forwarding and DMZ
- Port Filtering
- Trusted IP
- MAC Address Filtering

DEVICE MANAGEMENT

- AirVantage Management Service next-generation device management application
- ACEManager device configuration utility

ALEOS APPLICATION FRAMEWORK

- Lua language coding platform
- Remote application management
- Eclipse-based IDE
- Integrated real-time debugging

ENVIRONMENTAL

- Operating Temperature: -30°C to +70°C / -22°F to +158°F
- Storage Temperature: -40°C to +85°C / -40°F to +185°F
- Humidity: 90% RH @ 60 °C
- Military Spec MIL-STD-810 conformance to thermal, mechanical shock and humidity

INDUSTRY CERTIFICATIONS

- PTCRB
- FCC, Industry Canada
- CE, E-Mark
- RoHS Compliant
- Class I, Div 2

CARRIER APPROVALS

- AT&T
- Sprint
- Verizon Wireless

WARRANTY

- 3-year

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SIERRA WIRELESS™ | AirLink®

Wilson Electronics
Say Goodbye to Dropped Calls

General Mobile External Antennas

Stay Connected on the Road with Wilson Electronics Mobile Antennas

Designed for use with our mobile signal boosters, Wilson Electronics wide range of mobile antennas offers top performance and multiple mounting options. Our best-selling magnet-mount antennas install in seconds and are transferable between vehicles. For a more permanent installation, users can choose from glass- or NMO-mount options.



301103 • 301125 • 301128 • 301703 • 304202
Magnet-Mount Antenna



301113 • 301126 • 301131 • 301132
Mini Magnet-Mount Antenna

FEATURES

- Perfect for cars, vans and light trucks
- Mobile and indoor use

SPECIFICATIONS

	Magnet-Mount Antennas					Mini Magnet-Mount Antennas			
Part Number	HOT 301103	301125	301128	301703	304202	301113	301126	301131 WHITE	301132 WHITE
Frequency Range (MHz)	Refer to table on page 40								
Impedance	50 ohms								
Antenna Gain	Refer to table on page 40								
Signal Pattern	Omni								
Polarization	Vertical								
Ground Plane	Metal ground plane required								
Connector	FME Female	SMA Male	TNC Male	FME Female	FME Female	FME Female	SMA Male	FME Male	N Male
Material	Whip - Stainless Steel					Whip - Plastic Coated Steel Wire			
Coax Cable	RG174 - 10 feet / 3.05 meters								
Height	12.25 inches / 31.12 cm					4.175 inches / 10.60 cm			
Mount	Rare earth magnet					Rare earth magnet			

Wilson Electronics
Say Goodbye to Dropped Calls

Antenna Frequency Specific Gain Chart (dBi)

		FREQUENCY IN MHz					
		700-800	824-894	880-960	1710-1880	1850-1990	2110-2170
MAGNET MOUNT ANTENNAS	301103	1.9	5.1	3.1	-4.0	6.1	2.3
	301125	1.9	5.1	3.1	-4.0	6.1	2.3
	301126	1.9	5.1	3.1	-4.0	6.1	2.3
	304202	1.9	5.1	3.1	-4.0	6.1	2.3
	301703	-1.9	4.8	4.6	0.3	4.1	0.6
MINI MAGNET MOUNT ANTENNAS	301113	1.7	2.1	0.5	2.2	3.1	1.4
	301126	1.7	2.1	0.5	2.2	3.1	1.4
	301131	1.7	2.1	0.5	2.2	3.1	1.4
	301132	1.7	2.1	0.5	2.2	3.1	1.4
DUAL BAND TRUCKER ANTENNAS	301101		5.1			6.1	
	301701			5.1	6.1		
RV TRUCKER W/SPRING ANTENNAS	301119	3.1	4.1	2.0	-1.8	5.1	-2.6
	301133	3.1	4.1	2.0	-1.8	5.1	-2.6
GLASS MOUNT ANTENNAS	301102	1.8	3.5	2.8	-1.5	4.8	1.0
	304201	1.8	3.5	2.8	-1.5	4.8	1.0
MINI GLASS MOUNT ANTENNAS	301114		1.4			2.4	
NMO ANTENNAS	301104	2.0	4.9	0.0	-3.1	5.9	1.3
	301112	2.4	5.5	-0.9	-1.2	5.5	1.7
	304203	3.7	4.4	4.3	-4.1	3.7	0.3
	301105	4.1	1.4	2.4	-3.5	-7.0	-10.2
DUAL BAND LOW PROFILE ANTENNAS	301106	3.4	2.2	1.2	1.4	3.2	4.3
	301127	3.4	2.2	1.2	1.4	3.2	4.3
	301208	-0.8	1.5	1.2	2.4	3.4	1.2
	301209	-0.8	1.5	1.2	2.4	3.4	1.2
YAGI ANTENNAS	301111	10.0	10.8	8.8	-16.4	-14.9	-13.8
	301124	-18.7	-23.4	-21.6	9.1	12.5	-10.6
	301129	-0.9	10.1	-7.9	-10.3	-11.9	-8.7
	301142	-3.6	3.7	10.1	-12.1	-10.2	-13.4
	304411	7.3	8.1	7.4	9.2	10.6	10.4
	304475	7.3	8.1	7.4	9.2	10.6	10.4
DOME ANTENNAS	301121	-2.5	2.5	-0.5	3.5	4.1	1.5
	301123	3.3	5.4	-2.3	-4.3	0.5	-8.0
MARINE ANTENNAS	301130	3.4	4.1	3.5	3.1	5.1	0.2
PANEL ANTENNAS	301135	5.2	4.4	4.2	10.1	10.6	8.2
	301155	5.2	4.4	4.2	10.1	10.6	8.2
	304451	5.2	4.4	4.2	10.1	10.6	8.2
	304471	5.2	4.4	4.2	10.1	10.6	8.2
	304452	5.2	4.4	4.2	10.1	10.6	8.2
	304472	5.2	4.4	4.2	10.1	10.6	8.2
	304453	5.2	4.4	4.2	10.1	10.6	8.2
	304473	5.2	4.4	4.2	10.1	10.6	8.2
ULTRA SLIM ANTENNAS	301143	-5.7	-6.8	-9.5	3.1	3.9	5.0
	301149	-5.7	-6.8	-9.5	3.1	3.9	5.0
CRADLE PLUS - PHONE CRADLE	301146	-5.0	0.7	-0.8	2.3	2.6	1.5
	301148	-5.0	0.7	-0.8	2.3	2.6	1.5
EXTERIOR BUILDING ANTENNAS	301141	0.7	4.0	3.6	-1.7	5.5	4.7
	301201	3.2	4.1	2.7	0.6	5.1	-7.5
	301202	3.2	4.1	2.7	0.6	5.1	-7.5

Cellular Data Cards

Adapter plugs into the adapter port on the end of the cellular data card or plugs in as an antenna replacement for data cards with this feature. Check the model for a specific adapter type.

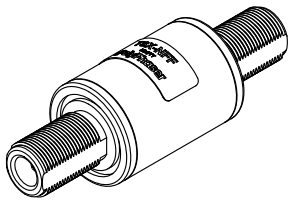
For information about Wilson's cellular adapters for modems and data cards visit www.WilsonElectronics.com

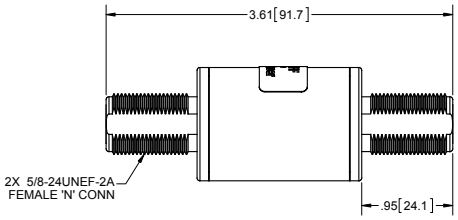


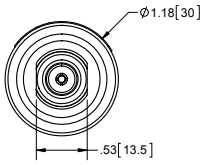




REVISIONS				
REV.	DESCRIPTION	ECN	DATE	APPROVED
A	PRE-PRODUCTION RELEASE		5/15/12	CP

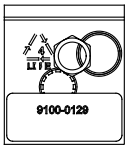






MAXIMUM CHARACTERISTICS

APPLICATION:
DC SHORT/RF ONLY (NO POWER SUPPLY PROVISIONS)
BULKHEAD MOUNT BI-DIRECTIONAL
WEATHERPROOF WHEN INSTALLED
FREQUENCY RANGE:
698MHz TO 2.7GHz @ -26dB RETURN LOSS
MAX SURGE:
IEC 61000-4-5 8/20µs WAVEFORM
40kA MAX
20kA MULTIPLE
INSERTION LOSS:
≤0.1dB
CONTINUOUS POWER:
500W @ 920MHz
(750W @ 50°C)
LET THROUGH VOLTAGE:
≤±200mV FOR 3kA @ 8/20µs WAVEFORM
THROUGHPUT ENERGY:
≤5nJ FOR 3kA @ 8/20µs WAVEFORM
TEMPERATURE:
-50°C TO +85°C STORAGE/OPERATING
VIBRATION:
1G @ 5Hz TO 100Hz
MATERIAL:
BODY: TRI-PLATED BRASS
PTFE: DIELECTRIC
CENTER PINS: GOLD PLATED
ENVIRONMENTAL:
MEETS IEC 60529 IP67
MEETS BELLCORE #TA-NWT-000487
PROCEDURE 4.11, 120MPH WIND DRIVEN
RAIN INTRUSION TEST
RoHS COMPLIANT



QTY	DESCRIPTION
1	5/8 MOUNTING NUT
1	INT TOOTH LOCKWASER
1	O-RING

CUSTOMER APPROVAL: _____ DATE: _____

ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.

UNLESS OTHERWISE SPECIFIED
LEADING DIMENSIONS ARE INCHES
DIMENSIONS IN [ ] ARE MILLIMETERS
TOLERANCES:
FRACTIONS± 1/32 .XX± .01
ANGLES± 1 ° .XXX± .005
MATERIAL
.
THIRD-ANGLE PROJECTION

		DATE
DRAWN	RD	02/09/2012
ENG APPD	JJ	5/15/12
PRODUCT MGR	CP	5/15/12
MARKETING APPD	LJ	5/15/12
PROJECT NO.	.	

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PolyPhaser

TITLE
BI-DIRECTIONAL BROADBAND DC SHORT FILTER 'N'
CUSTOMER SPECIFICATION

SIZE	CAGE	DOCUMENT NAME	REV
B	61114	TSX-NFF-C	A

SCALE	PROD CAT	PART NUMBER	SHEET	OF
1:1	RFP	TSX-NFF	1	1

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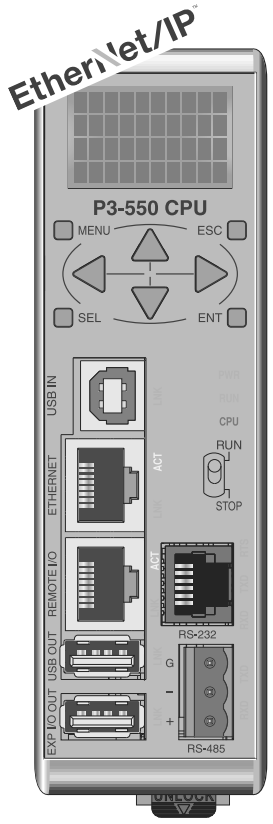
protection technology group
POLYPHASER | TRANSTECTOR | DOWN | LEA | RC ASSOCIATES

CPU Specifications

User Memory	50M (Includes program, data and documentation)		
Memory Type	Flash and Battery Backed RAM		
Retentive Memory*	Models C3 and earlier: 100K Models D and later: 492K		
Scan Time	650µs (3K Boolean, 1K I/O)		
Display	LCD, 4x10 characters, backlit, 8 control buttons; LCD characters are 5x7 with a dot pitch of 0.45mm; 2.25mm x 3.15mm		
Communications 7 Integrated Ports	**USB IN:** Programming, Monitoring, Debug, Firmware **ETHERNET**:** (10/100Mbps Ethernet) Programming, Monitoring, Debug, Firmware, Email SMTP Client, Modbus TCP Client (32 Slaves) and Server (32 Masters), EtherNet/IP Scanner (128 connections) and Adapter (16 connections) **REMOTE I/O:** (10/100Mbps Ethernet) 16 P3-RS or RX Remote Base Groups, and 32 GS-EDRV100 (GS Drives) **USB OUT:** (2.0) Data Logging or Project Transfer using SDCZ4-2048-A10 Pen Drive **EXP I/O OUT:** (2.0 Proprietary) 4 P3-EX Local Expansion Bases **RS-232:** Modbus RTU and ASCII (half and full duplex) **RS-485:** Removable Terminal Included, (1200-115.2k Baud) ASCII, Modbus		
Hardware Limits of System	**17 Base Groups:** 1 Local (P3-550) + 16 Remote (P3-RS / P3-RX) **5 Bases per Base Group:** 1 P3-550, P3-RS or P3-RX + 4 Expansion (P3-EX) **85 Bases Total:** 1 (CPU) + 16 (Remote) + 68 (Expansion) **59,840 Hardware I/O Points** (All 64-point I/O Modules) **32 GS Series Drives** as Remote I/O		
Instruction Types	Application Functions Array Functions Counters/Timers Communications Data Handling	Drum Sequencers Math Functions PID Program Control	String Functions System Functions Contacts Coils HSI/HSO
Real Time Clock Accuracy	+/- 5s per day typical at 25°C +/- 15s per day maximum at 60°C		

*To utilize the 492K of retentive memory in the P3-550 rev. D or later CPU, you must use Productivity3000 software version 1.0.7.XX and firmware version 1.1.13.XX or later.

**For EtherNet/IP support in the P3-550 CPU, you must use ProductivitySuite software version 1.10.0.11 and firmware version 1.1.15.97 or later.



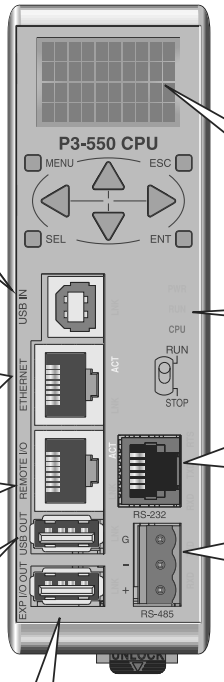
P3-550 CPU

The P3-550 is a full-featured, high-performance CPU for use with the Productivity3000 Programmable Automation Controller.

CPU Specifications 1
CPU Front Panel 2
CPU Installation Procedure 2
Battery Installation Procedure 3
USB Out Port Specifications 3
Exp I/O Out Port Specifications 3
RS-232 Port specifications 4
RS-485 Port specifications 4
Ethernet Port Specifications 5
Remote I/O Port Specifications 5
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Front Panel LCD Display Monitoring and Configuration 6
Front Panel LCD Message Display 7
Safety Information 8
CPU Status Indicators 8
CPU Run/Stop Switch Specifications 8
General Specifications 8
Hot Swap Information 8

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

CPU Front Panel



USB 2.0 (Type B) Port
- Programming
- Online monitoring

10/100 MB Ethernet Port
- Programming
- Online monitoring
- Email (SMTP client)
- Modbus TCP Client and Server
- EtherNet/IP Scanner and Adapter

Local Ethernet Network
- GS Series drives
- Remote IO

USB 2.0 (Type A) Port
- USB Flash Drive data logger
- Project Transfer

LCD
- 4 x 10 character
- 8 control buttons
- User defined messages
- User adjustable settings
- PAC system errors / information

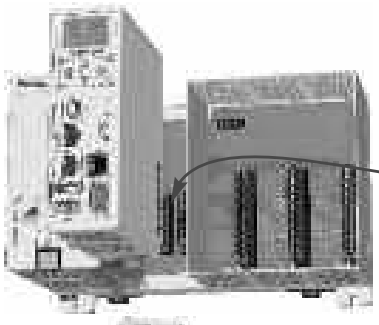
CPU Status Indicators

RS-232 Serial Port (RJ12)
- Modbus/ASCII (master or slave, half or full duplex) peripheral device

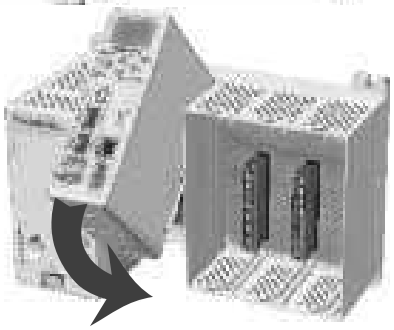
RS-485 Serial Port (TB Style)
- Modbus/ASCII (master peripheral device or multiple slave devices) using the same protocol

USB 2.0 (Type A) Port
Local expansion bases (connect up to 4 expansion bases per base group)

CPU Installation Procedure



Step One:
Locate the two sockets next to the power supply; the CPU will be inserted into this location.



Step Two:
Insert the CPU at a 45° angle into the notch located at the top of the base and rotate down until seated.



Step Three:
Snap retaining tab into the locked position.

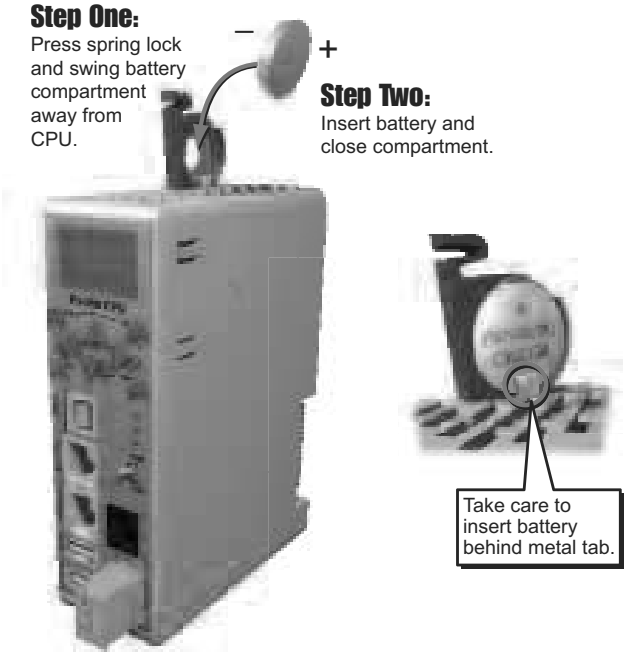
WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot swap.

AVERTISSEMENT: Risque d'explosion: ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud.

Battery Installation Procedure

Step One:
Press spring lock and swing battery compartment away from CPU.

Step Two:
Insert battery and close compartment.



Battery (Optional)

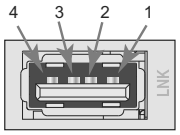
D2-BAT-1	Coin type, 3.0V Lithium battery, 560mA, battery number CR2354

Note: Although not needed for program backup, an uninstalled battery is included with the P3-550. Install this battery if you want the CPU to retain the Time and Date along with any Tagname values that you have set up as retentive.

Port Specifications

USB Type A Master Output Specifications

Port Name	USB OUT	EXP I/O OUT
Description	Standard USB 2.0 Master output for connection to high-speed Flash drive (Sandisk SDCZ4-2048-A10) for data logging or program transfer with built-in surge protection. Not compatible with older full speed USB devices. A 0.5m male-to-female "port extender" cable is included to assist with Flash drive connection.	Proprietary USB 2.0 Master output for connection with up to four P3-EX local expansion bases, with built-in surge protection.
Transfer Rate	480 Mbps	
Port Status LED	Green LED is illuminated when LINK is established to connected device	
Cables	None required	USB Type A to USB Type B: 6 ft. cable part # P3-EX-CBL6 (included with P3-EX module)



Mating face of USB type A female

USB OUT

Pin #	Signal
1	+5
2	– Data
3	+ Data
4	GND

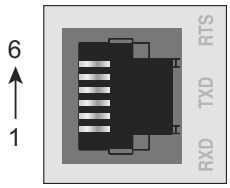
EXP I/O OUT

Pin #	Signal
1	Reset
2	– Data
3	+ Data
4	GND

Port Specifications

RS-232 Specifications

Port Name	RS-232
Description	Non-isolated RS-232 DTE port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Data Rates	Selectable,1200, 2400, 4800, 9600, 19200, 33600, 38400, 57600, and 115200.
+5V Cable Power Source	210mA maximum at 5V, +/- 5%. Reverse polarity and overload protected.
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for flow control.
GND	Logic ground
Maximum Output Load (TXD/RTS)	3K Ω, 1,000pf
Minimum Output Voltage Swing	+/-5V
Output Short Circuit Protection	+/-15mA
Port Status LED	Green LED is illuminated when active for TXD, RXD and RTS



6-pin RJ12 Female Modular Connector

Pin #	Signal	
1	GND	Logic Ground
2	+5V	210 mA Maximum
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground

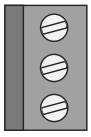
RS-485 Port Specifications

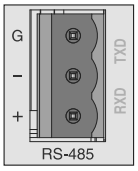
Port Name	RS-485
Description	Non-isolated RS-485 port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active.
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600, 38400, 57600, and 115200.
TXD+/RXD+	RS-485 transceiver high
TXD-/RXD-	RS-485 transceiver low
GND	Logic ground
Input Impedance	19K Ω
Maximum load	50 transceivers, 19K Ω each, 60 Ω termination
Output Short Circuit Protection	+/- 250mA, thermal shut-down protection
Electrostatic Discharge Protection	+/-8KV per IEC1000-4-2
Electrical Fast Transient Protection	+/-2KV per IEC1000-4-4.
Minimum Differential Output Voltage	1.5V with 60 Ω load
Fail safe inputs	Logic high input state if inputs are unconnected
Maximum Common Mode Voltage	-7.5V to 12.5V.
Port Status LED	Green LED illuminated when active for TXD and RXD
Cable Options	L19827-100, L19827-500, L19827-1000 or Belden 9841 equivalent.

Termination Connector Specifications

Number of Positions	Pitch	Screw Driver Width	Screw Size	Screw Torque
3	5 MM	1/8 Inch (3.175mm) maximum	M2.5	4.5 Lb-in
Wire Range	28-12 AWG Solid Conductor – 30-12AWG Stranded Conductor			

Removable Terminal Connector included. Spare connectors available (part no. P3-RS485CON).





Pin #	Signal
G	GND
–	TXD-/RXD-
+	TXD+/RXD+

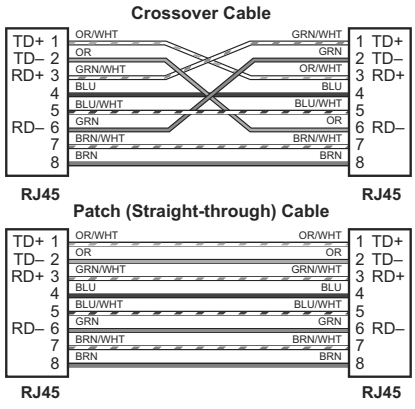
Port Specifications

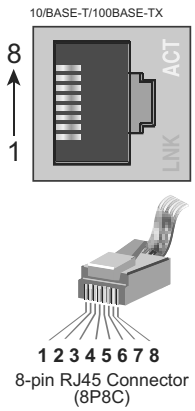
Ethernet Specifications

Port Name	ETHERNET	REMOTE I/O
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, Email (SMTP client), Modbus/TCP client/server connections (fixed IP or DHCP) and EtherNet/IP Scanner/Adapter.	Standard transformer isolated Ethernet port with built-in surge protection for connection to the P3-RS/RX Remote I/O system. Supports 16 Remote I/O slaves and 32 GS Series drives.
Transfer Rate	10/100 Mbps	
Port Status LED	Green LED illuminated when network LINK is established. Yellow LED is illuminated when port is active (ACT).	
Cables	Use a Patch (straight through) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used.	

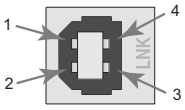
USB Type B Slave Input Specifications

Port Name	USB IN
Description	Standard USB 2.0 Slave input for programming and online monitoring, with built-in surge protection. Not compatible with older full speed USB devices.
Transfer Rate	480 Mbps
Port Status LED	Green LED is illuminated when LINK is established to programming software.
Cables	USB Type A to USB Type B: 3 ft. cable part # USB-CBL-AB3 6 ft. cable part # USB-CBL-AB6 10 ft. cable part # USB-CBL-AB10 15 ft. cable part # USB-CBL-AB15





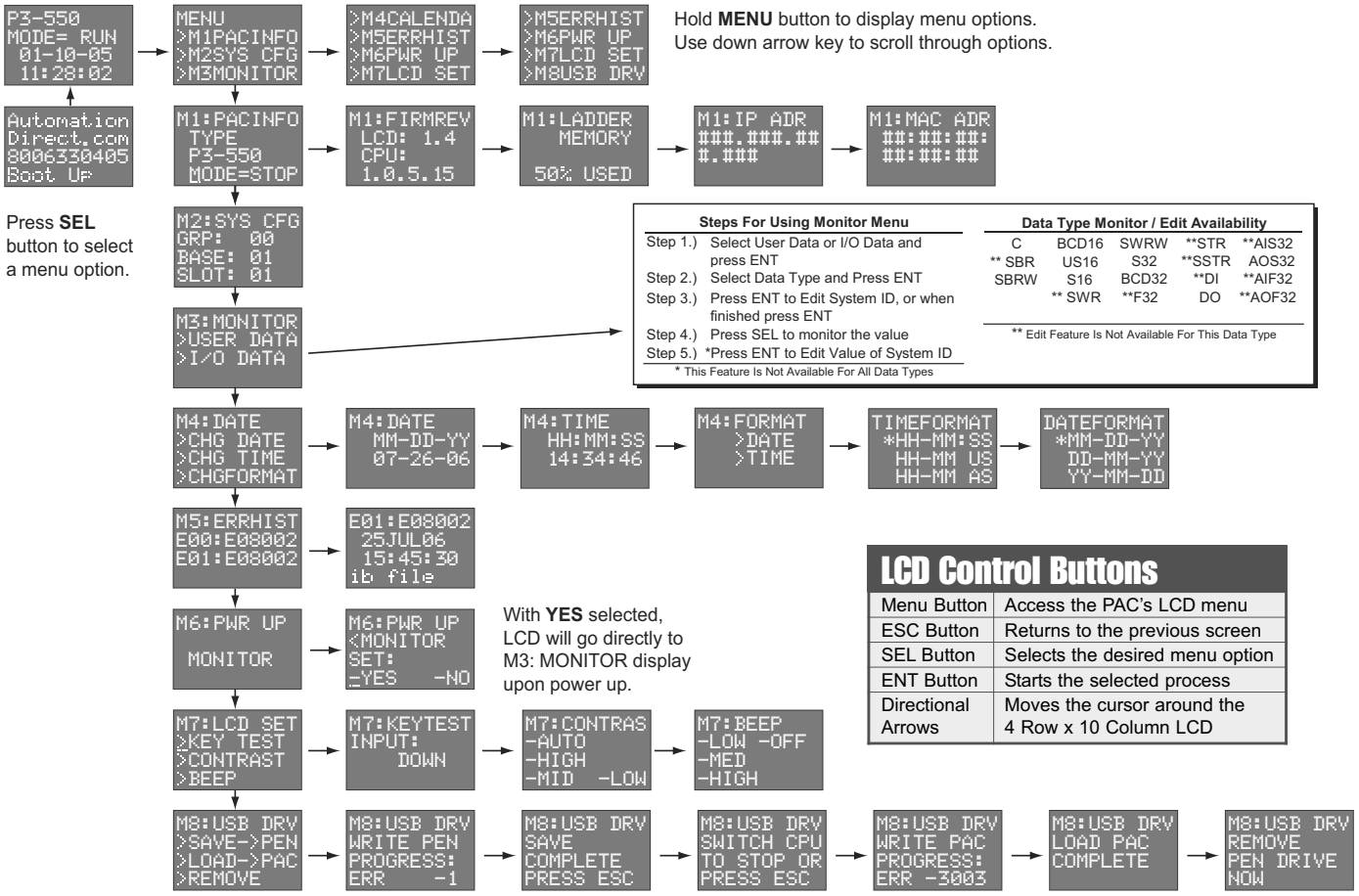
8-pin RJ45 Connector (8P8C)



Mating face of USB type B female

Pin #	Signal
1	+5
2	–Data
3	+Data
4	GND

Front Panel LCD Display Monitoring and Configuration



LCD Control Buttons

Menu Button	Access the PAC's LCD menu
ESC Button	Returns to the previous screen
SEL Button	Selects the desired menu option
ENT Button	Starts the selected process
Directional Arrows	Moves the cursor around the 4 Row x 10 Column LCD

Front Panel LCD Message Display





The CPU incorporates a 4 line x 10 character LCD for PAC system alarms and information and for displaying user defined messages.

LCD characters are 5x7 with a dot pitch of 0.45mm; 2.25mm x 3.15mm.

LCD control buttons located beneath the display allow the user to navigate through a menu and arrow buttons allow for configuration of time and date settings.

For user-defined messages, the display is configured using the Productivity3000 Programming Software. An LCD Page instruction allows the user to program text into user-defined tags and display the messages based on the ladder execution.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

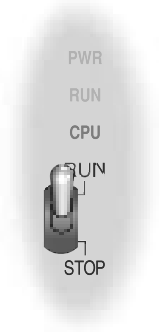
Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

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CPU Status Indicators

PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, power down, or watch-dog time-out.



CPU Run/Stop Switch Specifications

RUN position	Executes user program, run-time edits possible
STOP position	Does not execute user program, normal program load position

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Heat Dissipation	7W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Location	Controller slot in the local base in a Productivity3000 System
EU Directive	See the "EU Directive" topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Weight	260g (9 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.



Hot-Swapping Information
Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d'explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Document Name	Edition/Revision	Date
P3-CPU-M	1st Ed. Revision K	3/3/2015

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Input Specifications

Inputs per Module		16 (sinking / sourcing)
Operating Voltage Range (Tolerance)	CE	12-24 VDC (± 10%)
	UL	12-24 VDC (± 10%)
Peak Voltage		26.4 VDC
Input Current (Typical)		5 mA @ 12 VDC 11 mA @ 24 VDC
Maximum Input Current @ Temp		12.5 mA @ 60° C (26.4 VDC)
Input Impedance		2.7k Ω @ 12-24 VDC
ON Voltage Level		> 10 VDC
OFF Voltage Level		< 3 VDC
Minimum ON Current		4 mA
Maximum OFF Current		2 mA
OFF to ON Response		Max. 2 ms Typical 1ms
ON to OFF Response		Max. 2 ms Typical 1ms
Status Indicators		Logic Side (16 points)
Terminal Type (not included)		20 position removable terminal block
Commons		4 Isolated (4 points / common)

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

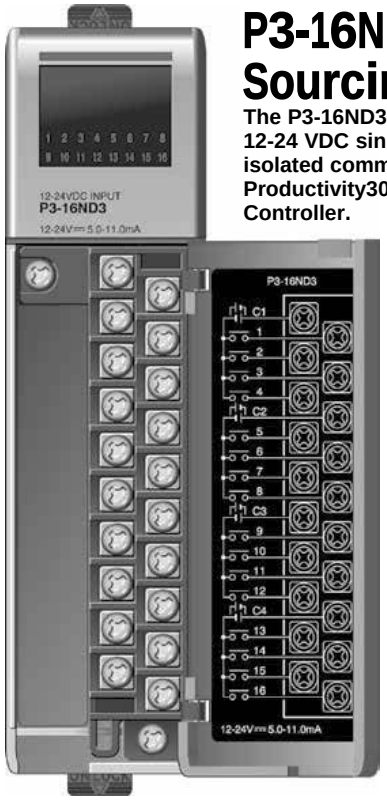
AVERTISSEMENT: Risque d'explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

Document Name	Edition/Revision	Date
P3-16ND3-M	1st Ed. Rev. A	12/30/2013

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AUTOMATIONDIRECT.com
Productivity3000™



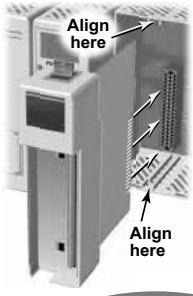
P3-16ND3 Sinking/ Sourcing Input

The P3-16ND3 DC Input Module provides 16 12-24 VDC sinking or sourcing inputs with 4 isolated commons for use with the Productivity3000 Programmable Automation Controller.

Input Specifications 1
Module Installation Procedure 2
Terminal Block Removal 2
Hot Swap Information 2
Wiring Options 3
Schematic and Wiring Diagram 3
Safety Information 4
Removable Terminal Block Specifications 4
General Specifications 4

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 3).

Module Installation Procedure

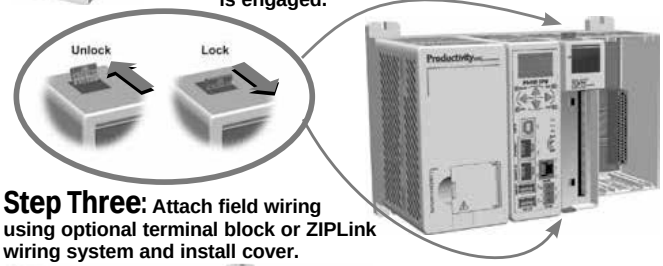


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

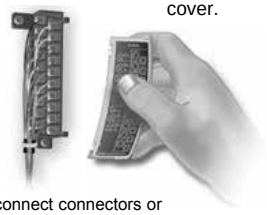
Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



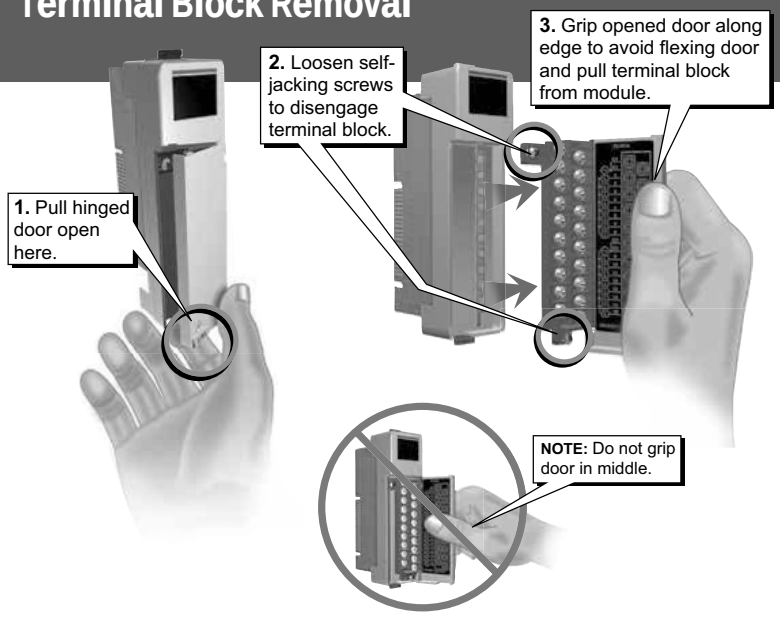
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 ZIPLink Connection System
Cable + ZIPLink Module = Complete System



ZIPLink pre-wired terminal block cables

0.5m (1.6FT) cable	ZL-P3-CBL20-L
1.0m (3.3FT) cable	ZL-P3-CBL20-1L
2.0m (6.6FT) cable	ZL-P3-CBL20-2L



ZIPLink Modules

Feed through	ZL-RTB20



LED Sensor Input	ZL-LTB16-24

2 Terminal Block with pigtail cable



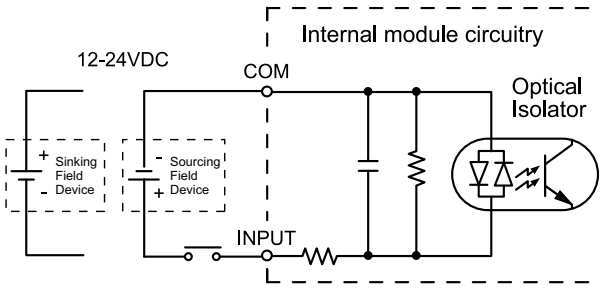
0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

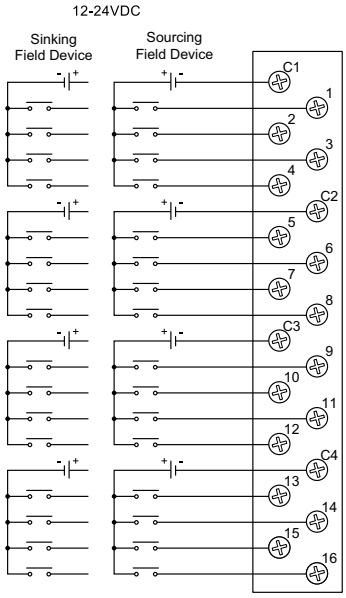
3 Terminal Block only



P3-RTB
(Quantity 1)

Schematic and Wiring Diagrams





To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

This publication is based on information that was available at the time it was printed. At AutomationDirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum “USE COPPER CONDUCTORS, 60°C” or equivalent*.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	5.61W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable Terminal Block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 3.
EU Directive	See the “EU Directive” topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Weight	80g (2.82 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

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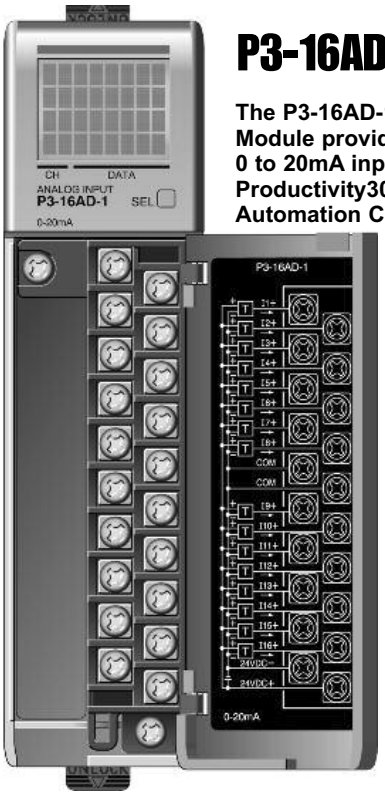
This publication is based on information that was available at the time it was printed. At AutomationDirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum "USE COPPER CONDUCTORS, 60°C" or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

AUTOMATIONDIRECT.com

Productivity3000™



P3-16AD-1 Analog Input

The P3-16AD-1 Current Analog Input Module provides 16 channels for receiving 0 to 20mA input signals for use with the Productivity3000 Programmable Automation Controller.

Safety Information 1
Removable Terminal Block Specifications 1
General Specifications 2
Input Specifications 2
Schematic and Wiring Diagram . . .3
Module Installation Procedure 4
Terminal Block Removal 4
Hot Swap Information 4
Wiring Options 5
Module Configuration 5
Linear Scaling 6
Non-Linear Scaling 6
LCD Panel Display Menus 7

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 5).

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1 second
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	2.1 W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable terminal block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 5.
EU Directive	See the "EU Directive" topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

Input Specifications

Input Channels	16 sinking
Module Signal Input Range	0 - 20mA
Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	0-20mA = 305µA per count (1 LSB = 1 count)
Data Range	0-65535 counts
Input Type	Single-ended (1 common)
Maximum Continuous Overload	±31mA
Input Impedance	250 Ω ±0.1% ¼W
Filter Characteristics	Low Pass, -3dB @ 100Hz
Sample Duration Time	7 ms per channel (does not include ladder scan time)
All Channel Update Rate	112 ms
Open Circuit Detection Time	Zero reading within 1s
Conversion Method	Successive approximation
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Inaccuracy	0.1% of range (including temperature drift)
Linearity Error (end to end)	±10 LSB maximum (±0.015% of range) Monotonic with no missing codes
Input Stability and Repeatability	±10 LSB
Full Scale Calibration Error (not including offset)	±10 LSB maximum (±0.015% of range)
Offset Calibration Error	±10 LSB maximum
Max Crosstalk	-76 dB, ±10 LSB
Recommended Fuse (external)	Edison S500-32-R, .032A fuse
External DC Power Required	24VDC (-20% / + 25%) 20mA

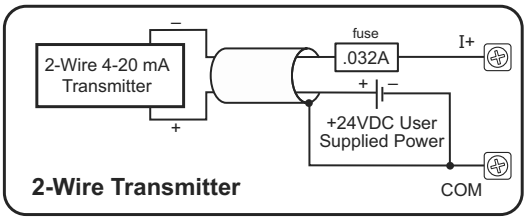
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

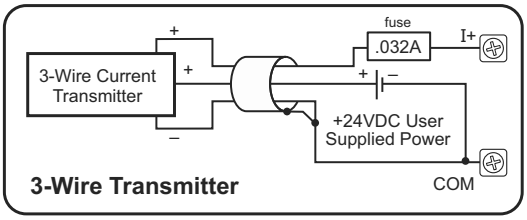
AVERTISSEMENT: Risque d’explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

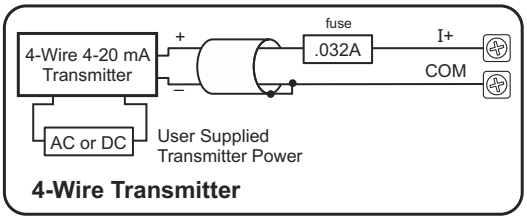
Wiring Diagram

Current Input Circuits

An Edison S500-32-R 0.032A fast-acting fuse is recommended for current loops.

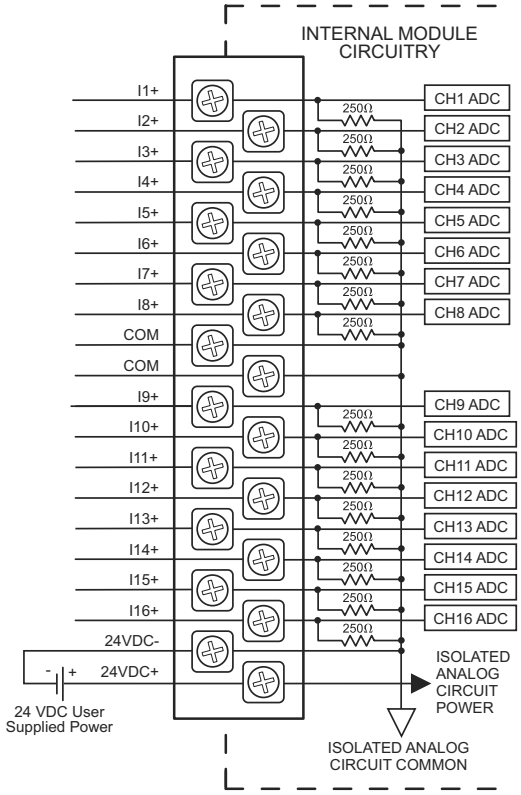




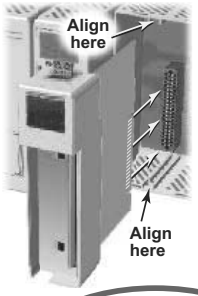


Note: Do not connect both ends of shield.

Schematic



Module Installation Procedure

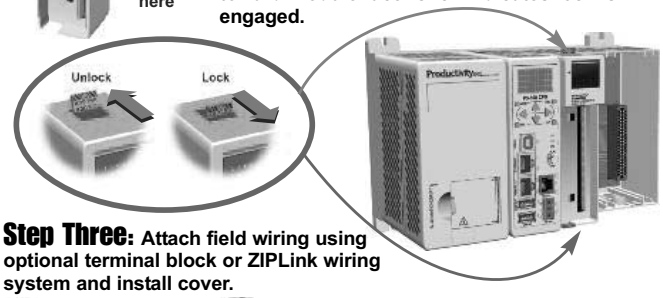


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

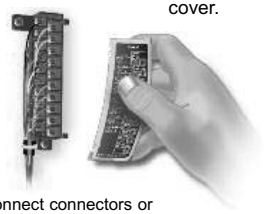
Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



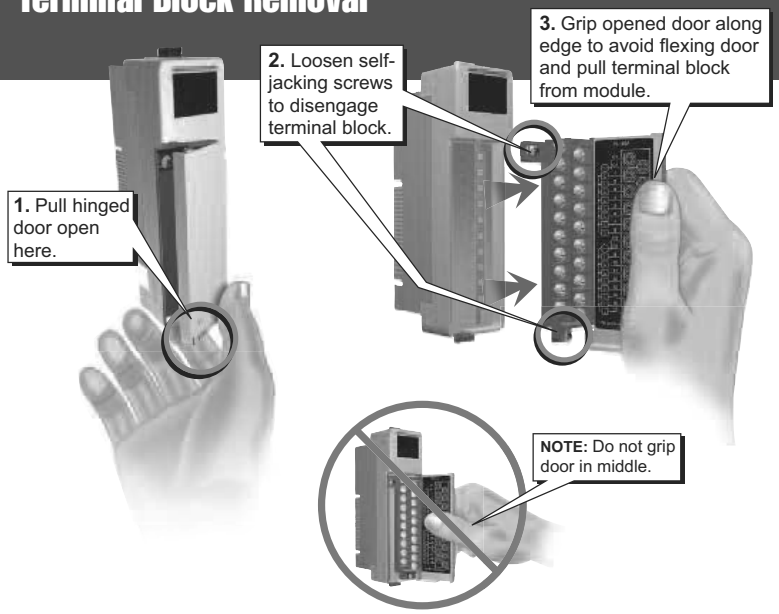
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 **ZIPLink Connection System**
Cable + ZIPLink Module = Complete System

ZIPLink pre-wired terminal block cables



0.5m (1.6FT) cable	ZL-P3-CBL20-L
1.0m (3.3FT) cable	ZL-P3-CBL20-1L
2.0m (6.6FT) cable	ZL-P3-CBL20-2L



ZIPLink Modules

Feed through	ZL-RTB20

2 **Terminal Block with pigtail cable**



0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

3 **Terminal Block only**

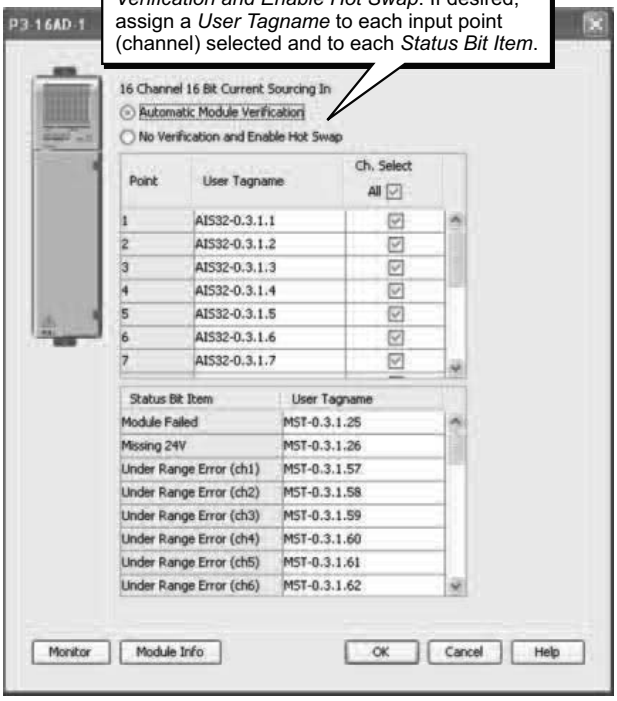


P3-RTB
(Quantity 1)

Module Configuration

Using the Hardware Configuration tool in the Productivity Suite programming software, drag and drop the P3-16AD-1 module into the base configuration.

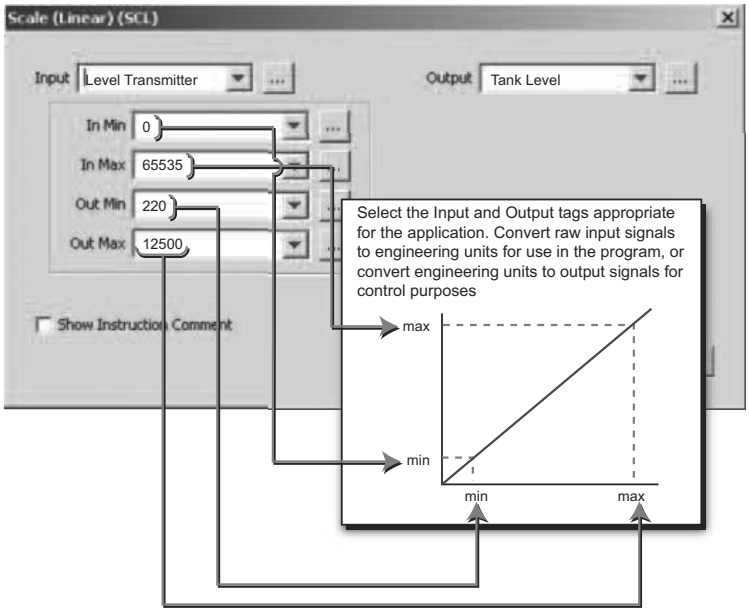
Select *Automatic Module Verification* or *No Verification and Enable Hot Swap*. If desired, assign a *User Tagname* to each input point (channel) selected and to each *Status Bit Item*.



Linear Scaling

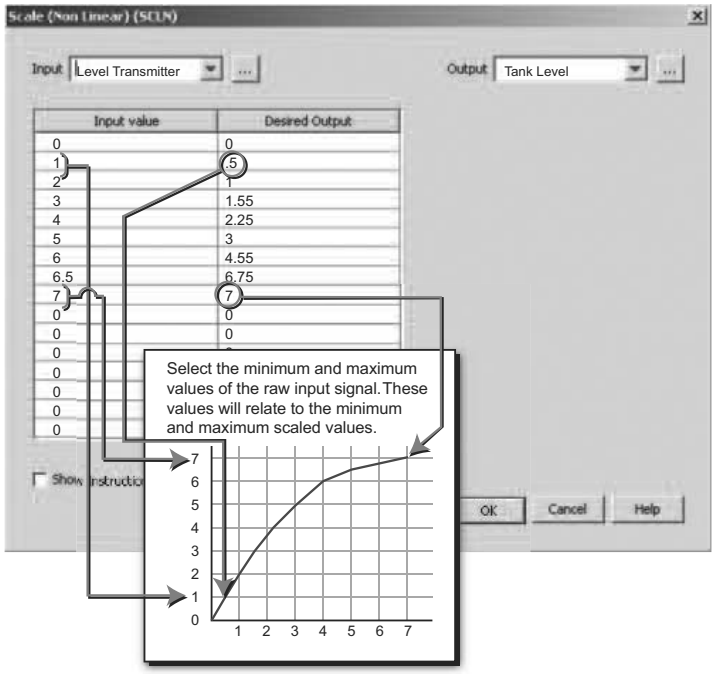
The Scale (Linear) function can be used to:

- **Convert analog field input signals from the range which is native to the analog input module to an application specific range.**
- **Make other linear conversions in ranges appropriate to the application.**

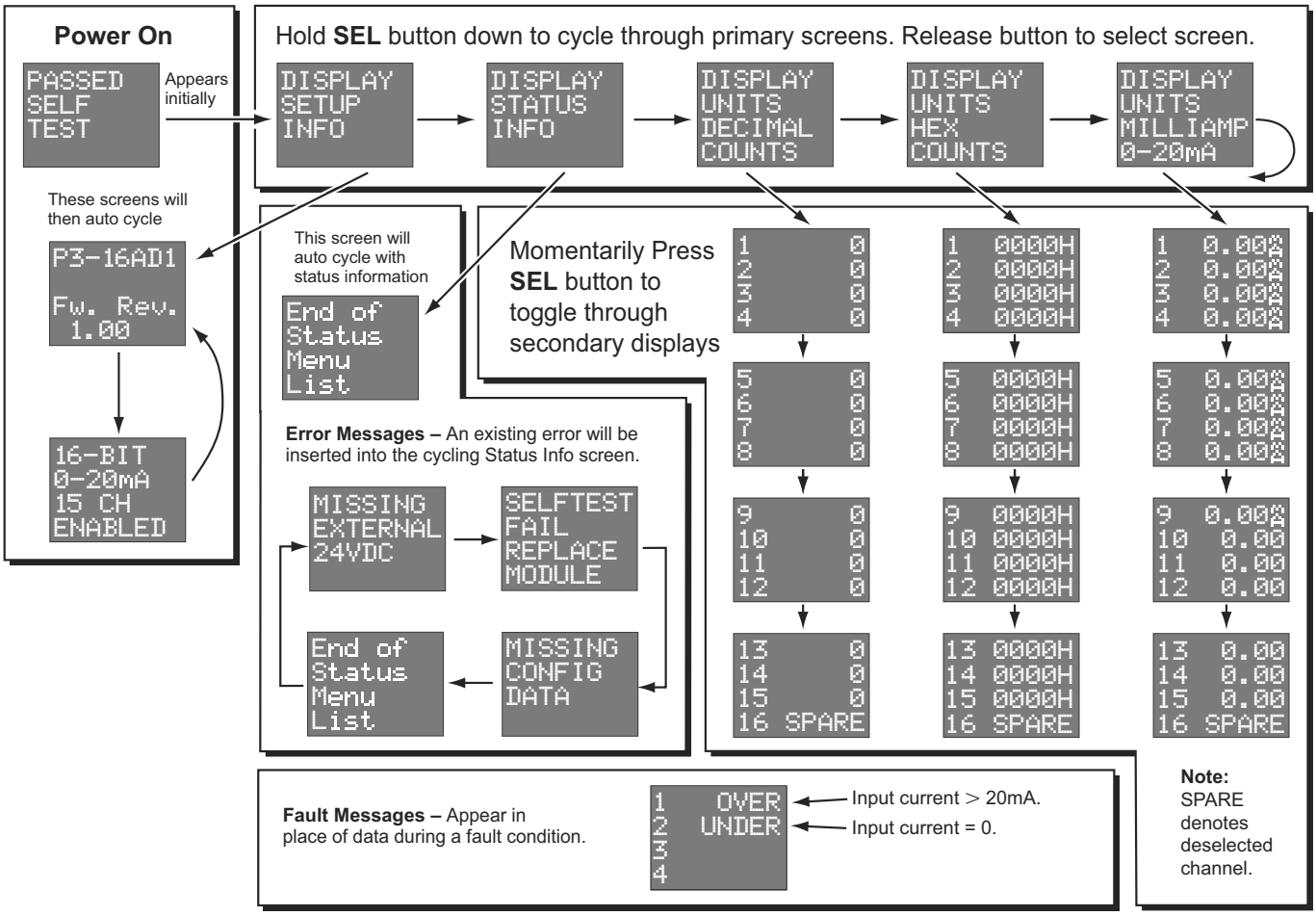


Non-Linear Scaling

The Scale (Non-Linear) function can be used for Non-Linear applications.



LCD Panel Display



Document Name	Edition/Revision	Date
P3-16AD-1-M	1st Ed. Rev. A	12/20/2013

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Output Specifications

Outputs per Module		16
Operating Voltage Range (Tolerance)	(CE)	6.25 - 24 VDC (-15% / + 20%) 6 - 240 VAC (-15% / + 10%)
	(UL)	6 - 27 VDC (-15% / + 10%) 6 - 240 VAC (-10% / + 10%)
Output type		Relay, form A (SPST)
AC Frequency		47 - 63 Hz
Maximum Output Current @ Temp		1.25A / point, 6.3A / common @ 60°C for both AC and DC
Minimum Load Current		5 mA @ 5 VDC
Maximum Inrush Current		4A for 10 ms
OFF to ON Response		≤ 10 ms
ON to OFF Response		≤ 10 ms
Status Indicators		Logic Side (16 points)
Error Status Indicator		Blown Fuse (one for each common)
Terminal Type (not included)		20 position removable terminal block
Commons per module		2 Isolated (8 point / common)
Fuses		6.3A user replaceable fuse per common For replacement, order P3-FUSE-2. (Qty. 5/pkg.)

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

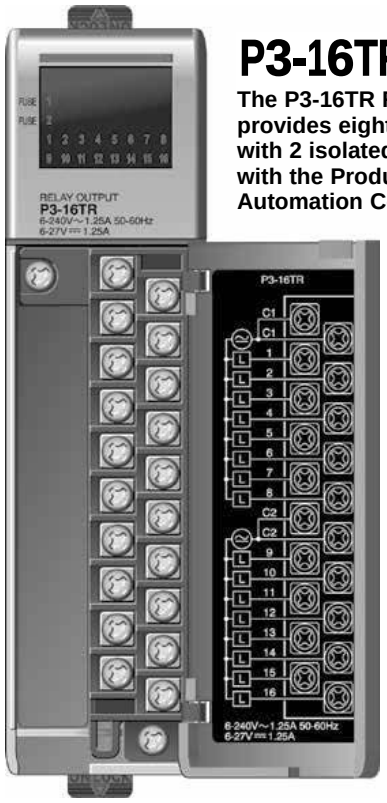
AVERTISSEMENT: Risque d'explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

Document Name	Edition/Revision	Date
P3-16TR-M	1st Ed. Rev. B	12/30/2013

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Productivity3000™



P3-16TR Relay Output

The P3-16TR Relay Output Module provides eight 1.25 amp relay outputs with 2 isolated fused commons for use with the Productivity3000 Programmable Automation Controller.

Output Specifications 1
Module Installation Procedure.....2
Terminal Block Removal 2
Hot Swap Information.....2
Wiring Options.....3
Schematic and Wiring Diagram.....3
Replacement Fuses 3
Safety Information 4
Typical Relay Life.....4
Removable Terminal Block Specifications 4
General Specifications 4

Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 3).

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

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If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

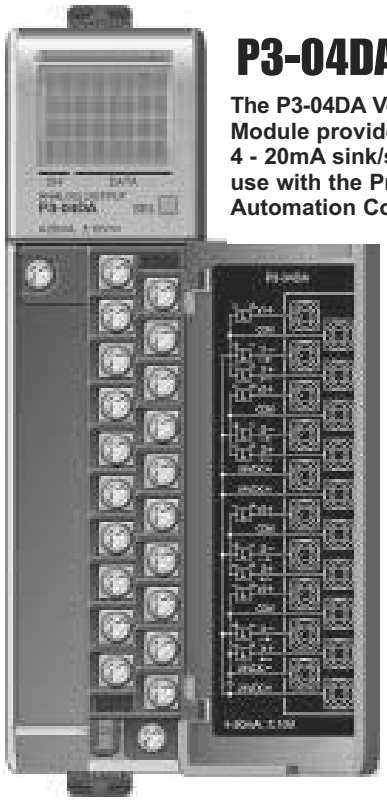
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Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum "USE COPPER CONDUCTORS, 60°C" or equivalent*.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

AUTOMATIONDIRECT.com

Productivity3000™



P3-04DA Analog Output

The P3-04DA Voltage/Current Analog Output Module provides 4 channels of ± 10 VDC or 4 - 20mA sink/source selectable outputs for use with the Productivity3000 Programmable Automation Controller.

Safety Information 1
Removable Terminal Block Specifications 1
General Specifications 2
Output Specifications 2
Schematic and Wiring Diagram . . .3
Module Installation Procedure 4
Terminal Block Removal 4
Hot Swap Information 4
Wiring Options 5
Module Configuration 5
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Terminal Block sold separately, Terminal Block Cover included (see wiring options on page 5).

Warranty: Thirty-day money-back guarantee. Two-year limited replacement. (See www.productivitypac.com for details).

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1 second
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	2.6 W voltage outputs 3.4 W current outputs
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable terminal block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 5.
EU Directive	See the "EU Directive" topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

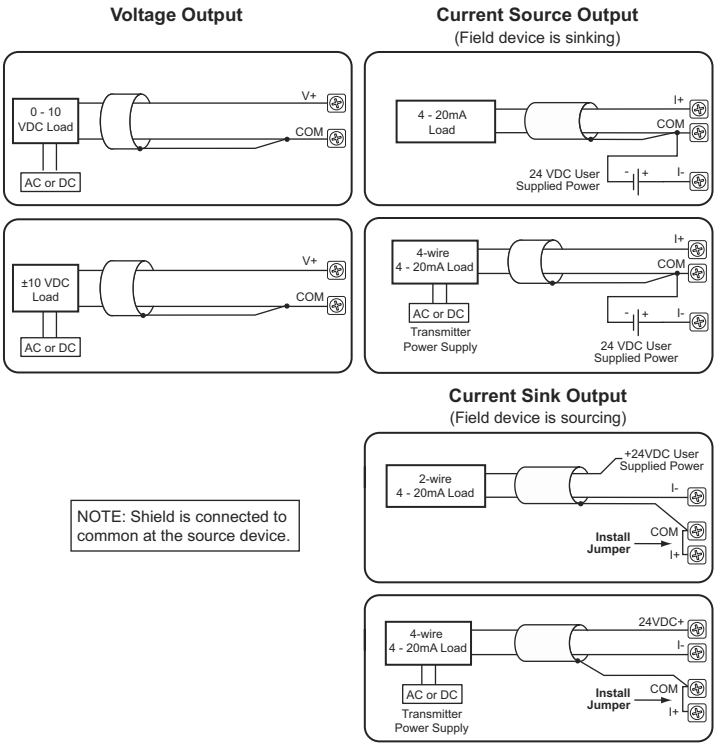
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT: Risque d’explosion : la substitution de composants peut compromettre la convenance pour la Classe I, Zone 2 ou pour la Classe I, Division 2.

Output Specifications

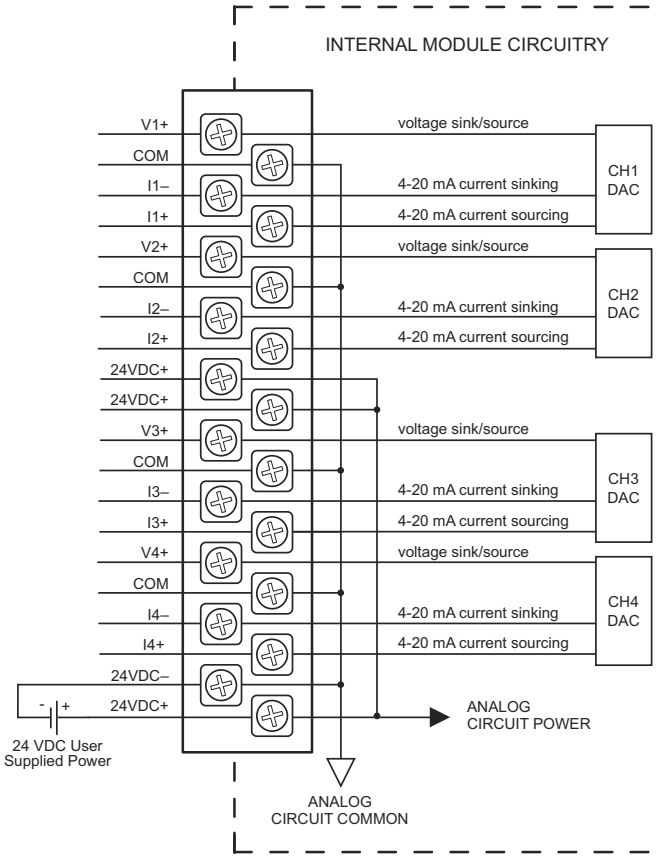
Output Channels	4
Module signal output range	±10V or 4-20mA sink or source selectable each channel
Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	± 10V = 305µV/ count 4-20mA = 0.244µA/ count 1 LSB = 1 count
Data Range	0 - 65535 counts uni-polar and -32768 to + 32767 counts bi-polar
Output Type	Voltage outputs sourcing/sinking at 10mA max, or Current outputs sink or source at 20mA max.
Output Value in Fault Mode	Voltage outputs 0V or 0mA current outputs
Load Impedence (Minimum External Power Supply)	>1000Ω voltage outputs)(19.2 - 30 VDC) 0-755Ω Sinking, 0-600Ω Sourcing (19.2 VDC) 0-875Ω Sinking, 0-700Ω Sourcing (21.6 VDC) 0-1000Ω Sinking, 0-855Ω Sourcing (24.0 VDC) 0-1110Ω Sinking, 0-970Ω Sourcing (26.4 VDC) 0-1350Ω Sinking, 0-1150Ω Sourcing (30 VDC)
Maximum Capacitive Load	.01µF maximum voltage outputs
Maximum Inductive Load	1 mH maximum current outputs
Allowed Load Type	Grounded
Maximum Inaccuracy (% of range)	0.1% voltage, 0.1% current (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±.025% of range maximum voltage outputs ±.025% of range maximum current outputs
Maximum Offset Calibration Error	±.025% of range maximum
Accuracy vs. Temperature	±25 ppm/ °C max f.s. calibration change (± .0025% of range / °C)
Max Crosstalk	-80 dB, 6 LSB
Linearity Error (End to End)	±16 LSB maximum (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 minute warm-up (typical)
Output Ripple	.05% of Full Scale
Output Settling Time	0.3 ms max, 5 µs min (full scale change)
All Channel Update Rate	0.6ms
Maximum Continuous Overload	Voltage Outputs current limited to 35mA typical. Current Outputs open circuit protected
Type of Output Protection	15VDC Peak Output Voltage Current outputs current limited to <=20mA
Output Signal (power-up, -down)	0V voltage outputs, 0mA current outputs
External DC Power Required	94mA voltage operation 4 channels 126mA current operation 4 channels 24VDC -20% / + 25%

Wiring Diagram

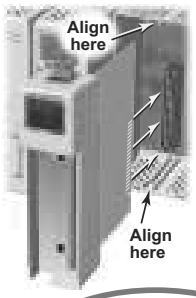


NOTE: Shield is connected to common at the source device.

Schematic



Module Installation Procedure

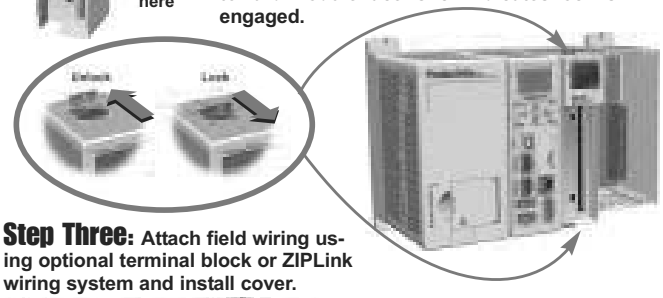


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

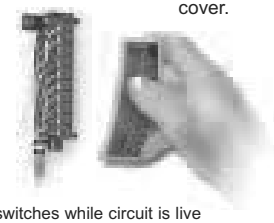
Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



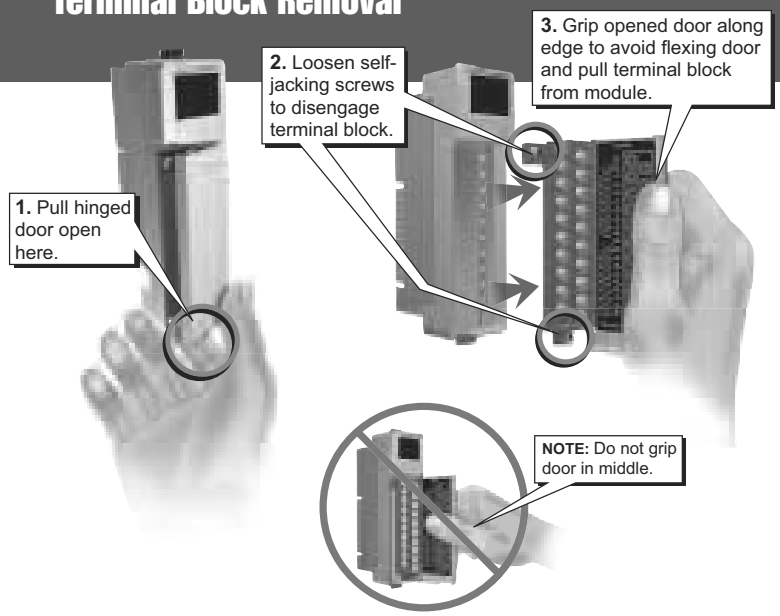
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



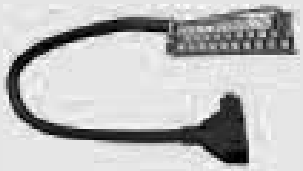
Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 ZIPLink Connection System
Cable + ZIPLink Module = Complete System

ZIPLink pre-wired terminal block cables



0.5m (1.6FT) cable	ZL-P3-CBL20-L
1.0m (3.3FT) cable	ZL-P3-CBL20-1L
2.0m (6.6FT) cable	ZL-P3-CBL20-2L

ZIPLink Modules



Feed through	ZL-RTB20

2 Terminal Block with pigtail cable



0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

3 Terminal Block only

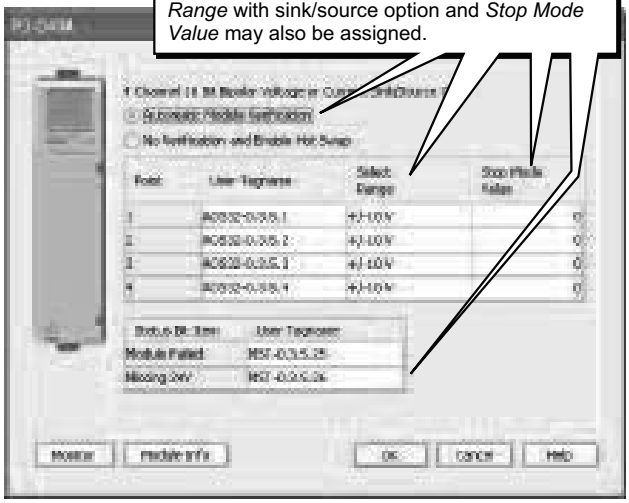


P3-RTB
(Quantity 1)

Configuration Settings

Using the Hardware Configuration tool in the Productivity Suite programming software, drag and drop the P3-04DA module into the base configuration.

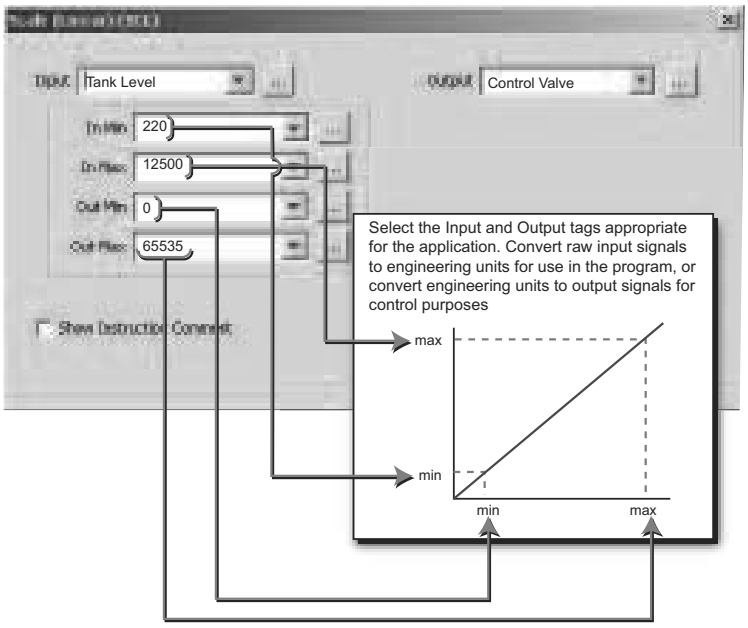
Select *Automatic Module Verification* or *No Verification and Enable Hot Swap*. If desired, assign a *User Tagname* to each output point (channel) selected and to each *Status Bit Item*. *Range* with sink/source option and *Stop Mode Value* may also be assigned.



Linear Scaling

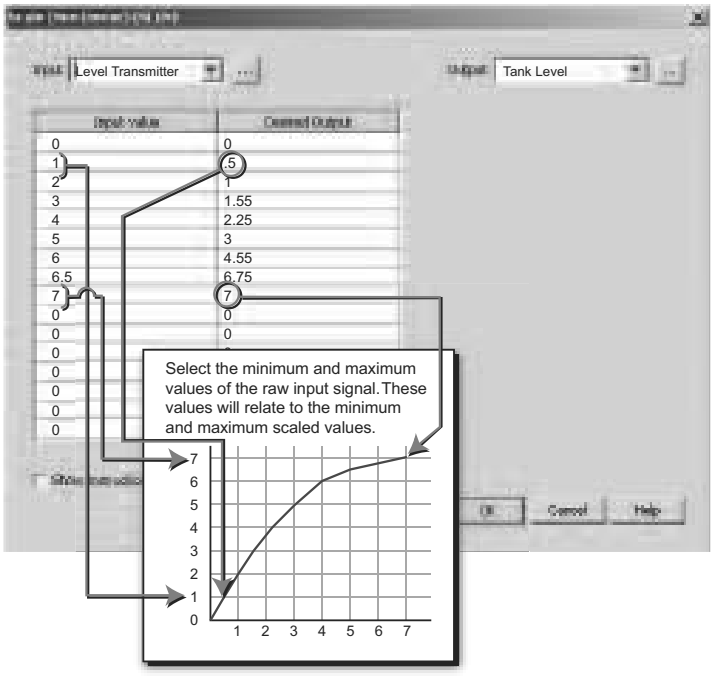
The Scale (Linear) function can be used to:

- **Convert an application specific range to a range which is native to the analog output module.**
- **Make other linear conversions in ranges appropriate to the application.**

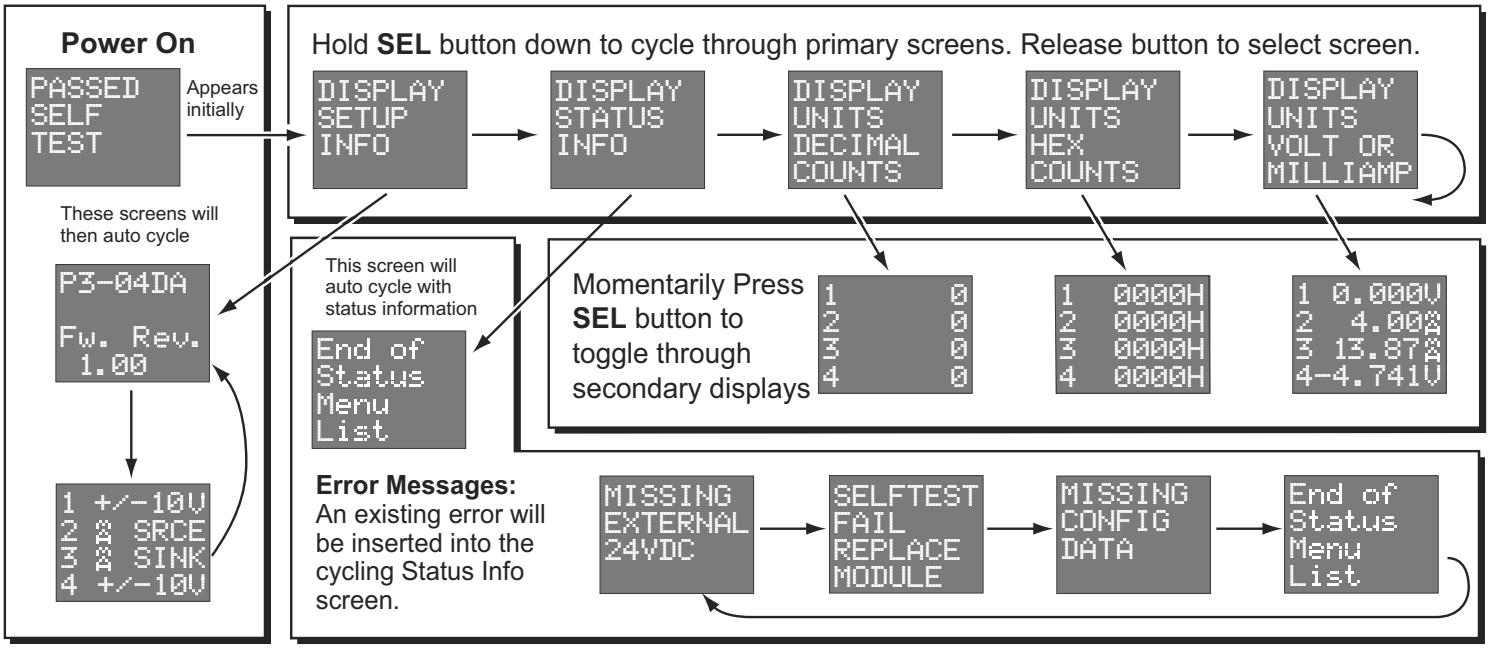


Non-Linear Scaling

The Scale (Non-Linear) function can be used for Non-Linear applications.



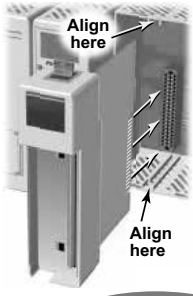
LCD Panel Display



Document Name	Edition/Revision	Date
P3-04DA-M	1st Ed.Revision A	12/18/2013

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Module Installation Procedure

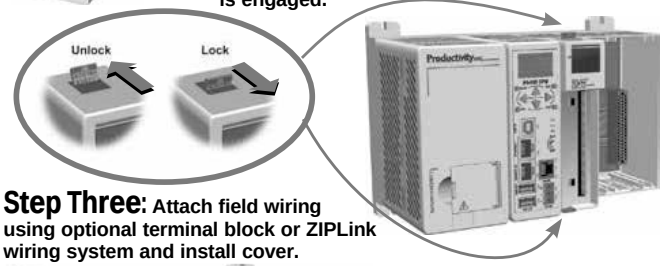


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

AVERTISSEMENT: Ne pas appliquer la puissance de champ avant l'exécution des étapes qui suivent. Consultez la procédure de remplacement à chaud pour les exceptions.

Step One: Align circuit card with slot and press firmly to seat module into connector.

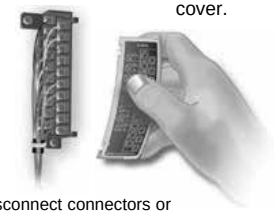
Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



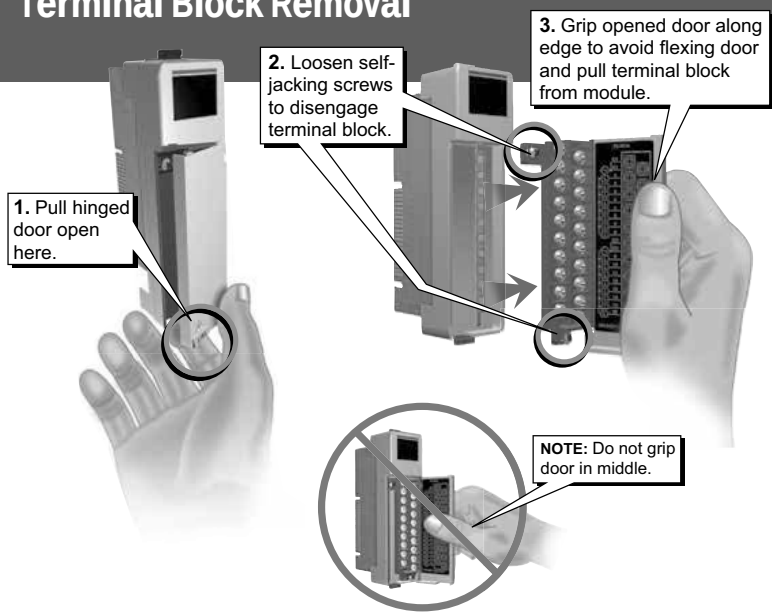
To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

AVERTISSEMENT: Risque d'explosion : ne pas connecter ou déconnecter les connecteurs ni actionner les commutateurs alors que le circuit est sous tension, à moins que la zone ne soit reconnue non dangereuse. Ne pas remplacer à chaud les modules à moins que la zone ne soit reconnue non dangereuse.

Terminal Block Removal



Important Hot-Swap Information

The Productivity3000 PAC supports hot-swap! Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the PAC system continues controlling your process. Before attempting to use the hot-swap feature, be sure to read the hot-swap topic in the programming software's help file or our online documentation at AutomationDirect.com for details on how to plan your installation for use of this powerful feature.

Wiring Options

1 ZIPLink Connection System
Cable + ZIPLink Module = Complete System



ZIPLink pre-wired terminal block cables

0.5m (1.6FT) cable	ZL-P3-CBL20
1.0m (3.3FT) cable	ZL-P3-CBL20-1
2.0m (6.6FT) cable	ZL-P3-CBL20-2



ZIPLink Modules

Feedthrough	ZL-RTB20



Remote Fuse	ZL-RFU20

2 Terminal Block with pigtail cable



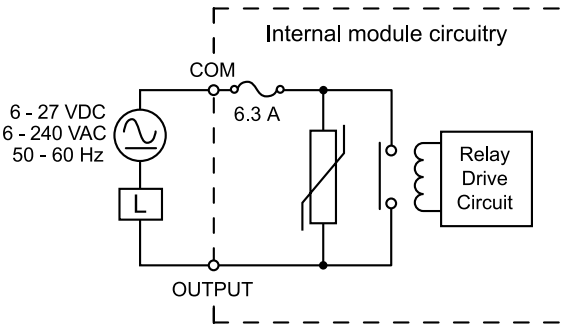
0.5m (1.6FT) cable	ZL-P3-CBL20-P
1.0m (3.3FT) cable	ZL-P3-CBL20-1P
2.0m (6.6FT) cable	ZL-P3-CBL20-2P

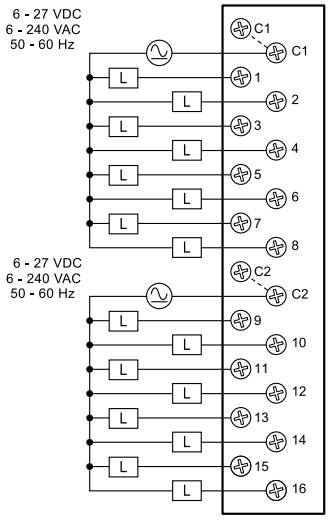
3 Terminal Block only



P3-RTB
(Quantity 1)

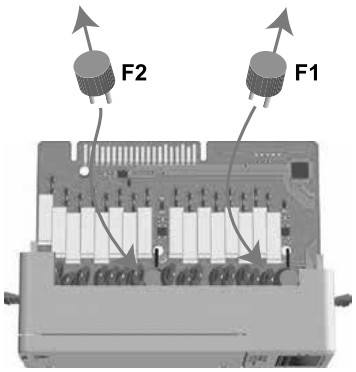
Schematic and Wiring Diagram





Replaceable Fuses

Order Part Number P3-FUSE-2.
(Qty. 5 per pkg.) One spare included with this module.



To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call Technical Support at 770-844-4200.

This publication is based on information that was available at the time it was printed. At AutomationDirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

Typical Relay Life

Voltage & Type of Load	Operations at 1.25A Load Current
30VDC Resistive	240K
30VDC Solenoid	110K
120VAC Resistive	320K
120VAC Solenoid	210K
240VAC Resistive	240K
240VAC Solenoid	140K

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22-14 AWG (0.324 to 2.08 sq. mm) solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum “USE COPPER CONDUCTORS, 60°C” or equivalent*.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals – 7 - 9 in./lb (.0.882 - 1.02 Nm) Self-jacking screws – 2.7 - 3.6 in./lb (0.3 - 0.4 Nm). Do not overtighten screws when installing terminal block.

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	3.93W
Enclosure Type	Open Equipment
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Field Wiring	Removable Terminal Block (not included). Use ZIPLink Wiring System or optional terminal block. See “Wiring Options” on page 3.
EU Directive	See the “EU Directive” topic in the Productivity3000 Help File. Information can also be obtained at: www.productivitypac.com
Weight	160g (5.64 oz)

*Meets EMC and Safety requirements. See the D.O.C. for details.

WARNING: Exposure to some chemicals may degrade the sealing properties of materials used in the Sealed Relay Device.

AVERTISSEMENT: L’exposition à certains produits chimiques peut dégrader les propriétés d’étanchéité des matériaux employés dans le dispositif de relais étanche.

C-more Operator Panels Overview

Getting started

Installing the software and configuring the *C-more* panel is simple. You will need the following to successfully connect, configure and send a project to the panel:

- ***C-more*** touch panel - 6", 8", 10", 12" or 15" model
- ***C-more*** Programming Software, p/n EA9-PGMSW
- ***C-more*** programming cable, USB or Ethernet
- 12-24 VDC switching power supply or the optional ***C-more*** AC Power Adapter, p/n EA-AC
- Personal Computer - to run ***C-more*** programming software
- PLC communications cable (serial or Ethernet) to connect the ***C-more*** Touch Panel to your controller

Part Number	Description	Price
EA9-T6CL-R	***C-more*** EA9 series touch screen interface panel, 6-inch color TFT (5.7 inch viewable screen), base model, 64k colors, 320 x 240 pixel QVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (1) serial port, USB 2.0 Type A and B ports, supports SD memory card, no Ethernet support. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T6CL	***C-more*** EA9 series touch screen interface panel, 6-inch color TFT (5.7 inch viewable screen), 64k colors, 320 x 240 pixel QVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T8CL	***C-more*** EA9 series touch screen interface panel, 8-inch color TFT (8.4 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T10CL	***C-more*** EA9 series touch screen interface panel, 10-inch color TFT (10.4 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T12CL	***C-more*** EA9 series touch screen interface panel, 12-inch color TFT (12.1 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports (2) SD memory cards. Includes HDMI video out. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-T15CL	***C-more*** EA9 series touch screen interface panel, 15-inch color TFT (15 inch viewable screen), 64k colors, 1024 x 768 pixel XGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB <None>2.0 Type A and B ports and Ethernet port; supports (2) SD memory cards. Includes HDMI video out. Compatible with EA9-PGMSW programming software version 5.0 or later.	<--->
EA9-PGMSW	***C-more*** Windows-based programming software on CD for the ***C-more*** EA9 series touch panels. Requires Windows XP Pro 32-bit, Windows 7 (Pro, Ultimate, 32 or 64-bit) or Windows 8 (Pro, Ultimate, 32 or 64-bit). Requires USB or Ethernet connection to touch panel. Cables sold separately. (Does not support ***C-more*** EA7 series panels.)	<--->
USB-CBL-AB3	Standard 3-ft. (0.9m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->
USB-CBL-AB6	Standard 6-ft. (1.8m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->
USB-CBL-AB10	Standard 10-ft (3 meter) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->
USB-CBL-AB15	Standard 15-ft. (4.6m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a power source for configuration and operation.)	<--->

C-more Selection Guide & Specifications

Specification \ Model	6" TFT color w/ base features	6" TFT color w/ full features	8" TFT color w/ full features	10" TFT color w/ full features	12" TFT color w/ full features	15" TFT color w/ full features
Part Number	EA9-T6CL-R	EA9-T6CL	EA9-T8CL	EA9-T10CL	EA9-T12CL	EA9-T15CL
Price	<--->	<--->	<--->	<--->	<--->	<--->
Display Actual Size and Type	5.7" TFT color		8.4" TFT color	10.4" TFT color	12.1" TFT color	15.0" TFT color
Display Viewing Area	4.54" x 3.40" [115.2 mm x 86.4 mm]		6.71" x 5.03" [170.4 mm x127.8mm]	8.31" x 6.24" [211.2 mm x 158.4 mm]	9.69" x 7.26" [246.0 mm x 184.5 mm]	11.97" x 8.98" [304.1 mm x 228.0 mm]
Weight	1.56 lb [710g]	1.59 lb [720g]	2.93 lb [1330g]	4.19 lb [1900g]	4.89 lb [2200g]	6.50 lb [2950g]
Screen Pixels	320 x 240 (QVGA)		800 x 600 (SVGA)			1024 x 768 (XGA)
Display Brightness	280 nits (typ)		310 nits (typ)	280 nits (typ)		
LCD Panel Dot Pitch	0.18 mm x 0.18 mm		0.213 mm x 0.213 mm	0.264 mm x 0.264 mm	0.3075 mm x 0.3075 mm	0.297 mm x 0.297 mm
Color Scale	65,536 colors					
Backlight Average Lifetime*	50,000 hours @ 25°C					
Touch Panel Type	Four-wire analog resistive					
Project Memory	26MB				82MB	
Number of Screens	Up to 999 screens – limited by project memory					
Realtime Clock	Realtime Clock Built into panel, backed up for 30 days at 25°C					
Calendar - Month / Day / Year	Yes - monthly deviation 60 sec (Reference)					
Serial Port 1	15-pin D-sub female - RS232C, RS-422/485					
Serial Port 2	N/A	3-wire terminal block - RS-485				
Serial Port 3	N/A	RJ-12 modular jack - RS-232C				
USB Port - Type B	USB 2.0 High speed (480 Mbps) Type B - Download/Program					
USB Port - Type A	USB 2.0 High speed (480 Mbps) Type A -for USB device options					
Ethernet Port	N/A	Ethernet Port Ethernet 10/100 Base-T, auto MDI/MDI-X				
Audio Line Out	N/A	3.5 mm mini jack – requires amplifier and speaker(s)				
Mic In	N/A	3.5 mm mini jack				
SD Card Slot	1 slot supports max 2 GB (SD,) max 32 GB (SDHC)				2 slots support max 2 GB (SD), max 32 GB (SDHC)	
HDMI Out	N/A				Yes	
Supply Power	12-24 VDC Class 2, or use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz power source. Reverse Polarity Protected					
Power Consumption	16.0 W 1.30 A @ 12VDC 0.66 A @ 24VDC		18.0 W 1.50 A @ 12VDC 0.75 A @ 24VDC	18.0 W 1.50 A @ 12VDC 0.75 A @ 24VDC	21.0 W 1.75 A @ 12VDC 0.88 A @ 24VDC	29.0 W 2.40 A @ 12VDC 1.20 A @ 24VDC
Internal Fuse (non-replaceable)	4.0 A		6.3 A			
Operating Temperature	0 to 50 °C (32 to 122 °F) Maximum surrounding air temperature rating: 50°C (122°F) IEC 60068-2-14 (Test Nb, Thermal Shock)					
Storage Temperature	–20 to +60°C (–4 to +140 °F) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)					
Humidity	5–95% RH (non-condensing)					
Environment	For use in Pollution Degree 2 environment, no corrosive gases permitted					
Noise Immunity	NEMA ICS3-304 (EN61131-2) RFI, (145MHz, 440Mhz 10W @ 10cm) Impulse 1000V @ 1mS pulse EN61000-4-2 (ESD), EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Serge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity)					
Withstand Voltage	1000 VAC, 1 min. (FG to Power supply)					
Insulation Resistance	> 10M ohm @ 500VDC (FG to Power supply)					
Vibration	IEC60068-2-6 (Test Fc)					
Shock	IEC60068-2-27 (Test Ea)					
Emission	EN55011 Class A (Radiated RF emission)					
Enclosure	NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 indoor use only (When mounted correctly)					
Agency Approvals	UL508, E157382 CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2					

**** NOTE: The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.***

C-more 8" TFT Color Touch Panel - Full Model

Part No. EA9-T8CL

C-more EA9 series touch screen interface panel, 8-inch color TFT (8.4 inch viewable screen), 64k colors, 800 x 600 pixel SVGA screen resolution, 800 MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight. Includes (3) serial ports, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 5.0 or later.



<--->

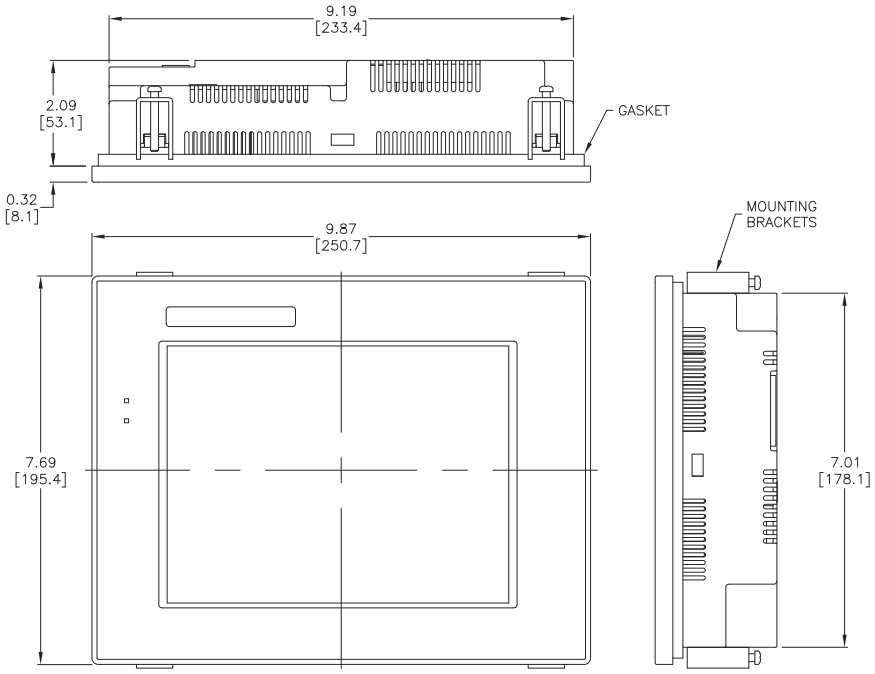
Features

- 8.4" diagonal color TFT (Thin Film Transistor) LCD display with 64K colors
- 800 x 600 pixel resolution
- 310 NITS display brightness
- 50,000 hour average backlight half-life
- Analog resistive (1024 X 1024) touch screen allowing unlimited touch areas
- USB port B (program/download) and USB port A (USB device options)
- Ethernet 10/100 Base-T port (program/download & PLC communication)
- Remote Internet Access
- Serial PLC interface (RS-232/422/485)
- One built-in SD memory card slot
- 12–24 VDC powered, 110VAC power adapter (optional)
- Audio Line Out, stereo - requires amplifier and speaker(s)
- Microphone in
- 26MB project memory
- Data logging
- 0 to 50°C [32 to 122°F] operating temperature range
- NEMA 4/4X, IP65 compliant when mounted correctly, indoor use only
- Slim design saves panel space
- UL, cUL CE agency approvals
- 2-year warranty from date of purchase

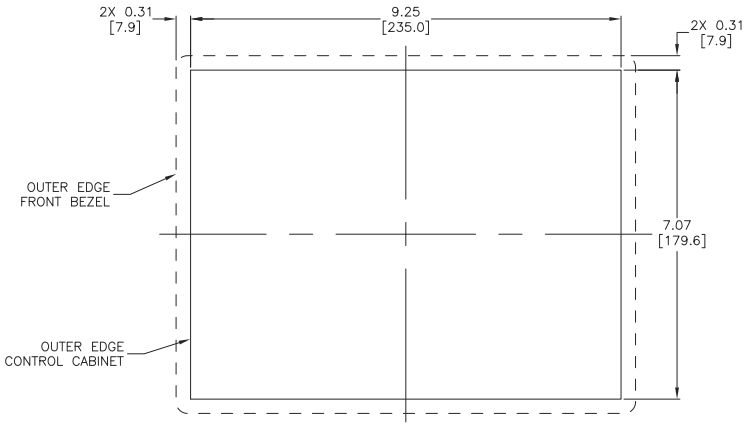
Function	Available
Ethernet	Yes
USB	Yes
SD Card	Yes
Audio Out	Yes
Mic In	Yes
HDMI Out	No

Dimensions

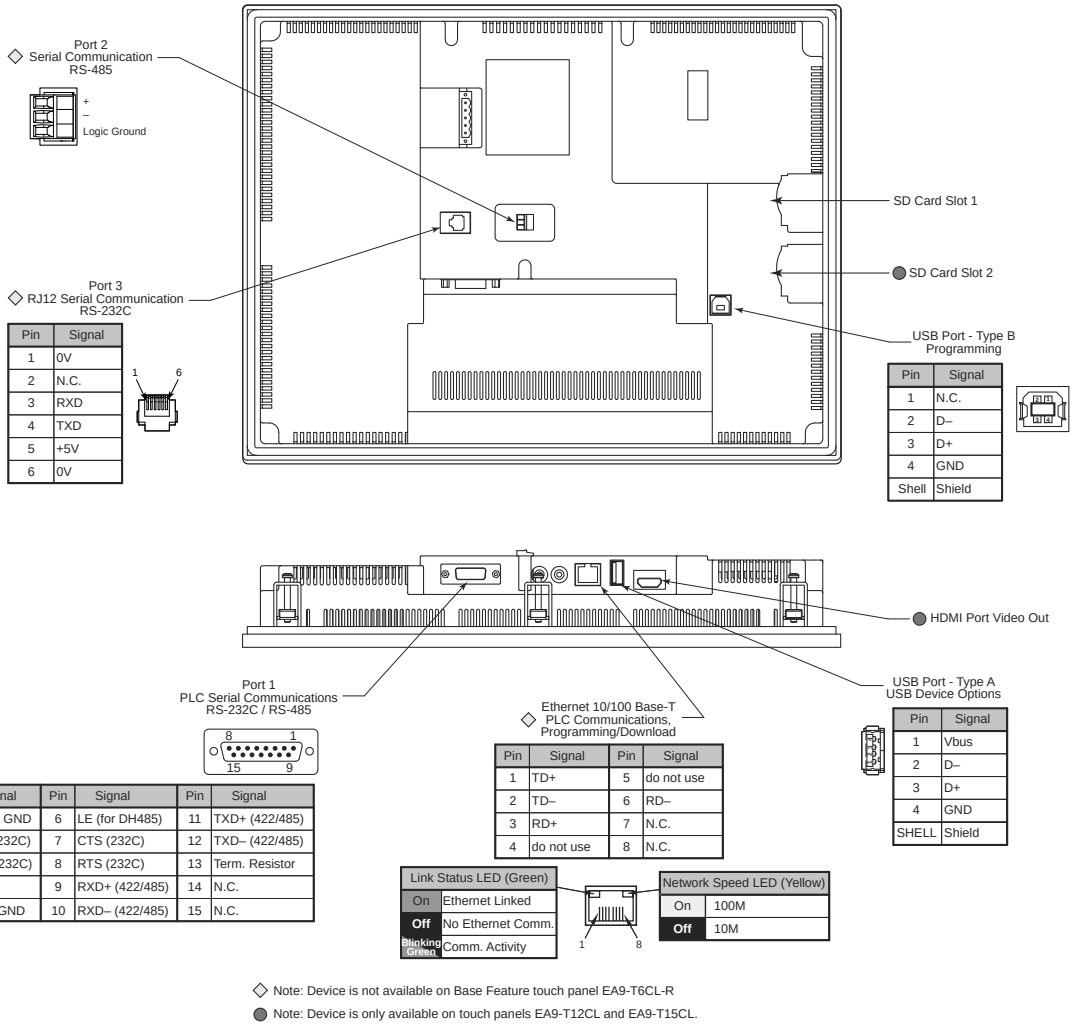
inches / [mm]



Mounting Cutout



C-more Communication Ports



Pin	Signal
1	0V
2	N.C.
3	RXD
4	TXD
5	+5V
6	0V

Pin	Signal
1	N.C.
2	D–
3	D+
4	GND
Shell	Shield

Pin	Signal	Pin	Signal	Pin	Signal
1	Frame GND	6	LE (for DH485)	11	TXD+ (422/485)
2	TXD (232C)	7	CTS (232C)	12	TXD– (422/485)
3	RXD (232C)	8	RTS (232C)	13	Term. Resistor
4	VCC	9	RXD+ (422/485)	14	N.C.
5	Logic GND	10	RXD– (422/485)	15	N.C.

Pin	Signal	Pin	Signal
1	TD+	5	do not use
2	TD–	6	RD–
3	RD+	7	N.C.
4	do not use	8	N.C.

Pin	Signal
1	Vbus
2	D–
3	D+
4	GND
SHELL	Shield

Link Status LED (Green)	
On	Ethernet Linked
Off	No Ethernet Comm.
Blinking Green	Comm. Activity

Network Speed LED (Yellow)	
On	100M
Off	10M

◇ Note: Device is not available on Base Feature touch panel EA9-T6CL-R

● Note: Device is only available on touch panels EA9-T12CL and EA9-T15CL.

Ethernet Port

The Ethernet port has several uses:

- **Download program to panel**
- **Communicate to PLCs/PCs**
- **Send e-mail**
- **Access FTP server**
- **Act as a Web server**
- **Remote Internet Access**

The Ethernet port has an RJ-45 8-wire modular connector with green and yellow LEDs.

- **The yellow LED indicates network speed; off for a 10 Mbps connection and illuminated for a 100 Mbps connection.**
- **The green LED indicates link status and illuminates when a link is established.**

Note: The base panels (-R part numbers) do not include an Ethernet port, and do not have these capabilities.

USB Port B

Program *C-more* via the USB programming port. It's fast and easy, with no baud rate settings, parity, or stop bits to worry about. We stock standard USB cables for your convenience. USB Port B can be used to upload or download projects to and from a PC.

USB Port A

The Universal Serial Bus (USB) Port A is a standard feature for all models and can be used to connect various USB HID (Human Input Device) devices to the panel, such as:

- **USB pen drives, (USB-FLASH)**
- **USB keyboards**
- **USB barcode scanners**
- **USB card scanners**

C-more can log data to the USB pen drive as well as load projects to the panel from the pen drive. You can also back up project files and panel firmware.

Sound Interface (Audio Line Out)

When attached to an amplifier and speaker(s), *C-more* can play warning sounds or pre-recorded messages such as: "conveyor is jammed". *C-more* supports WAV type files. The output is stereo.

Serial Port

Port 1 - Connect to your serial controller network via Port 1. Port 1 is a 15-pin port that supports RS-232 or RS-422/485.

Port 2 - Connect your RS-485 network via Port 2. Port 2 is provided with a 3-wire removable terminal block.

Port 3 - Connect to your RS-232C device via Port 3. Port 3 is an RJ12 connection.

HDMI Port

EA9-T12CL and EA9-T15CL include an HDMI Type A port to provide video output to a projector or remote monitor.

C-more Communication Protocols & Cables

Compatibility Table			
PLC Family	***Model***		***Protocols***
Allen-Bradley	MicroLogix 1000/1100/1200/1400/1500, SLC 5-/01/02/03, PLC5		DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500		DF1 Half Duplex; DF1 Full Duplex
	SLC 5-/03/04/05		
	ControlLogix™, CompactLogix™, FlexLogix™		
	PLC-5		DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Tag Based		DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging		EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based		EtherNet/IP Client
	MicroLogix 1100 & SLC 5/05, both via native Ethernet port		
	MicroLogix 1000, 1100, 1200, 1400,1500 & SLC 5-03/04/05, all via ENI Adapter		
	Micro 800 series		Modbus RTU
			Modbus TCP
Modbus TCP/IP	Modbus TCP/IP devices		Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro		SNPX
Mitsubishi	FX Series		FX Direct
	Q02, Q02H, Q06H, Q12H, Q25H		Q CPU
	Q, QnA Serial		QnA Serial
	Q, QnA Ethernet		QnA Ethernet
Omron	C200 Adapter, C500		Host Link
	CJ1/CS1 Serial, CJ1/CS1 Ethernet		FINS
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx		Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial		PPI
	S7-200 CPU, S7-300 CPU, S7-400, S7-1200 CPU; Ethernet		Ethernet ISO over TCP
Productivity Series	Productivity3000 Serial (P3-550)		AutomationDirect P3000 Serial
	Productivity3000 Ethernet (P3-550)		AutomationDirect P3000 Ethernet
Do-more	all		Do-more Serial
			Do-more Ethernet
CLICK	all		AutomationDirect Modbus (CLICK)
***Direct*LOGIC**	DL05/DL06	all	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		H0-ECOM/H0-ECOM100	***Direct*LOGIC Ethernet**
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			***Direct*NET**
		D2-250/D2-250-1/D2-260	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 using D2-DCM	***Direct*NET**
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	***Direct*LOGIC Ethernet**
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	***Direct*NET**
		D3-340	***Direct*NET**
		D3-350	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		D3-350 using D3-DCM	***Direct*NET**
			Modbus (Koyo addressing)
	DL405	D4-430	K-Sequence
			***Direct*NET**
		D4-440	K-Sequence
			***Direct*NET**
		D4-450	K-Sequence
			***Direct*NET**
			Modbus (Koyo addressing)
		All with D4-DCM	***Direct*NET**
			Modbus (Koyo addressing)
		H4-ECOM/H4-ECOM100	***Direct*LOGIC Ethernet**
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version		Think & Do Modbus RTU (serial port)
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later		Think & Do Modbus TCP/IP (Ethernet port)

Cable Description	Cable Part Number	Price
AutomationDirect Productivity Series, Do-more, CLICK, ***Direct*LOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WinPLC (RS-232C)	***EA-2CBL***	<--->
***Direct*LOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	***EA-2CBL-1***	<--->
***Direct*LOGIC PLC RJ-11 port, D3-340 (RS-232C)	***EA-3CBL***	<--->
***Direct*LOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	***EA-4CBL-1***	<--->
***Direct*LOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C)	***EA-4CBL-2***	<--->
Allen-Bradley MicroLogix 1000, 1100, 1200, 1400 & 1500 (RS-232C)	***EA-MLOGIX-CBL***	<--->
Allen-Bradley SLC 5-03/04/05 ControlLogix, CompactLogix, FlexLogix, DF1 port (RS-232C)	***EA-SLC-232-CBL***	<--->
Allen-Bradley PLC-5 DF1 port (RS-232C)	***EA-PLC5-232-CBL***	<--->
Allen-Bradley SLC 500 DH485 port (RS-485A)	***EA-DH485-CBL***	<--->
GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A)	***EA-90-30-CBL***	<--->
MITSUBISHI FX Series 25-pin port (RS-422A)	***EA-MITSU-CBL***	<--->
MITSUBISHI FX Series 8-pin mini-DIN (RS-422A)	***EA-MITSU-CBL-1***	<--->
OMRON Host Link C200 Adapter, C500 (RS-232C)	***EA-OMRON-CBL***	<--->

Example Cables:

EA-2CBL



EA-2CBL-1



C-more Computer Programming Connections

Using the *C-more* Programming Software EA9-PGMSW for project development, the touch panel can be connected to a PC (personal computer) in one of several ways:

- Connect a USB Programming Cable such as (USB-CBL-AB15) from a USB port type A on the PC to the USB type B programming port on the C-more touch panel. The USB connection is for direct connection only and does not support USB hubs.
- Connect the ***C-more*** touch panel to a PC with a Cat5 Ethernet cable via an Ethernet switch. Multiple panels can be programmed in this configuration.

Following are the minimum system requirements for running *C-more* Programming Software, p/n EA9-PGMSW, on a PC:

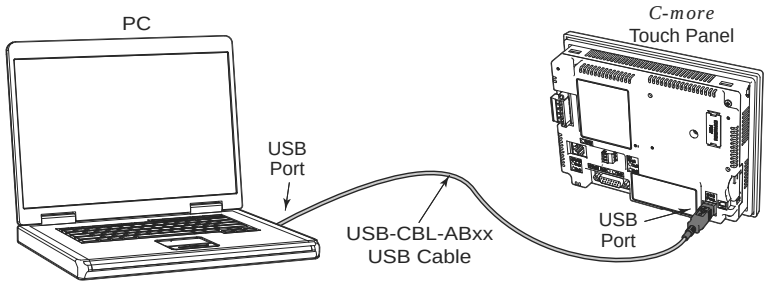
- Keyboard and Mouse or compatible pointing device
- Super VGA color video adapter and monitor with at least 800 x 600 pixels resolution (1024 x 768 pixels recommended) 64K color minimum
- 300 MB free hard-disk space
- CD-ROM or DVD drive for installing software from the CD
- USB port or Ethernet 10/100 Mbps port for project transfer from software to touch panel (Ethernet port not available on -R models)
- Operating System - Windows® XP Professional Edition (32 bit), Windows 7 (32 or 64 bit) or Windows 8 (32 or 64 bit)

NOTE: Regarding Ethernet access to a C-more panel.

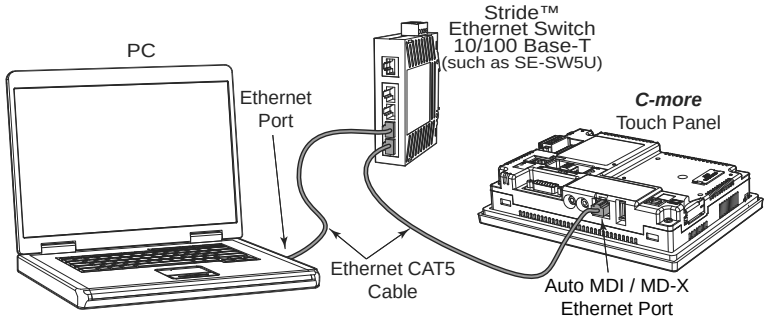
If you intend to take advantage of the methods of remote access to the panel, including the web server, PC remote access, FTP, iPhone or iPad app, you need to consider the security exposure in order to minimize the risks to your process and your C-more panel.

Security measures may include password protection, changing the ports exposed on your network, including a VPN in your network, and other methods. Security should always be carefully evaluated for each installation.

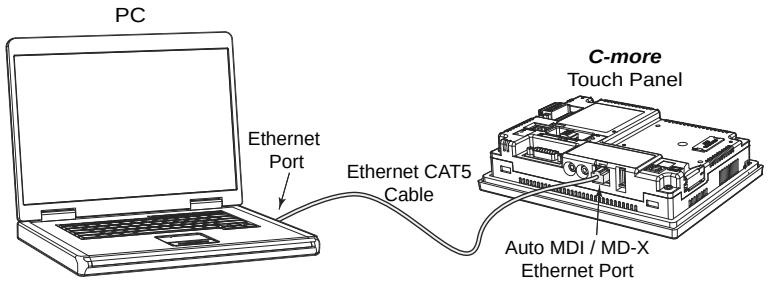
USB Connectivity



Ethernet Connectivity via a Hub or Switch



Ethernet Direct Connection



USB Programming Cable



Part No. USB-CBL-AB15

<--->

Other lengths available see
USB-CBL-AB3, USB-CBL-AB6, USB-CBL-AB10

Stride™ Ethernet Switch



Part No. SE-SW5U

<--->

Ethernet Configuration Kit



Part No. RT-CNFGKIT

<--->

The Ethernet Configuration Kit includes a five-port 10/100 Base-T Ethernet switch, four straight-through cables, and one crossover cable. (The cables are at least five feet in length.) The kit provides a great convenience for configuring systems, demonstration systems or basic control projects using Ethernet.

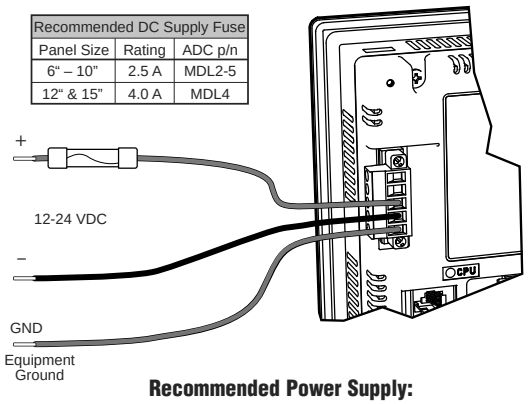
C-more Power Connection Wiring

Providing Power to the Touch Panel

- Connect a dedicated 12–24 VDC Class 2 power supply to the DC connector on the rear of the ***C-more*** touch panel. Connect the ground terminal to a proper equipment ground.
- or, install a ***C-more*** AC Power Adapter (EA-AC) to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60 Hz, to its AC connector.
- then, turn on the power source and check the LED status indicators on the front and rear of the ***C-more*** touch panel for proper operation.

DC Wiring

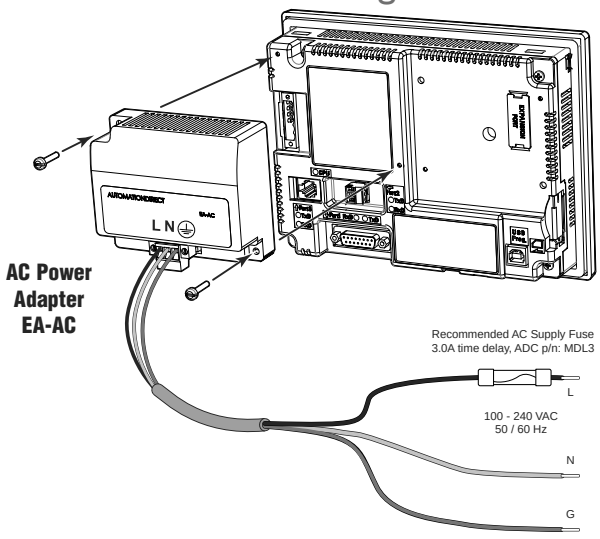
Recommended DC Supply Fuse		
Panel Size	Rating	ADC p/n
6" – 10"	2.5 A	MDL2-5
12" & 15"	4.0 A	MDL4



Recommended Power Supply:
AutomationDirect Part No. PSC-24-060

DC-CON Tightening Torque	
Power connector screw torque	70.4 oz-in [0.5 Nm]
Power connector mounting torque	56 oz-in [0.4 Nm]

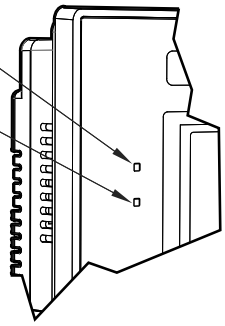
AC Wiring



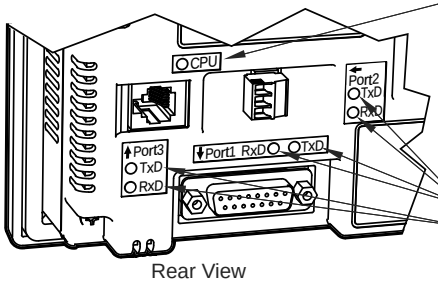
EA-AC Tightening Torque	
Power supply cable torque	71 - 85 oz-in [0.5 - 0.6 Nm]
Power connector mounting torque	71 - 85 oz-in [0.5 - 0.6 Nm]
Mounting flange screw torque	57 - 71 oz-in [0.4 - 0.5 Nm]

Power LED (Green)	
On	Power On
Off	Power Off

User Defined LED (Green, Orange & Red)	
Off	User Defined (Refer to online help file for further details)
Green	
Red	
Orange	
Blinking Red	
Blinking Orange	
Blinking Green	



Front View



Rear View

CPU Status LED (Green, Orange & Red)	
Off	Power Off
Green	Normal – CPU Run State
Red	Memory Error
Blinking Red	Watchdog Timer Error
Blinking Orange	OS Error
Blinking Green	Power Loss Detection

Serial TxD/RxD LED (Green)	
On	Comm. is active
Off	No communication



WARNING: To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 1-800-633-0405 or 770-844-4200.

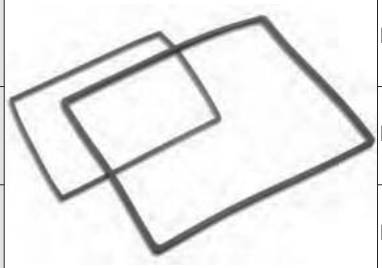
This publication is based on information that was available at the time it was printed.

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C-more Replacement Parts

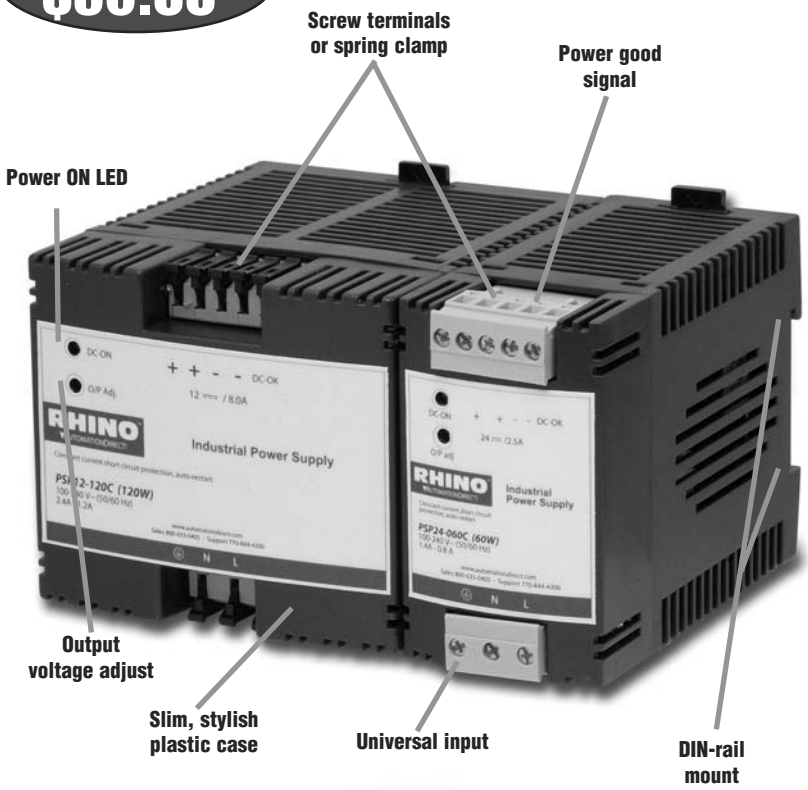
The optional replacement parts can be used to replace damaged, worn or lost *C-more* components.

Replacement parts at a glance:

Part Number		Description
EA9-BRK		Panel mounting brackets, replacement, for C-more EA9 series touch panels. Package of 8 brackets and screws.
EA9-LBL		Blank label insert for front bezel, replacement, for C-more EA9 series touch panels. Package of 10.
EA9-3TB		3-pole terminal block, replacement, for 3-wire RS485 communications port on C-more EA9 series panels. Package of 2.
EA-DC-CON		5-terminal DC power connector, replacement, for C-more EA7 and EA9 series touch panels
EA-AC-CON		3-terminal AC power connector, replacement, for C-more EA7 and EA9 series touch panels
EA9-15-GSK		Panel mounting gasket, replacement, for C-more EA9-T15CL 15-inch touch panel, NEMA 4/4X
EA9-12-GSK		Panel mounting gasket, replacement, for C-more EA9-T12CL 12-inch touch panel, NEMA 4/4X
EA9-10-GSK		Panel mounting gasket, replacement, for C-more EA9-T10CL 10-inch touch panel, NEMA 4/4X
EA9-8-GSK		Panel mounting gasket, replacement, for C-more EA9-T8CL 8-inch touch panel, NEMA 4/4X
EA9-6-GSK		Panel mounting gasket, replacement, for C-more EA9-T6CL(-R) 6-inch touch panels, NEMA 4/4X

RHINO PSP Series 5,12 & 24 VDC Power Supplies

Starting at $56.00



Slimline Power Supplies

RHINO PSP series power supplies are plastic housed ultracompact switching supplies available in 5V, 12V and 24V adjustable models. There are 13 models available with power ratings of 20W to 240W and up to 10A output current. They are DIN rail or panel-mountable and feature universal inputs, adjustable DC voltage outputs, power good signal and feature low output ripple along with short circuit, overvoltage and overload protection.

The RHINO PSP series of switching power supplies offer an excellent price/performance ratio. They provide tightly regulated output voltage for sensitive loads in industrial environments. The slim plastic case is lightweight and compact, and comes in both screw and spring clamp terminal versions. The constant-current, short-circuit protection limits the output current as the voltage is reduced, to safely protect the control components from direct shorts and device failures. Once a fault is corrected, the power supply automatically resumes supplying full-voltage power. (PSPxx-024x models have foldback current protection with auto-recovery.)

The RHINO PSP power supplies have a **Power ON** LED for easy visual indication of operation as well as a **Power Good** signal for feedback to your system controller.

With a UL 508C rating, the RHINO PSP series is the right choice for space limited applications.



Features

- Regulated switch mode type
- Ultra-compact plastic case
- Finger-safe terminals
- Reliable snap-on mounting on DIN-rails
- Wall mounting bracket included
- Universal input 85-264 VAC, 50/60 Hz or 85-375 VDC (85-132/187-264 VAC only for PSP24-240S input)
- Models with 5, 12 or 24 VDC output
- Output voltage adjustable
- Parallel operation up to five units (not PSP24-240S)
- Power good signal (some models)
- Low ripple and noise
- Overload and short-circuit protection
- UL/cUL 508 listed, UL/cUL 60950 recognized*
- Worldwide safety approvals
- 3-year product warranty

**** Note: PSP24-240S is not cUL listed. PSP05-020S, PSP12-024S, and PSP24-240S are not UL 60950 recognized.***

Company Information
Terminal Blocks
Power Distribution Blocks
Wiring Accessories
ZIPLink Connection System
Multi-wire Connectors
Sensor Cables and Connectors
M12 Junction Blocks
Panel Interface Connectors
Wiring Duct
Cable Ties
Wire
Flexible Cord
Multi-conductor Flex Cable
Data Cables
Wire Management Products
Power Supplies
DC Converters
Transformers and Filters
Circuit Protection
Tools
Test Equipment
Enclosures
Enclosure Climate Control
Safety: Electrical Components
Safety: Protective Wear
Terms and Conditions

RHINO PSP Series Power Supplies Specifications



PSP05-020S
PSP12-024S
PSP24-024S



PSP24-024C



PSP12-060S
PSP24-060S



PSP12-060C
PSP24-060C



PSP12-120C
PSP24-120C



PSP24-120S
PSP12-120S



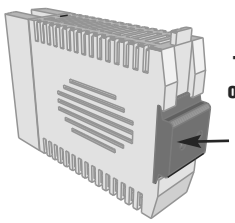
PSP24-240S

Input Specifications

Part Number	Input Voltage Range		Input Freq. Range	Input Current (Typical) at full load		Efficiency (Typ.)	C-Curve Circuit Breaker or Slow-blow Fuse
				115 VAC	230 VAC		
PSP05-020S	85-264 VAC 85-375 VDC	30% output derating below 93 VAC/ 130 VDC	47-63 Hz	0.35 A	0.2A	88%	5.0 A
PSP12-024S		20% output derating below 93 VAC/ 130 VDC					
PSP24-024S				0.35 A	0.2 A		
PSP24-024C							
PSP12-060S		15% output derating below 93 VAC/ 130 VDC		1.2 A	0.6 A	88%	
PSP12-060C							
PSP24-060S							
PSP24-060C							
PSP12-120S				2.0 A	1.0 A	88%	
PSP12-120C							
PSP24-120S							
PSP24-120C							
PSP24-240S	85-132/ 187-264 VAC	20% output derating below 93 VAC		4.7 A	2.0 A		

Output Specifications

Part Number	Price	Output Voltage	Output Volt. Adjust. Range	Output Current (Max.)	Output Power (Max.)	Hold-Up Time		MTBF (IEC 1709 @ 25°C)
						115 VAC	230 VAC	
PSP05-020S	$77.00	5.1 VDC	5-5.25 VDC	4.0 A	20 W	15 ms	125 ms	2,681,000 hours
PSP12-024S	$73.00	12 VDC	12-16 VDC	2.0 A	24 W			
PSP24-024S	$56.00	24 VDC	24-28 VDC	1.0 A	24 W			
PSP24-024C	$59.00							
PSP12-060S	$97.00	12 VDC	12-15 VDC	4.0 A	60 W			2,947,000 hours
PSP12-060C	$107.00							
PSP24-060S	$85.00	24 VDC	24-28 VDC	2.5 A				
PSP24-060C	$86.00							
PSP12-120S	$153.00	12 VDC	12-15 VDC	8.0 A	120 W			1,620,000 hours
PSP12-120C	$158.00							
PSP24-120S	$135.00	24 VDC	24-28 VDC	5.0 A				
PSP24-120C	$142.00							
PSP24-240S	$180.00			10.0 A	240 W			1,912,000 hours



The unit can be mounted on a chassis or wall using the included mounting bracket.

Part numbering system

PSP24-024S

- Terminal Connector Type: C: Clamp S: Screw
- Output Watts
- Output Volts
- PSP: Series Name

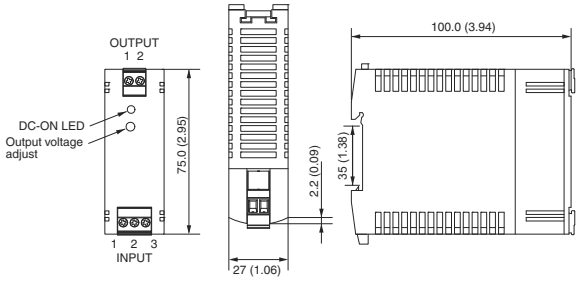
RHINO PSP Series Power Supplies Dimensions

General Specifications	
Temperature	**Operating:** -10°C to +70°C (14°F to 158°F), Derating at 93-132 VAC or 130-187 VDC: -1.10%/C above 40°C, Derating at 187-264 VAC or 265-375 VDC: -1.67%/C above 50°C, Derating at 85-93 VAC or 85-130 VDC: -1.30%/C above 30°C, Temperature Coefficient: 0.02%/C **Storage:** -25°C to +85°C (-13°F to 185°F)
Humidity	95% (non-condensing) relative humidity max.
Output Regulation	2.5% (1% for PSP12-060x), 10 to 90% load variation
Switching Frequency	55 - 180 kHz depending on load
Safety Standards	IEC/EN 60950 (output SELV), UL 60950, UL 508, EN 50178, EN 60204, EN 61558-2-8
Output Voltage Ripple	<50 mV peak-to-peak
Output Protection	Current Limit at 120% typ., constant current, auto recovery (PSPxx-024x foldback, auto-recovery), Voltage Limit <40 VDC
Power Good Signal*	Trigger Point / Output Signal (reference to -Vout) 12 VDC Models: >11 V / 11.0 V+/- 1.0 V @ 60 mA max. 24 VDC Models: >22 V / 22.0 V+/- 2.0 V @ 30 mA max.
Electromagnetic Compatibility (EMC)	EN 61000-3-2, EN 61000-6-2, EN 61000-6-3
Enclosure Rating	IP 20
Enclosure Material	Plastic FR2010-110C (UL 94 V-O rated)
Mounting	35 mm DIN rails, snap on with self-locking spring or wall mount adapter included
Connection	S models: Plug-in Screw Terminals, C Models: Clamp Terminals. For 28-12 AWG wire
Agency Approvals	UL/cUL 508 listed File E197592(PSP24-240S not cUL), UL 60950 recognized, file E198298 (except PSP05-020S, PSP12-024S and PSP24=240S).

Note: PSP05-020S, PSP12-024S and PSP24-024x models do not have Power Good output.

Note: All specifications are valid at nominal input voltage, full load and +25°C after warmup time, unless otherwise stated.

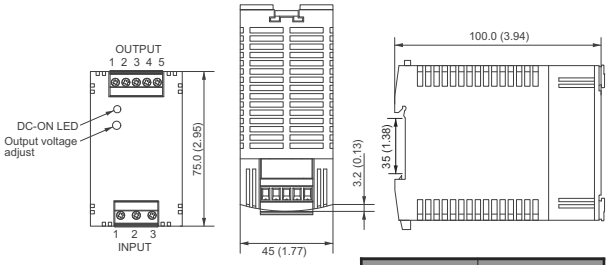
PSP05-020S, PSP12-024S, PSP24-024x



Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	-Vout
3	Line		

Weight: 140g (4.9 oz.)

PSPxx-060x

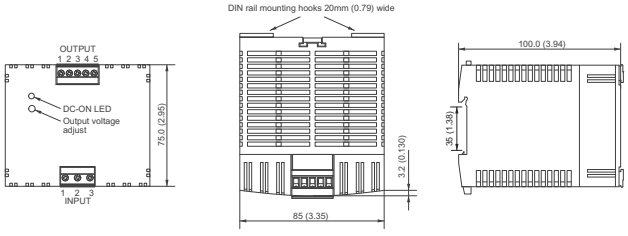


Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	+Vout
3	Line	3	-Vout
		4	-Vout
		5	Power Good

Weight: 265g (9.4 oz.)

Note: All dimensions are in millimeters (inches).

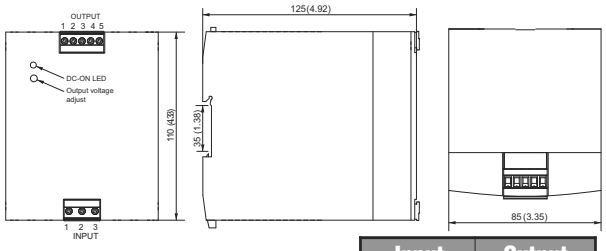
PSPxx-120x



Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	+Vout
3	Line	3	-Vout
		4	-Vout
		5	Power Good

Weight: 440g (15.5 oz.)

PSP24-240S



Input		Output	
1	AC Ground	1	+Vout
2	Neutral	2	+Vout
3	Line	3	-Vout
		4	-Vout
		5	Power Good

Weight: 950g (33.5 oz.)

Product Data Sheet

ZB5AS54

MUSHROOM PB



List Price	$78.00 USD
Availability	**Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Bezel Material	Black Plastic
Approvals	UL Listed File Number E164353 CCN NKCR - CSA Certified File Number LR44087 Class 321103 - CE Marked
Color	Red
Enclosure Rating	NEMA 1/2/3/4/4X/13
Degree of Protection	IP 65
Operator Type	Non-Illuminated
Markings	Unmarked
Style	Mushroom Button: 40mm
Operator Action	Maintained - Turn-to-Release
Shape of Head	Round
Size	22mm
Type	XB5

Shipping and Ordering

Category	22467 - Push Buttons, Plastic, 22mm, ZB5, XB5
Discount Schedule	I
GTIN	00785901354819
Package Quantity	1
Weight	0.08 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	FR

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Type 4 Mild Steel Wallmount Enclosure *Eclipse Series*

Hinge Door with Quarter Turn/Handle







Panel Sold Separately

Application

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

Standards

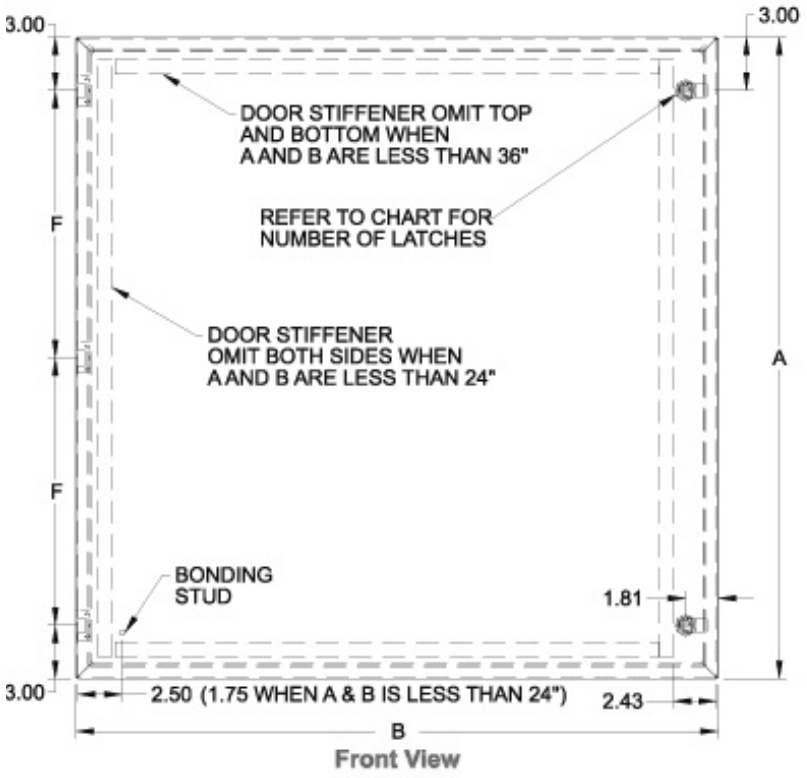
- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
  - NEMA Type 3R, 4, and 12
  - IEC 60529, IP66

Construction

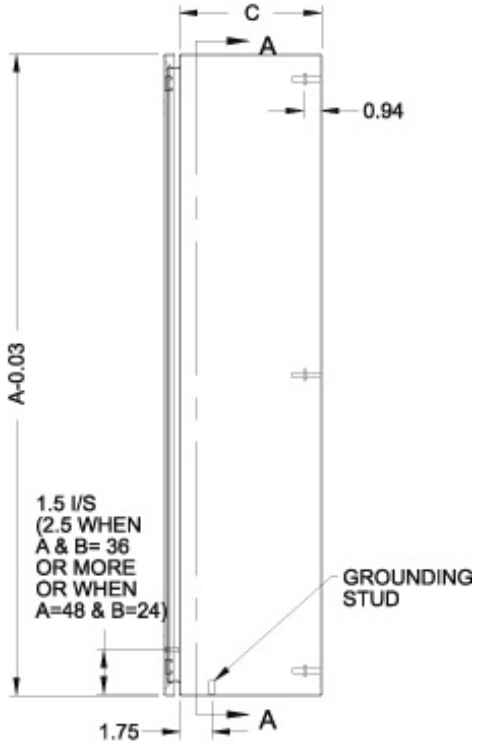
- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

Finish

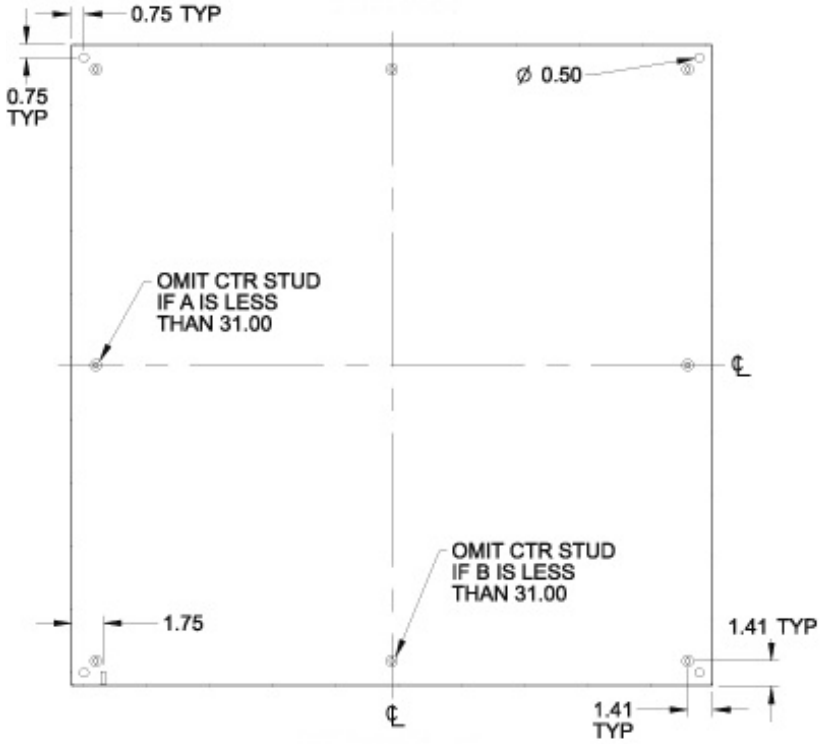
- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).



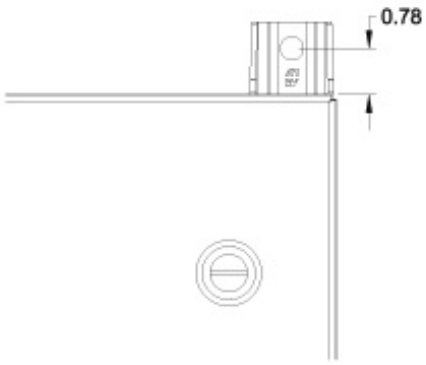
Front View



Side View



SECTION A-A



Mounting Foot Detail

Part No. (ANSI 61 Gray)	Part No. (RAL 7035 Light Gray)	Overall Dimensions A	B	C	Door/Body Gauge	Latches Qty	Type	Opt. Panel Part No.	Panel Size D	E	# Hinges	F	Ship Wt. (lbs)
EN4SD12126GY	**EN4SD12126LG**	12.00	12.00	6.00	16	1	Qtr Turn	**EP1212**	10.20	10.20	2	6.00	12
EN4SD12246GY	**EN4SD12246LG**	12.00	24.00	6.00	16	1	Qtr Turn	**EP1224**	10.20	22.20	2	18.00	24
EN4SD16126GY	**EN4SD16126LG**	16.00	12.00	6.00	16	1	Qtr Turn	**EP1612**	14.20	10.20	2	10.00	16
EN4SD16166GY	**EN4SD16166LG**	16.00	16.00	6.00	16	1	Qtr Turn	**EP1616**	14.20	14.20	2	10.00	19
EN4SD16206GY	**EN4SD16206LG**	16.00	20.00	6.00	16	1	Qtr Turn	**EP1620**	14.20	18.20	2	10.00	22
EN4SD20126GY	**EN4SD20126LG**	20.00	12.00	6.00	16	1	Qtr Turn	**EP2012**	18.20	10.20	2	14.00	20

EN4SD242410GY	**EN4SD242410LG**	24.00	24.00	10.00	14	2	Qtr. Turn	**EP2424**	22.20	22.20	2	18.00	45
EN4SD243010GY	**EN4SD243010LG**	24.00	30.00	10.00	14	2	Qtr. Turn	**EP2430**	22.20	28.20	2	18.00	53
EN4SD302010GY	**EN4SD302010LG**	30.00	20.00	10.00	14	2	Qtr. Turn	**EP3020**	28.20	18.20	3	12.00	47
EN4SD302410GY	**EN4SD302410LG**	30.00	24.00	10.00	14	2	Qtr. Turn	**EP3024**	28.20	22.20	3	12.00	53
EN4SD303010GY	**EN4SD303010LG**	30.00	30.00	10.00	14	2	Qtr. Turn	**EP3030**	28.20	28.20	3	12.00	75
EN4SD362410GY	**EN4SD362410LG**	36.00	24.00	10.00	14	2	Qtr. Turn	**EP3624**	34.20	22.20	3	15.00	70
EN4SD363010GY	**EN4SD363010LG**	36.00	30.00	10.00	14	2	Qtr. Turn	**EP3630**	34.20	28.20	3	15.00	84
EN4SD363610GY	**EN4SD363610LG**	36.00	36.00	10.00	14	2	Qtr. Turn	**EP3636**	34.20	34.20	3	15.00	100
EN4SD423010GY	**EN4SD423010LG**	42.00	30.00	10.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	107
EN4SD423610GY	**EN4SD423610LG**	42.00	36.00	10.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	117
EN4SD482410GY	**EN4SD482410LG**	48.00	24.00	10.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	95
EN4SD483010GY	**EN4SD483010LG**	48.00	30.00	10.00	14	1	3-point	**EP4830**	46.20	28.20	4	14.00	120
EN4SD483610GY	**EN4SD483610LG**	48.00	36.00	10.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	125
EN4SD603610GY	**EN4SD603610LG**	60.00	36.00	10.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	150
EN4SD201612GY	**EN4SD201612LG**	20.00	16.00	12.00	16	1	Qtr Turn	**EP2016**	18.20	14.20	2	14.00	32
EN4SD202012GY	**EN4SD202012LG**	20.00	20.00	12.00	16	1	Qtr Turn	**EP2020**	18.20	18.20	2	14.00	34
EN4SD242012GY	**EN4SD242012LG**	24.00	20.00	12.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	38
EN4SD242412GY	**EN4SD242412LG**	24.00	24.00	12.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	47
EN4SD302412GY	**EN4SD302412LG**	30.00	24.00	12.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	57
EN4SD303012GY	**EN4SD303012LG**	30.00	30.00	12.00	14	2	Qtr Turn	**EP3030**	28.20	28.20	3	12.00	80
EN4SD362412GY	**EN4SD362412LG**	36.00	24.00	12.00	14	2	Qtr Turn	**EP3624**	34.20	22.20	3	15.00	62
EN4SD363012GY	**~~EN4SD363012LG~~**	36.00	30.00	12.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	91
EN4SD363612GY	**EN4SD363612LG**	36.00	36.00	12.00	14	2	Qtr Turn	**EP3636**	34.20	34.20	3	15.00	104
EN4SD423012GY	**EN4SD423012LG**	42.00	30.00	12.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	111
EN4SD423612GY	**EN4SD423612LG**	42.00	36.00	12.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	121
EN4SD482412GY	**EN4SD482412LG**	48.00	24.00	12.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	98
EN4SD483612GY	**EN4SD483612LG**	48.00	36.00	12.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603612GY	**EN4SD603612LG**	60.00	36.00	12.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	165
EN4SD723012GY	**EN4SD723012LG**	72.00	30.00	12.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	190
EN4SD723612GY	**EN4SD723612LG**	72.00	36.00	12.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	195
EN4SD242016GY	**EN4SD242016LG**	24.00	20.00	16.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	52
EN4SD242416GY	**EN4SD242416LG**	24.00	24.00	16.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	66
EN4SD302416GY	**EN4SD302416LG**	30.00	24.00	16.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	85
EN4SD363016GY	**EN4SD363016LG**	36.00	30.00	16.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	102
EN4SD423616GY	**EN4SD423616LG**	42.00	36.00	16.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	140
EN4SD483616GY	**EN4SD483616LG**	48.00	36.00	16.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603616GY	**EN4SD603616LG**	60.00	36.00	16.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	200
EN4SD723016GY	**EN4SD723016LG**	72.00	30.00	16.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	215
EN4SD723616GY	**EN4SD723616LG**	72.00	36.00	16.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	217
EN4SD242420GY	**EN4SD242420LG**	24.00	24.00	20.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	70
EN4SD302420GY	**EN4SD302420LG**	30.00	24.00	20.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	82
EN4SD363020GY	**EN4SD363020LG**	36.00	30.00	20.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	117

HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Tube Axial Fans *DNMF Series*









Features

- Choice of 4.70" (120mm), 3.15" (80mm), 5.91" (150mm) or 10" (254mm).
- Choice of either 115 or 230 VAC, 50/60 Hz.
- Impedance protected motor.
- Class-B insulated.
- Ball bearing construction, metal or plastic blades.
- Diecast aluminum body.
- DNMF100AC, FAN150AC and FAN10A fans have male plug terminations (requires fan cords).
- FAN80AC fans have 11" long lead wires.
- Fan is cooled by incoming air.
- Fan component is recognized to UL 507 and CSA certified.
- Includes mounting hardware.

Accessories

- Fan Cords

Part No. 115 VAC	Part No. 230 VAC	Overall Dimensions Height	Width	Depth	CFM	Wattage 50Hz	60Hz	Speed (RPM)	Noise (dB)	Use With Fan Guard Part No.	Use With Filter Grill Part No.
FAN80AC115	**FAN80AC230**	3.15	3.15	1.50	32	11	10	3100	34	FAN80FG	XPFA80*
DNMF100AC115	**DNMF100AC230**	4.70	4.70	1.50	105	24	22	3000	50	DNFG	XPFA120*
FAN150AC115	**FAN150AC230**	5.75 & 5.90	6.72	2.00 & 2.20	210 & 230	27 & 46	26 & 40	3100 & 3400	63 & 53	FAN150FG	n/a
FAN10A115	**FAN10A220**	10.00 dia.		3.50	550	30	35	1650	55	FAN10FG	XPFA254*

Data subject to change without notice

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HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Thermostats *SKT Series*



Features

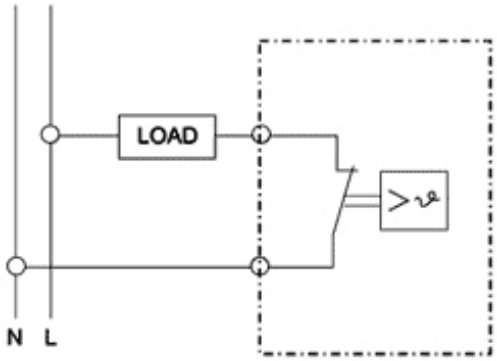
- Designed to provide air temperature control and monitoring in cabinets.
- Thermostat NC (Normally Closed) for the control of heaters and heater fans
- Thermostat NO (Normally Open) for the control of cooling units, or for switching signal transmitters in case of overheating.
- Available in Fahrenheit or Celsius.

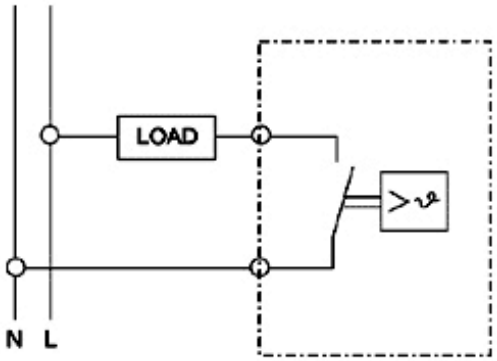
NC - Normally Closed (Red)

- Used in conjunction with heaters.
- Contact opens when rising temperatures reach the set point temperature, shutting heater off.

NO - Normally open (Blue)

- Used in conjunction with fans.
- Contact closes when rising temperatures reach the set point temperature, turning fan on.





Part No.	Scale	Contact Type	Dimensions Height x Width x Depth	Switching Capacity	Ship Wt. lbs
SKT011409NC	F°	Normally Closed	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1

Part No.	Scale	Contact Type	Dimensions Height x Width x Depth	Switching Capacity	Ship Wt. lbs
SKT011409NC-C	C°	Normally Closed	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1
SKT011419NO	F°	Normally Open	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1
SKT011419NO-C	C°	Normally Open	2.8 x 1.5 x 1.4	15 A (1) AC 120 V, 10 A (1) AC 250 V	1

Sensor Element:	Thermostatic bi-metal
Switching difference (hysteresis):	+ or - 4°F (+or- 3°K)
Adjustment Range:	30 - 140°F
Noise Suppression:	N (according to VDE 0875)
Connection:	2 pole terminal for AWG 14 (2.5 mm²)
Mounting:	Easily installed by clip mounting on 35 or 38mm DIN rail (included)
Housing:	Flame retardant plastic UL94VO
Color:	Gray (SB)
Protection:	IP20
Approval:	UL Recognized Component, cUL Recognized Component, CE

Data subject to change without notice

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Stride® Unmanaged Industrial Ethernet Switches

5-Port Ethernet Switch - Plastic Case

STRIDE SlimLine Industrial Unmanaged Ethernet Switch, plastic case, -10 to +60 °C operating temperature range, five 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection, auto-crossover, DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL1604 (Class I, Div. 2, Groups A, B, C, D) and CE marked.



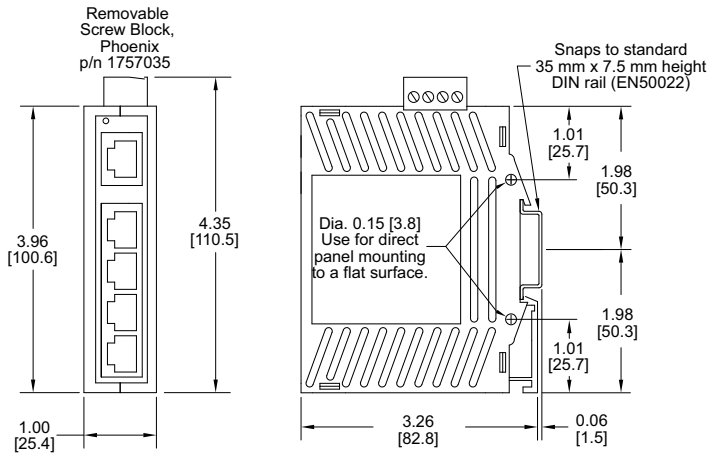
SE-SW5U

$99.00

Dimensions

Inches [mm]

5 Port – SE-SW5U



ACT/LNK LED

This is the **Yellow** LED on models with a Yellow and a Green LED per RJ45 port.

ON (yellow) (not flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, but no communications activity is detected.
ON (yellow) (flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, and that there is communications activity.
OFF	Indicates that there is not a proper Ethernet connection (Link) between the port and another Ethernet device. Make sure the cable has been plugged securely into the ports at both ends.

Speed 10/100 LED

This is the **Green** LED on models with a Yellow and a Green LED per RJ45 port.

ON (green)	A 100 Mbps (100BaseT) connection is detected.
OFF	A 10 Mbps (10BaseT) connection is detected.

Specifications

The following are specifications relevant to the SE-SW5U 5-Port Ethernet Switch.

Input power (typical with all ports active at 100 Mbps)	2.0 W
Weight	4 oz (0.11 kg)
Power connector max. screw torque	5.0 lb-in (0.57 Nm)

Stride® Unmanaged Industrial Ethernet Switches & Media Converter

General Specifications		
Ethernet switch type	Up to 9 ports	
Operating mode	Store and forward wire speed switching, non-blocking	
Devices supported	All IEEE 802.3 compliant devices are supported	
Standards	IEEE 802.3, 802.3u, 802.3x	
MAC addresses	1024 addresses	
Memory bandwidth	3.2 Gbps	
Latency for 10 Mbps ports	16 us + frame time (typical)	
Latency for 100 Mbps ports	5 us + frame time (typical)	
Power input	Redundant Input Terminals	
Input power (typical with all ports active at 100 Mbps)	SE-MC2U-ST SE-MC2U-SC SE-SW5U SE-SW5U-WT	2.0 W
	SE-SW5U-ST SE-SW5U-SC SE-SW5U-ST-WT SE-SW5U-SC-WT	3.0 W
	SE-SW8U SE-SW8U-WT	4.0 W
	SE-SW9U-ST SE-SW9U-SC SE-SW9U-ST-WT SE-SW9U-ST-WC	5.0 W
Input voltage	10-30 VDC (continuous) - Class 2 Power Supply	
Reverse power protection	Yes	
Transient protection	15,000 watts peak	
Spike protection	5,000 watts (10x for 10 uS)	
Ethernet isolation	1500 VRMS 1 minute	
Operating temperature range	SE-MC2U-ST SE-MC2U-SC SE-SW5U SE-SW8U SE-SW5U-ST SE-SW5U-SC SE-SW9U-ST SE-SW9U-SC	-10 to +60 °C (+14 to +140 °F), cold startup at -10 °C (+14 °F)
	SE-SW5U-WT SE-SW8U-WT SE-SW5U-ST-WT SE-SW5U-SC-WT SE-SW9U-ST-WT SE-SW9U-SC-WT	-40 to +85 °C (-40 to +185 °F), cold startup at -40 °C (-40 °F)
Storage temperature range	-40 to +85 °C (-40 to +185 °F)	
Humidity (non-condensing)	5 to 95% RH	
Environmental Air	No corrosive gasses permitted	
Vibration, shock & freefall	IEC68-2-6, -27, -32	
Agency Approvals	UL/cUL 508, CSA C22 per EN61010-1, UL/cUL 1604 (Class 1, Div. 2, Groups A, B, C, D), CSA C 22.2/213 9 per EN50021/EN60079-15 (Zone 2, Category 3), CE (ATEX)	
EMI emissions	FCC part 15, ICES-003, EN55022	
EMC immunity	IEC61326-1	
RoHS and WEEE	RoHS (Pb free) and WEEE compliant	
Environmental Air	For use in Pollution Degree 2 environment	

General Specifications Cont'd		
Packaging and protection	SE-MC2U-ST SE-MC2U-SC SE-SW5U SE-SW8U SE-SW5U-ST SE-SW5U-SC SE-SW9U-ST SE-SW9U-SC	UL94VO Lexan, IP30
	SE-SW5U-WT SE-SW8U-WT SE-SW5U-ST-WT SE-SW5U-SC-WT SE-SW9U-ST-WT SE-SW9U-SC-WT	Aluminum IP30
Dimensions (L x W x H)	See mechanical diagrams for details	

Copper RJ45 Ports: (10/100BaseT)	
10/100BaseT ports	Shielded RJ45
Protocols supported	All standard IEEE 802.3
Ethernet compliancy	IEEE 802.3, 802.3u, 802.3x
Auto-crossover	Yes, allows you to use straight-through or crossover wired cables
Auto-sensing operation	Yes, Full and half duplex
Auto-negotiating	Yes, 10BaseT and 100BaseT
Auto-polarity	Yes, on the TD and RD pair
Flow control	Automatic
Ethernet isolation	1500 VRMS 1 minute
Plug and play	Yes
Cable requirements	Twisted pair (Cat. 5 or better) (shielded recommended)
Max. cable distance	100 meters

Fiber Port: (100BaseFX multimode)	
100BaseFX ports	1
Fiber port mode	Multimode (mm)
Fiber port connector	ST – models SE-XXXX-ST and SE-XXXX-ST-WT SC – models SE-XXXX-SC and SE-XXXX-SC-WT
Optimal fiber cable	50/125 or 62.5/125 µm
Center wavelength	1300 nm
Multimode	Links up to 4 km typ.; 1300 nm; use with 50 or 62.5/125 um fiber > Transmitter power (dB): -21 min, -17 typ, -14 max > Receiver sensitivity (dB): -34 typ, -31 max
Nominal max. distance (full duplex)	4 km
Half and full duplex	Full duplex
Ethernet compliance	100BaseFX
Eye safety (laser)	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11

Complete documentation

Documentation can be downloaded from www.automationdirect.com.

DURAPULSE AC Drives – Introduction



DURApulse Drives																
Motor Rating	*Hp*	*1*	*2*	*3*	*5*	*7.5*	*10*	*15*	*20*	*25*	*30*	*40*	*50*	*60*	*75*	*100*
	kW	*.75*	*1.5*	*2.2*	*3.7*	*5.5*	*7.5*	*11*	*15*	*18.5*	*22*	*30*	*37*	*45*	*55*	*75*
Single/Three-Phase Input 230V		✔	✔	✔												
Three-Phase 230VClass					✔	✔	✔	✔	✔	✔	✔	✔	✔			
Three-Phase 460V Class		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Overview

The ***DURAPULSE*** series of AC drives offers all of the features of our GS2 series of drives including dynamic braking, PID, removable keypad and RS-485 Modbus communication. The ***DURAPULSE*** AC drive also offers sensorless vector control with the option of encoder feedback for enhanced speed control. The standard **smart** keypad (or Human Interface Module) is designed with defaults for the North American customer and allows you to configure the drive, set the speed, start and stop the drive, and monitor critical parameters for your application. In addition, this keypad has internal memory that allows **four** complete programs to be stored and transferred to any ***DURAPULSE*** drive. The ***DURAPULSE*** series offers three analog inputs, eleven digital inputs, and one SPDT relay output.

Features

- Simple Volts/Hertz control
- Sensorless vector control with autotune
- Sensorless vector control with optional encoder feedback card, for better speed control
- Sinusoidal pulse width modulation (PWM)
- Variable carrier frequency, depending on model
- IGBT technology
- Starting torque: 125% @ 0.5 Hz/150% @ 1Hz
- 150% rated current for one minute
- Electronic overload protection
- Stall prevention
- Adjustable accel and decel ramps with linear and S-curve settings
- Automatic torque and slip compensation
- Internal dynamic braking circuit for models under 20 hp; optional baking units available for models 20 hp and above
- DC braking
- Five skip frequencies
- Trip history
- Programmable jog speed
- Integral PID control
- Removable **smart** keypad with parameter upload/download
- Keypad with memory to store up to four programs of any *DURAPULSE* drive
- Eleven programmable digital inputs
- Three programmable analog inputs
- Three digital and one SPDT relay programmable outputs
- One programmable analog output
- One digital frequency output
- RS-485 Modbus communications
- Ethernet communication optional
- Two-year warranty
- UL/cUL/CE listed

Accessories

- AC line reactors
- EMI filters
- RF filter
- Braking resistors
- Braking units (for models 20 hp and above)
- Fuse kits and replacement fuses
- Replacement cooling fans
- Remote panel adapter
- Replacement keypad
- Keypad cables in 1, 3, and 5-meter lengths
- Ethernet interface
- Four and eight-port RS-485 multi-drop termination boards
- KEP***Direct*** I/O or OPC Server
- GSoft drive configuration software
- GS3-FB – feedback card
- GS-485HD15-CBL – ***ZIP***Link RS485 communication cable for connection to the DL06 and D2-260 15-pin ports
- USB-485M – USB to RS-485 PC adapter (see "Communications Products" chapter for detailed information)

Detailed descriptions and specifications for GS accessories are available in the "GS/DURAPULSE Accessories" section.

DURAPULSE part numbering system

GS3 - 2 020

Applicable Motor Capacity

1P0: 1HP	2P0: 2HP
3P0: 3HP	5P0: 5HP
7P5: 7.5HP	010: 10HP
015: 15HP	020: 20HP
025: 25HP	030: 30HP
040: 40HP	050: 50HP
060: 60HP*	075: 75HP*
100: 100HP*	

* 60, 75 and 100HP models available in GS3-4xxx only

Input Voltage

2: 200-240VAC
4: 380-480VAC

Series Name

Typical Applications

- Conveyors
- Fans
- Pumps
- Compressors
- HVAC
- Material handling
- Mixing
- Shop tools
- Extruding
- Grinding

DURApulse AC Drives Specifications

230V Class													
Model Name: GS3-xxx			21P0	22P0	23P0	25P0	27P5	2010	2015	2020	2025	2030	2040	2050
Price			$242.00	$293.00	$347.00	$400.00	$549.00	$698.00	$889.00	$1,104.00	$1,298.00	$1,486.00	$2,177.00	$2,637.00
Output Rating	**Maximum Motor Output**	**HP**	1.0	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50
		kW	.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37
	Rated Output Current (A)		5	7	11	17	25	33	49	65	75	90	120	145
	Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)											
	Rated Frequency		0.1 to 400 Hz											
*** Input Rating**	**Rated Voltage/Frequency**		Single/Three-phase			Three-phase								
			200/208/220/230/240 VAC, 50/60Hz											
	Rated Input Current (A)		11.9 / 5.7	15.3 / 7.6	22 / 15.5	20.6	26	34	50	60	75	90	110	142
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%											
Watt Loss @ 100% I (W)			60	82	130	194	301	380	660	750	920	1300	1340	1430
Weight (lb [kg])			4.5 [2.034]	4.5 [2.034]	9.4 [4.24]	9.4 [4.24]	13.3 [6.031]	13.3 [6.031]	14.3 [6.487]	26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]

** All 3-phase power sources must be symmetrical.*
Do not connect any DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

460V Class – Three-Phase																
Model Name: GS3-xxx			41P0	42P0	43P0	45P0	47P5	4010	4015	4020	4025	4030	4040	4050	4060	4075	4100
Price			$323.00	$360.00	$385.00	$427.00	$613.00	$734.00	$957.00	$1,165.00	$1,383.00	$1,570.00	$2,001.00	$2,436.00	$2,788.00	$3,130.00	$3,498.00
Output Rating	**Maximum Motor Output**	**HP**	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100
		kW	.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
	Rated Output Current (A)		2.7	4.2	5.5	8.5	13	18	24	32	38	45	60	73	91	110	150
	Maximum Output Voltage		Three-phase 380 to 480V (proportional to input voltage)														
	Rated Frequency		0.1 to 400 Hz														
***Input Rating**	**Rated Voltage/ Frequency**		Three-phase, 380/400/415/440/460/480VAC, 50/60Hz														
	Rated Input Current (A)		3.2	4.3	5.9	11.2	14	19	25	32	39	49	60	63	90	130	160
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%														
Watt Loss @ 100% I (W)			70	102	132	176	250	345	445	620	788	1290	1420	1680	2020	2910	3840
Weight (lb [kg])			3.9 [1.759]	4.4 [1.994]	4.1 [1.857]	9.4 [4.24]	13.2 [6.002]	13.5 [6.106]	14.4 [6.525]	26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]	77.2 [35]	116.8 [53]	116.8 [53]

** All 3-phase power sources must be symmetrical.*
Do not connect any DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

DURAPULSE AC Drives General Specifications

General Specifications			
Control Characteristics			
Control System			Pulse Width Modulation, Carrier frequency adjustable from 1k–15kHz depending on the model. This system determines the control methods of the AC drive. 00: V/Hz open loop control 01: V/Hz closed loop control 02: Sensorless Vector 03: Sensorless Vector with external feedback
Rated Output Frequency			0.1 to 400.0 Hz
Output Frequency Resolution			0.1 Hz
Overload Capacity			150% of rated current for 1 minute
Torque Characteristics			Includes auto-torque boost, auto-slip compensation, starting torque 125% @ 0.5 Hz / 150% @ 1.0 Hz
Braking Torque			20% without braking resistor, 125% with optional braking resistor (braking circuit built-in only for units under 20 hp)
DC Braking			Operation frequency 60–0 Hz, 0–100% rated current, Start time 0.0–5.0 seconds, Stop time 0.0–25.0 seconds
Acceleration/Deceleration Time			0.1 to 600 seconds (linear or non-linear acceleration/deceleration), second acceleration/deceleration available
Voltage/Frequency Pattern			Settings available for Constant Torque - low & high starting torque, Variable Torque - low & high starting torque, and user configured
Stall Prevention Level			20 to 200% of rated current
Operation Specifications			
Inputs	***Frequency Setting***	***Keypad***	Setting by <UP> or <DOWN> buttons
		External Signal	Potentiometer - 3 to 5 kΩ, 0 to 10 VDC (input impedance 10 kΩ), -10 to +10 VDC, 4 to 20 mA (input impedance 250Ω), 0 to 20 mA; Multi-Speed Inputs 1 to 4, RS-232C/RS-485 communication interface
	Operation Setting	***Keypad***	Setting by <RUN>, <STOP>, <JOG> , <FWD>, <REV> buttons
		External Signal	Forward/Stop, Reverse/Stop (run/stop, fwd/rev), 3-wire control, Serial Communication RS-232C & RS-485 (Modbus RTU)
	Input Terminals	***Digital Sink/Source Selectable***	11 user-programmable: FWD/STOP, REV/STOP, RUN/STOP, REV/FWD, RUN momentary (N.O.), STOP momentary (N.C.), External Fault (N.O./N.C.), External Reset, Multi-Speed Bit (1-4), Manual Keyboard Control, Jog, External Base Block (N.O./ N.C.), Second Accel/Decel Time, Speed Hold, Increase Speed, Decrease Speed, Reset Speed to Zero, PID Disable (N.O.), PID Disable (N.C.), Input Disable
		Analog	3 user-configurable, 0 to 10V (input impedance 10 kΩ), 0 to 20 mA, 4 to 20 mA (input impedance 250Ω), 10 bit resolution -10V to +10V, 10 bit resolution
Outputs	***Output Terminals***	***Digital 3 transistors 1 relay***	4 user-programmable: Inverter Running, Inverter Fault, At Speed, Zero Speed, Above Desired Frequency, Below Desired Frequency, At Maximum Speed, Over Torque Detected, Above Desired Current, Below Desired Current, PID Deviation Alarm, Heatsink Overheat Warning (OH), Soft Braking Signal, Above desired Frequency 2, Below desired Frequency 2, Encoder Loss
		Digital Square Wave	One digital square wave output representing drive frequency
		Analog	1 user-programmable, 0 to 10V, 8 bit resolution frequency, current, process variable PV
Operating Functions			Automatic voltage regulation, voltage/frequency characteristics selection, non-linear acceleration/deceleration, upper and lower frequency limiters, 15-stage speed operation, adjustable carrier frequency (1 to 15 kHz), PID control, 5 skip frequencies, analog gain & bias adjustment, jog, electronic thermal relay, automatic torque boost, trip history, software protection
Protective Functions			Electronic Thermal, Overload Relay, Auto Restart after Fault, Momentary Power Loss, Reverse Operation Inhibit, Auto Voltage Regulation, Over-Voltage Stall Prevention, Auto Adjustable Accel/Decel, Over-Torque Detection Mode, Over-Torque Detection Level, Over-Torque Detection Time, Over-Current Stall Prevention during Acceleration, Over-Current Stall Prevention during Operation
Operator Interface	***Operator Devices***		9-key, 2 line x 16 character LCD display, 5 status LEDs
	Programming		Parameter values for setup and review, fault codes
	Status Display		Output Frequency, Motor Speed, Scaled Frequency, Output Current, Motor Load, Output Voltage, DC Bus Voltage, PID Setpoint, PID Feedback, Frequency Setpoint
	Key Functions		RUN, STOP/RESET, FWD/REV, PROGRAM, DISPLAY, <UP>, <DOWN>, ENTER
Environment	***Enclosure Rating***		Protected Chassis, IP20
	Ambient Temperature		-10°C to 40°C (14°F to 104°F)
	Storage Temperature		-20°C to 60°C (-4°F to 140°F) – during short term transportation period
	Ambient Humidity		20 to 90% RH (non-condensing)
	Vibration		9.8 m/s^2 (1G) less than 10 Hz; 5.9 m/s^2 (0.6G) 10 to 60 Hz
	Installation Location		Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust
Options			Noise filter, input AC reactor, output AC reactor, cable for remote operator, programming software, dynamic braking resistor, dynamic braking unit; RF filter; remote panel adapter; Ethernet interface; four and eight port RS-485 multi-drop termination boards, replacement keypads, fuse kits and replacement fuses

DURAPULSE Drives Specifications – Installation

Understanding the installation requirements for your *DURAPULSE* AC drive will help to ensure that it operates within its environmental and electrical limits.

Note: Never use only this catalog for installation instructions or operation of equipment; refer to the user manual, GS3-M.

Environmental Specifications	
Protective Structure [1]	IP20
Ambient Operating Temperature [2]	-10 to 40°C (14°F to 104°F) f
Storage Temperature [3]	-20 to 60°C (-4°F to 140°F)
Humidity	To 90% (no condensation)
Vibration [4]	9.8 m/s² (1g), less than 10 Hz 5.9 m/s² (0.6g),10 to 60 Hz
Location	Altitude 1,000 m or less, indoors (no corrosive gases, liquids or dust)

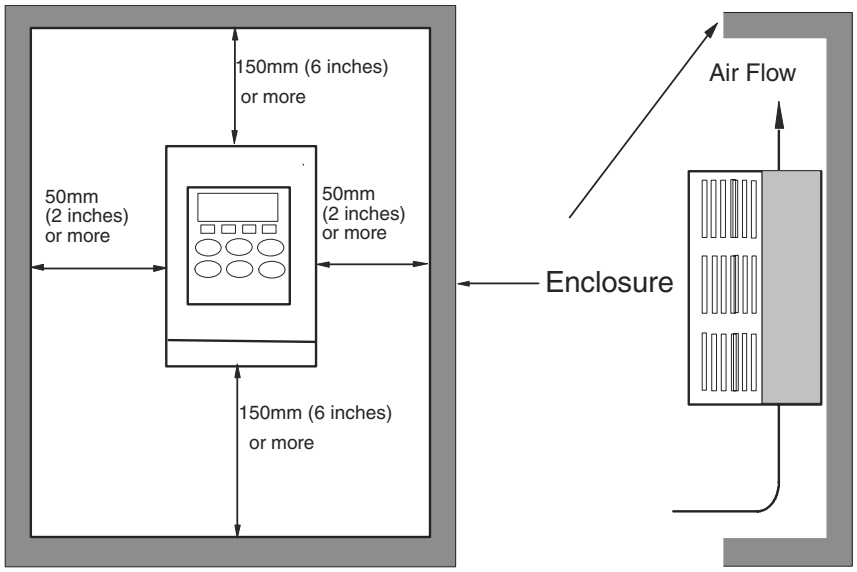
1: Protective structure is based upon EN60529

2: The ambient temperature must be in the range of -10° to 40°C. If the range will be up to 50°C, you will need to set the carrier frequency to 2.1 kHz or less and derate the output current to 80% or less.

3: The storage temperature refers to the short-term temperature during transport.

4: Conforms to the test method specified in JIS CO911 (1984)

Watt-loss Chart	
GS3 Drive Model	***At full load***
GS3-21P0	60
GS3-22P0	82
GS3-23P0	130
GS3-25P0	194
GS3-27P5	301
GS3-2010	380
GS3-2015	660
GS3-2020	750
GS3-2025	920
GS3-2030	1300
GS3-2040	1340
GS3-2050	1430
GS3-41P0	70
GS3-42P0	102
GS3-43P0	132
GS3-45P0	176
GS3-47P5	250
GS3-4010	345
GS3-4015	445
GS3-4020	620
GS3-4025	788
GS3-4030	1290
GS3-4040	1420
GS3-4050	1680
GS3-4060	2020
GS3-4075	2910
GS3-4100	3840



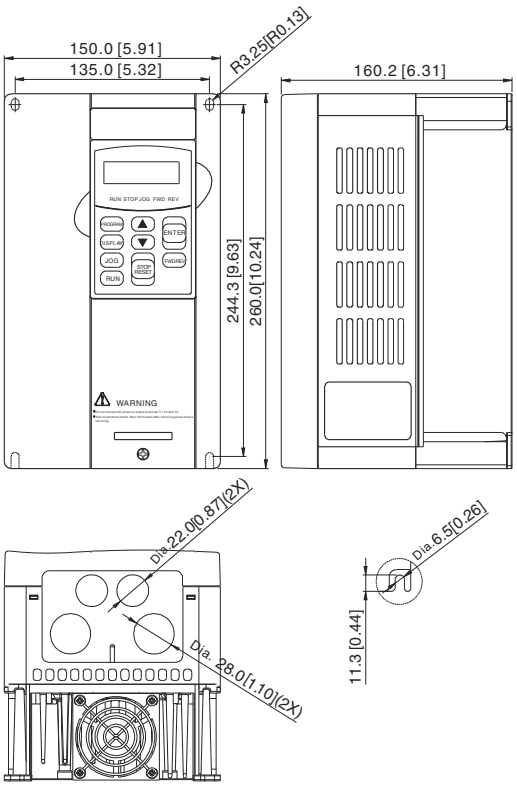
Minimum Clearances and Air Flow

Warning: AC drives generate a large amount of heat which may damage the AC drive. Auxiliary cooling methods are typically required in order not to exceed maximum ambient temperatures.

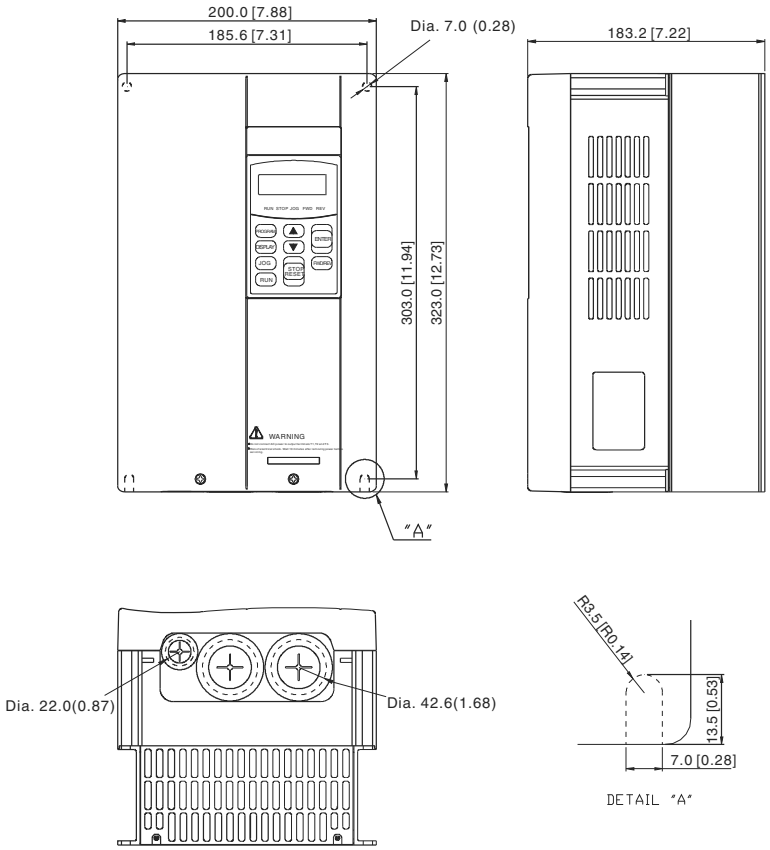
Warning: Maximum ambient temperatures must not exceed 50°C (122°F), or 40°C (104°F) for models 7.5 hp (5.5 kW) and higher!

DURAPULSE AC Drives — Dimensions

GS3-23P0, GS3-25P0, GS3-45P0



GS3-27P5, GS3-2010, GS3-2015, GS3-47P5, GS3-4010, GS3-4015



unit: mm(in)

GS/*DURAPULSE* Accessories – Ethernet Interface

GS-EDRV100 Overview

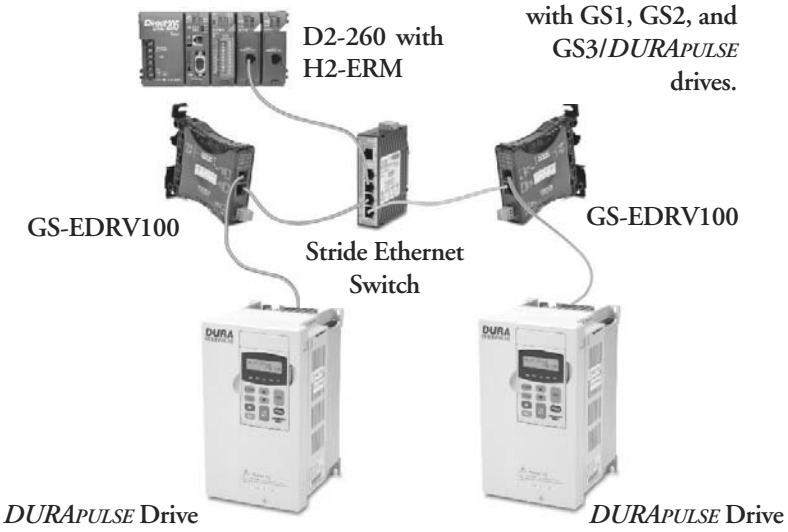
The GS-EDRV100 Ethernet interface provides a high-performance Ethernet link between a control system and any GS or *DURAPULSE* AC drive. The GS-EDRV100 processes signals to and from the drive, mounts on 35mm DIN rail, and connects the drive to an Ethernet hub or PC. It formats drive signals to conform with the Ethernet standard and transmits these signals to the H2-ERM or H4-ERM, Productivity3000, KEP*Direct* OPC Server, KEP*Direct* EBC I/O Server, or independent controller with a Modbus TCP/IP driver. This allows for greater connectivity to many control system architectures.

An additional feature is the built-in Web server which allows users to configure and control the drive from any Web browser via the IP address of the GS-EDRV100 card.

Note: The GS-EDRV100 requires an external 24 VDC power supply.

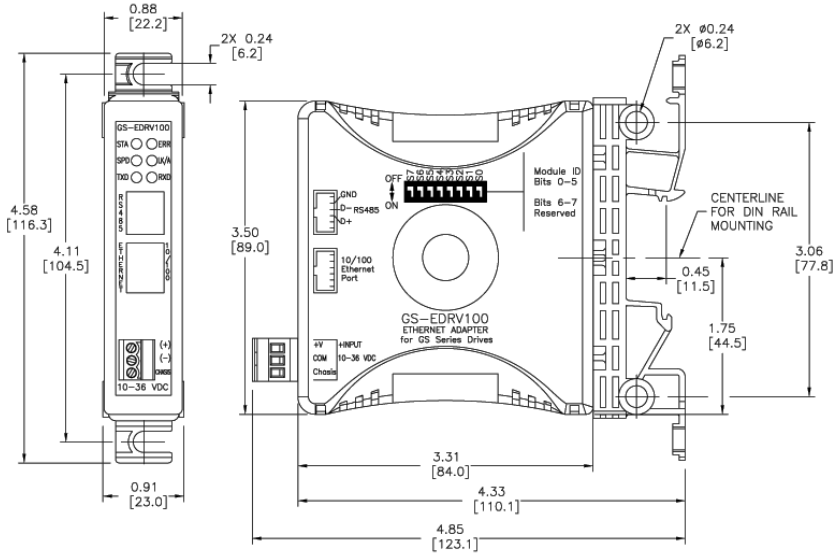
Automatic power shut-down

The GS series drives have a provision for shutting down control or power to the inverter in the event of a communications time-out. This function can be set up through the drive's parameter group 9.





Dimensions: inches[mm]



Specifications	
Part Number	***GS-EDRV100***
Price	$185.00
Approvals	cUL Listed, file number E185989
Input Voltage	10–36 VDC
Input Current	50–220 mA
NOTE: Can be used with all GS/DURApulse series AC drives.	
NOTE: Package includes 2-ft. serial communications cable.	
NOTE: Mounts on 35mm DIN rail.	

TABLE 1
PROCESS INSTRUMENTATION DIAGRAM INSTRUMENT LIST

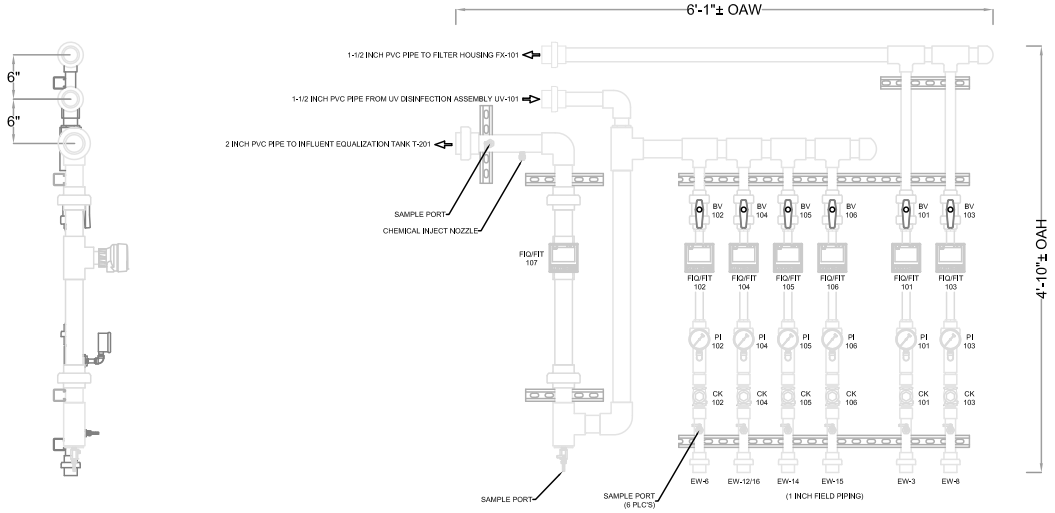
REVISION 0 (90%) MARCH 23, 2016

15-183 GES - BASF FACILITY - RENSSELAER, NY

TAG	ITEM	MODEL	MANUFACTURER	SPECIFICATION
PI-101 / 106	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
FIT-101 / 106	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-101 / 106	FLOW SENSOR INSTALLATION FITTING, 0.75 IN	PV8T007	GF SIGNET	FLOWMETER INSTALLATION TEE / PVC / 0.75 IN
PSH-101	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
PI-107,108	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
FIT-107	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-107	FLOW SENSOR INSTALLATION FITTING, 2 IN	PV8T020	GF SIGNET	FLOWMETER INSTALLATION TEE / PVC / 2 IN
LT-201	EQ TANK ULTRASONIC LEVEL TRANSMITTER	LU80-5101	FLOWLINE - ECHOSPAN	ULTRASONIC LEVEL TRANSMITTER 9.8 FT RANGE / 4 IN DEAD BAND / PVDC WITH VITON GASKET / 12-28 VDC INPUT / 4-20 MA, 2-WIRE OUTPUT
LSHH-200	EQ TANK EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
PI-200 / 204	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
PSH-201	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
TI-300	TEMPERATURE INDICATOR, (-20) TO 120 F	1NFY8	AV	BIMETAL THERMOMETER / -20 TO 120 F / 2.5 INCH STEM / 3 INCH DIAL / 0.5 INCH MNPT BACK-MOUNT / SS CASE
PI-301	PRESSURE INDICATOR, 0 - 10 PSI	SGX-D8022N	DWYER	0 TO 10 PSI / 2.5 INCH SS CASE / BRASS INTERNALS / 0.25 INCH BOTTOM MOUNT / 212 F MAX PROCESS
LT-301	TRAY STRIPPER LEVEL TRANSMITTER	L500-TRANS	FPI SENSOR	CONTINUOUS LEVEL TRANSMITTER / SS ROD / 2 INCH NPT / SS FLOAT - S.G. 0.60 / N.C. - HH / 9.25 INCH UDB, 11 INCH MR, 2 INCH LDB / SPST / 50W / 10-30 VDC / 4-20 MA OUTPUT
LSHH-300	TRAY STRIPPER EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
LSHH-301	POST-TRAY STRIPPER MS LEVEL SWITCH HIGH-HIGH	F6-HPS-31	DWYER	HORIZONTAL MOUNT LEVEL SWITCH / POLYPROPYLENE FLOAT AND STEM / TEMPERATURE LIMIT 176 F / PRESSURE LIMIT 116 PSIG / SPECIFIC GRAVITY 0.6 MINIMUM
VSL-301	VACUUM SWITCH - LOW, 4 TO 20 IWC	1950-20-2F	DWYER	ADJUSTABLE 0.4 TO 20 IWC / 0.6 MAX DEAD BAND / -40 TO 140 F TEMP LIMITS / 45 IWC MAX PRESSURE / SPDT SWITCH TYPE / 15AMP @ 125 VAC SWITCH RATING / 0.125 INCH CONNECTION
VI-301, 302	VACUUM INDICATOR, (-)60 - 0 IWC(V)	LPG4-D7522N	DWYER	(-)60 TO 0 IWC-V / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT CONNECTION
VI-303	VACUUM INDICATOR, (-)100 - 0 IWC(V)	LPG4-D7722N	DWYER	(-)100 TO 0 IWC-V / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT CONNECTION
TI-301	TEMPERATURE INDICATOR, 0 TO 250 F	1NFY4	AV	BIMETAL THERMOMETER / 0 TO 250 F / 2.5 INCH STEM / 3 INCH DIAL / 0.5 INCH MNPT BACK-MOUNT / SS CASE
FE-301	FLOW ELEMENT PITOT TUBE, 6 IN	DS-300-6	DWYER	6 INCH AVERAGING STYLE PITOT TUBE / STAINLESS STEEL CONSTRUCTION WITH BRASS ISOLATION VALVE / 0 - 200 F TEMPERATURE LIMITS
FI-301	PITOT TUBE MAGNEHELIC GAUGE, 0-4 IWC	2003	DWYER	0 - 4 IN WC D.P. RANGE (MINOR DIV. 0.10) / CAST ALUMINUM CASE / 4 IN ACRYLIC COVER / -20 IN Hg TO 15 PSIG PRESSURE LIMITS / 20 - 140 F RANGE / 0.125 IN CONNECTIONS

TABLE 1
PROCESS INSTRUMENTATION DIAGRAM INSTRUMENT LIST

TAG	ITEM	MODEL	MANUFACTURER	SPECIFICATION
PI-303	PRESSURE INDICATOR, 0 - 60 IWC	LPG4-D8422N	DWYER	0 - 60 IWC / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT
PSH-301	PRESSURE SWITCH - HIGH, 0.5 TO 2 PSID	1950P-2-2F	DWYER	ADJUSTABLE / 0.5 TO 2 PSID / 0.3 MAX DEAD BAND @ 0.5 PSID / (-)40 TO 140 F TEMP RATING / 35 PSI MAX PRESSURE / SPDT SWITCH TYPE / 15AMP @ 125 VAC SWITCH RATING / 0.125 INCH PROCESS
PI-302	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
PI-401 / 404	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
DPT-401	PRESSURE TRANSMITTER, 0 - 25 PSID	629-03-CH-P2-E5-S1	DWYER	WET/WET DIFFERENTIAL PRESSURE TRANSMITTER, RANGE 25 PSID, WORKING PRESSURE 50 PSI, OVER PRESSURE 250 PSI.
PSH-501	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
PI-501 / 506	PRESSURE INDICATOR, 0 - 100 PSI	SGZ-D10522N-GF	DWYER	0 TO 100 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
PSH-600	PRESSURE SWITCH - HIGH, 4 - 75 PSI	A1F-PC-SS-1-2	DWYER	DIAPHRAGM PRESSURE SWITCH / 4-75 PSIG / 316SS AND PTFE WETTED / NEMA 4X POLYCARBONATE ENCLOSURE / MAX PRESSURE 750 PSIG / TEMP -40 TO 175 F / ONE SPDT SWITCH
FIT-601, 602	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-601	FLOW SENSOR INSTALLATION FITTING, 1.5 IN	PV8T015	GF SIGNET	FLOWMETER INSTALLATION TEE / PVC / 1.5 IN
LSHH-700	BACKWASH SUPPLY TANK EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
LSH-700, LSL-700	BACKWASH SUPPLY TANK HIGH & LOW LEVEL SWITCH	MBLU40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY OPEN / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
PI-701	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
FIT-701	MAGNETIC FLOW SENSOR TRANSMITTER	3-2551-P0-22	GF SIGNET	0.5 - 4 IN PIPE / 0.15 - 33 FPS INSERTION MAGNETIC FLOWSENSOR WITH DISPLAY / POLYPRO SENSOR BODY / 316 SS ELECTRODES & GROUND / 4-20 MA OUTPUT WITH RELAYS / 14 - 158 F TEMP / 50 MA @ 24 VDC
FIT-701	FLOW SENSOR INSTALLATION FITTING, 3 IN	PV8T030	GF SIGNET	FLOWMETER INSTALLATION TEE - SADDLE / PVC / 3 IN
LSHH-800	BACKWASH SUPERNATANT TANK EMERGENCY HIGH LEVEL SWITCH	MYEL40T	GEMS	NARROW ANGLE (2-8 IN) MECHANICAL TILT SWITCH / ABS SHELL / NEOPRENE CABLE / NORMALLY CLOSED / 40 FT CORD / 2 WIRE / 32 F TO 221 F WET / SPST 13 AMPS @ 120/240 VAC
PI-801 / 803	PRESSURE INDICATOR, 0 - 60 PSI	SGZ-D10422N-GF	DWYER	0 TO 60 PSI / 2.5 IN DIAL / 304SS HOUSING & 316 SS WETTED PARTS / GLYCERIN FILLED / 0.25 IN BOTTOM MNPT / 140 F MAX TEMP
LSL, 1001,1002	CHEMICAL DRUM LOW LEVEL SWITCH	F7-SS2	DWYER	FLOAT SWITCH SG 0.75 / 316SS FLOAT, 316SS STEM / 300°F TEMP LIMIT / 450 PSIG PRESSURE LIMIT / 25 VA: 1A @ 200 VAC
LSHH-1200	BUILDING SUMP HIGH LEVEL SWITCH	F7-SB	DWYER	FLOAT SWITCH SG 0.60 / BUNA-N EPOXY 316 SS CONSTR / 220 F TEMP LIMIT / 150 PSIG PRESS LIMIT 0.125 IN PROCESS CONNECTION / 25 VA:1A @ 220 VAC
LSHH-1201	CONTAINMENT PAD SUMP HIGH LEVEL SWITCH	F7-SB	DWYER	FLOAT SWITCH SG 0.60 / BUNA-N EPOXY 316 SS CONSTR / 220 F TEMP LIMIT / 150 PSIG PRESS LIMIT 0.125 IN PROCESS CONNECTION / 25 VA:1A @ 220 VAC

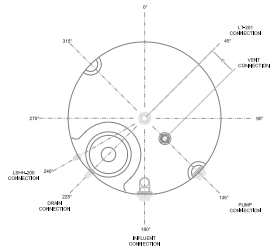


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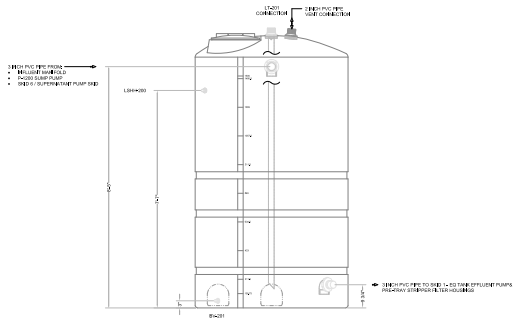
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0	90% DESIGN SUBMITTAL	03-23-16	CJJ

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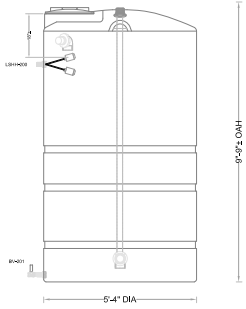
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CHK BY / DATE	
APPR BY / DATE	
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	GES - GWTS BASF FACILITY - RENSSELAER, NY
JOB NO.	15-183
SCALE	10
SIZE	C
DWG NO.	M-3
SHEET	1 OF 1
REV	0



TANK FITTING LAYOUT
PLAN VIEW



TANK FITTING LAYOUT
FRONT ELEVATION
VIEW



TANK FITTING LAYOUT
135° ELEVATION VIEW

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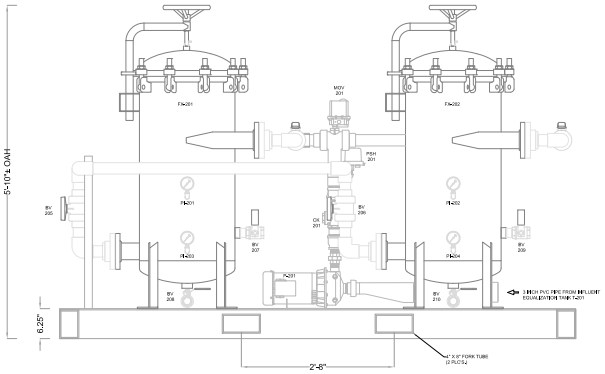
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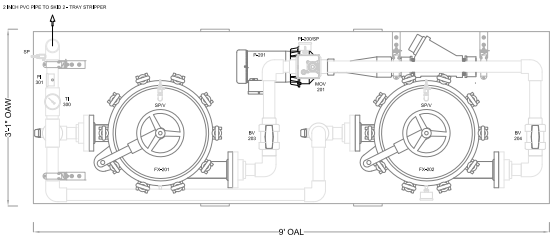
TITLE: T-201 INFLUENT EQUALIZATION TANK

GES - GWTS
BASF FACILITY - RENSSELAER, NY
JOB NO. 19-165

SCALE: 3/8"
SIZE: D
DRAWING: M-4
SHEET: 1 OF 1
REV: 0



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-03-15	CJJ

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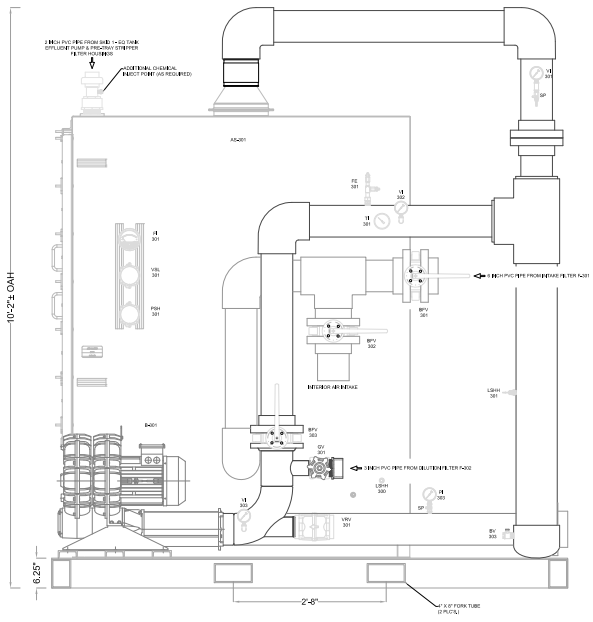
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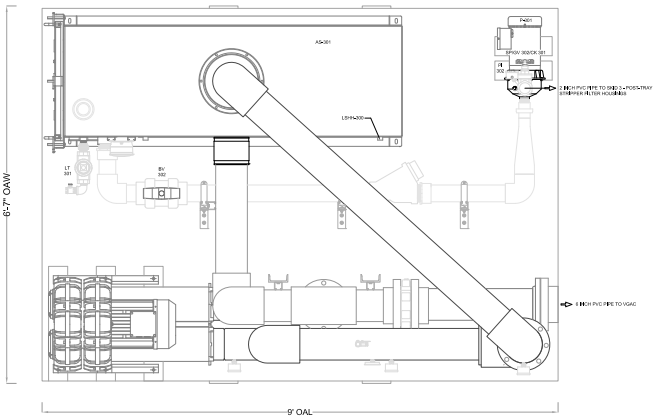
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APPR BY: — DATE:

TITLE: SKID 1 - EQ TANK EFFLUENT PUMP & PRE-TRAY STRIPPER FILTER HOUSINGS

2015 - 0247.01 — JOB NO.: 15-160
BASF FACILITY - RENSSELAER, NY
SCALE: 1/2 — SIZE: D — DRAWING: M-5 — SHEET: 1 OF 1 — REV: 0



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

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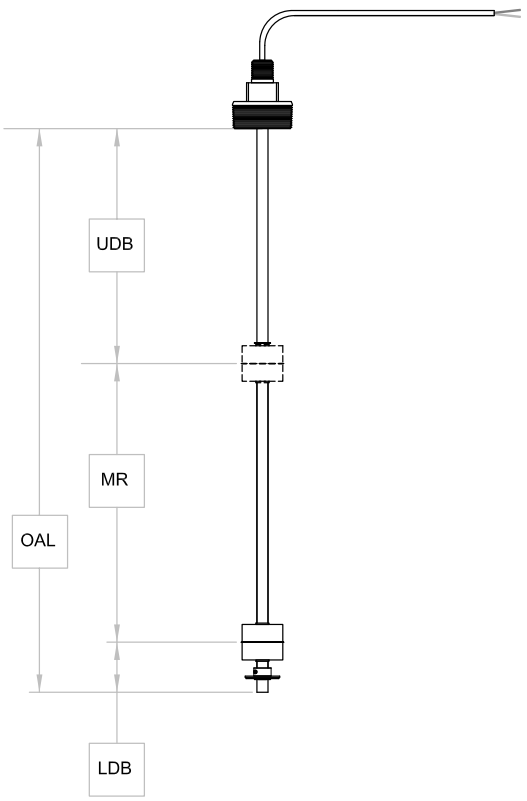
DRAWN BY: CJJ DATE: 03-25-19
CHK BY: DATE:
APPR BY: DATE:

TITLE: SKID 2 - TRAY STRIPPER

GES - DAYTS
BASF FACILITY - RENSSELAER, NY

JOB NO.: 19-165
SCALE: 1/2
SIZE: D
DWG NO.: M-6
SHEET: 1 OF 1
REV: 0

RED SIGNAL
BLK NEGATIVE VOLTAGE
(LOOP POWERED 10-30 VDC)



UL LISTED	
HOUSING	N/A
CONDUIT CONNECTION	$\frac{1}{2}$ NPT
FITTING AND STEM MATERIAL	STAINLESS STEEL
STEM DIAMETER	$\frac{1}{2}$ INCH
FITTING SIZE	2 INCH NPT
FLOAT STOP	SNAP RING / COLLAR
FLOAT MATERIAL	STAINLESS STEEL
OUTPUT	4-20 mA
SPECIFIC GRAVITY	0.6
CENTERING DISC	STAINLESS STEEL

OAL - 22.25 INCHES
MR - 11 INCHES
UDB - 9.25 INCHES
LDB - 2 INCHES
CABLE LENGTH - 120 INCHES
U.L. LISTED

NOTES:
1. FOR TERMINAL BLOCK LOCATION SEE DRAWING (I-1)
2. FOR WIRING TERMINAL DESIGNATION SEE DRAWING (I-2)

REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN	03-23-16	CJJ

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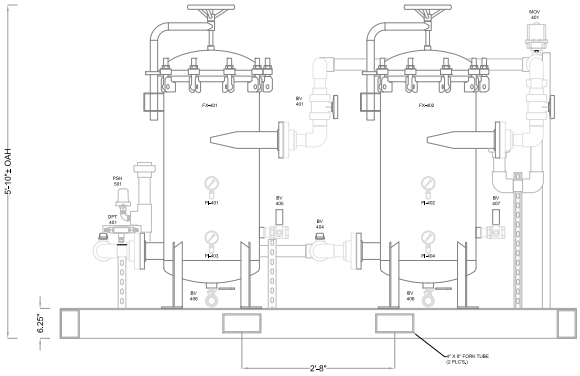
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TITLE
LT-301 LEVEL TRANSMITTER

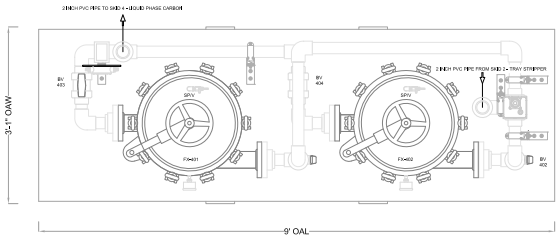
GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	M-7	1 OF 1	0



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

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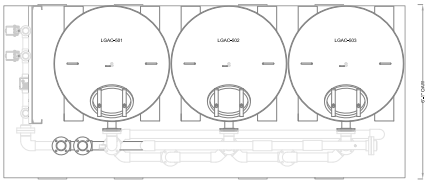
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APPR BY: — DATE:

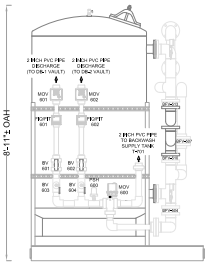
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508-226-1100 (Phone) 508-222-1101 (Fax)
www.NESMA.com

TITLE: SKID 3 - POST-TRAY STRIPPER FILTER HOUSINGS
GES = 03/15
JOB NO.: 15-163
BASF FACILITY - RENSSELAER, NY
SCALE: 10
SIZE: D
DRAWING: M-8
SHEET: 1 OF 1
REV: 0

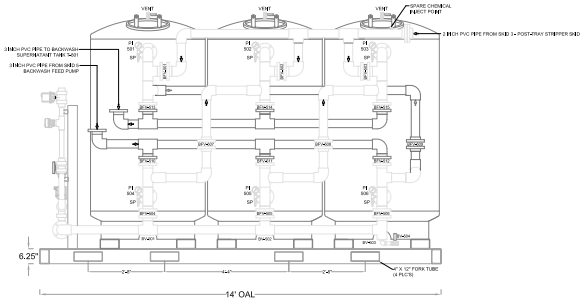
LIQUID PHASE CARBON VALVE DESIGNATION			
VALVE TAG NUMBER	LGAC-001 PRIMARY / LGAC-002 SECONDARY	LGAC-002 PRIMARY / LGAC-003 SECONDARY	LGAC-003 PRIMARY / LGAC-001 SECONDARY
BFV-001	OPEN	CLOSED	CLOSED
BFV-002	CLOSED	OPEN	CLOSED
BFV-003	CLOSED	CLOSED	OPEN
BFV-004	CLOSED	CLOSED	OPEN
BFV-005	OPEN	CLOSED	CLOSED
BFV-006	CLOSED	OPEN	CLOSED
BFV-007	OPEN	CLOSED	CLOSED
BFV-008	CLOSED	OPEN	CLOSED
BFV-009	CLOSED	CLOSED	OPEN
BFV-010	CLOSED	CLOSED	CLOSED
BFV-011	CLOSED	CLOSED	CLOSED
BFV-012	CLOSED	CLOSED	CLOSED
BFV-013	CLOSED	CLOSED	CLOSED
BFV-014	CLOSED	CLOSED	CLOSED
BFV-015	CLOSED	CLOSED	CLOSED



SKID LAYOUT
PLAN VIEW



SKID LAYOUT
LEFT SIDE ELEVATION



SKID LAYOUT
ELEVATIONAL VIEW

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REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-25-19	CJJ

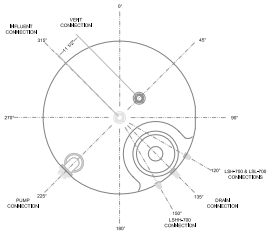
REVISIONS

DRAWN BY: CJJ — DATE: 03-25-19
CHK BY: — DATE:
APPR BY: — DATE:

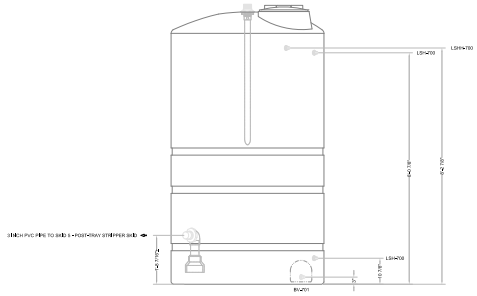
TITLE: SKID 4 - LIQUID PHASE CARBON

GES - DAYTS — JOB NO. 19-183
BASF FACILITY - RENSSELAER, NY

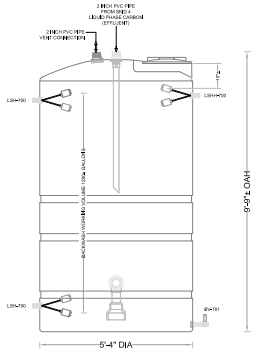
SCALE: 3/8" — SIZE: D — DWG NO.: M-9 — SHEET: 1 OF 1 — REV: 0



TANK FITTING LAYOUT
PLAN VIEW



TANK FITTING LAYOUT
FRONT ELEVATION
VIEW



TANK FITTING LAYOUT
225° ELEVATION VIEW

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REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-25-15	CJJ

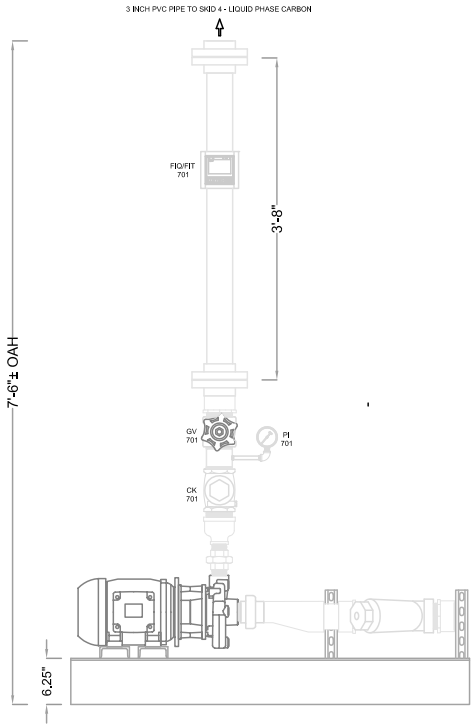
REVISIONS

DRAWN BY: CJJ DATE: 03-25-15
CHK BY: DATE:
APPR BY: DATE:

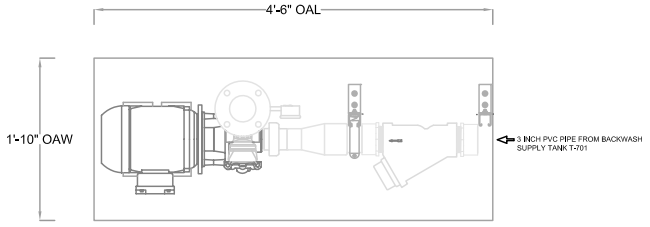
TITLE: T-701 BACKWASH SUPPLY TANK

GES - WWTS
BASF FACILITY - RENSSELAER, NY
JOB NO. 15-183

SCALE: 3/8"
SIZE: D
DRAWING: M-10
SHEET: 1 OF 1
REV: 0



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-23-16	CJJ

REVISIONS

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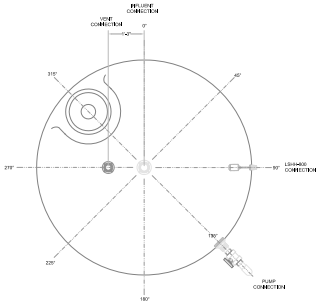
DRWN BY / DATE	CJJ 03-23-16
CHK BY / DATE	
APPR BY / DATE	

TITLE: SKID 5 - BACKWASH FEED PUMP

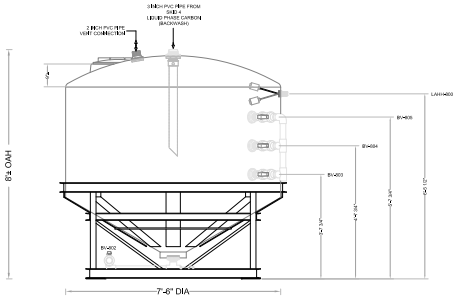
GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

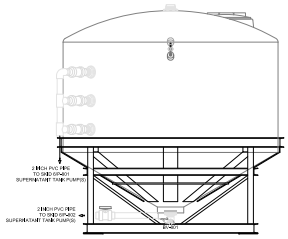
SCALE	SIZE	DWG NO.	SHEET	REV
10	C	M-11	1 OF 1	0



TANK FITTING LAYOUT
PLAN VIEW



TANK FITTING LAYOUT
180° ELEVATION VIEW



TANK FITTING LAYOUT
90° ELEVATION VIEW

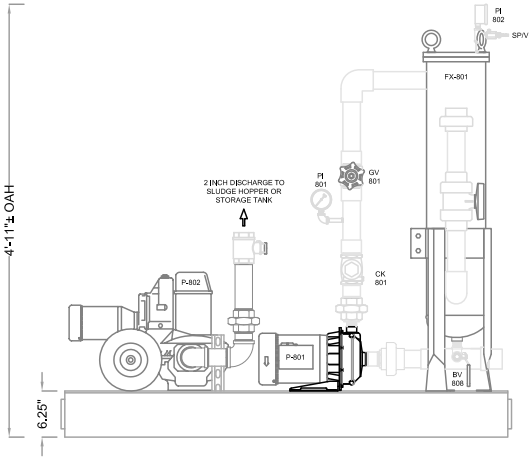
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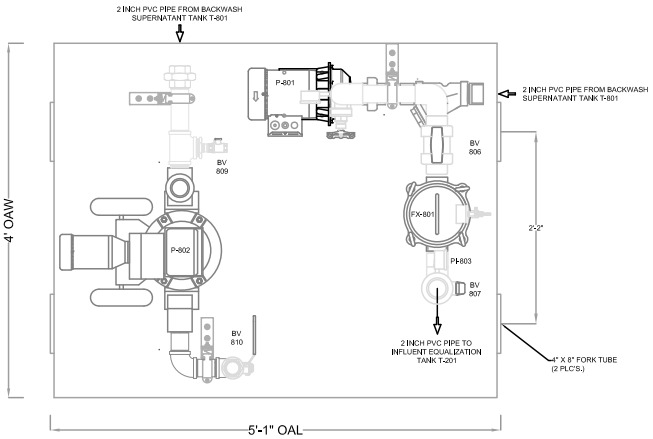
REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-25-19	CJJ
REVISIONS			

DRAWN BY: CJJ DATE: 03-25-19
CHK BY: DATE:
APPR BY: DATE:

TITLE: T-801 BACKWASH SUPERNATANT TANK
GES - DWTS
BASF FACILITY - RENSSELAER, NY
JOB NO. 19-165
SCALE: 3/8
SIZE: D
DRAWING: M-12
SHEET: 1 OF 1
REV: 0



SKID LAYOUT
ELEVATIONAL VIEW



SKID LAYOUT
PLAN VIEW

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-23-16	CJJ

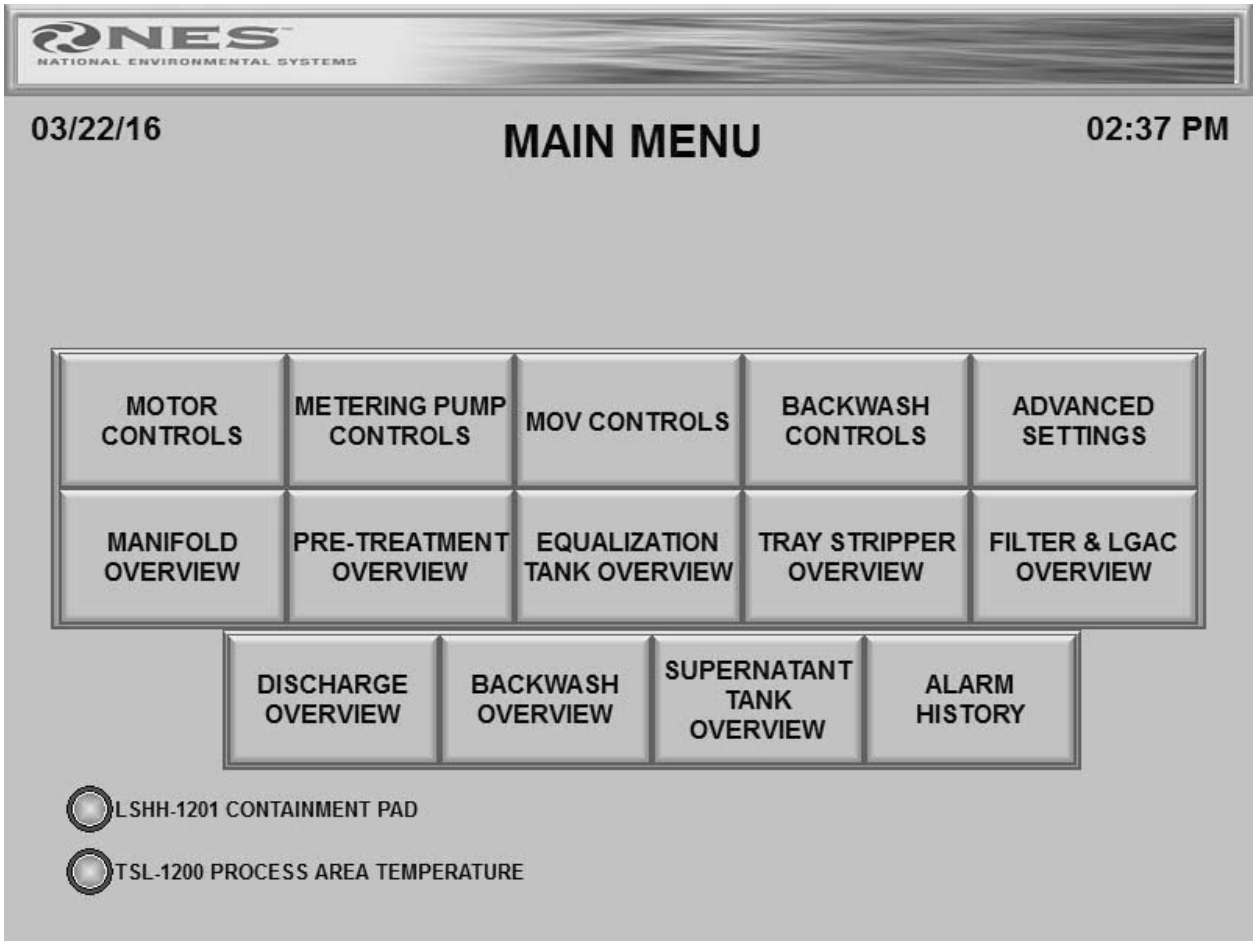
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DRWN BY	DATE	TITLE	
CJJ	03-23-16	SKID 6 - SUPERNATANT TANK PUMP(S)	
CHK BY	DATE	GES - GWTS BASF FACILITY - RENSSELAER, NY	JOB NO. 15-183
APPR BY	DATE	SCALE: 10 / SIZE: C / DWG NO.: M-13 / SHEET: 1 OF 1 / REV: 0	

NES PROJECT: 15-183, MARCH 23, 2016

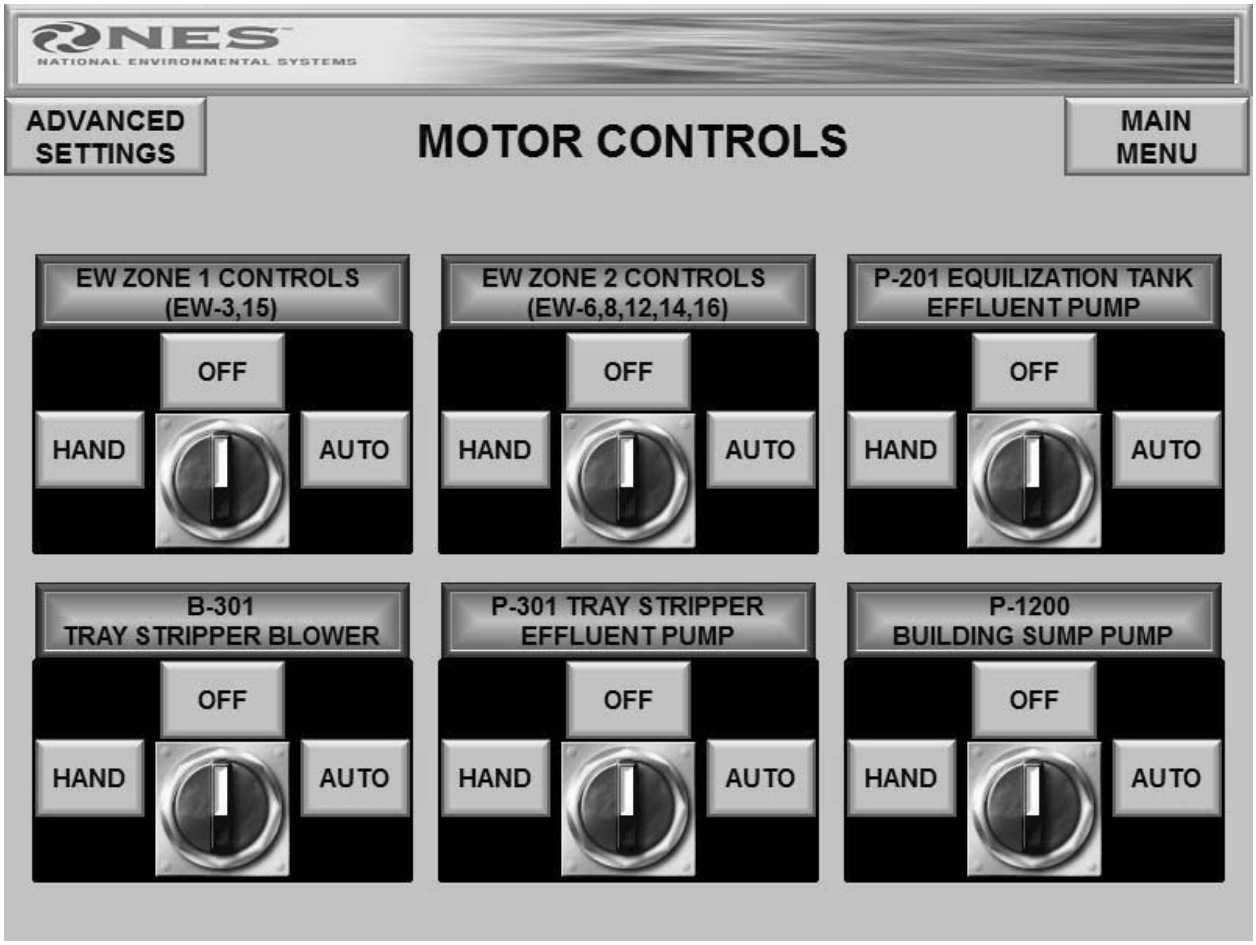
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

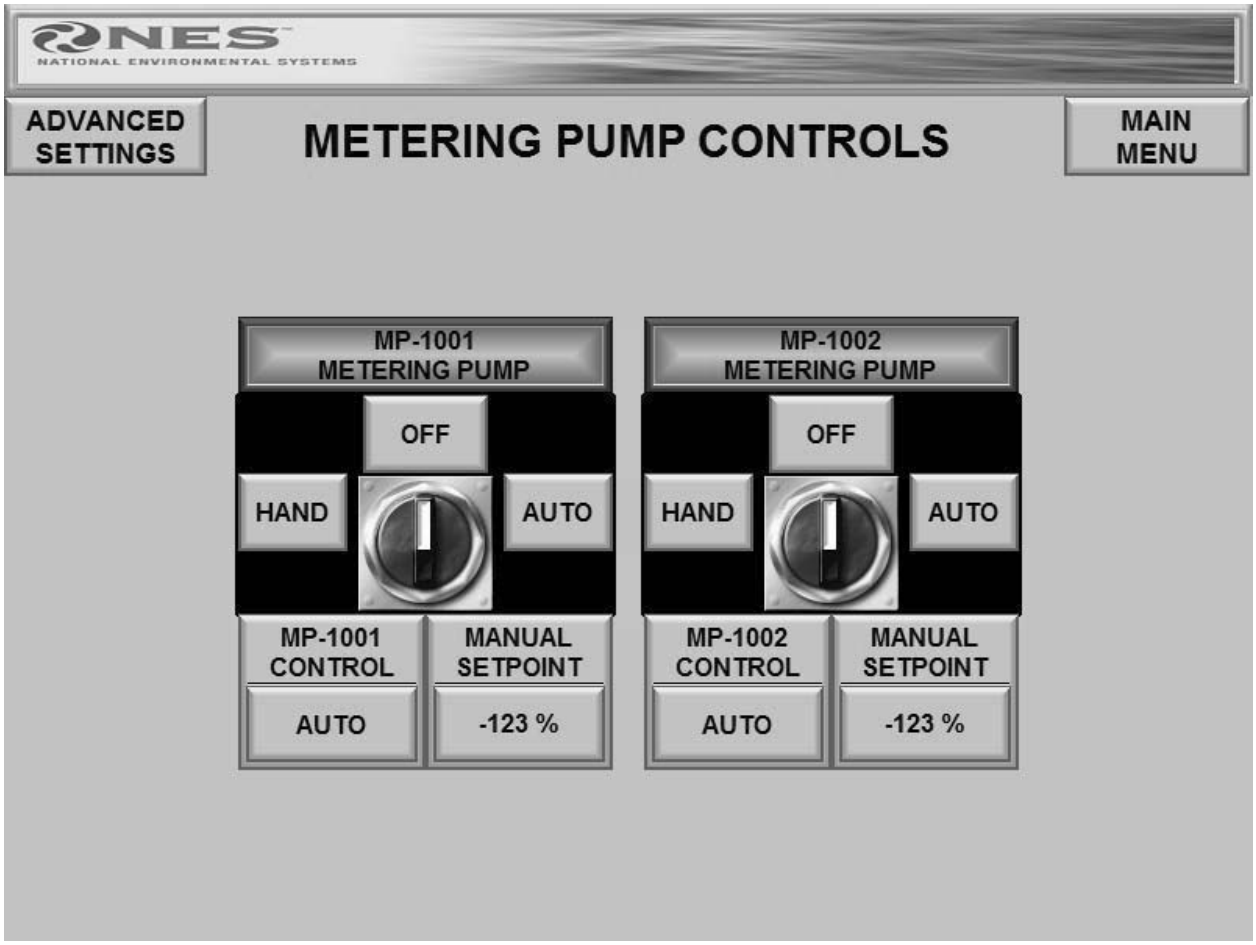
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

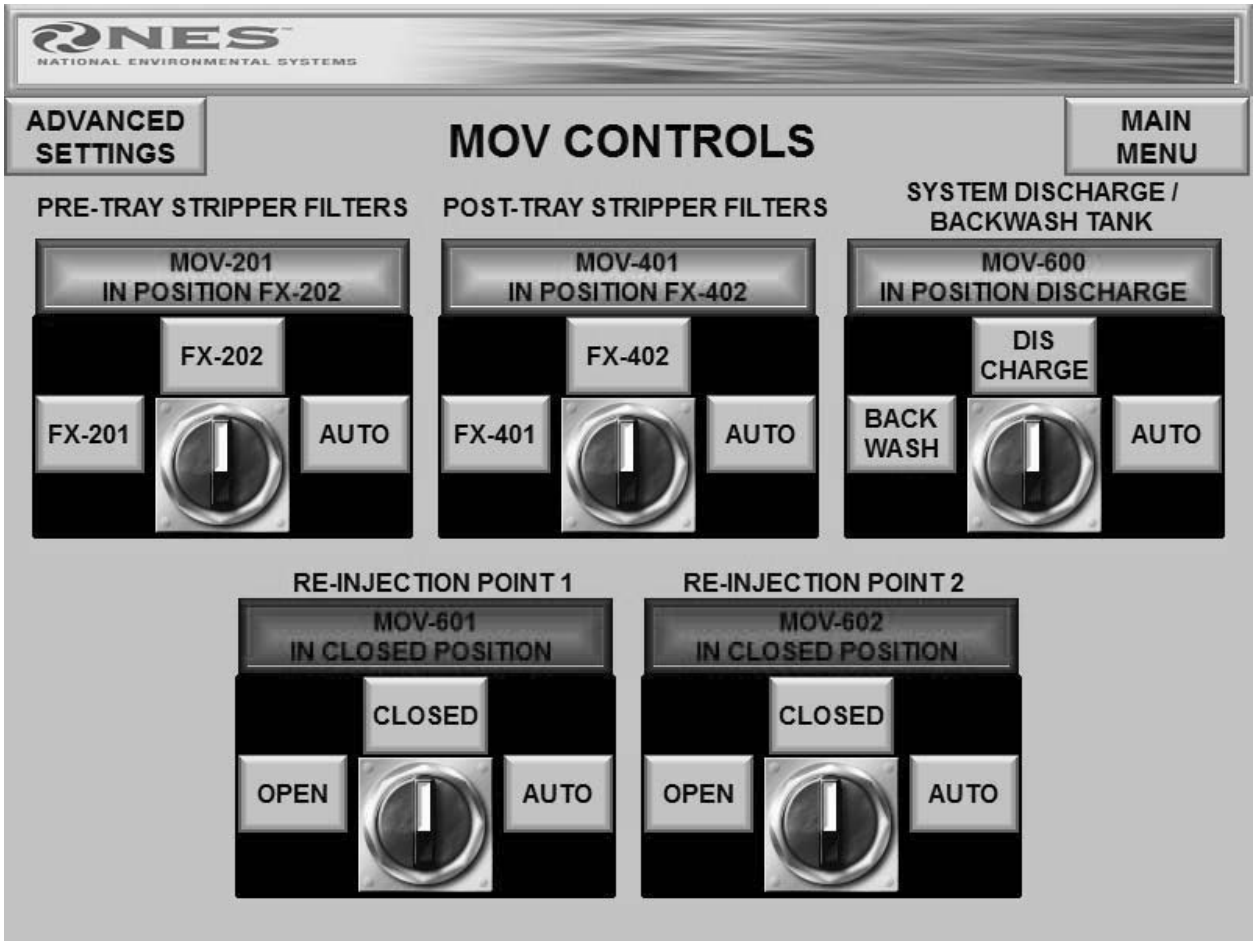
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NES PROJECT: 15-183, MARCH 23, 2016

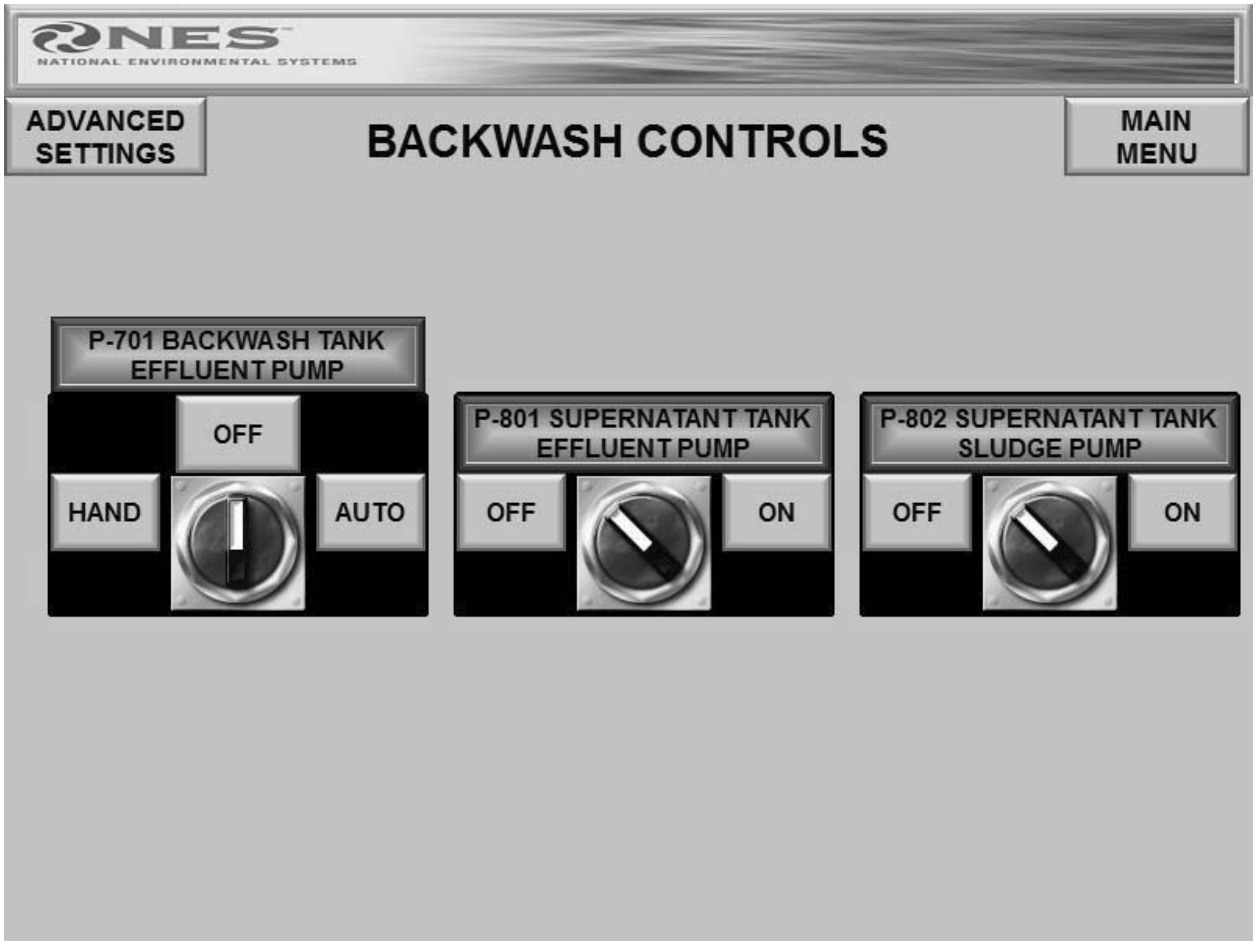
HMI SCREEN SUMMARY – 90% DESIGN



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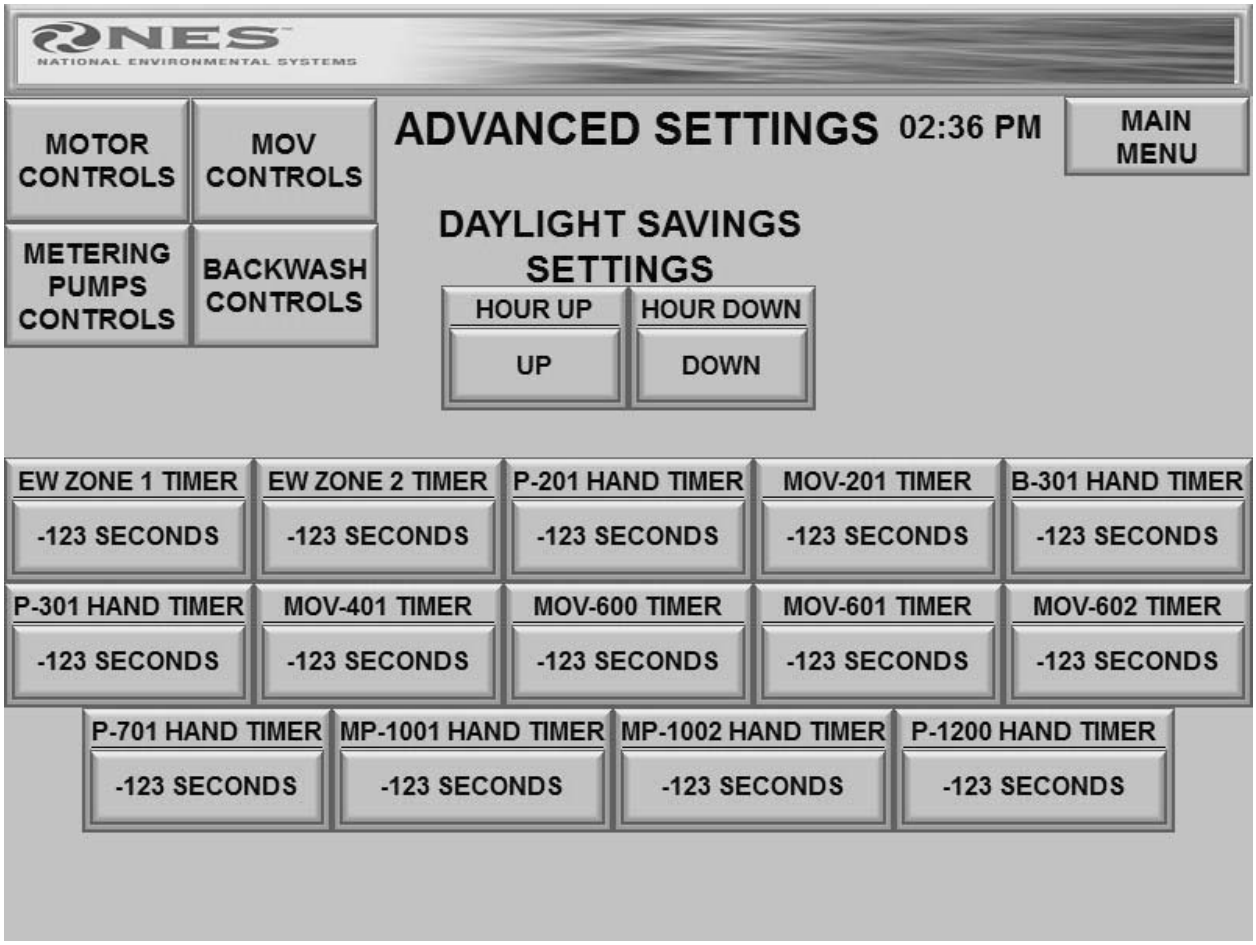
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

HMI SCREEN SUMMARY – 90% DESIGN

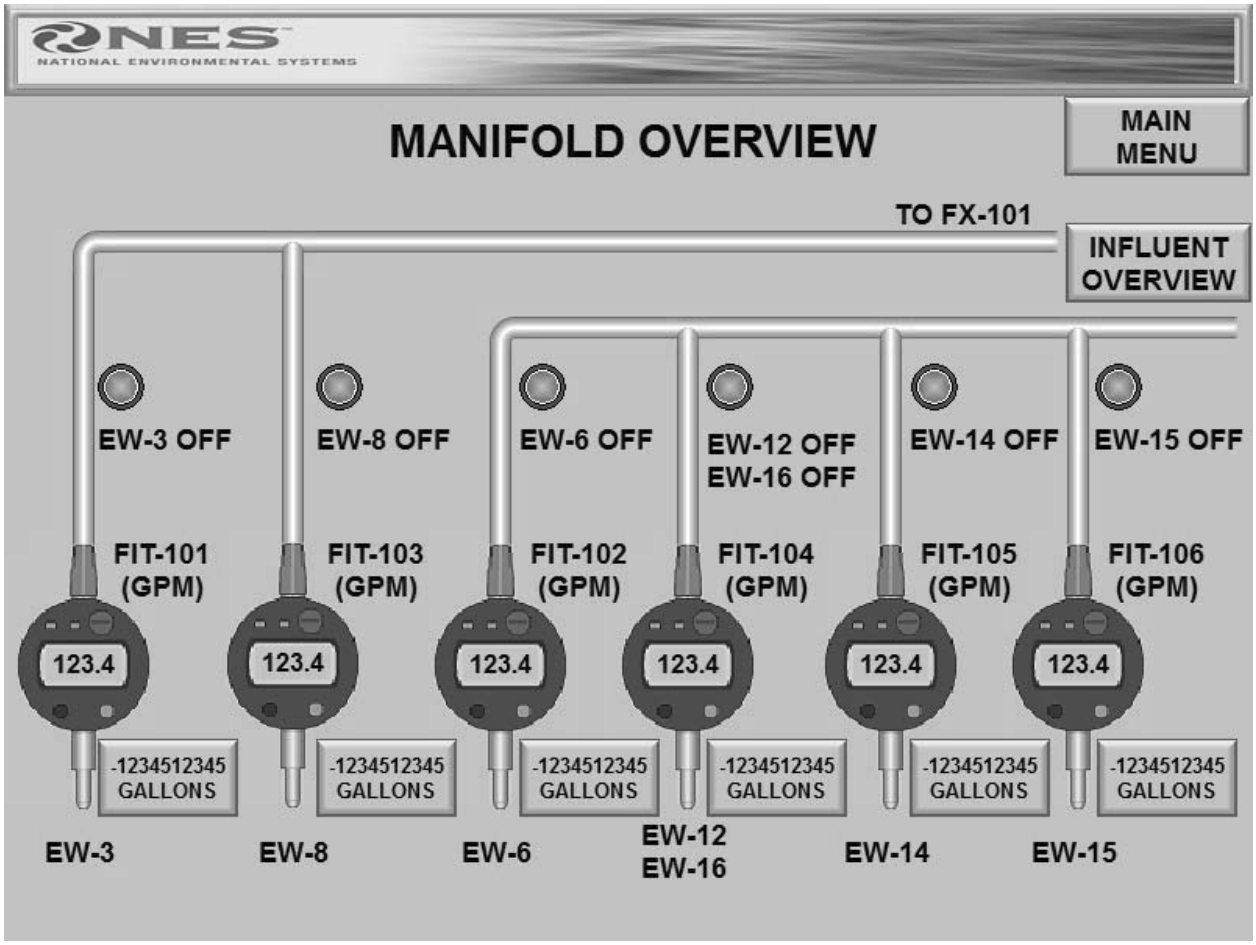


Password Protected Screen

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NES PROJECT: 15-183, MARCH 23, 2016

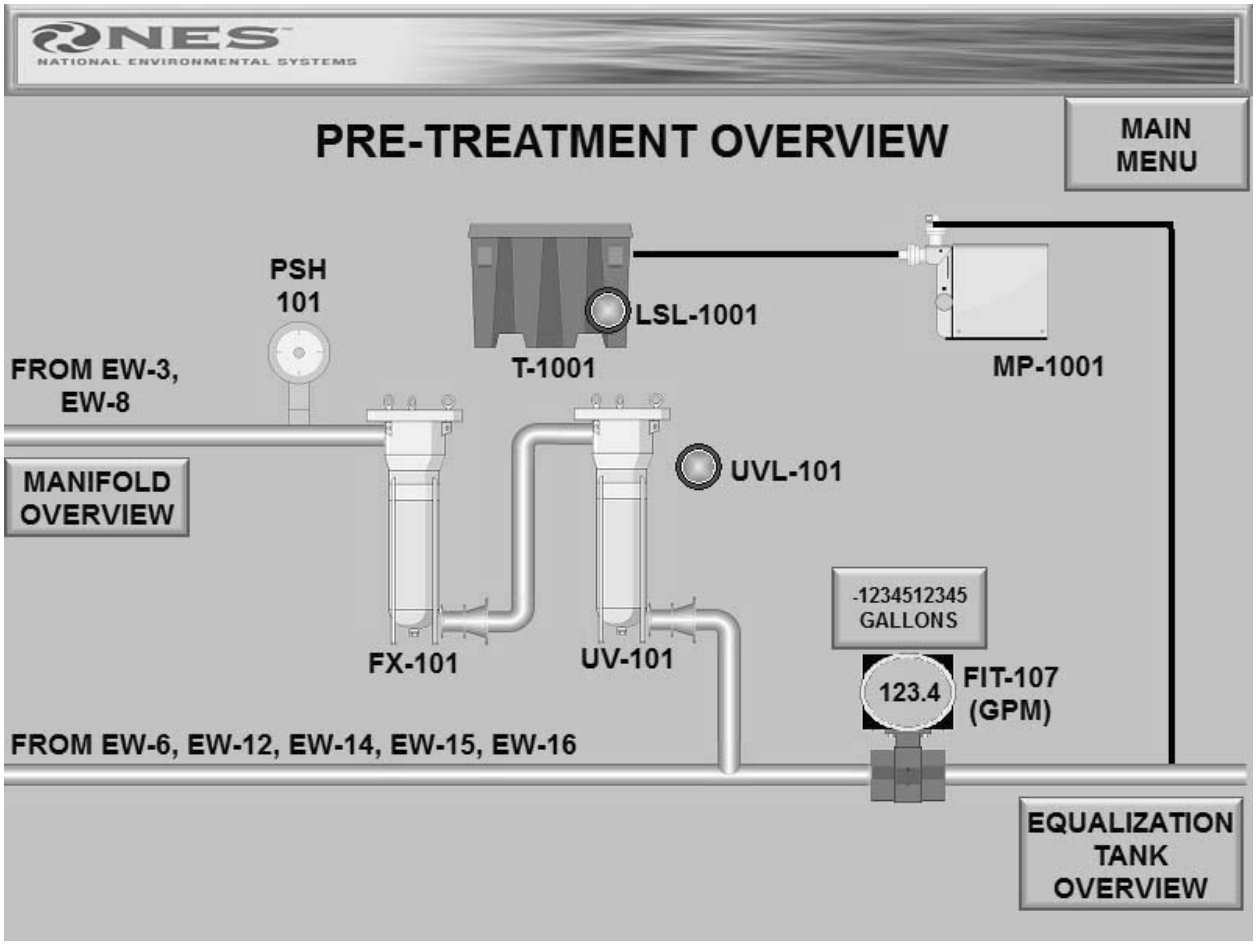
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

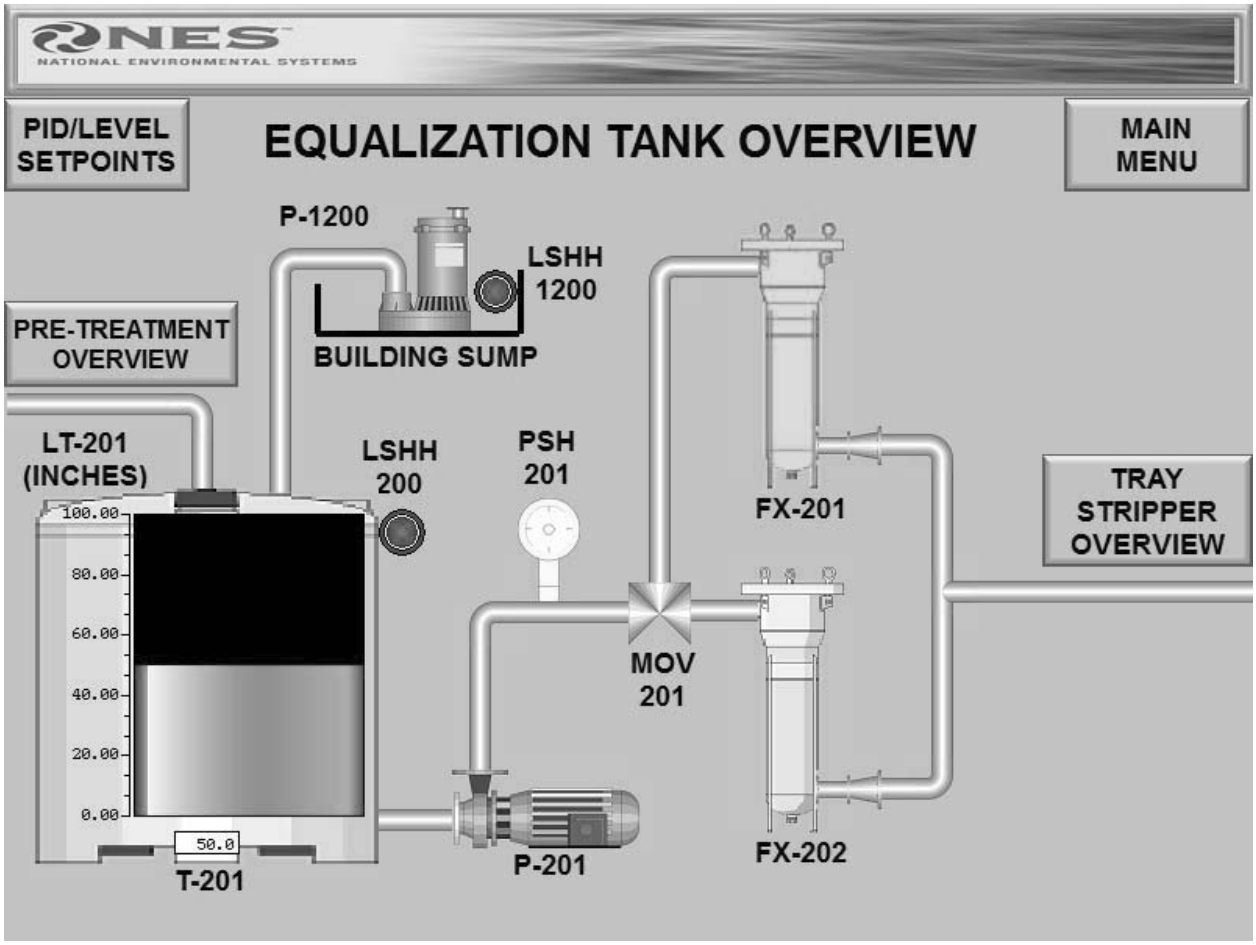
HMI SCREEN SUMMARY – 90% DESIGN



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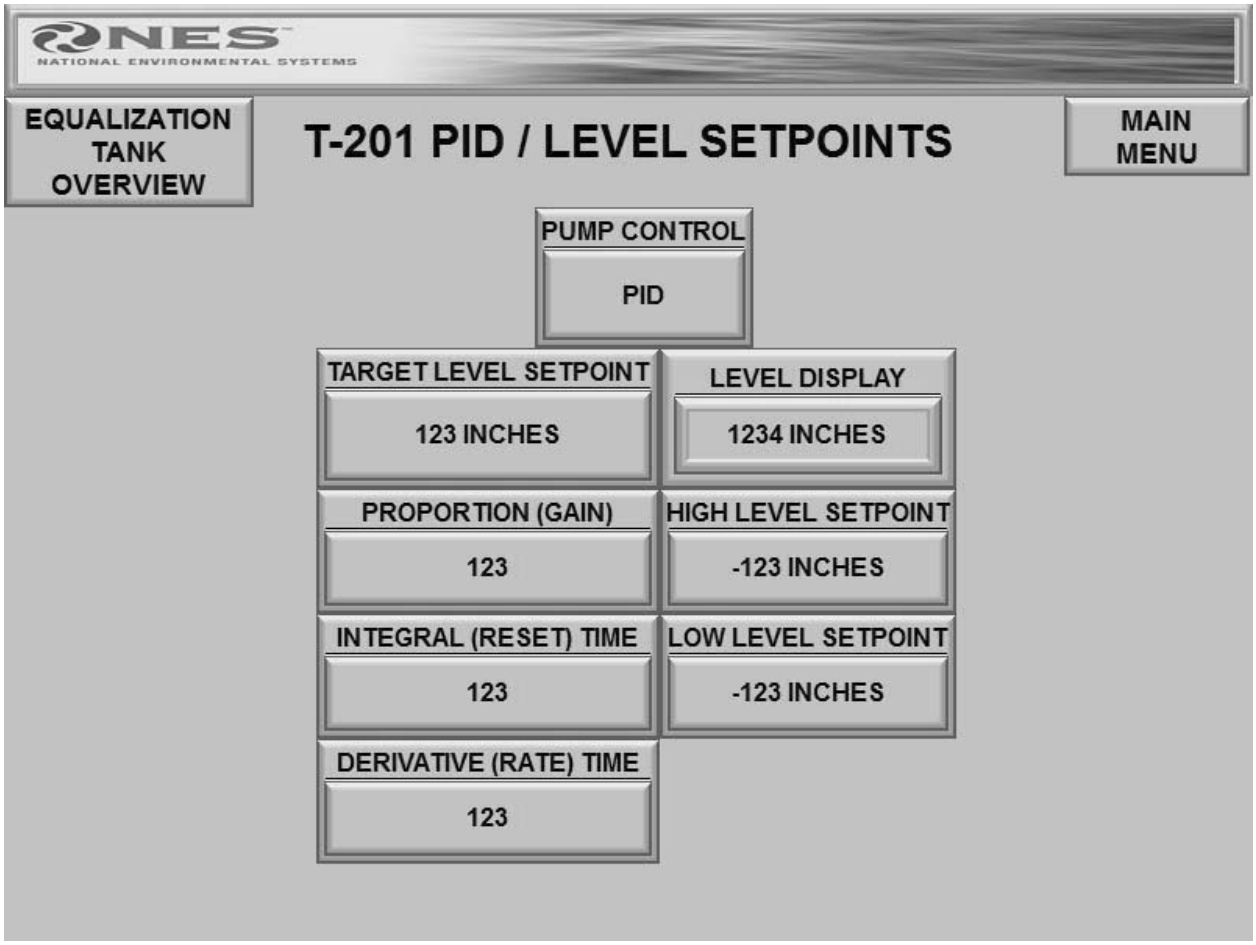
HMI SCREEN SUMMARY – 90% DESIGN



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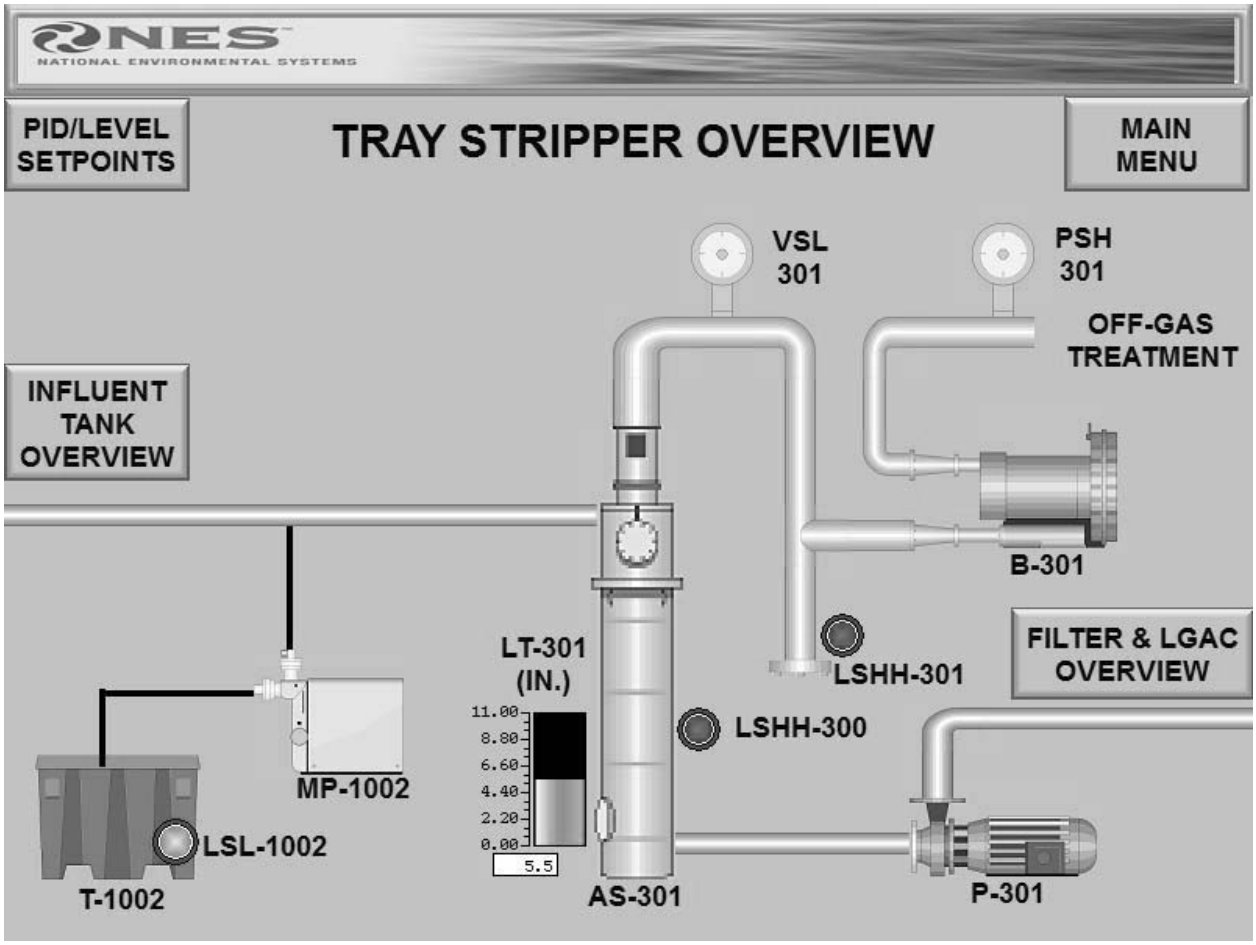
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

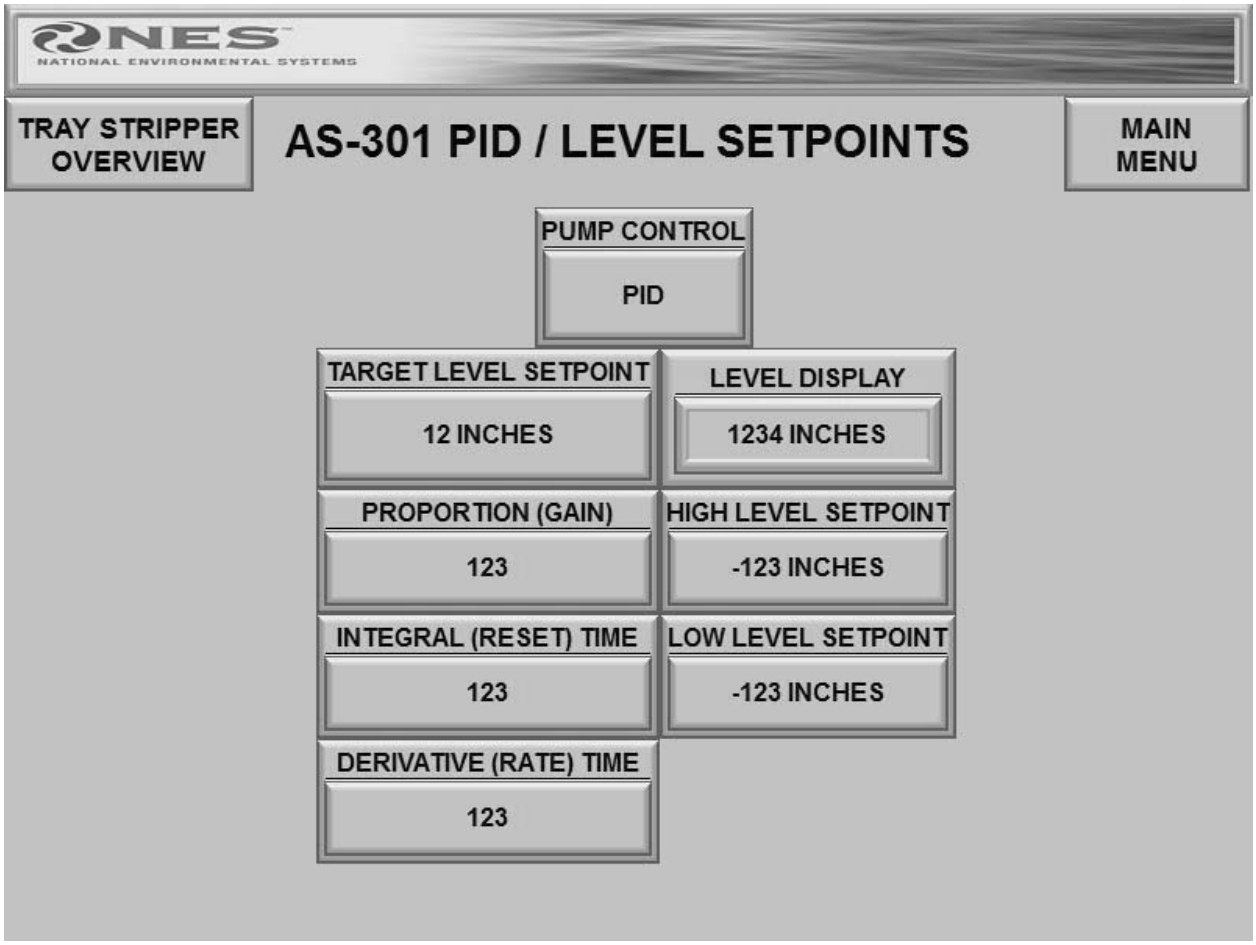
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

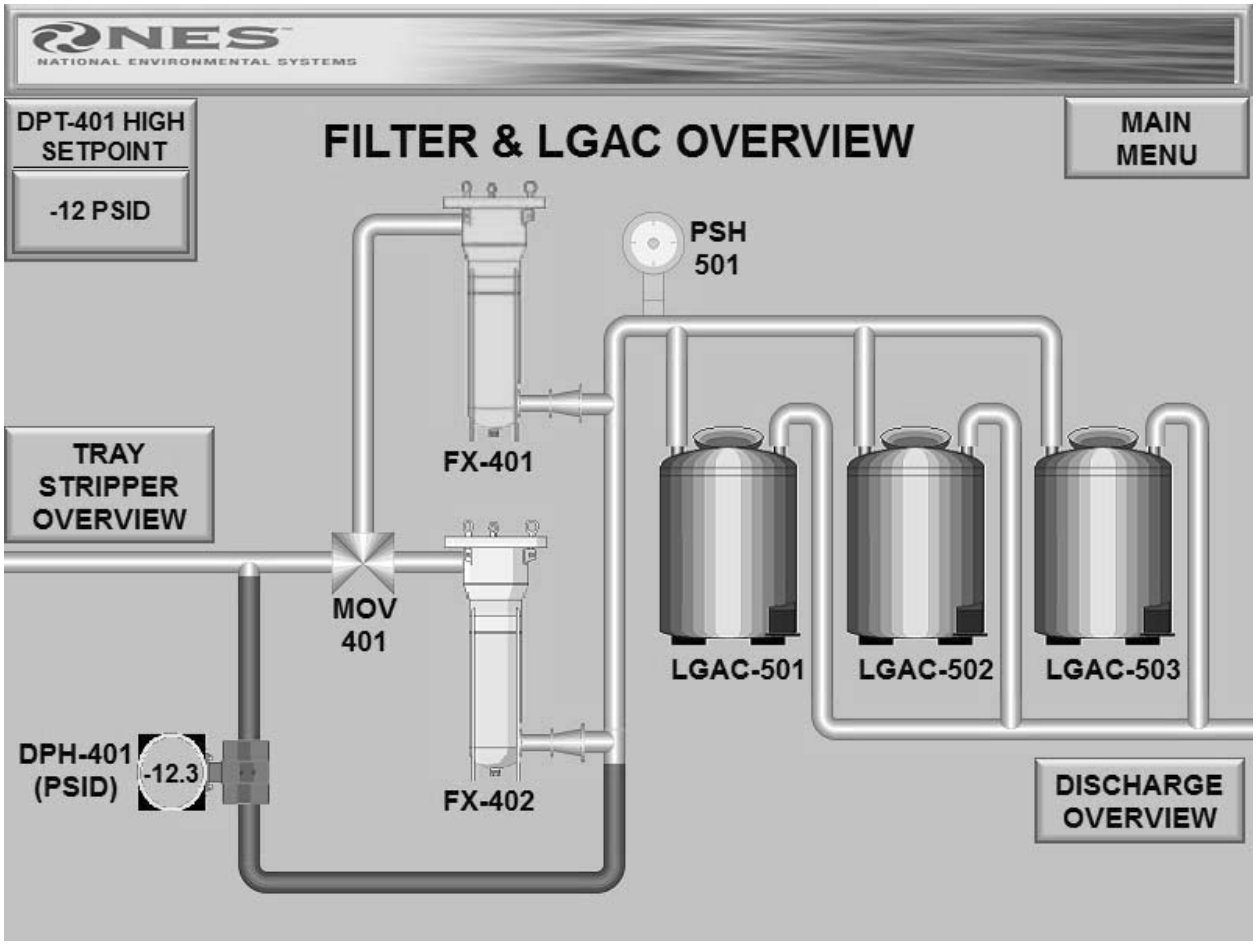
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NES PROJECT: 15-183, MARCH 23, 2016

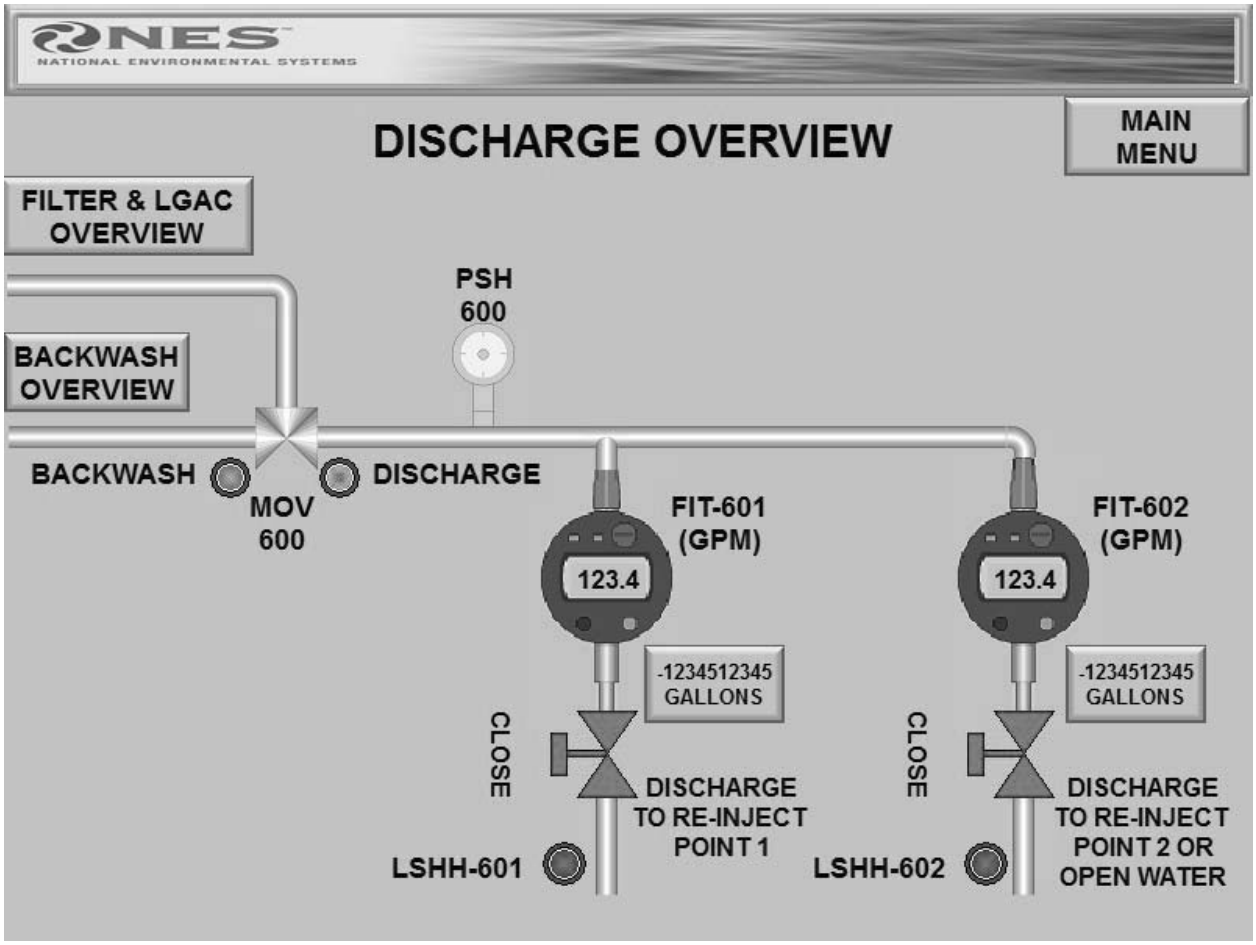
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

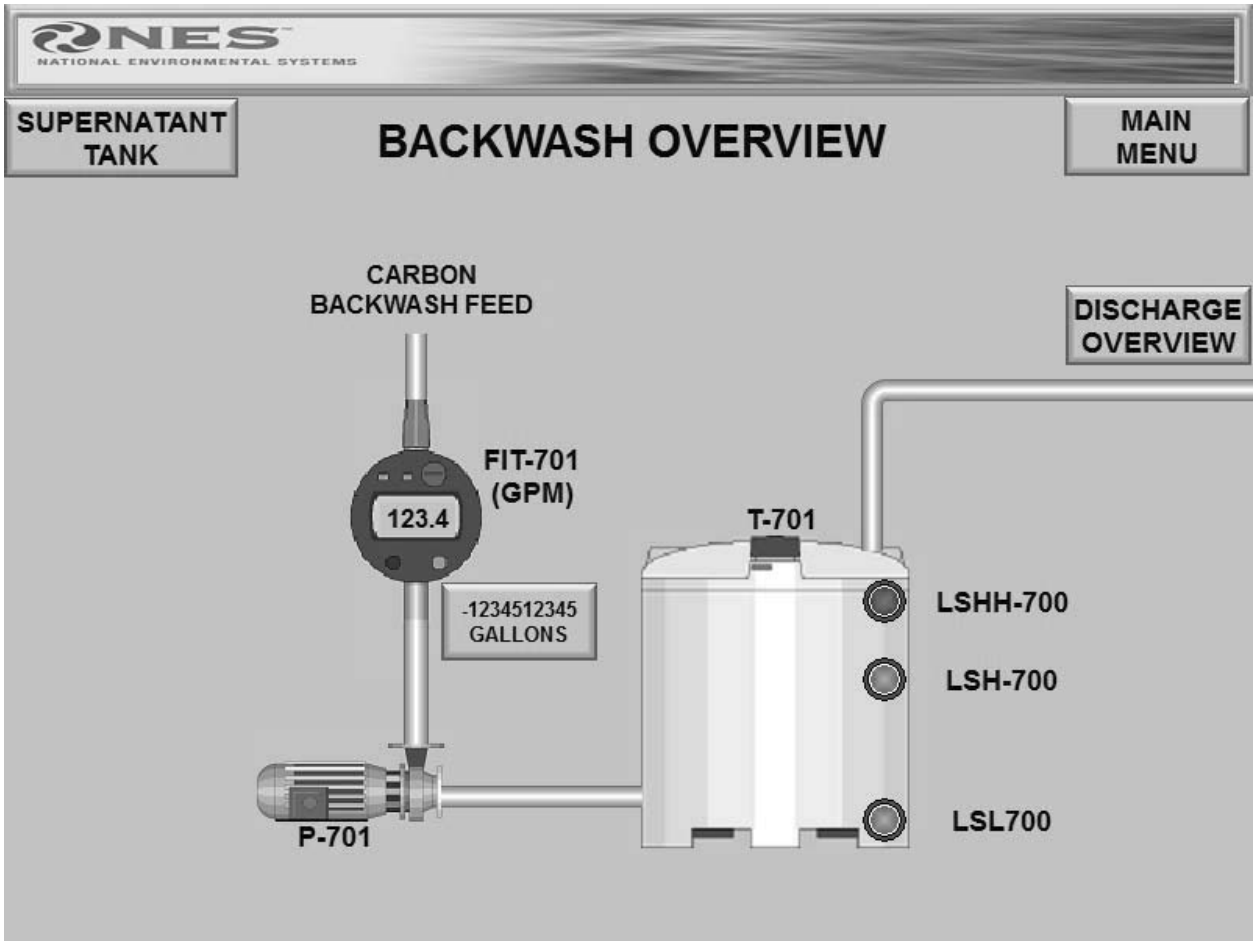
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

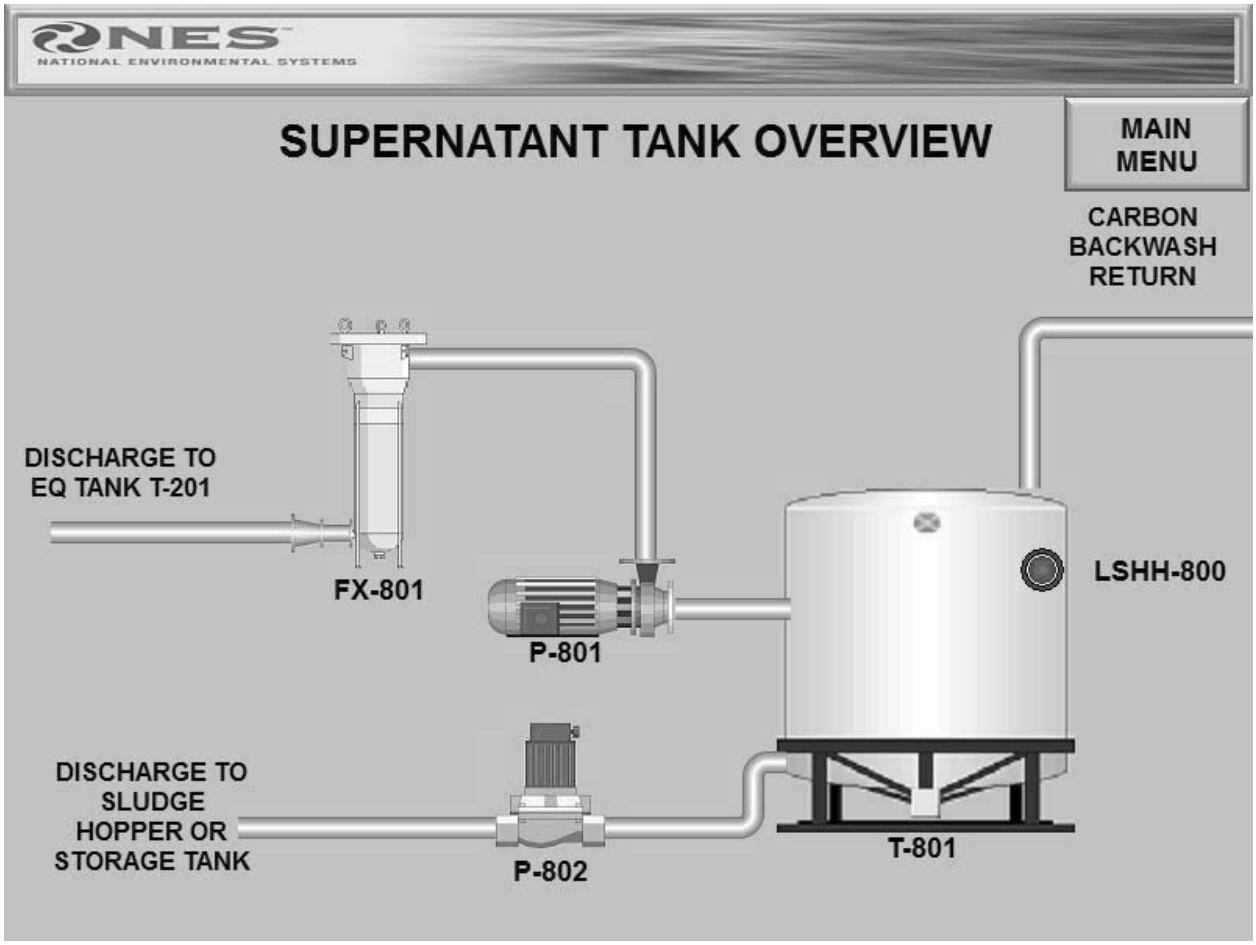
HMI SCREEN SUMMARY – 90% DESIGN



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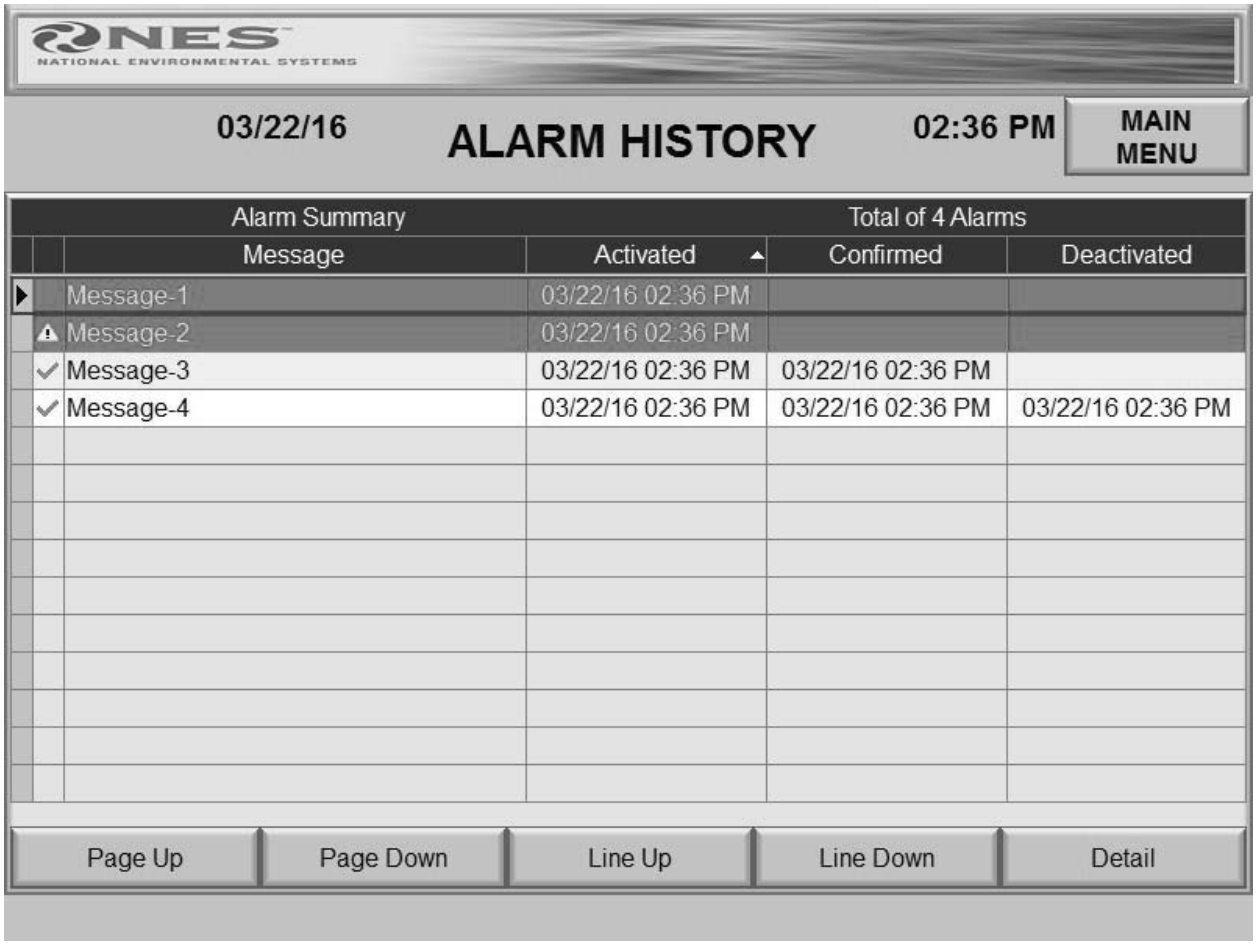
HMI SCREEN SUMMARY – 90% DESIGN



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NES PROJECT: 15-183, MARCH 23, 2016

HMI SCREEN SUMMARY – 90% DESIGN



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ONES

TABLE 2

NES 15-183, REVISION 0 (90% DESIGN SUBMITTAL 03-23-16) BY: EMB CHK: RB
GES - GWTS / BASE FACILITY
RENSSELAER, NY

Interlock	Interlock ID	Interlock Description	Ex-Service Well Pumps Run-Permissive (EW-3, EW-5)	Ex-Service Well Pumps Run-Permissive (EW-6, EW-8, EW-12/16, EW-4)	P-301, Effluent Pump (Influent EQ Tank)	MOV-201, Motor Operated Valve (Inf. EQ Tank)	B-301, Blower (Tray Stripper)	P-301, Effluent Pump (Tray Stripper)	MOV-401, Motor Operated Valve (Post-Tray Stripper Bag Filters)	MOV-402, Motor Operated Valve (Backwash Tank/System Effluent)	MOV-601, Motor Operated Valve (Reinjection Point 1)	MOV-602, Motor Operated Valve (Reinjection Point 2)	P-701, Effluent Pump (Backwash Supply Tank)	P-801, Effluent Pump (Backwash Supernatant Tank)	P-802, Diaphragm Pump (Backwash Supernatant Tank)	MP-1000, Chemical Metering Pump	MP-1020, Chemical Metering Pump	P-1300, Sump Pump (Building)	OPERATOR INTERFACE	Addressable Set Point (HMI-Screen Display)	Warning Notification (HMI Screen Display)	Alarm Notification (HMI Screen Display)	Warning Notification (Local Panel Display)	Alarm Notification (Local Panel Display)	Manual Reset (Warning / Alarm)	Remote Warning Notification	Remote Alarm Notification	Warning/Alarm Log	Data Log (10 minutes)	INSTRUMENT USE	NOT FACTORY TESTED AT HOME
		Emergency Stop	O	O	O		O	O					O	O	O	O	O	O												D	
1		No alarms present	I	I			I				I	O	M	M	M	I		I/O													
2	FIT/FIQ-101	EW-3 Influent Flow Indicating Transmitter/Totalizer																												A/D	
3	FIT/FIQ-102	EW-6 Influent Flow Indicating Transmitter/Totalizer																												A/D	
4	FIT/FIQ-103	EW-8 Influent Flow Indicating Transmitter/Totalizer																												A/D	
5	FIT/FIQ-104	EW-12 & EW-16 Influent Flow Indicating Transmitter/Totalizer																												A/D	
6	FIT/FIQ-105	EW-14 Influent Flow Indicating Transmitter/Totalizer																												A/D	
7	FIT/FIQ-106	EW-15 Influent Flow Indicating Transmitter/Totalizer																												A/D	
8	FIT/FIQ-107	System Influent Flow Indicating Transmitter/Totalizer													P	P														A/D	
9	PSH-101	Extraction Well Filter Housing (FX-101) Pressure Switch High	O	O											O	O						Y				Y		Y	Y	D	
10	UVL-101	Ultraviolet Disinfection Lamp Sensitivity Low																			Y		Y		Y	Y	Y			D	
11	LSHH-200	Influent Equalization Tank (T-201) Level Switch High-High	O	O											O	O	O					Y		Y		Y	Y		Y	D	
12	LT-201	Influent Equalization Tank (T-201) Level Transmitter			P															Y										A	
13	LTL-201	Influent Equalization Tank (T-201) Level Transmitter Low			O											O				Y										L	
14	LTH-201	Influent Equalization Tank (T-201) Level Transmitter High			I											I				Y										L	
15	PSH-201*	Pre-Tray Stripper Filter Housing (FX-201,FX-202) Pressure Switch High	O	O	O	I/O										O	O	O			Y	Y	Y	Y	Y	Y	Y	Y	Y	D	
16	LSHH-300	Tray Stripper (AS-301) Level Switch High-High	O	O	O											O	O	O				Y		Y		Y	Y		Y	D	
17	LSHH-301	Post-Tray Stripper Moisture Separator Level Switch High-High	O	O	O											O	O	O				Y		Y		Y	Y		Y	D	
18	LT-301	Tray Stripper (AS-301) Level Transmitter						P												Y									Y	A	
19	LTL-301	Tray Stripper (AS-301) Level Transmitter Low						O												Y										L	
20	LTH-301	Tray Stripper (AS-301) Level Transmitter High						I												Y										L	
21	VSL-301	Tray Stripper Blower (B-301) Vacuum Switch Low	O	O	O		O									O	O	O				Y		Y	Y			Y	Y	D	
22	PSH-301	Tray Stripper Blower (B-301) Discharge Pressure Switch High	O	O	O		O									O	O	O				Y		Y	Y			Y	Y	D	
23	DPT-401	Post-Tray Stripper Filter Housing (FX-401,FX-402) Differential Pressure Transmitter																											Y	A	
24	DPTH-401*	Post-Tray Stripper Filter Housing (FX-401,FX-402) Differential Pressure Transmitter High	O	O	O			O	I/O							O	O	O		Y	Y	Y	Y	Y	Y	Y	Y	Y		L	
25	PSH-501	Liquid Phase Carbon Vessel (LGAC-501,LGAC-502) Pressure Switch High	O	O	O			O								O	O	O				Y		Y	Y			Y	Y	D	
26	PSH-600	System Effluent Pressure Switch High	O	O	O			O								O	O	O				Y		Y	Y			Y	Y	D	
27	FIT/FIQ-601	Reinjection Point 1 Effluent Flow Indicating Transmitter/Totalizer																												A/D	
28	FIT/FIQ-602	Reinjection Point 2 Effluent Flow Indicating Transmitter/Totalizer																												A/D	
29	LSHH-601	Reinjection Point 1 Level Switch High-High									O	I												Y		Y	Y		Y	D	
30	LSHH-602	Reinjection Point 1 Level Switch High-High									I	O												Y		Y	Y		Y	D	
31	FIT/FIQ-701	Backwash Flow Indicating Transmitter/Totalizer																												A/D	
32	LSL-700	Backwash Supply Tank (T-701) Level Switch Low							I				O																	D	
33	LSH-700	Backwash Supply Tank (T-701) Level Switch High							O				I																	D	
34	LSHH-700	Backwash Supply Tank (T-701) Level Switch High-High	O	O	O			O								O	O	O						Y		Y	Y		Y	D	
35	LSHH-800	Backwash Supernatant Tank (T-801) Level Switch High-High											O											Y		Y	Y		Y	D	
36	LSL-1001	Chemical Tote (T-1001) Low Switch Level																			Y		Y		Y	Y				D	
37	LSL-1002	Chemical Tote (T-1002) Low Switch Level																			Y		Y		Y	Y				D	
38	LSHH-1200	Building Sump Level Switch High-High	O	O	O		O	O					O	O	O	O	O	O					Y		Y	Y		Y	Y	D	
39	LSHH-1201	Containment Pad Sump Level Switch High-High																			Y		Y		Y	Y				D	
40	TSL-1200	Process Area Temperature Switch Low																			Y		Y		Y	Y				D	
41	SPD-VFD-201	Effluent Pump (P-201) Speed (Influent EQ Tank)																											Y	A	
42	FLT-VFD-201	Effluent Pump (P-201) VFD Fault (Influent EQ Tank)	O	O	O											O	O	O					Y		Y	Y			Y	D	
43	O/L B-301	Tray Stripper Blower (B-301) Overload	O	O	O		O									O	O	O					Y		Y	Y			Y	D	
44	SPD-VFD-301	Effluent Pump (P-301) Speed (Tray Stripper)																											Y	A	
45	FLT-VFD-301	Effluent Pump (P-301) VFD Fault (Tray Stripper)	O	O	O			O								O	O	O					Y		Y	Y			Y	D	
46	O/L P-701	Effluent Pump (P-701) Overload (Backwash Supply Tank)											O										Y		Y	Y			Y	D	
47	O/L P-801	Effluent Pump (P-801) Overload (Backwash Supernatant Tank)												O									Y		Y	Y			Y	D	
48	O/L P-802	Diaphragm Pump (P-802) Overload (Backwash Supernatant Tank)													O								Y		Y	Y			Y	D	
49	FLT-PWR	Main Power Failure	O	O	O		O	O					O	O	O	O	O	O					Y		Y				Y	D	

Note:

HMI - Human Machine Interface

O - Off
I - On
I/O - On / Off Control
M - Manual Operation
P- Proportional Control

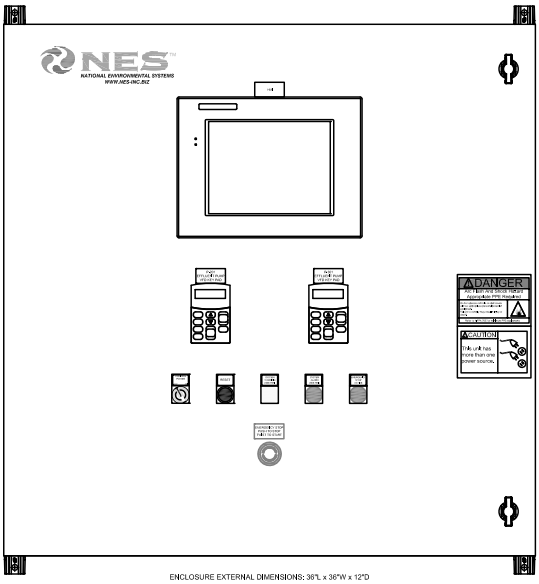
Y - Yes

A - Analog
D - Digital
L - Internal Logic

***** Upon reaching the High Pressure Setpoint the online filter housing is switched to the standby filter housing and a "warning" message is initiated. The standby filter housing will now remain in the online position. After the fouled filters are changed and the Manual "RESET" button has been pushed the recently changed filter housing will now be in standby mode and the process will be repeated after the High Pressure Setpoint is reached. If the Manual "Reset" button is not pushed the online filter housing will remain in that position and after the High Pressure Setpoint is reached the GWTS is shutdown and an "alarm" message is initiated.

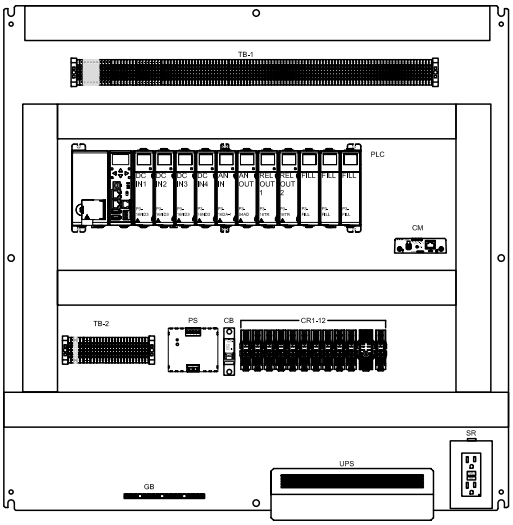
RapidTech LLC d/b/a National Environmental Systems
84 Dunham Street - Attleboro, MA 02703
Phone: (508)226-1100; Fax: (508)226-1180; Email: Info@nes-inc.biz

PANEL EXTERIOR



ENCLOSURE EXTERNAL DIMENSIONS: 36"L x 36"W x 12"D

PANEL INTERIOR



LEGEND	
ABBREV.	DESCRIPTION
CB	- CIRCUIT BREAKER
CM	- CELLULAR MODEM
CR	- CONTROL RELAY
GB	- GROUND BAR
HMI	- HUMAN MACHINE INTERFACE
PLC	- PROGRAMMABLE LOGIC CONTROLLER
PS	- POWER SUPPLY
SR	- SERVICE RECEPTACLE
TB	- TERMINAL BLOCK
UPS	- UNINTERRUPTIBLE POWER SUPPLY

NOTES
1) REFER TO TABLE 3 FOR BILL OF MATERIALS.
2) H/O/A CONTROL VIA HMI SCREEN
3) ALL ALARM LIGHTS AND EMERGENCY STOP SWITCH LOCATED ON PANEL EXTERIOR.
4) MASTER CONTROL PANEL IS UL 508A LISTED.
5) GROUND IN ACCORDANCE WITH N.E.C. ARTICLE 250.122 & LOCAL AUTHORITY HAVING JURISDICTION.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-23-16	EMB

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DRWN BY	EMB	DATE 03-23-16
CHK BY		DATE
APPR BY		DATE

NES
NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-225-1100 (Phone) / 508-225-1180 (Fax)
WWW.NES-INC.BIZ

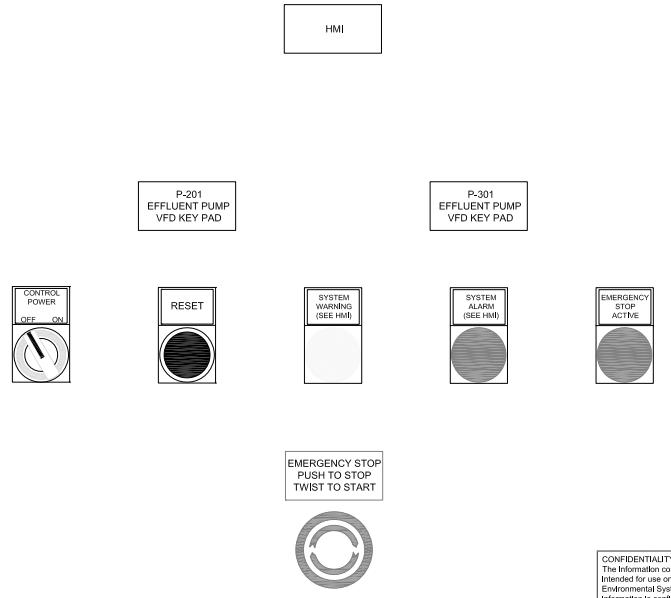
TITLE: MASTER CONTROL PANEL
INTERIOR / EXTERIOR LAYOUT DRAWING

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	C	I-1A	1 OF 2	0

OPERATOR DETAILS



REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-23-16	EMB

REVISIONS

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DRWN BY	EMB	DATE 03-23-16
CHK BY		DATE
APPR BY		DATE

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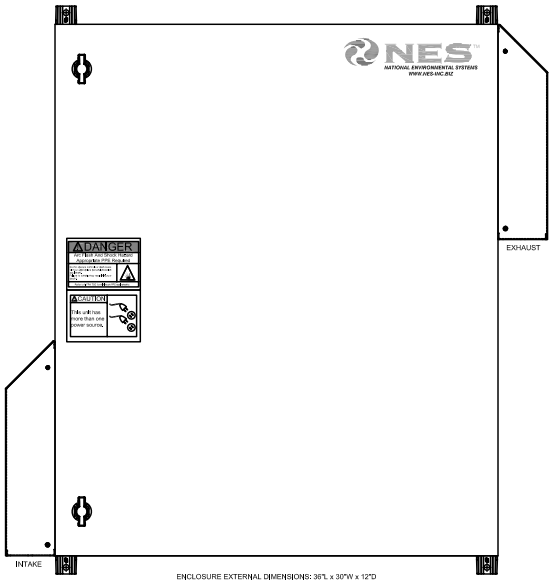
TITLE: MASTER CONTROL PANEL
INTERIOR / EXTERIOR LAYOUT DRAWING

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

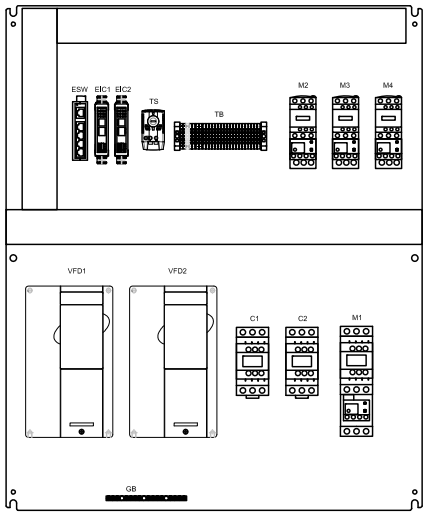
SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-1A	2 OF 2	0

PANEL EXTERIOR



ENCLOSURE EXTERNAL DIMENSIONS: 36"L x 30"W x 12"D

PANEL INTERIOR



LEGEND	
ABBREV.	DESCRIPTION
C	- CONTACTOR
GB	- GROUND BAR
EIC	- ETHERNET INTERFACE CARD
ESW	- ETHERNET SWITCH
M	- MOTOR STARTER
TB	- TERMINAL BLOCK
TS	- TEMPERATURE SWITCH
VFD	- VARIABLE FREQUENCY DRIVE

NOTES
1) REFER TO TABLE 3 FOR BILL OF MATERIALS.
2) VFD KEYPADS MOUNTED ON THE MASTER CONTROL PANEL.
3) MOTOR CONTROL PANEL IS UL 508A LISTED.
4) GROUND IN ACCORDANCE WITH N.E.C. ARTICLE 250.122 & LOCAL AUTHORITY HAVING JURISDICTION.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
0	90% DESIGN SUBMITTAL	03-23-16	EMB

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WWW.NES-HVC.BIZ

DRWN BY	EMB	DATE	03-23-16
CHK BY	RXB	DATE	01-26-16
APPR BY		DATE	

TITLE: MOTOR CONTROL PANEL
INTERIOR / EXTERIOR LAYOUT DRAWING

GES - GWTS
BASF FACILITY - RENSSELAER, NY

JOB NO. 15-183

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	C	I-1B	1 OF 1	0

TABLE 3
PANEL BILL OF MATERIALS

REVISION 0 (90%) MARCH 23, 2016

15-183 GES - BASF FACILITY - RENSSELAER, NY

TAG	QUANTITY	ITEM	MODEL	MANUFACTURER
		SECTION 7 - MASTER CONTROL PANEL COMPONENTS		
ENCL	1	ENCLOSURE NEMA 4 36 X 36 X 12 - MILD STEEL/GRAY	EN4SD363612GY	HAMMOND
ENCL	1	BACK-PANEL 36 X 36 MILD STEEL/WHT	EP3636	HAMMOND
ENCL	1	MOUNTING FEET SET OF 4 - ZINC PLATED	EZPMFHD	HAMMOND
ENCL	2	PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	SCE-PLWKB	SCE
UPS	1	UPS 350VA 200W 120V 1PH 3 UPS & SURGE OUTLET 3 SURGE ONLY	BE350G	APC
CM	1	3G WIRELESS GATEWAY EVDO 800/1900 MHZ - VERIZON	LS300 - 1101489	SIERRA WIRELESS
CM	1	LS300 BRACKET-DIN MOUNT	6000558	SIERRA WIRELESS
CM	1	STATIC IP 12 IN MAGNET MOUNT ANTENNA 10FT RG174 CABLE SMA-MALE	301125	WILSON ELECTRONICS
CM	1	RF COAXIAL SURGE PROTECTOR 698 MHZ 2.7 GHZ	TSX-NFF	POLYPHASER
CM	1	FOR POLYPHASER 1 FT LMR-195 COAXIAL CABLE ASSEMBLY	GW195-12-SM-NM	GET WIRELESS
CM	1	FOR POLYPHASER N MALE TO SMA FEMALE ADAPTER	RSA-3478	RF INDUSTRIES
PLC	1	11-SLOT I/O BASE FOR P3000 PAC REQ P3-01AC OR P3-01DC	P3-01B	ADI
PLC	1	POWER SUPPLY 100-240VAC FOR P3000 PAC	P3-01AC	ADI
PLC	1	CPU 266 MHz PROCESSOR 50MB MEMORY FOR P3000 PAC	P3-550	ADI
PLC	4	16PT 12-24VDC INPUT SINK/SOURCE FOR P3000 PAC	P3-16ND3	ADI
PLC	1	16CH ANALOG CURRENT INPUT 16-BIT MODULE FOR P3000 PAC	P3-16AD-1	ADI
PLC	1	ANALOG 4-CH OUT VOLTAGE/CURRENT 16-BIT FOR P3000	P3-04DA	ADI
PLC	2	16PT RELAY OUTPUT SPST 6-27VDC / 6-240VAC FOR P3000 PAC	P3-16TR	ADI
PLC	3	FILLER MODULE FOR P3000 PAC	P3-FILL	ADI
PLC	8	TERMINAL BLOCK FOR ALL 8 & 16 POINT I/O MODULES FOR P3000 PAC	P3-RTB	ADI
HMI	1	CABLE C-MORE PANEL TO ADI PLC RJ12 PORT 10 FT RS232C	EA-2CBL	ADI
HMI	1	C-MORE TOUCH PANEL 8 IN COLOR TFT ETHERNET & USB	EA9-T8CL	ADI
HMI	1	C-MORE AC DC POWER ADAPTER FOR EA7 & EA9	EA-AC	ADI
HMI	1	VER97303 HMI MEMORY CARD 8 GB NON-VOLATILE DATA STORAGE	19NY57	VERBATIM
PS	1	POWER SUPPLY 24 VDC 5A 120W DIN RAIL SLIM LINE	PSP24-120S	ADI
CR1-10,12	11	RELAY 120V 1PDT W/LIGHT BLADE PARALLEL	RH1B-UL-AC120V	IDEC
CR1-10,12	11	SOCKET DIN RAIL/SURFACE 5-BLADE FOR RH1B	SH1B-05	IDEC
CR11	1	RELAY 2PDT 10AMP 120VAC W/INDICATOR LIGHT	RH2B-UL-AC120V	IDEC
CR11	1	SOCKET DIN RAIL/SURFACE 8-BLADE FOR RH2B	SH2B-05	IDEC
SR	1	DUPLEX GFCI RECEPTACLE 125 VAC 15 AMP 2-POLE NEMA 5-15R WHITE	1595-TRWRW	LEGRAND
SR	1	1-GANG WEATHERPROOF RECEPT. BOX	IHD3- 1	RED DOT
CB	1	CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	MG24430_	SQUARE D
ESTOP	1	MUSHROOM SWITCH RED TRIGGER ACTION - TURN TO RELEASE	ZB5AS844_	SQUARE D
LT	2	PILOT LIGHT HEAD - RED	ZB5AV043_	SQUARE D
LT	1	PILOT LIGHT HEAD - YELLOW	ZB5AV053_	SQUARE D
PB	2	CONTACT BLOCK 1-N.O. SCREW CLAMP	ZBE101_	SQUARE D
PB	1	CONTACT BLOCK 1-N.C. SCREW CLAMP	ZBE102_	SQUARE D
PB	1	PUSH BUTTON OPERATOR NON-ILLUM BLACK	ZB5AA2_	SQUARE D
PB	2	MOUNTING COLLAR LATCH	ZB5AZ009_	SQUARE D
SW	1	MOUNTING BASE120V GREEN PROTECTED LED	ZB5AVG3_	SQUARE D
SW	2	MOUNTING BASE120V RED PROTECTED LED	ZB5AVG4_	SQUARE D

TABLE 3
PANEL BILL OF MATERIALS

15-183 GES - BASF FACILITY - RENSSELAER, NY

TAG	QUANTITY	ITEM	MODEL	MANUFACTURER
SW	1	MOUNTING BASE120V YELLOW PROTECTED LED	ZB5AVG5_	SQUARE D
SW	1	2 POS SELECTOR SWITCH ILLUM. GREEN MAINTAINED	ZB5AK1233_	SQUARE D
TB	145	TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	NSYTRV22	SQUARE D
TB	8	TERMINAL BLOCK END BARRIERS GRAY	NSYTRAC22	SQUARE D
TB	4	TERMINAL BLOCK END ANCHORS	NSYTRAABV35	SQUARE D
TB	6	TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	NSYTRV22PE	SQUARE D
GB	1	LOAD CENTER GROUND BAR 15 TERMINALS	PK15GTA	SQUARE D
		SECTION 8 - MOTOR CONTROL PANEL COMPONENTS		
ENCL	1	ENCLOSURE NEMA 4 36 X 30 X 12 - MILD STEEL/GRAY	EN4SD363012GY	HAMMOND
ENCL	1	BACK-PANEL 36 X 30 MILD STEEL/WHT	EP3630	HAMMOND
ENCL	1	MOUNTING FEET SET OF 4 - ZINC PLATED	EZPMFHD	HAMMOND
ENCL	2	PANEL WING-KNOB PAD-LOCKING HANDLE BLACK - 2 REQUIRED	SCE-PLWKB	SCE
VF	1	VENT FAN 210CFM 115VAC 6 IN	FAN150AC115	HAMMOND
VF	1	VENT FAN ADJ. 30-140F BI-METAL TEMP SWITCH N.O.	SKT011419NO	HAMMOND
VF	1	VENT FAN FINGER GUARD 6 IN	FAN150FG	HAMMOND
VF	2	VENT FAN 6 IN RAIN HOOD GRILL & SOLID COVER KIT	RHA40000G	HAMMOND
VF	2	VENT FAN 6 IN RAIN HOOD NEMA 3R	RHA40000GY	HAMMOND
VF	1	VENT FAN POWER CORD 24 IN	DNMFC	HAMMOND
VF	1	VENT FAN 6 IN FILTER FOR LOUVER KIT	AFLT66	HOFFMAN
C1, C2	2	CONTACTOR 3PST-NO 120VAC 50A DIN RAIL (EXISTING EXTRACTION WELLS)	LC1D50AG7	SQUARE D
M1	3	CONTACTOR 3PST-NO 120VAC 50A DIN RAIL	LC1D50AG7	SQUARE D
M1	1	3PH O/L RELAY 25-40 AMPS	LRD340L	SQUARE D
M2,M3,M4	3	CONTACTOR 3PST-NO 120VAC 20A DIN RAIL	LC1D09G7	SQUARE D
M2	1	3PH O/L RELAY 5.5-8 AMPS	LRD12	SQUARE D
M3	1	3PH O/L RELAY 2.5-4 AMPS	LRD08	SQUARE D
M4	1	3PH O/L RELAY 1.6-2.5 AMPS	LRD07	SQUARE D
ESW	1	ETHERNET SWITCH UNMANAGED 10/100 BASET RJ45 PORTS	SE-SW5U	ADI
VFD 1,2	2	DURAPULSE VFD 5 HP 9.6 AMP 460V 3-PHASE	GS3-45P0	ADI
VFD 1,2	2	GS3 VFD FLUSH MOUNT BEZEL FOR KEYPAD (MOUNT IN MCP)	GS3-BZL	ADI
VFD 1,2	2	DURAPULSE REMOTE VFD KEYPAD CABLE 16 FT	GS-CBL2-5L	ADI
VFD 1,2	2	CABLE GS DRIVE/EDRV 6.6FT RJ12-RJ12 6-WIRE RS485	GS-EDRV-CBL-2	ADI
EIC 1,2	2	ETHERNET MODULE 100Mbps FOR GS SERIES AC DRIVES	GS-EDRV100	ADI
TB	25	TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	NSYTRV22	SQUARE D
TB	3	TERMINAL BLOCK END BARRIERS GRAY	NSYTRAC22	SQUARE D
TB	2	TERMINAL BLOCK END ANCHORS	NSYTRAABV35	SQUARE D
TB	1	TERMINAL BLOCK GROUND SCREW CLAMP 20 AMP 600 V GREEN	NSYTRV22PE	SQUARE D
GB	1	LOAD CENTER GROUND BAR 15 TERMINALS	PK15GTA	SQUARE D

APPENDIX C – TREATMENT CHEMICAL SAFETY DATA SHEETS

1 PRODUCT AND COMPANY IDENTIFICATION

Manufacturer

Redux Technology
A Division of Azure Water Services, LLC
280 Callegari Drive
West Haven, CT 06516

Contact: Brad Horn
Phone: 203/933-9071
Fax: 203/933-1751
Email: info@reduxtech.com
Web: www.reduxtech.com

Product Name:	Redux-390
Revision Date:	11-11-15
SDS Number:	redux390
Common Name:	Aqueous Blended Deposit Control Formulation
CAS Number:	N/A
Product Code:	N/A
EPA Number:	N/A
RCRA Number:	N/A
Chemical Family:	Aqueous Blended Deposit Control Formulation
Chemical Formula	Proprietary
Synonyms:	Blended Product
Internal ID:	N/A
Product Use:	Water Treatment Compound

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and OSHA GHS

Printing date 20.03.2015 Revision: 19.03.2015

SECTION 1: Identification of the substance/mixture and of the company/ undertaking

· **1.1 Product identifier**

· **Trade name: Armacell WB Finish**

· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.

· **Application of the substance / the mixture** Coating compound/ Surface coating/ paint

· **1.3 Details of the supplier of the Safety Data Sheet**

· **Manufacturer/Supplier:**
Mon-Eco Industries, Inc.
5 Joanna Ct.
East Brunswick, NJ 08816
Phone: 732-257-7942

· **1.4 Emergency telephone number:**
ChemTel Inc.
(800)255-3924, +1 (813)248-0585

MON-ECO INDUSTRIES, INCORPORATED

SECTION 2: Hazards identification

· **2.1 Classification of the substance or mixture**

· **Classification according to Regulation (EC) No 1272/2008**
The following Hazard Statements are applicable only to the EU regulations and not the US GHS regulation: H317, H360Df, H411.
Classifications listed also are applicable to the OSHA GHS Hazard Communication Standard (29CFR1910.1200).
The following classifications are applicable only to OSHA (USA) regulations and not the specific CLP regulation: H360.
Repr. 1 H360: May damage fertility or the unborn child


health hazard

Carc. 1B	H350	May cause cancer.
Repr. 1B	H360Df	May damage the unborn child. Suspected of damaging fertility.


environment

Aquatic Chronic 2	H411	Toxic to aquatic life with long lasting effects.



Skin Sens. 1	H317	May cause an allergic skin reaction.

· **Classification according to Directive 67/548/EEC or Directive 1999/45/EC**

T; Toxic

R45-60-61: May cause cancer. May impair fertility. May cause harm to the unborn child.

(Contd. on page 2)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and OSHA GHS

Printing date 20.03.2015 Revision: 19.03.2015

Trade name: Armacell WB Finish

(Contd. of page 1)


Xn; Harmful

R62: Possible risk of impaired fertility.


Xi; Sensitising

R43: May cause sensitisation by skin contact.


N; Dangerous for the environment

R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

· **Information concerning particular hazards for human and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.
The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

· **Additional information:**
There are no other hazards not otherwise classified that have been identified.
0 percent of the mixture consists of component(s) of unknown toxicity

· **2.2 Label elements**

· **Labelling according to Regulation (EC) No 1272/2008**
The following Hazard Statements are applicable only to the EU regulations and not the US GHS regulation: H317,H360Df, H411.
The following Hazard Statements are applicable only to the general GHS regulations and not the specific CLP regulation: H360.
The product is additionally classified and labelled according to the Globally Harmonized System within the United States (GHS).
The product is classified and labelled according to the CLP regulation.

· **Hazard pictograms**


This pictogram only applicable for EU regulations. Not for use in the United States (OSHA GHS).


GHS07 GHS08 GHS09

· **Signal word** Danger

· **Hazard-determining components of labelling:**
benzyl butyl phthalate
Attapulgite (Palygorskite)
Quartz (SiO2)
Petroleum Distillates

(Contd. on page 3)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and OSHA GHS

Printing date 20.03.2015 Revision: 19.03.2015

Trade name: Armacell WB Finish

(Contd. of page 2)

· **Hazard statements**
The following Hazard Statements are applicable only to the EU regulations and not the US GHS regulation: H317,H360Df, H411.
The following Hazard Statements are applicable only to the general GHS regulations and not the specific CLP regulation: H360.
H360: May damage fertility or the unborn child.
H317 May cause an allergic skin reaction.
H350 May cause cancer.
H360Df May damage the unborn child. Suspected of damaging fertility.
H411 Toxic to aquatic life with long lasting effects.

· **Precautionary statements**
The following Precautionary Statements are applicable only to the EU CLP regulations and not the OSHA GHS regulations: P302+P352, P333+P313.
P280 Wear protective gloves.
P273 Avoid release to the environment.
P202 Do not handle until all safety precautions have been read and understood.
P363 Wash contaminated clothing before reuse.
P308+P313 IF exposed or concerned: Get medical advice/attention.
P333+P313 If skin irritation or rash occurs: Get medical advice/attention.
P302+P352 IF ON SKIN: Wash with plenty of water.
P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Additional information:**
Restricted to professional users.

· **Hazard description:**

· **WHMIS-symbols:**
D2A - Very toxic material causing other toxic effects



· **NFPA ratings (scale 0 - 4)**



Health = 1
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**



Health = *1
Fire = 0
Reactivity = 0

* - Indicates a long term health hazard from repeated or prolonged exposures.

· **HMIS Long Term Health Hazard Substances**	
13463-67-7	titanium dioxide
85-68-7	benzyl butyl phthalate
14808-60-7	Quartz (SiO2)

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· **2.3 Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

SECTION 3: Composition/information on ingredients

· **3.2 Mixtures**
· **Description:** Mixture of substances listed below with nonhazardous additions.

· **Dangerous components:**

CAS: 85-68-7 EINECS: 201-622-7 Index number: 607-430-00-3	benzyl butyl phthalate T Repr. Cat. 2, 3 R61; Xn R62; N R50/53 Repr. 1B, H360Df Aquatic Acute 1, H400; Aquatic Chronic 1, H410	2,5-10%
CAS: 12174-11-7 EC number: 601-805-5	Attapulgite (Palygorskite) Xn R40 Carc. 2, H351	≤ 2,5%
CAS: 9016-45-9 NLP: 500-024-6	4-nonylphenyl-polyethylene glycol Xi R36/38; N R51/53 Aquatic Chronic 2, H411 Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 1%
CAS: 14808-60-7 EINECS: 238-878-4	Quartz (SiO2) T R49; Xn R48 Carc. 1A, H350	< 1%
	Petroleum Distillates Carc. 1B, H350	< 1%

· **SVHC**

85-68-7	benzyl butyl phthalate
9016-45-9	4-nonylphenyl-polyethylene glycol

· **Dangerous Components (Alternative Classifications):**

CAS: 13463-67-7 EINECS: 236-675-5	titanium dioxide	Carc. 2, H351	10-25%

· **Additional information:**
For the listed ingredients, the identity and exact percentages are being withheld as a trade secret.
For the wording of the listed risk phrases refer to section 16.

· **Notable Trace Components (≤ 0,1% w/w)**

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CAS: 55965-84-9 Index number: 613-167-00-5	reaction mass of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-2H-isothiazol-3-one [EC no. 220-239-6] (3:1) T R23/24/25; C R34; Xi R43; N R50/53 Acute Tox. 3, H301; Acute Tox. 3, H311; Acute Tox. 3, H331 Skin Corr. 1B, H314 Aquatic Acute 1, H400; Aquatic Chronic 1, H410 Skin Sens. 1, H317
CAS: 1897-45-6 EINECS: 217-588-1 Index number: 608-014-00-4	chlorothalonil (ISO) T+ R26; Xn R40; Xi R37-41; Xi R43; N R50/53 Carc. Cat. 3 Acute Tox. 2, H330 Carc. 2, H351 Eye Dam. 1, H318 Aquatic Acute 1, H400; Aquatic Chronic 1, H410 Skin Sens. 1, H317; STOT SE 3, H335

SECTION 4: First aid measures

· **4.1 Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Take affected persons out into the fresh air.
· **After inhalation:**
Supply fresh air; consult doctor in case of complaints.
Provide oxygen treatment if affected person has difficulty breathing.
· **After skin contact:**
Immediately remove any clothing soiled by the product.
Immediately wash with water and soap and rinse thoroughly.
Launder contaminated clothing before re-use.
If skin irritation continues, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed**
Headache
Dizziness
Nausea in case of ingestion.
Gastric or intestinal disorders when ingested.
Allergic reactions
· **Hazards**
May cause cancer.
Suspected of damaging fertility or the unborn child.

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· **4.3 Indication of any immediate medical attention and special treatment needed**
Medical supervision for at least 48 hours.
If necessary oxygen respiration treatment.
Treat skin and mucous membrane with antihistamine and corticoid preparations.
Contains reaction mass of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-2H-isothiazol-3-one [EC no. 220-239-6] (3:1). May produce an allergic reaction.

SECTION 5: Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:**
Foam
Water haze or fog
Fire-extinguishing powder
Carbon dioxide
· **For safety reasons unsuitable extinguishing agents:** None.
· **5.2 Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information** Cool endangered receptacles with water spray.

SECTION 6: Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation
Particular danger of slipping on leaked/spilled product.
For large spills, use respiratory protective device against the effects of fumes/dust/aerosol.
· **6.2 Environmental precautions:**
Do not allow to enter sewers/ surface or ground water.
Inform respective authorities in case of seepage into water course or sewage system.
· **6.3 Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Send for recovery or disposal in suitable receptacles.
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

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SECTION 7: Handling and storage

· **7.1 Precautions for safe handling**
Prevent formation of aerosols.
Use only in well ventilated areas.
Avoid splashes or spray in enclosed areas.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:**
Avoid storage near extreme heat, ignition sources or open flame.
· **Information about storage in one common storage facility:**
Store away from foodstuffs.
Do not store together with oxidising and acidic materials.
· **Further information about storage conditions:**
Store in cool, dry conditions in well sealed receptacles.
Keep container tightly sealed.
· **7.3 Specific end use(s)** No further relevant information available.

SECTION 8: Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**

· **Ingredients with limit values that require monitoring at the workplace:**	
13463-67-7 titanium dioxide	
PEL (USA)	Long-term value: 15* mg/m³ *total dust
REL (USA)	See Pocket Guide App. A
TLV (USA)	Long-term value: 10 mg/m³ withdrawn from NIC
EL (Canada)	Long-term value: 10* 3** mg/m³ *total dust;**respirable fraction; IARC 2B
EV (Canada)	Long-term value: 10 mg/m³ total dust
14808-60-7 Quartz (SiO2)	
PEL (USA)	see Quartz listing
REL (USA)	Long-term value: 0,05* mg/m³ *respirable dust; See Pocket Guide App. A
TLV (USA)	Long-term value: 0,025* mg/m³ *as respirable fraction

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EL (Canada)	Long-term value: 0,025 mg/m³ ACGIH A2; IARC 1
EV (Canada)	Long-term value: 0,10* mg/m³ *respirable fraction

· **DNELs** No further relevant information available.
· **PNECs** No further relevant information available.
· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
The usual precautionary measures are to be adhered to when handling chemicals.
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Do not inhale gases / fumes / aerosols.
Avoid contact with the eyes and skin.
Pregnant women should strictly avoid inhalation or skin contact.
· **Respiratory protection:**
Use suitable respiratory protective device when high concentrations are present.
Use respiratory protection when grinding or cutting material.
For spills, respiratory protection may be advisable.
NIOSH or EN approved organic vapor respirator equipped with a dust/mist prefilter should be used.
· **Protection of hands:**



Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**



Safety glasses

· **Body protection:** Protective work clothing
· **Limitation and supervision of exposure into the environment**
No further relevant information available.

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· **Risk management measures**
See Section 7 for additional information.
No further relevant information available.

SECTION 9: Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Liquid
Colour:	White
· **Odour:**	Mild
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Not Determined.
Boiling point/Boiling range:	>100 °C (>212 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Auto/Self-ignition temperature:**	Not determined.
· **Decomposition temperature:**	Not determined.
· **Self-igniting:**	Product is not self-igniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure at 20 °C (68 °F):**	23 hPa (17 mm Hg)
· **Density at 20 °C (68 °F):**	1,4 g/cm³ (11,683 lbs/gal)
· **Relative density**	Not determined.
· **Vapour density at 20 °C (68 °F)**	> 1 g/cm³ (> 8,345 lbs/gal) (Air= 1)
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with water:**	Dispersible.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.

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· **9.2 Other information** No further relevant information available.

SECTION 10: Stability and reactivity

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used and stored according to specifications.
· **10.3 Possibility of hazardous reactions**
Toxic fumes may be released if heated above the decomposition point.
Reacts with strong acids and oxidising agents.
· **10.4 Conditions to avoid**
Keep away from heat and direct sunlight.
Store away from oxidising agents.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Nitrogen oxides (NOx)
Hydrogen chloride (HCl)

SECTION 11: Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **LD/LC50 values relevant for classification:** None.
· **Primary irritant effect:**
· **on the skin:** Slight irritant effect on skin and mucous membranes.
· **on the eye:** Slight irritant effect on eyes.
· **Sensitisation:** Sensitisation possible through skin contact.
· **Subacute to chronic toxicity:** No further relevant information available.
· **Additional toxicological information:**
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:
Irritant
Danger through skin adsorption.
May cause cancer.
May damage fertility or the unborn child.
· **Sensitisation:** May cause an allergic skin reaction.
· **Repeated dose toxicity:**
May cause damage to organs through prolonged or repeated exposure.
Repeated exposures may result in skin and/or respiratory sensitivity.
May cause cancer.
· **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction):**
Carc. 1B, Repr. 1B

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SECTION 12: Ecological information

· **12.1 Toxicity**
· **Aquatic toxicity:** Toxic for aquatic organisms
· **12.2 Persistence and degradability** No further relevant information available.
· **12.3 Bioaccumulative potential** No further relevant information available.
· **12.4 Mobility in soil** No further relevant information available.
· **Ecotoxical effects:**
· **Remark:** Toxic for fish
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system, even in small quantities.
Danger to drinking water if even extremely small quantities leak into the ground.
Also poisonous for fish and plankton in water bodies.
Toxic for aquatic organisms
Due to available data on eliminability/decomposition and bioaccumulation potential prolonged term damage of the environment can not be excluded.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **12.6 Other adverse effects** No further relevant information available.

SECTION 13: Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Must not be disposed together with household garbage. Do not allow product to reach sewage system.
Can be burned with household garbage after consulting with the waste disposal facility operator and the pertinent authorities and adhering to the necessary technical regulations.
The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes. Residual materials should be treated as hazardous.

· **Uncleaned packaging:**
· **Recommendation:** Disposal must be made according to official regulations.

SECTION 14: Transport information

· **14.1 UN-Number**
· **DOT** Not Regulated
· **ADR, IMDG, IATA** UN3082

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· **14.2 UN proper shipping name**



Limited Quantity for packages less than 30 kg (66 lb) and inner packagings less than 5 L (1.3 gal).

· **DOT**	Not Regulated
· **ADR**	3082 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (benzyl butyl phthalate)
· **IMDG**	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (benzyl butyl phthalate, chlorothalonil (ISO)), MARINE POLLUTANT
· **IATA**	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (benzyl butyl phthalate)

· **14.3 Transport hazard class(es)**

· **DOT**

· **Class**	Not Regulated

· **ADR**



· **Class**	9 (M6) Miscellaneous dangerous substances and articles.
· **Label**	9

· **IMDG, IATA**



· **Class**	9 Miscellaneous dangerous substances and articles.
· **Label**	9
· **14.4 Packing group**	
· **DOT**	Not Regulated
· **ADR, IMDG, IATA**	III
· **14.5 Environmental hazards:**	Product contains environmentally hazardous substances: benzyl butyl phthalate
· **Marine pollutant:**	Yes Symbol (fish and tree)
· **Special marking (ADR):**	Symbol (fish and tree)
· **Special marking (IATA):**	Symbol (fish and tree)
· **14.6 Special precautions for user**	Warning: Miscellaneous dangerous substances and articles.
· **Danger code (Kemler):**	90
· **EMS Number:**	F-A,S-F
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.

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· **Transport/Additional information:**

· **ADR**	
· **Limited quantities (LQ)**	5L
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
· **Transport category**	3
· **Tunnel restriction code**	E
· **IMDG**	
· **Limited quantities (LQ)**	5L
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
· **UN "Model Regulation":**	UN3082, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (benzyl butyl phthalate), 9, III

SECTION 15: Regulatory information

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **United States (USA)**
· **SARA**

· **Section 355 (extremely hazardous substances):**
None of the ingredients are listed.

· **Section 313 (Specific toxic chemical listings):**
None of the ingredients are listed.

· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**
· **Chemicals known to cause cancer:**
Reference to Attapulgite is based on unbound respirable particles and is not generally applicable to product as supplied.
Reference to Titanium Dioxide is based on unbound respirable particles and is not generally applicable to product as supplied.
Reference to Crystalline Silica and/or Quartz is based on unbound respirable particles and is not generally applicable to product as supplied.

13463-67-7	titanium dioxide
12174-11-7	Attapulgite (Palygorskite)
14808-60-7	Quartz (SiO2)
1897-45-6	chlorothalonil (ISO)

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients are listed.

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· **Chemicals known to cause reproductive toxicity for males:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**

85-68-7	benzyl butyl phthalate

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**

85-68-7	benzyl butyl phthalate	C

· **IARC (International Agency for Research on Cancer)**

13463-67-7	titanium dioxide	2B
85-68-7	benzyl butyl phthalate	3
12174-11-7	Attapulgite (Palygorskite)	2B
14808-60-7	Quartz (SiO2)	1

· **TLV (Threshold Limit Value established by ACGIH)**

13463-67-7	titanium dioxide	A4
14808-60-7	Quartz (SiO2)	A2

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**

13463-67-7	titanium dioxide
14808-60-7	Quartz (SiO2)

· **Canada**

· **Canadian Domestic Substances List (DSL)**

All ingredients are listed.

· **Canadian Ingredient Disclosure list (limit 0.1%)**

None of the ingredients are listed.

· **Canadian Ingredient Disclosure list (limit 1%)**

85-68-7	benzyl butyl phthalate

· **Information about limitation of use:**
Workers are not allowed to be exposed to the hazardous carcinogenic materials contained in this preparation. Exceptions can be made by the authorities in certain cases.

· **Other regulations, limitations and prohibitive regulations**
This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.

· **Substances of very high concern (SVHC) according to REACH, Article 57**

85-68-7	benzyl butyl phthalate
9016-45-9	4-nonylphenyl-polyethylene glycol

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

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SECTION 16: Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant phrases**
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H350 May cause cancer.
H351 Suspected of causing cancer.
H360Df May damage the unborn child. Suspected of damaging fertility.
H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting effects.
H411 Toxic to aquatic life with long lasting effects.

R36/38 Irritating to eyes and skin.
R40 Limited evidence of a carcinogenic effect.
R48 Danger of serious damage to health by prolonged exposure.
R49 May cause cancer by inhalation.
R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R61 May cause harm to the unborn child.
R62 Possible risk of impaired fertility.

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonised System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level (REACH)
PNEC: Predicted No-Effect Concentration (REACH)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
Skin Irrit. 2: Skin corrosion/irritation, Hazard Category 2
Eye Irrit. 2: Serious eye damage/eye irritation, Hazard Category 2
Skin Sens. 1: Sensitisation - Skin, Hazard Category 1
Carc. 1A: Carcinogenicity, Hazard Category 1A
Carc. 1B: Carcinogenicity, Hazard Category 1B
Carc. 2: Carcinogenicity, Hazard Category 2
Repr. 1B: Reproductive toxicity, Hazard Category 1B
Aquatic Acute 1: Hazardous to the aquatic environment - AcuteHazard, Category 1
Aquatic Chronic 1: Hazardous to the aquatic environment - Chronic Hazard, Category 1
Aquatic Chronic 2: Hazardous to the aquatic environment - Chronic Hazard, Category 2

· **Sources**
SDS Prepared by:
ChemTel Inc.

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Toll Free North America 1-888-255-3924 Intl. +01 813-248-0573
Website: www.chemtelinc.com

1 PRODUCT AND COMPANY IDENTIFICATION

Manufacturer

Redux Technology
A Division of Azure Water Services, LLC
280 Callegari Drive
West Haven, CT 06516

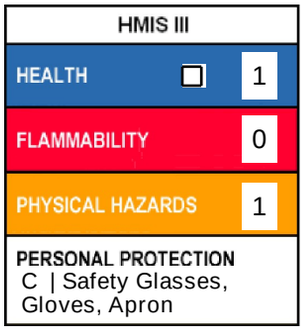
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Phone:	203/933-9071
Fax:	203/933-1751
Email:	info@reduxtech.com
Web:	www.reduxtech.com

Product Name:	Redux Foamtrol-100
Revision Date:	11-17-15
SDS Number:	reduxfoamtrol100
Common Name:	Antifoam
CAS Number:	N/A
Product Code:	N/A
EPA Number:	N/A
RCRA Number:	N/A
Chemical Family:	Blended Product
Chemical Formula	Proprietary
Synonyms:	Blended Product
Internal ID:	N/A
Product Use:	Water Treatment Compound

2 HAZARDS IDENTIFICATION

Route of Entry:	Inhalation; Skin; Ingestion.
Target Organs:	Esophagus; Eyes; Lungs; Mucous membranes; Respiratory system; Skin; Upper respiratory tract;
Inhalation:	Can cause irritation and inflammation of the respiratory tract.
Skin Contact:	May cause irritation. May cause burning.
Eye Contact:	May cause irritation. May cause loss of vision. May cause permanent eye damage.
Ingestion:	Aspiration hazard: Harmful or fatal if swallowed.

HMIS III: H1/F0/PH1



GHS Signal Word:
NONE

GHS Classifications:
None, None, None

GHS Phrases:
H000 - None

GHS Precautionary Statements:
P101 - If medical advice is needed, have product container or label at hand.
P235+410 - Keep cool. Protect from sunlight.
P260 - Do not breathe dust/fume/gas/mist/vapors/spray.
P262 - Do not get in eyes, on skin, or on clothing.
P273 - Avoid release to the environment.
P301+330+331 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P304+340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+351+338 - IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P314 - Get Medical advice/attention if you feel unwell.
P352 - Wash with soap and water.
P363 - Wash contaminated clothing before reuse.

This product is not classified as hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200).

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients:
This product is not classified as Hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200).

All of the product's ingredients are either listed or exempt from the TSCA Inventory.

Cas #	Percentage	Chemical Name
organosilicone emulsion	50%	Proprietary

Specific chemical identity is being withheld as a trade secret.

4 FIRST AID MEASURES

Inhalation: Get immediate medical attention. If symptoms develop, move victim to fresh air. If symptoms persist, obtain medical attention. Give oxygen or artificial respiration if needed.

Skin Contact: Promptly flush skin with water for at least 15 minutes or until all chemical is removed. Remove contaminated clothing and wash before reuse.

Eye Contact: Remove contact lenses if applicable and continue to flush with large amounts of water for at least 15 minutes, holding lids apart to ensure flushing of the entire surface. Washing eyes within 1 minute is essential to achieve maximum effectiveness. Remove contact lenses if applicable. Get immediate medical attention.

Ingestion: Do NOT induce vomiting or attempt chemical neutralization. For spontaneous vomiting, keep head below hips. Dilute with fluids (e.g. water, milk, juice, etc.). Bring to the attention of a physician.

5 FIRE FIGHTING MEASURES

Flammability:	N/A
Flash Point:	Non-flammable/aqueous solution.
Flash Point Method:	Non-flammable/aqueous solution.
Burning Rate:	N/A
Autoignition Temp:	N/A.
LEL:	N/A
UEL:	N/A

Wear self contained breathing apparatus and other protective clothing. Approach the fire from upwind to avoid hazardous vapors. Use a water spray to keep fire exposed containers cool. Extinguish fire using water, carbon dioxide, foam, or dry powder.

Evacuate the area and fight the fire from a safe distance or a protected location.

Firefighters should wear proper protective equipment and self-containd breathing apparatus with full facepiece operated in a positive pressure mode.

6 ACCIDENTAL RELEASE MEASURES

Pick up excess with inert absorbant material and place into separate waste container.
Vacuum or sweep the material into a bag or other sealed container and dispose in accordance with local requirements.
Restrict access to the area until completion of the clean-up process. Ensure that this clean-up is only conducted by trained personnel. Wear required protective clothing and equipment. Properly ventilate the area of the spill. If safely possible, contain the spill or leak.

7 HANDLING AND STORAGE

Handling Precautions:	Wear recommended protective equipment when handling. Keep material out of reach of children. Use approved containers only . Launder contaminated clothing. Wash thoroughly after handling. Store in a cool, dry and well ventilated area. Mix only with water. Follow appropriate tank entry procedures (ANSI X117) and OSHA Confined Space Regulations.
Storage Requirements:	Store in cool/dry and well ventilated area. Keep from freezing.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use mechanical (general) ventilation for storage areas. Facilities using this product must be equipped with an eyewash station.
Personal Protective Equip:	HMIS PP, C | Safety Glasses, Gloves, Apron HMIS PP, C | Goggles, Gloves, Apron Chemical goggles; Apron; Chemical resistant gloves;

Follow good work and hygiene practices. Provide a safety shower and wash basin in immediate work area.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Milky white liquid		
Physical State:	Liquid	Odor:	Mild
Particle Size:	N/A	Molecular Formul:	N/A
Spec Grav./Densit	0.98 - 1.01	Solubility:	Complete
Viscosity:	NDA	Softening Point:	N/A
Sat. Vap. Conc.:	N/A	Percent Volatile:	NDA
Boiling Point:	Greater than 212 degrees F.	Heat Value:	NDA
Vapor Pressure:	NDA	Freezing/Melting F	Less than 32 degrees F.
pH:	Approx. 7.0	Octanol:	N/A
Evap. Rate:	NDA	Vapor Density:	NDA
Molecular weight:	N/A	VOC:	NDA
		Bulk Density:	8.2 lbs/gal

10 STABILITY AND REACTIVITY

Stability:	Product is stable under normal conditions.
Hazardous Polymerization:	Will not occur.

11 TOXICOLOGICAL INFORMATION

NDA

12 ECOLOGICAL INFORMATION

The procedures follow the protocols described by the United States Environmental Protection Agency.

Test Objective: Identify LD50 (lethal dose to 50% of test polulation) for use in discharge permitting.

Tests Completed:
LD50 Rangefinder Test: This involved 24 hour bioassay testing using Pimephales promelas (Fathead minnow) at concentrations of 8,000 ppm, 4,000 ppm, 2,000 ppm, 1,000 ppm, 500 ppm, 0 ppm (control).

Results: recommended concentrations used in LD50 tests below.
LD50 tests: This involved 48 hour bioassay testing using daphnia and minnows.

Results: Average LD50 (for daphnia) - 365 ppm
Average LD50 (for minnows) - 5,464 ppm

All tests were completed per EPA protocol (EPA/600/4-90/027F).

13 DISPOSAL CONSIDERATIONS

Dispose of in accordance with local regulations.

Empty containers may be triple rinsed, then offered for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.

14 TRANSPORT INFORMATION

For all transportation accidents, call CHEMTREC at 800/424-9300. All spills and leaks of this material must be handled in accordance with local, state, and federal regulations.

DOT SHIPPING DESIGNATION:

Not hazardous under 29 CFR 1910.1200 water treatment compound

15 REGULATORY INFORMATION

According to our information this product is not a dangerous material and is not classified as hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200).

REGULATORY KEY DESCRIPTIONS

CERCLA = Superfund clean up substance
CSWHS = Clean Water Act Hazardous substances
MASS = MA Massachusetts Hazardous Substances List
OSHAWAC = OSHA Workplace Air Contaminants
PA = PA Right-To-Know List of Hazardous Substances
TXAIR = TX Air Contaminants with Health Effects Screening Level
APP9 = Appendix 9
EPCRAWPC = EPCRA Water Priority Chemicals
HAP = Hazardous Air Pollutants
HWRCRA = RCRA Hazardous Wastes
NJHS = NJ Right-to-Know Hazardous Substances
NRC = Nationally Recognized Carcinogens
OSHAHTS = OSHA Hazardous and Toxic Substances
PRIPOL = Clean Water Act Priority Pollutants
PROP65 = CA Prop 65

SARA313 = SARA 313 Title III Toxic Chemicals
TOXICPOL = Clean Water Act Toxic Pollutants
TOXICRCRA = RCRA Toxic Hazardous Wastes (U-List)
TXHWL = TX Hazardous Waste List
TSCA = Toxic Substances Control Act

16 OTHER INFORMATION

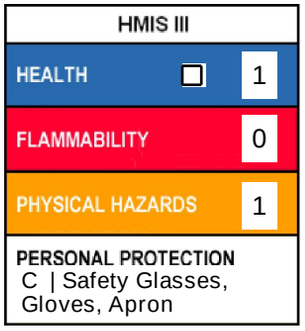
DISCLAIMER:
All information, recommendations and suggestion appearing herein concerning our product are based upon tests and data believed to be reliable. However, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the acutal use by others is beyond our control, no guarantee, expressed or implied, is made by Azure Water Services, LLC as to the effects of such use, the results to be obtained, or the safety and toxicity of the product; nor does Azure Water Services, LLC assume any liability arising out of use, by others, of the product referred to herein. The information herein is not to be construed as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

For manufacturing use only. Not for food or drug use.

2 HAZARDS IDENTIFICATION

Route of Entry:	Inhalation; Skin; Ingestion.
Target Organs:	Esophagus; Eyes; Lungs; Mucous membranes; Respiratory system; Skin; Upper respiratory tract;
Inhalation:	Can cause irritation and inflammation of the respiratory tract.
Skin Contact:	May cause irritation. Prolonged or repeated exposure may cause burns on exposed tissure.
Eye Contact:	May cause irritation. May cause corneal injury which may cause permanent impairment of vision or even blindness
Ingestion:	Aspiration hazard: Harmful or fatal if swallowed.

HMIS III: H1/F0/PH1



GHS Signal Word:
NONE

GHS Classifications:
None, None, None

GHS Phrases:
H000 - None

GHS Precautionary Statements:
P103 - Read label before use.
P235+410 - Keep cool. Protect from sunlight.
P260 - Do not breathe dust/fume/gas/mist/vapors/spray.
P262 - Do not get in eyes, on skin, or on clothing.
P305+351+338 - IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P314 - Get Medical advice/attention if you feel unwell.
P403+233 - Store in a well ventilated place. Keep container tightly closed.
P304+340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for

breathing.
P306+360 - IF ON CLOTHING: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.

This product is not classified as hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200).

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients:

Cas #	Perc.	Chemical Name
	10 - 15%	Organophosphorous Compound
	5 - 10%	Other ingredients

Specific chemical identity is being withheld as a trade secret

4 FIRST AID MEASURES

Inhalation: Get immediate medical attention. If symptoms develop, move victim to fresh air. If symptoms persist, obtain medical attention. Give oxygen or artificial respiration if needed.

Skin Contact: Promptly flush skin with water until all chemical is removed.
If irritation develops or persists, get medical attention.
Remove contaminated clothing and wash before reuse.

Eye Contact: Flush with large amounts of water for at least 15 minutes, holding lids apart to ensure flushing of the entire surface. Washing eyes within 1 minute is essential to achieve maximum effectiveness. Remove contact lenses if applicable and continue flushing for at least 15 minutes.
Get immediate medical attention.

Ingestion: Do NOT induce vomiting or attempt chemical neutralization. For spontaneous vomiting, keep head below hips and keep airway clear. Immediately dirnk a large quqntity of fluids (e.g. water, milk, juice, etc.). Bring to the attention of a physician.

5 FIRE FIGHTING MEASURES

Flammability:	N/A
Flash Point:	Non-flammable/aqueous solution.
Flash Point Method:	Non-flammable/aqueous solution.
Burning Rate:	N/A
Autoignition Temp:	N/A.
LEL:	N/A
UEL:	N/A

Wear self contained breathing apparatus and other protective clothing. Approach the fire from upwind to avoid hazardous vapors. Use a water spray to keep fire exposed containers cool. Extinguish fire using water, carbon dioxide, foam, or dry powder.

Evacuate the area and fight the fire from a safe distance or a protected location.

Firefighters should wear proper protective equipment and self-containd breathing apparatus with full facepiece operated in a positive pressure mode.

6 ACCIDENTAL RELEASE MEASURES

Pick up excess with inert absorbant material and place into separate waste container.
Vacuum or sweep the material into a bag or other sealed container and dispose in accordance with local requirements.
Restrict access to the area until completion of the clean-up process. Ensure that this clean-up is only conducted by trained personnel. Wear required protective clothing and equipment. Properly ventilate the area of the spill. If safely possible, contain the spill or leak. Do not allow entry into sewers or waterways.

7 HANDLING AND STORAGE

Handling Precautions:	Wear recommended protective equipment when handling. Mix only with water. Follow appropriate tank entry procedures (ANSI Z117) and OSHA Confined Space Regulations. Keep material out of reach of children. Use approved containers only. Launder contaminated clothing. Wash thoroughly after handling. Store in a cool, dry and well ventilated area.
Storage Requirements:	Store in cool/dry and well ventilated area.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use mechanical (general) ventilation for storage areas. Facilities using this product must be equipped with an eyewash station.
Personal Protective Equip:	HMIS PP, C | Safety Glasses, Gloves, Apron HMIS PP, C | Goggles, Gloves, Apron, Respirator, Boots; Chemical resistant gloves; Chemical goggles or face shield; PVC, Neoprene or Vinyl Apron is required; Chemical resistant gloves required; use PVC, neoprene or Nitrile with long gauntlet or protective cuff. NIOSH/MSHA approved respirator where mists or sprays may be generated. Rubber boots.

Follow good work and hygiene practices. Provide a safety shower and wash basin in immediate work area.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear pale yellow liquid		
Physical State:	Liquid	Odor:	Slight
Particle Size:	N/A	Molecular Formul	N/A
Spec Grav./Densit	1.09	Solubility:	Complete
Viscosity:	NDA	Softening Point:	N/A
Sat. Vap. Conc.:	N/A	Percent Volatile:	NDA
Boiling Point:	>210-220 degrees F.	Heat Value:	NDA
Vapor Pressure:	NDA	Freezing/Melting F	Less than 32 degrees F.
pH:	~6.0	Octanol:	N/A
Evap. Rate:	Similar to water	Vapor Density:	NDA
Molecular weight:	N/A	VOC:	NDA
		Bulk Density:	8.6 lbs/gal

10 STABILITY AND REACTIVITY

Stability:	Product is stable under normal conditions.
Conditions to Avoid:	None
Materials to Avoid:	Do not mix with anything but water.
Hazardous Decomposition:	Will not occur.
Hazardous Polymerization:	Will not occur.

11 TOXICOLOGICAL INFORMATION

Aquatic Toxicity Test (48 hour, LD50 Protocol):

Species	LD40 (ppm)
D. pulex (daphnia)	5,726
P. pimephales (fathead minnow)	5,523

The average NOAEL (no-observed acute effect level, the highest concentration with 90% survival) is 2,500 ppm for the daphnia and 4,000 ppm for the fathead minnow.

12 ECOLOGICAL INFORMATION

Ecotoxicity:
Ceriodaphnia: 48 hr LD50 - 5,800 mg/l
NOAEL - 4,000 mg/l
Fathead Minnow: 96 hr LD50 - 11,400 mg/l
NOAEL - 4,000 mg/l
Rainbow Trout: 96 hr LD50 - 12,500

Environmental Fate: Contact manufacturer
Environmental Degradation: Contact manufacturer
Soil Absorbtion/Mobility: Contact manufacturer

Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Considered biodegradable

13 DISPOSAL CONSIDERATIONS

Dispose of in accordance with local regulations. Prevent product flow to sewers or public waterways.

Product that cannot be used according to the label must be disposed of as a hazardous waste at an approved hazardous waste management facility. Empty containers may be triple rinsed, then offered for recycling or reconditioning, or puncture and sipose of in a sanitary landfill.

Code: 32- HDPE

14 TRANSPORT INFORMATION

For all transportation accidents, call CHEMTREC at 800/424-9300. All spills and leaks of this material must be handled in accordance with local, state, and federal regulations.

DOT SHIPPING DESIGNATION:

Non-hazardous under 29 CFR 1910.1200 water treatment compound

15 REGULATORY INFORMATION

According to our information this product is not a dangerous material and is not classified as hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200).

REGULATORY KEY DESCRIPTIONS

CERCLA = Superfund clean up substance
CSWHS = Clean Water Act Hazardous substances
MASS = MA Massachusetts Hazardous Substances List
OSHAWAC = OSHA Workplace Air Contaminants
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NRC = Nationally Recognized Carcinogens
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PRIPOL = Clean Water Act Priority Pollutants
PROP65 = CA Prop 65
SARA313 = SARA 313 Title III Toxic Chemicals
TOXICPOL = Clean Water Act Toxic Pollutants
TOXICRCRA = RCRA Toxic Hazardous Wastes (U-List)
TXHWL = TX Hazardous Waste List

16 OTHER INFORMATION

DISCLAIMER:
All information, recommendations and suggestion appearing herein concerning our product are based upon tests and data believed to be reliable. However, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the acutal use by others is beyond our control, no guarantee, expressed or implied, is made by Azure Water Services, LLC as to the effects of such use, the results to be obtained, or the safety and toxicity of the product; nor does Azure Water Services, LLC assume any liability arising out of use, by others, of the product referred to herein. The information herein is not to be construed as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

For manufacturing use only. Not for food or drug use.

APPENDIX D – CONTROL INTERLOCK TABLE, HMI INTERFACE SCREENS

TABLE 2

NES 15-183, REVISION A (JUNE 2016) BY: EMB CHK: EJ
GES - GWTS / BASF FACILITY
RENSSELAER, NY

Interlock	Interlock ID	Interlock Description	Extraction Well Pumps Run Permissive (EW-3, EW-15)	Extraction Well Pumps Run Permissive (EW-6, EW-8, EW-12/16, EW-14)	P-201, Effluent Pump (Influent EQ Tank)	MOV-201, Motor Operated Valve (Pre-Tray Stripper Bag Filters)	B-301, Blower (Tray Stripper)	P-301, Effluent Pump (Tray Stripper)	MOV-401, Motor Operated Valve (Post-Tray Stripper Bag Filters)	MOV-600, Motor Operated Valve (Backwash Tank/System Effluent)	MOV-601, Motor Operated Valve (Backwash Tank/System Effluent)	MOV-602, Motor Operated Valve (Reinjection Point 1)	P-701, Effluent Pump (Backwash Supply Tank)	P-801, Effluent Pump (Backwash Supply Tank)	P-802, Effluent Pump (Backwash Supernatant Tank)	MP-1001, Chemical Metering Pump (Backwash Supernatant Tank)	MP-1002, Chemical Metering Pump	P-1200, Sump Pump (Building)	**OPERATOR INTERFACE**	Adjustable Set Point (HMI Screen Display)	Warning Notification (HMI Screen Display)	Alarm Notification (HMI Screen Display)	Warning Notification (Local Panel Display)	Alarm Notification (Local Panel Display)	Manual Reset (Warning / Alarm)	Remote Warning Notification	Remote Alarm Notification	Warning/Alarm Log	Data Log (10 Minutes)	**INSTRUMENT TYPE**	**NES FACTORY TEST SET POINT**
		Emergency Stop	O	O	O		O	O						O	O	O	O	O	O				Y		Y			Y	Y			D	
1		No alarms present	I	I			I				I	O	M	M	M	I		I/O														
2	FIT/FIQ-101	EW-3 Influent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-50gpm
3	FIT/FIQ-102	EW-6 Influent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-50gpm
4	FIT/FIQ-103	EW-8 Influent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-50gpm
5	FIT/FIQ-104	EW-12 & EW-16 Influent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-50gpm
6	FIT/FIQ-105	EW-14 Influent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-50gpm
7	FIT/FIQ-106	EW-15 Influent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-50gpm
8	FIT/FIQ-107	System Influent Flow Indicating Transmitter/Totalizer															P	P												Y	A/D	0-100gpm
9	PSH-101	Extraction Well Filter Housing (FX-101) Pressure Switch High	O	O													O	O					Y		Y	Y		Y	Y		D	50 PSI
10	UVL-101	Ultraviolet Disinfection Lamp Sensitivity Low																			Y			Y		Y	Y		Y		D	
11	LSHH-200	Influent Equalization Tank (T-201) Level Switch High-High	O	O									O			O	O	O				Y		Y	Y		Y	Y		D	
12	LT-201	Influent Equalization Tank (T-201) Level Transmitter			P															Y									Y	A	0-9FT
13	LTL-201	Influent Equalization Tank (T-201) Level Transmitter Low			O												O			Y										L	
14	LTH-201	Influent Equalization Tank (T-201) Level Transmitter High			I												I			Y										L	
15	PSH-201*	Pre-Tray Stripper Filter Housing (FX-201,FX-202) Pressure Switch High	O	O	O	I/O										O	O	O			Y	Y	Y	Y	Y	Y	Y	Y		D	50 PSI
16	LSHH-300	Tray Stripper (AS-301) Level Switch High-High	O	O	O											O	O	O				Y		Y	Y		Y	Y		D	
17	LSHH-301	Post-Tray Stripper Moisture Separator Level Switch High-High	O	O	O											O	O	O				Y		Y	Y		Y	Y		D	
18	LT-301	Tray Stripper (AS-301) Level Transmitter						P												Y									Y	A	0-13.2IN
19	LTL-301	Tray Stripper (AS-301) Level Transmitter Low						O												Y										L	
20	LTH-301	Tray Stripper (AS-301) Level Transmitter High						I												Y										L	
21	VSL-301	Tray Stripper Blower (B-301) Vacuum Switch Low	O	O	O		O									O	O	O				Y		Y	Y		Y	Y		D	4" WC
22	PSH-301	Tray Stripper Blower (B-301) Discharge Pressure Switch High	O	O	O		O									O	O	O				Y		Y	Y		Y	Y		D	50" WC
23	DPT-401	Post-Tray Stripper Filter Housing (FX-401,FX-402) Differential Pressure Transmitter																											Y	A	
24	DPTH-401*	Post-Tray Stripper Filter Housing (FX-401,FX-402) Differential Pressure Transmitter High	O	O	O			O	I/O							O	O	O		Y	Y	Y	Y	Y	Y	Y	Y			L	
25	PSH-501	Liquid Phase Carbon Vessel (LGAC-501,LGAC-502) Pressure Switch High	O	O	O			O								O	O	O				Y		Y	Y		Y	Y		D	50 PSI
26	PSH-600	System Effluent Pressure Switch High	O	O	O			O								O	O	O				Y		Y	Y		Y	Y		D	50 PSI
27	FIT/FIQ-601	Reinjection Point 1 Effluent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-100gpm
28	FIT/FIQ-602	Reinjection Point 2 Effluent Flow Indicating Transmitter/Totalizer																												Y	A/D	0-100gpm
29	LSHH-601	Reinjection Point 1 Level Switch High-High									O	I											Y		Y	Y		Y	Y		D	
30	LSHH-602	Reinjection Point 2 Level Switch High-High									I	O											Y		Y	Y		Y	Y		D	
31	FITFIQ-701	Backwash Flow Indicating Transmitter/Totalizer																												Y	A/D	0-250gpm
32	LSL-700	Backwash Supply Tank (T-701) Level Switch Low								I			O																	D	
33	LSH-700	Backwash Supply Tank (T-701) Level Switch High								O			I																	D	
34	LSHH-700	Backwash Supply Tank (T-701) Level Switch High-High	O	O	O			O								O	O	O					Y		Y	Y		Y	Y		D	
35	LSHH-800	Backwash Supernatant Tank (T-801) Level Switch High-High											O										Y		Y	Y		Y	Y		D	
36	LSL-1001	Chemical Tote (T-1001) Low Switch Level														O					Y			Y		Y	Y			D	
37	LSL-1002	Chemical Tote (T-1002) Low Switch Level															O				Y			Y		Y	Y			D	
38	LSHH-1200	Building Sump Level Switch High-High	O	O	O		O	O					O	O	O	O	O	O					Y		Y	Y		Y	Y		D	
39	LSHH-1201	Containment Pad Sump Level Switch High-High																			Y			Y		Y	Y		Y		D	
40	TSL-1200	Process Area Temperature Switch Low																			Y			Y		Y	Y		Y		D	
41	SPD-VFD-201	Effluent Pump (P-201) Speed (Influent EQ Tank)																												Y	A	
42	FLT-VFD-201	Effluent Pump (P-201) VFD Fault (Influent EQ Tank)	O	O	O												O	O	O				Y		Y	Y		Y	Y		D	
43	O/L B-301	Tray Stripper Blower (B-301) Overload	O	O	O		O										O	O	O				Y		Y	Y		Y	Y		D	
44	SPD-VFD-301	Effluent Pump (P-301) Speed (Tray Stripper)																												Y	A	
45	FLT-VFD-301	Effluent Pump (P-301) VFD Fault (Tray Stripper)	O	O	O			O									O	O	O				Y		Y	Y		Y	Y	Y	D	
46	O/L P-701	Effluent Pump (P-701) Overload (Backwash Supply Tank)											O										Y		Y	Y		Y	Y		D	
47	O/L P-801	Effluent Pump (P-801) Overload (Backwash Supernatant Tank)												O									Y		Y	Y		Y	Y		D	
48	O/L P-802	Diaphragm Pump (P-802) Overload (Backwash Supernatant Tank)													O								Y		Y	Y		Y	Y		D	
49	FLT-PWR	Main Power Failure	O	O	O		O	O					O	O	O	O	O	O					Y		Y			Y	Y		D	

Note:

HMI - Human Machine Interface

O - Off
I - On
I/O - On / Off Control
M - Manual Operation
P- Proportional Control

Y - Yes

A - Analog
D - Digital
L - Internal Logic

* Upon reaching the High Pressure Setpoint the online filter housing is switched to the standby filter housing and a "warning" message is initiated. The standby filter housing will now remain in the online position. After the fouled filters are changed and the Manual "RESET" button has been pushed the recently changed filter housing will now be in standby mode and the process will be repeated after the High Pressure Setpoint is reached. If the Manual "Reset" button is not pushed the online filter housing will remain in that position and after the High Pressure Setpoint is reached the GWTS is shutdown and an "alarm" message is initiated.

RapidTech LLC d/b/a National Environmental Systems
84 Dunham Street - Attleboro, MA 02703
Phone: (508)226-1100; Fax: (508)226-1180; Email: Info@nes-inc.biz

APPENDIX E – CRITICAL SPARE PARTS LIST

Recommended Spare Parts

FX-101, FX-201-202, FX-401-402					
	Gasket O-ring	3	PN 363-E	sales@harmsco.com	800-327-3248
	Replacement Cartridges	6	Harmsco Hurricane HC 170 filter cartridge	sales@harmsco.com	800-327-3248
UV-101					
	Spare UV Lamps	2	ATS AS19-254	www.aquat.com	800-224-7476
	Spare Quartz Tube	3	ATS28-889D	www.aquat.com	800-224-7476
	Spare Nuts	3	1170861	www.aquat.com	800-224-7476
	Spare Bolts	3	1170059	www.aquat.com	800-224-7476
	Spare Seals	1	ASO-90000-EN	www.aquat.com	800-224-7476
	Spare Gasket O-ring	1	ASV-90006-OR	www.aquat.com	800-224-7476
P-201					
	Spare Pump End	1	Goulds 316SS L, 5.5" Impeller	Local Pump Supplier	
	Spare Motor End	1	Motor 2ST1J5H4	Local Pump Supplier	
AS-301					
	Spare Gasket	1	EZ-12.6SS-Gasket	info@qedenv.com	800-624-2026
FX-801					
	Bag Filters	25	8 x 30, 25 micron	www.mcmaster.com	609-689-3000
	Spare O-ring	2	#8x30, PB Basket, VS (Viton) Seal	www.mcmaster.com	609-689-3000
MP-1001					
	Spare Meter Pump	1	LMI AD951-935SI, 1 GPH, 115 VAC	www.lmipumps.com	215-293-0401
MOV-201, 401, 600					
	Spare 3 way valve	2	Hayward TW1200ST-EK61	www.haywardflowcontrol.com	888-429-4635
	Spare Electric Actuator	2	Maxairtech AE03-120VAC-LED	www.maxairtech.com	888-842-9998
MOV-601, 602					
	Spare 2 way valve	2	Hayward TB1200ST-EK61	www.haywardflowcontrol.com	888-429-4635
			Maxairtech AE02-120VAC-LED	www.maxairtech.com	888-842-9998
Gauges and Flow Meters					
	Pressure Gauge	4	Dwyer SGZ-D10422N-GF	www.dwyer-inst.com	
	Flow Meter	2	GF Signet 3-2551-P0-22	www.signetinstrumentation.com	877-742-2878
Level Switches					
	Level Transmitter	1	Echospan LU80	www.flowline.com	562-598-3015
	High High Switch	2	GEMS MYEL40T	www.gemssensors.com	

APPENDIX F – EXAMPLE LABORATORY CHAIN OF CUSTODY

Adirondack Environmental Services Inc.®
Experience is the solution

314 North Pearl Street
Albany, New York 12207
518-434-4546/434-0891 FAX

CHAIN OF CUSTODY RECORD

AES Work Order #

A full service analytical research laboratory offering solutions to environmental concerns

Client Name:	Address:	
Send Report To:	Project Name (Location)	Samplers: (Names)
Client Phone No: / Client Email:	PO Number:	Samplers: (Signature)

AES Sample Number	Client Sample Identification & Location	Date Sampled	Time A=a.m. P=p.m.	Sample Type: Matrix	Comp	Grab	Number of Cont's	Analysis Required
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					
			A / P					

Shipment Arrived Via:

FedEx UPS Client AES Other:_____

Turnaround Time Request:

☐ 1 Day ☐ 3 Day ☐ Normal
☐ 2 Day ☐ 5 Day

Note: Samples received after 3:30 pm are considered next business day

CC Report To / Special Instructions/Remarks:

Relinquished by: (Signature)	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Received for Laboratory by:	Date/Time

Temperature	AES Bottles	Properly Preserved	Received Within Holding Times
Ambient or Chilled	Y ☐ N ☐	Y N	Y N
Notes:		Notes:	Notes:

WHITE - Lab Copy YELLOW - Sampler Copy PINK - Generator Copy

APPENDIX G - EXAMPLE DAILY TREATMENT SYSTEM LOG

BASF Groundwater Treatment System Log

Site Name BASF Rensselaer, NY
Operator

Date: 09/28/2016 **Time: 7:00**
Date: 09/29/2016
Weather: Cloudy, 59

System Status at Arrival:		**On**	**Off X**					
System Alarms at Arrival:		**Yes**	**No**	**If yes, list alarm(s) and time (if system is down):**				
System Status at Departure:		**On**	**Off x**					
Groundwater Extraction Well Flow Rate Data								
Extraction Well Number	**EW 14**	**EW 6**	**EW 12 &16**	**EW 15**	**EW 8**	**EW 3**		**INFLUENT**
Transmitter Number	**FT-102**	**FT-104**	**FT-101**	**FT-105**	**FT-103**	**FT-106**	**TOTAL**	**FT-107**
Flow Rate (GPM):								
Flowmeter totalizer (Gallons):								
Differential								
Pressure Indicator	**PI-102**	**PI-104**	**PI-101**	**PI-105**	**PI-103**	**PI-106**		
Pressure (PSI):								
Groundwater Treatment System Flow Rate Data:								
	P-701			**P-301**	**P-801**	**CB**	**FI-602 (Gallery 2)**	**FI-601 (Gallery 1)**
Flow (GPM)			**Pressure Indicator**	**PI-301**	**PI-802**			
Flowmeter totalizer (Gallons):			**Pressure (PSI)**					
			Temp. Indicator	**TI-300**	**PI-801**			
Differential			**Temperature**					
Pressure Indicator	**PI-702**	**PI-200**		**PI-302**	**PI-803**			
Pressure (PSI):								
Air Stripper: B-301			**FI-301 (IOW)**	**TI-301 (Deg F**	**VI-301 (SCFM)**	**VI-302 (SCFM)**	**VI-303 (SCFM)**	**PI-303 (PSI)**
Filter Bags:			**FX-101**	**FX-201**	**FX-202**	**FX-401**	**FX-402**	
Pressure Indicator			**PI-107**	**PI-201**	**PI-202**	**PI-401**	**PI-402**	
Pressure (PSI)								
Pressure Indicator			**PI-108**	**PI-203**	**PI-204**	**PI-403**	**PI-404**	
Pressure (PSI)								
Pressure Difference								
GAC Units:			**501**	**502**	**503**			
Pressure Indicator			**PI-501**	**PI-502**	**PI-503**			
Pressure (PSI)								
Pressure Indicator			**PI-504**	**PI-503**	**PI-506**			
Pressure (PSI)								
GENERAL COMMENTS								
SYSTEM OFF FOR P-301								

APPENDIX D

Excavation Work Plan for OU1

May 7, 2014

EXCAVATION WORK PLAN FOR OU1

Former BASF Manufacturing Plant
Riverside Avenue
Rensselaer, New York

Prepared for

BASF CORPORATION
100 Park Avenue
Florham Park, New Jersey

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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1.0 INTRODUCTION

On behalf of the BASF Corporation ("BASF"), Remedial Engineering, P.C ("Remedial Engineering") has prepared this "General" Excavation Work Plan ("EWP") for the BASF Main Plant (OU-1) Parcel (NYSDEC Site No. 4-42-027) of the Closed BASF Rensselaer Facility located in Rensselaer, New York, which is shown on Figures 1 and 2. Remedial Engineering is a New York State professional service corporation organized primarily for the purpose of providing engineering services for clients of Roux Associates, Inc. ("Roux Associates"). Site No. 4-42-027 id defined in the September 2003 Record of Decision ("ROD") issued by the New York State Department of Environmental Conservation ("NYSDEC"). The area subject to this EWP is more fully described in Section 1.2 of the SMP.

1.1 Purpose

The site has been remediated for restricted industrial/commercial use. Any future intrusive work that will penetrate the composite cover system and expose underlying, remaining fill material/ soil will be performed in compliance with this EWP. Any work conducted pursuant to this EWP must also be conducted, at a minimum, in accordance with the following plans:

- Procedures defined in a project-specific Health and Safety Plan ("HASP"). A sample HASP is provided as a guide/ template in Appendix E of the SMP;
- Procedures defined in the general Community Air Monitoring Plan ("CAMP") provided in Appendix F of the SMP;
- Procedures defined in the general Construction Contingency Plan ("CCP") provided in Appendix G of the SMP;
- Procedures defined in the general Quality Assurance Project Plan ("QAPP") provided in Appendix I of the SMP; and
- Procedures defined in a project-specific Soil Erosion and Sedimentation Control ("SESC") Plan, if applicable, that shall be prepared in accordance with the minimum requirements specified in Section 2.11 of this EWP.

The project-specific HASP and SESC Plan and amendments/ revisions to the general CAMP, CCP, and QAPP, if warranted, must be prepared and submitted as part of the notification described in Section 2.0 of this EWP.

The Site owner and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all

intrusive work, the structural integrity of excavations, fluids management, control of runoff from open excavations into remaining contamination, and for structures that may be affected by excavations (such as building foundations and bridge footings). The Site owner will ensure that Site development activities will not interfere with, or otherwise impair or compromise, the engineering controls described in the SMP for the OU-1.

2.0 IMPLEMENTATION OF EXCAVATION WORK PLAN

This section describes, in detail, how this EWP will be implemented.

2.1 Notification

At least 15 days prior to the start of any intrusive work that will penetrate the composite cover system and expose underlying, residual contamination, the site owner, or their representative will notify NYSDEC. Currently, this notification will be made to:

John R. Strang
Regional Hazardous Waste Remediation Engineer
1130 North Westcott Road
Schenectady, New York 12306-2014

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent, plans for site re-grading, intrusive elements or utilities to be installed below the composite cover system, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP (Simple excavations may only require compliance with a portion of the EWP. For example, excavation of a small volume of soil from above the water table that is directly loaded for off-site disposal would not require the stockpiling or fluids management provisions of this EWP);
- A statement that the work will be performed in compliance with this EWP, 29 CFR 1910.120 and applicable local, state and federal requirements;
- A summary of all required local (noise permit), state (water quality permit, SPDES Equivalency Permit, etc…) and federal permits required.
- A copy of the project-specific HASP and SESC Plan, if applicable, in electronic format;
- Amendments/ revisions to the general CAMP, CCP and/ or QAPP, in electronic format;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results and clean fill certifications.

2.2 Soil Screening Methods

Visual, olfactory and instrument-based soil screening will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the Certificate of Completion ("COC").

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing and material that can be returned to the subsurface. It is anticipated that no excavated fill material can be used as cover soil.

2.3 Stockpile Methods

Stockpile staging areas shall be prepared for excavated fill materials and imported off-site fill materials as discussed below.

Soil stockpiles will be encircled with a berm and/or silt fence on the down-gradient side of the stockpile, at a minimum. Hay bales will be used as needed near any catch basins, surface waters and other discharge points in the vicinity of the stockpile staging areas and the Work in general.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be inspected and maintained on a daily basis. Damaged tarp covers will be promptly replaced. An adequate supply of polyethylene sheeting will be available to cover stockpiles and stabilization reagent, if applicable when not being actively managed. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC.

2.3.1 Excavated, Unsaturated Fill Material Stockpiles

All excavated, unsaturated fill materials are required to be stockpiled on 40-mil layer of plastic sheeting or high density polyethylene ("HDPE") geomembrane cushioned above and below with a 10 ounce non-woven geotextile. Approximately 3 inches of dense graded aggregate will be installed over the geomembrane. Each stockpile will be covered with 10-mil polyethylene sheeting and will be appropriately anchored.

Silt fence will be installed around the perimeter of the stockpile staging area to prevent unwarranted contaminant migration from the area.

2.3.2 Excavated, Saturated Fill Material Stockpiles

If excavated, saturated fill material will be excavated as part of the Work, a stockpile staging area will be constructed. The proposed stockpile staging area for excavated fill materials will be constructed so that it is large enough to accommodate anticipated stockpiles as well as stabilization reagent, equipment and operations, if required. Each stockpile, within the staging area, shall not exceed 250 cubic yards in size. The staging area will consist of a non-woven geotextile initially placed on the native subgrade or directly on the composite cover system, overlain with a 12 inch layer of 2 to 3 inch stone. Soil stockpiles will be encircled with a berm and/or silt fence on the down-gradient side of the stockpile, at a minimum. An impermeable geosynthetic liner system consisting of 40 mil "HDPE" geomembrane, cushioned above and below with a 10 ounce non-woven geotextile, will be placed on the floor and down-gradient berm, if applicable.

Approximately 3 inches of dense graded aggregate will be installed over the geosynthetic liner system. A 2 foot berm or concrete barrier will be constructed along the down-gradient sides to prevent decanted water from the stockpiles from migrating to clean areas outside the footprint of the stockpile area. A sump will be constructed on the down-gradient side inside the berms to collect decanted water from the individual stockpile(s). A submersible pump placed in the sump and a corresponding discharge hose will transfer the decanted water to a containment vessel (i.e., frac tank) and shall be managed as discussed in Section 2.8. Silt fence will be installed around the perimeter of the stockpile staging area to prevent unwarranted contaminant migration from the area.

The construction requirements for the excavated, saturated fill material stockpiles can be modified, with the NYSDEC's approval, depending on the actual scope of work to be performed.

2.3.3 Imported Fill Material Stockpiles

All approved off-site fill materials are required to be stockpiled on and covered with a minimum 10-mil layer of plastic sheeting. Covers will be appropriately anchored. Stockpiles will be routinely inspected and broken sheeting covers will be promptly replaced.

2.4 Materials Excavation and Load Out

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under the SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

The qualified environmental professional will be responsible for ensuring that all outbound trucks will be decontaminated at the equipment decontamination pad before leaving the site until the activities performed under this section are complete. Accordingly, an equipment decontamination pad will be constructed, operated, and maintained on-site that will be described in greater detail in the project-specific SESC Plan, if applicable, that would be prepared in accordance with Section 2.11 of this EWP. Equipment decontamination water will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

All equipment that comes into contact with impacted areas will be decontaminated prior to removal from the site.

2.5 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks will be washed prior to leaving the site. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

All trucks loaded with site materials will exit the vicinity of the site using only an approved truck route. The most appropriate route will take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site, to the extent practicable, in order to minimize off-site disturbance. Every effort will be made to eliminate any off-site queuing.

2.6 Materials Disposal Off-Site

All soil/fill/solid waste/hazardous waste excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State, 6NYCRR Part 360 and 364, and Federal regulations. If disposal of soil/fill from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e., hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading, and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2.

Waste characterization sampling shall be performed in accordance with the requirements of each disposal facility as discussed in the QAPP provided in Appendix I of the SMP.

2.7 Materials Re-Use On-Site

All excavated fill materials below the various demarcation layers discussed in Section 1.5.1 of the SMP proposed for on-site use shall be segregated in stockpiles not exceeding 250 cubic yards and in accordance with the requirements of Section 2.3 of this EWP. Sampling of excavated materials for onsite re-use shall be performed as discussed in the QAPP provided in Appendix I of the SMP.

The qualified environmental professional will ensure that procedures defined for materials re-use in this SMP are followed and that unacceptable material does not remain on-site. All excavated fill materials, including historic fill and contaminated soil, removed below existing demarcation layers that are acceptable for re-use on-site will be placed below the final surface of the existing or

modified (as approved by the NYSDEC) composite cover system and will not be re-used within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for re-use on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be re-used on-site.

2.8 Fluids Management

All liquids to be removed from the site, including excavation dewatering and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge, and development fluids may be recharged back to the land surface or subsurface of the site in the event that prior approval is obtained from the NYSDEC Case Manager. If this approval is not obtained, fluids will be managed via off-site disposal.

Discharge of water generated during large-scale construction activities to the wastewater treatment system located at the BASF Main Plant (NYSDEC Site Number 4-42-027) to the east of the Site, if applicable, will be performed under a Site-specific SPDES permit. Discharge of water generated during large-scale construction activities to the Rensselaer County Sewer District, if applicable, will be performed in accordance with the requirements of the Rensselaer County Sewer District (RCSD).

2.9 Composite Cover System Restoration

After the completion of soil removal and any other invasive activities, the composite cover system will be restored in a manner that complies with the requirements of the SMP for OU-1. For all components of the composite cover system, any constructed demarcation layer will be replaced to provide a visual reference to the top of the 'Remaining Contamination Zone', the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in the SMP for the OU-1. If the type of composite cover system changes, with NYSDEC approval, from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the

'Remaining Contamination'. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the SMP.

2.10 Backfill from Off-Site Sources

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in the SMP prior to receipt at the site.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported fill materials proposed for on-site use shall be certified clean from each off-Site source. The clean fill certification shall include information regarding past use of the site, confirmation that the source area background has been checked, and confirmation of its DOT certification, if applicable. Sampling of off-site fill material shall be performed in accordance with the requirements of the QAPP provided in Appendix I of the SMP for the OU-1. Chemical criteria for proposed fill material have been approved by NYSDEC and are listed in Table 3 of the SMP for the OU-1. To qualify for on-site use, all chemicals of concerns detected from for the initial fill material pre-qualification sample and follow-up post-qualification samples shall be below the criteria specified in Table 3 from the SMP. The Engineer, with the concurrence of the NYSDEC, will review results of pre- and post-qualification testing of off-site fill materials and shall be the sole judge as to acceptability of the material.

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

2.11 Stormwater Pollution Prevention

In general, for smaller excavations (i.e., less than 1 acre), procedures for stormwater pollution prevention should, at a minimum, include the following:

- Erosion and sediment control measures discussed herein shall be employed, where applicable, during all remedial and redevelopment construction activities.
- Silt fencing or hay bales will be installed around the entire perimeter of the construction area.
- All erosion and sedimentation controls installed will be inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.
- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.
- All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.
- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.
- Erosion and sediment control measures discussed herein shall be observed to ensure that they are operating correctly, where applicable. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

For larger excavations (active disturbances exceeding 1 acre), a project-specific SESC Plan shall be prepared that will address the following elements, at a minimum:

- A schedule for activities (clearing and grubbing, surveying, earthwork, etc…) during and after remediation will be provided.
- Identify pollutants (i.e., VOCs, lead, etc…) and activities (i.e., earthwork, waste disposal, vehicle traffic, etc…) that could impact stormwater during remediation.
- Identify types of temporary erosion and sediment controls to be used that will provide soil stabilization for disturbed areas and structural controls to divert runoff and remove sediment.

Identify good housekeeping and spill control practices that will be followed during remediation to minimize stormwater contamination from activities that could impact stormwater during remediation including, but not limited to, the following:

— Any petroleum-based substances used onsite will be used/applied according to the manufacturer's recommendation;

— Materials and equipment necessary for spill cleanup will be appropriately stored onsite , covered and secured.

— On-Site vehicles will be monitored for leaks and will receive regular preventive maintenance to reduce the chance of leakage;

— Petroleum products will be stored in tightly sealed containers which are clearly labeled;

— Spill kits will be included with all fueling sources and maintenance activities;

— Spills will be cleaned up immediately upon discovery;

— Dump trucks hauling material from the remediation site will be covered with a tarpaulin;

— Paved streets adjacent to the site entrances will be swept weekly (if needed) during periods of active remediation or more frequently if required to remove excess mud, dirt, or rock tracked from the site;

— Ruts caused by equipment used for clearing will be graded;

— Equipment or vehicle washing, when required, will be performed on an area stabilized with stone;

— Sanitary waste will be collected from portable units at least weekly by a licensed sanitary waste management contractor to avoid overfilling; and

— Waste materials will be collected and stored in a securely covered metal dumpster rented from a licensed solid waste management company. Trash and remediation debris from the site will be deposited in the dumpster. The dumpster will be emptied as required and the trash will be hauled to a solid waste landfill. Remediation materials will not be buried onsite.

Identify types of temporary erosion and sediment controls that will be used during the performance of remedial action or redevelopment including, but not limited to, the following:

— Stabilized construction entrance: The stabilized entrance will be installed adjacent to each staging area to capture mud and debris from vehicles before entering public roads and Site roads outside the remediation limits of disturbance to reduce tracking of sediments and minimize dust. The stabilized entrance will be constructed of stone (two to three inches in diameter), minimum thickness of six inches.

— Staging areas: Constructed as discussed in Section 2.3 of this EWP.

— Perimeter sediment controls: To minimize impacts resulting from remediation activities, a 10-foot buffer will be maintained between soil management areas and the limit of disturbance. Silt fencing and straw wattles will be installed before the start of earth disturbing activities in each work area. The perimeter controls will be removed should conflicts arise during remediation due to the location of the controls, or when measures become ineffective. Sediment that accumulates to one-third of the height of the silt fence will be removed and fabric that is torn or bulging will be replaced.

— Stormwater Bypass: A temporary stormwater bypass will be installed to convey surface water and stormwater runoff around the excavation areas.

- Identify types of permanent erosion and sediment controls (seeding, paving, stone placement, etc…) that will be used during the performance of remedial action. These stabilization measures will be initiated as soon as practicable in portions of the Site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the Site has temporarily or permanently ceased.

- Identify dust control measures as discussed in Section 2.15 of this EWP.

- Identify practices for management of construction water as discussed in Section 2.8 of this EWP.

- Identify required inspection activities: Inspections of cleared and graded areas on the site, and of structural Stormwater Management Practices ("SMPs"), will be performed weekly and within 24 hours after rainfalls of at least 0.5 inches. The inspection will verify that the structural SMPs are in good condition and are minimizing erosion. The inspection will also verify that the procedures used to prevent stormwater contamination from impacted materials are effective.

- Identify maintenance practices to maintain erosion and sediment controls including, but not limited to, the following:

  — Built-up sediment will be removed from silt fencing when it has reached one-third the height of the barrier/fence and fabric will be replaced when bulges develop;

  — Straw hay bales will be repaired or replaced promptly as needed;

  — Temporarily seeded areas will be reseeded, when needed;

  — Access roads and stabilized construction entrances will be stabilized by topping with aggregate as necessary and as remediation proceeds; and

  — Sediment that is washed or tracked to public rights-of-way will be removed immediately.

- Identify roles and responsibilities for inspecting and maintaining erosion and sediment controls.
- Identify requirements for modifying the NYSDEC-approved SESC Plan.

2.12 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product released will also be reported to the NYSDEC spills hotline. These findings will be also included in the periodic Review reports prepared pursuant to Section 5 of the SMP.

The general CCP is provided in Appendix G to the SMP. The CCP should be modified, if warranted, based on the project-specific scope of work to be performed.

2.13 Community Air Monitoring Plan

A generic Community Air Monitoring Plan is provided in Appendix F of the SMP.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

2.14 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's Qualified Professional, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

2.15 Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production, to the extent practicable.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

2.16 Other Nuisances

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX E

Consultant's Health and Safety Plan for OU1

Site-Specific Health and Safety Plan

Former BASF Manufacturing Plant
36 Riverside Avenue
Rensselaer, New York

November 19, 2019

Prepared for:

BASF Corporation
100 Park Avenue
Florham Park, New Jersey 07932

Prepared by:

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Site-Specific Emergency Information

Emergency Phone Numbers

Most emergency services can be obtained by calling 911. Where 911 service is not available, use the telephone numbers provided in the below table. The following is a master emergency phone list for use by the project management personnel. A more condensed version of the emergency numbers listed below will be posted throughout project work areas. Emergencies encountered on the site will be responded to by a combination of off-site emergency services and site personnel.

Emergency Contact Information			
Site Personnel			
Title	Contact		Telephone
Project Manager (PM)	Allen Fok		(631) 232-2600
Project Principal (PP)	Nathan Epler		(631) 630-2374
Site Supervisor (SS)	Wayne St. Clair		(518) 465-6534
Site Health and Site Safety Officer (SHSO)	Wayne St. Clair		(518) 465-6534
Office Health and Safety Manager (OHSM)	Levi Curnutte		(631) 630-2371
Corporate Health and Safety Manager (CHSM)	Brian Hobbs		(631) 630-2419
Client Emergency Contact	Wayne St. Clair		(518) 465-6534
Outside Assistance			
Agency	Contact	Telephone	Address/Location
Ambulance/emergency medical services (EMS)	Rensselaer Police (dispatches)	911	
Police	Rensselaer Police	**911** **(518) 462-7451**	201 Broadway, Rensselaer, NY 12144
Fire	Rensselaer Fire Department	(518) 465-3243	959 Broadway, Rensselaer, NY 12144

Directions to Albany Medical Center Emergency Room (See Figure 1):

- Head north on American Oil Road/Irwin Stewart Port Expy/Riverside Ave for 1.4 miles
- Continue onto South Street for 0.1 miles
- Turn left toward Columbia Street
- Turn right onto Columbia Street, continue for 0.5 miles
- Continue onto Dunn Memorial Bridge for 0.6 miles
- Use the left two lanes to continue onto Highway 20 W/Dunn Memorial Bridge
- Keep left to continue onto South Mall Arterial for 1 mile

- Turn right, continue for 0.2 miles
- Turn right onto Madison Ave, continue for 0.9 miles
- Turn left onto Robin Street
- Continue straight for 344 feet
- Turn right to arrive at Albany Medical Center Emergency Room

Directions to Albany Med EmUrgent Care (See Figure 1):

- Head north on American Oil Road/Irwin Stewart Port Expressway/Riverside Ave for 1.4 miles.
- Continue onto South Street
- turn left toward Columbia Street
- Turn right onto Columbia Street and continue for 0.5 miles onto Dunn Memorial Bridge
- Use the right lane to take the ramp to Troy. Merge onto I-787 N and continue for 0.9 miles
- Use the right two lanes to take exit 5 to merge onto I-90 toward Buffalo. Continue for 5.2 miles
- Keep left to stay on I-90 West. Continue for 1.3 miles
- Take exit 1S toward US-20/Western Ave and merge onto Adirondack Northway/Fuller Road Alt for 0.8 miles
- Use the right 2 lanes to turn right onto Highway 20 West/Western Ave (signs for Duanesburg). Continue for 2.3 miles
- Turn right, continue for 128 feet
- Turn left. Continue for 371 feet
- Arrive at Albany EmUrgent Care

1. Introduction

This Site-specific Health and Safety Plan (HASP) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) for use during the post-remediation Site monitoring, inspections, maintenance, and sampling at the BASF Corporation Facility, ("the Site"), located at 170 Riverside Avenue, Florham Park, New Jersey (see Figure 1). These activities fall within the scope of operations covered by the Occupational Safety and Health Administration (OSHA) standards promulgated at 29 CFR 1910.120 and 29 CFR 1926.65, both commonly referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. In accordance with the HAZWOPER Standard, this Site-specific HASP was prepared to address the safety and health hazards associated with the monitoring and maintenance activities being performed at the Site by Roux and to provide requirements and procedures for the protection of Roux employees, subcontractor personnel, government oversight personnel, Site personnel, and the general public. It also addresses client- and Site-specific requirements for health and safety.

Implementation of this HASP is the joint responsibility of the Project Manager (PM), the Site Health and Safety Officer (SHSO), and all field staff, with assistance from the Project Principal (PP), Office Health and Safety Manager (OHSM), and Corporate Health and Safety Manager (CHSM). The PM for this project is Allen Fok. The Site Supervisor (SS) is Wayne St. Claire and Site Health and Safety Officer (SHSO) is Wayne St. Claire.

This HASP will be introduced to, reviewed, and signed off on by all personnel through a formal training session prior to commencing work. A copy of the HASP will be kept at the Site at all times. The Roux SHSO or PM will be responsible for posting any changes, amendments, memos, etc. to the HASP. Any revisions to this HASP will be signed by appropriate personnel, which can include Roux's PP, CHSM, and SS. Any changes will be announced to all workers at the next safety meeting.

1.1 Roles and Responsibilities

Overall Roles and Responsibilities (R&Rs) of Roux personnel are provided in Roux's Policies and Procedures Manual. Only those R&Rs specific to HASP requirements are listed below.

Project Manager (PM)

The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Health and Safety Officer (SHSO), has the authority to oversee and monitor the performance of the SHSO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

- preparing and coordinating the Site work plan;
- providing Site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SSHO;
- ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC);
- serving as primary Site liaison with public agencies and officials and Site contractors.

Site Health and Safety Officer (SHSO)

The SHSO has full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO is on Site or readily accessible to the Site during all work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SHSO include:

- managing the safety and health functions on this Site;
- serving as the Site's point of contact for safety and health matters;
- ensuring Site monitoring, worker training, and effective selection and use of PPE;
- assessing Site conditions for unsafe acts and conditions and providing corrective action;
- assisting the preparation and review of this HASP;
- maintaining effective safety and health records as described in this HASP; and
- coordinating with the Site Supervisor(s) and others as necessary for safety and health efforts.

Site Supervisor

The Site Supervisor is responsible for field operations. The Site Supervisor ensures the implementation of the HASP requirements and procedures in the field. The specific responsibilities of the Site Supervisor include:

- executing the work plan and schedule as detailed by the PM;
- coordination with the SHSO on safety and health; and
- ensuring Site work compliance with the requirements of this HASP.

Employees

All Roux employees are responsible for reading and following all provisions of the Corporate Health and Safety Manual, including this HASP. Employees report to the SS at the project Site. Each employee is also responsible for the following:

- wearing all appropriate PPE as outlined within this HASP;
- attending all safety meetings;
- inspecting tools and equipment prior to use, and taking any defective tools or equipment out of service;
- appropriately documenting field events as they occur within a logbook or equivalent;
- properly operating machinery and/or equipment only if trained to do so;
- stopping work operations if unsafe conditions exist;
- identifying and mitigating hazards when observed;
- reporting all incidents and near misses to the Roux SHSO and SS immediately; and
- knowing where emergency equipment is located (e.g. first aid kit, fire extinguisher).

Subcontractors and Visitors

Subcontractors and visitors are responsible for complying with the same health and safety requirements. It is the responsibility of all to make sure subcontractors and visitors comply and uphold the HASP. Subcontractors and visitors have the following additional responsibilities:

- designating a qualified safety representative for the project that can make the necessary changes in work practices, as necessary;

- attending all safety meetings while participating in Roux Site work activities;
- reporting all incidents and near misses to Roux SHSO and SS immediately;
- conducting initial and periodic equipment inspections in accordance with manufacturer and regulatory guidelines; and
- providing copies of all Safety Data Sheets (SDS) to Roux SHSO for materials brought to the Site.

2. Background

The BASF Corporation Rensselaer facility is in an industrial area of Rensselaer, Rensselaer County, New York. The facility consists of an approximately 80-acre parcel of land that is separated into three areas commonly referred to as the Main Plant (including the wastewater treatment lagoons), South 40, and Closed Landfill. Each one of these three areas are listed separately in the NYSDEC Registry of Inactive Hazardous Waste Disposal Sites.

Relevant background information is provided below, including a general description of the Site; a brief review of the Site's history with respect to hazardous material use, handling, and/or storage; and a review of known and potential releases of hazardous substances at the Site.

2.1 Site Description

The Main Plant includes the lagoon area and is 35 acres in size. The Main Plant and lagoon area is zoned heavy industrial and is located next to the Hudson River. The Main Plant is bordered by Albany Molecular (formerly Sterling Organics) to the north, by a Coastal power plant to the south-west, by the Closed Landfill and South 40 to the southeast, by railroad tracks to the east, and the Hudson River to the west (See figure 1).

The Closed Landfill lies south of the Main Plant (with an active chemical manufacturing facility (Albany Molecular [Sterling Site NYSDEC Site Number 4-42-009]) and residential areas beyond. A steep slope immediately to the east of the Site rises to the Port of Rensselaer Access Highway. This roadway was constructed in the 1990s and crosses over three sets of railroad tracks immediately to the northeast of the Site. A portion of the Port of Rensselaer Access Highway was constructed over approximately 2.5 acres of the historical Landfill footprint. To the south of the Site is one set of railroad tracks and the Empire Generating Co, LLC power plant. The BASF Main Plant parking lot is located to the west with Riverside Avenue, the Lagoon area, and the Hudson River beyond.

South 40 is located south of the Main Plant. The South 40 parcel covers approximately 35 acres. The parcel was bisected into two areas by the construction of the Port of Rensselaer Access Highway in 1992. The northern portion of the parcel is 26.19 acres in size and lies to the north of the Port of Rensselaer Access Highway. The 8.8-acre portion of the parcel located to the South of the Port of Rensselaer Access Highway is isolated from the remainder of the parcel and has not been historically impacted by disposal activities. As such, that portion of the parcel was not subject to remediation.

2.2 Site History

The area that became the Closed Landfill was previously owned by multiple corporate entities and was under United States government control during World War I and II. Applications to construct and operate a solid waste facility were submitted by GAF Corporation to the NYSDEC in February 1978. The waste stream indicated for this facility included non-toxic industrial wastes such as spent iron reduction cakes, diatomaceous earth, activated carbon, tonsil clay (that included trace amounts of chlorobenzene and Azo Phloxine [CAS# 3734-67-6]), "Nuchar" (wood-based activated carbon), broken laboratory glassware, used empty containers, demolition and construction debris, waste metal drums, waste fiber drums, polyethylene liners, lead sulfate, chromium hydroxide, zinc, zinc oxide, slurry with intermediate samples, waste laboratory solvents, dye samples, in-process samples, product samples, and discarded reagents in small quantities.

In April 1978, BASF acquired the Rensselaer facility from GAF Corporation. BASF immediately discontinued use of the Landfill and removed a large number of steel drums stored in the area for reclamation or scrap. Following BASF's acquisition of the facility, the NYSDEC listed the Landfill in the NYSDEC Registry of Inactive Hazardous Waste Disposal Sites as a Class 2 site. This prompted BASF to initiate several investigations of the Site that resulted in the placement of a soil cap in 1982 and installation of a groundwater pump and treat system. The NYSDEC reclassified the Landfill as a Class 4 site in 1983.

In January 2001, BASF closed its manufacturing facility. In 2001, following initial remedial investigation activities beneath the Main Plant portion of the Rensselaer facility, the NYSDEC requested that the Landfill be re-investigated for potential source areas of groundwater contamination observed beneath the Main Plant.

In 2002, BASF entered into the VCP for the investigation and remediation of the Closed Landfill. Since then, BASF has performed four phases of investigation of fill and groundwater quality in the Landfill.

2.3 Known and Potential Releases of Hazardous Substances at the Site

This site history is characterized by heavy industrial use. Volatile organics, metals, and poly-chlorinated biphenyls (PCBs) have been historically present in the surrounding sediment that has since been dredged. Soil and groundwater contamination originated from numerous sources including four tanks that stored chlorobenzene. The closed landfill housed a variety of nontoxic wastes and has since been capped.

3. Scope of Work

The Scope of Work includes the following activities:

- Post Remediation Groundwater Monitoring
- Post Remediation Inspections and Reporting
  - Closed landfill cap inspections and annual certification
  - Ecology Preserve (Closed landfill) Monitoring
    - Assessment of plant health and maintenance needs
    - Tree inspection
    - Pollinator survey, incidental wildlife observations, bird survey

If there are any changes with the scope a revision of the HASP will be required to address any new hazards.

4. Site Control

This Site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the Site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the Site, and to deter vandalism and theft.

4.1 Site Map

A map of this Site, showing Site boundaries, designated work zones, and points of entry and exit is provided in Figures 1 and 2 of the SMP.

4.2 Site Access

Access to the Site is restricted to reduce the potential for exposure to its safety and health hazards. During hours of Site operation, Site entry and exit is authorized only at the points identified by the BASF Corporation Rensselear Facility's SHSO.

4.3 Buddy System

This section is not applicable for all components of the SOW described in Section 3. Some Site inspections, like well sampling and gauging, are completed by a single Roux employee. However, when completing these tasks, the single Roux employee is accompanied either by Roux subcontractors or the Site caretaker/other representatives from BASF Corporation Rensselear Facility. Any time Roux is on-site, BASF Corporation Rensselear Facility is made aware and communications with BASF and the Roux PM is maintained via cellular phone."

While working in the Exclusion Zone, Site workers use the buddy system. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- Remaining in close visual contact with partner;
- Providing partner with assistance as needed or requested;
- Observing partner for signs of heat stress or other difficulties;
- Periodically checking the integrity of partner's PPE; and
- Notifying the Site manager or other Site personnel if emergency assistance is needed.

4.4 Site Communications

The following communication equipment is used to support on-site communication:

- Telephones- cellular telephones will be available for communication with emergency support services/facilities. Each field person is equipped with a cellular telephone and is available for communication with emergency support services.

A current list of emergency contact numbers is posted in the ecology preserve building onsite.

As applicable, hand signals will be used according to the following:

Hand Signals

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm alright, okay
Thumbs down	No, negative

4.5 Site Work Zones

The SOW does not require the implementation of work zones; however, should the need arise, this section provides details for the proper execution of work zones at this Site

This Site is divided into three (3) major zones, described below. These zones are characterized by the presence or absence of biological, chemical, or physical hazards and the activities performed within them. Zone boundaries are clearly marked at all times and the flow of personnel among the zones is controlled. The Site is monitored for changing conditions that may warrant adjustment of zone boundaries. Zone boundaries are adjusted as necessary to protect personnel and clean areas. Whenever boundaries are adjusted, zone markings are also changed and workers are immediately notified of the change.

Exclusion Zone

The area where contamination exists is the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be delineated by orange high visibility fencing. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SHSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker)
- Required minimum level PPE
- Medical Authorization
- Training certification
- Requirement to be in the zone

Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) is established between the exclusion zone and the support zone. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination of personnel and equipment. The CRZ will be used for general Site entry and egress in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker)

- Appropriate PPE
- Medical authorization
- Training certification
- Requirement to be in the zone

Support Zone

The Support Zone (SZ) is an uncontaminated area that will be the field support area for the Site operations. The SZ will contain the project trailers and provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

5. Job Hazard Evaluation

Roux's work at the Site is expected to entail a variety of physical, chemical, and biological hazards, all of which must be sufficiently managed to allow the work to be performed safely. Some of the hazards are Site-specific, i.e., they are associated with the nature, physical characteristics, and/or routine operation of the Site itself, while others are activity-specific, i.e., they are associated with (or arise from) the particular activity being performed. The various hazards can be grouped into the following categories:

Caught/Crushed – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.

Contact – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.

Energy Sources – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).

Ergonomics – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration.

Exposure – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including but not limited to temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).

Falls – the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others.

The foregoing is intended to provide Roux employees with a general awareness of the hazards involved with Site work. A more detailed review of the potential hazards associated with each specific activity planned for the Site (or ongoing activity, as the case may be) is provided in the activity-specific Job Safety Analysis (JSA) forms in Appendix A. As can be seen in the JSA forms, the hazards are identified by category per the above, and specific measures designed to mitigate/manage those hazards are also identified. In preparing the JSA forms, all categories of hazards were considered, and all anticipated potential hazards were identified to the extent possible based on the experience of the personnel preparing and reviewing the JSA forms. However, there is always the possibility for an unanticipated hazard to arise, potentially as condition change over the course of the workday. Roux personnel must maintain a continual awareness of potential hazards in the work zone, regardless of whether the hazard is identified in the JSA form. Particular attention should be paid to hazards associated with exposure to hazardous substances (see Table 1 for a listing of the hazardous substances most likely to be encountered in environmental media at the Site) and to Site personnel being located "in the line of fire" with respect to moving equipment, pinch points, and latent energy, e.g., being located or having body parts located within the swing radius of an excavator, between two sections of pipe being connected, below a piece of suspended equipment, or adjacent to a compressed air line.

5.1 Hazard Communication and Overall Site Information Program

The information in the JSAs and safety data sheets is made available to all employees and subcontractors who could be affected by it prior to the time they begin their work activities. Modifications to JSAs are communicated during routine pre-work briefings.

The information in the JSAs and Safety Data Sheets (SDSs) is made available to all employees and subcontractors who could be affected by an exposure to the hazards covered in them prior to the time they begin their work activities. Modifications to JSAs are communicated during routine pre-work briefings, and periodically updated as needed in the HASP. SDSs will be maintained by the SHSO/SS for new chemicals brought on-site as needed.

6. Emergency Response Plan

This emergency response plan details actions to be taken in the event of Site emergencies. The PM and SHSO is responsible for the implementation of emergency response procedures onsite. The SHSO/PM provides specific direction for emergency action based upon information available regarding the incident and response capabilities and initiates emergency procedures and notification of appropriate authorities. In the event of an emergency, Site personnel are evacuated and do not participate in emergency response activities, response is facilitated through external emergency services.

6.1 Emergency Response

The SHSO, after investigating the incident and relevant information, shall determine the level of response required for containment, rescue and medical care. Limited on-site emergency response activities could occur therefore the SHSO is responsible for notifying external emergency response agencies. The SHSO provides relevant information to the responding organizations, including but not limited to the hazards associated with the emergency incident, potential containment problems, and missing Site personnel.

6.2 Emergency Alerting and Evacuation

If evacuation notice is given, Site workers leave the worksite, if possible, by way of the nearest exit. The routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by SHSO/PM.

Personnel exiting the Site gather at a designated assembly point. To determine that everyone has successfully exited the Site, personnel will be accounted for at the assembly Site. If any worker cannot be accounted for, notification is given to so that appropriate action can be initiated. Subcontractors on this Site have coordinated their emergency response plans to ensure that these plans are compatible and potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

6.3 Emergency Medical Treatment and First Aid

In the event of a work-related injury or illness, employees are required to follow the procedures outlined below. All work-place injury and illness situations require Roux's Project and Corporate Management Team to be notified when an injury/illness incident occurs, and communication with the contracted Occupational Health Care Management Provider, AllOne Health (AOH), is initiated. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included within Roux's Corporate Health and Safety Manual.

If on-site personnel require any medical treatment, the following steps will be taken:

a. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, AOH, immediately following the notifications provided above.

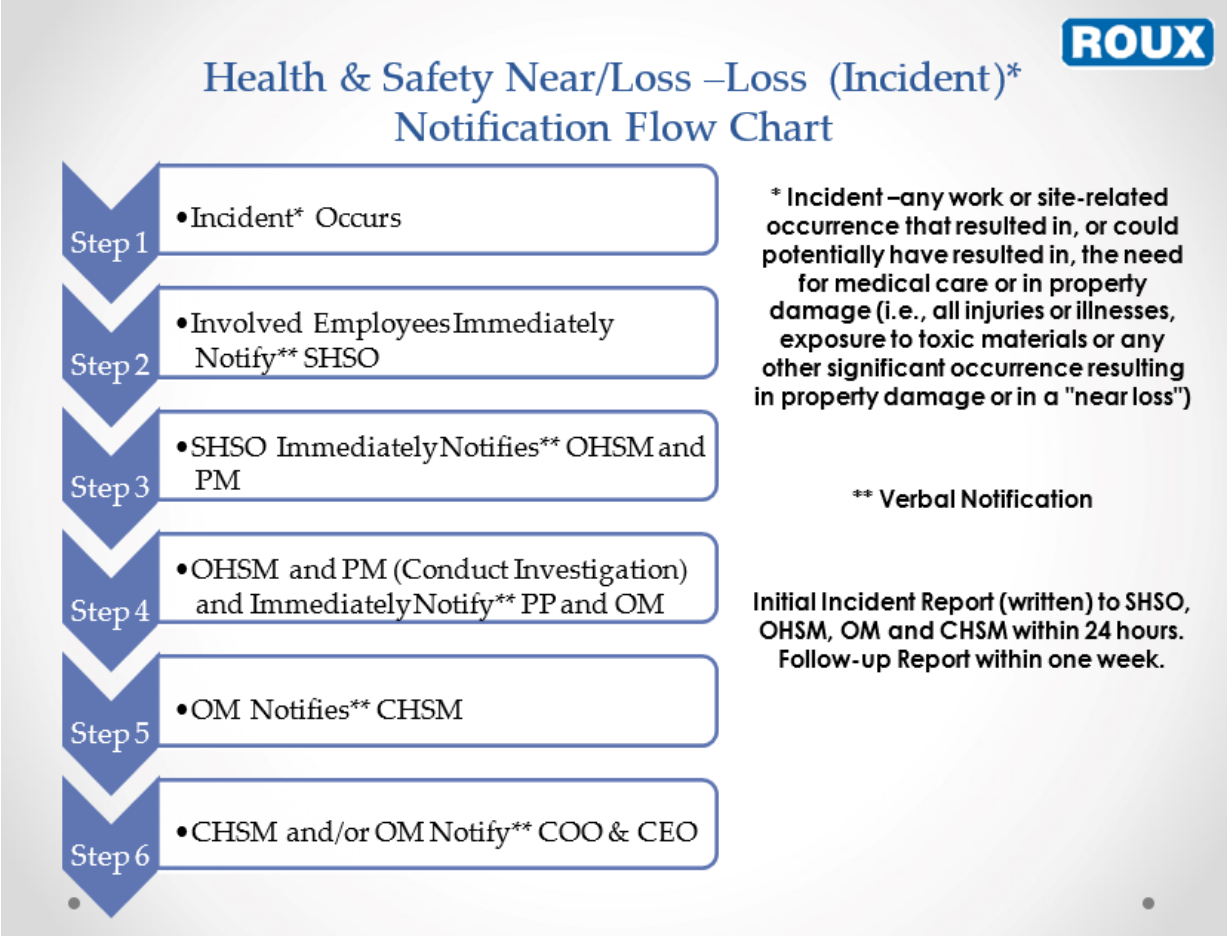
b. Based on discussions with the Project Team, Corporate Management and the AOH evaluation, if medical attention beyond onsite First Aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate

Management Team. An Urgent Care/Hospital Route map with location to Med EmUrgent Care / Albany Medical Center is included as **Figure 1**.

c. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.

d. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).

e. The SHSO and Project Manager will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the Acord Automobile Loss Notice.



6.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project principal will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related conditions.

- Limited visibility.
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

6.5 Electrical Storm Guidelines

In the event that lightning and/or thunder are observed while working onsite, all onsite activities shall stop and personnel shall seek proper shelter (e.g., substantial building, enclosed vehicle, etc.). Work shall not resume until the threat of lighting has subsided and no lightning or thunder has been observed for 30 minutes. If the possibility of lightning is forecast for the day, advise the onsite personnel on the risks and proper procedure at the pre-work safety briefing. Continuously monitor for changing weather conditions and allow enough time to properly stop work if lightning is forecast.

7. Safety Procedures

This section of the HASP presents the specific safety procedures to be implemented during Roux's activities at the Site in order to protect the health and safety of various on-site personnel. Minimum OSHA-mandated procedures are presented first, followed by client- and Site-specific procedures. Lastly, activity-specific procedures are discussed. These Site and activity-specific procedures supplement the general safety procedures included in Roux's Corporate Health and Safety Manual, which also must be followed in their entirely.

7.1 Training

At a minimum, Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety-trained prior to performing work onsite per OSHA 29 CFR 1910.120(e) and 29 CFR 1926.65(e). More specifically, all Roux, subcontractor, and other personnel engaged in sampling and remedial activities at the Site and who are exposed or potentially exposed to hazardous substances, health hazards, or safety hazards must have received at a minimum the 40 hour initial HAZWOPER training consistent with the requirements of 29CFR 1910.120(e)(3)(i) training and a minimum of 3 days' actual field experience under the direct supervision of a trained experienced supervisor, plus 8 hours of refresher training on an annual basis. Depending on tasks performed, less training may be permitted. Evidence of such training must be maintained at the Site at all times. Furthermore, all onsite management and supervisory personnel directly responsible for or who supervise the employees engaged in Site remedial operations, must have received an additional 8 hours of specialized training at the time of job assignment on topics including, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques, plus 8 hours of refresher training on an annual basis.

Roux personnel training records are maintained in a corporate database with records available upon request from either the OHSM/SHSO/CHSM or Human Resources Department.

7.2 Site-Specific Safety Briefings for Visitors

A site-specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

7.3 HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided a site-specific tailgate briefing prior to the commencement of work to ensure that employees are familiar with this HASP and the information and requirements it contains as well as relevant JSAs. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing site characterization and analysis. Conditions for which we schedule additional briefings include, but are not limited to: changes in site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during site work.

7.4 Medical Surveillance

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this site. Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA permissible exposure limits or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by site hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in Section 4 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f) as applicable.

7.4.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the site characterization and job hazard analysis documented in Section 4 and JSAs within Appendix A of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this site. The medical surveillance program provides that:

1. Workers assigned to tasks requiring the use of respirators receive medical examinations in accordance with 29 CFR 1910.134(e) to ensure they are physically capable to perform the work and use the equipment, and
2. If a worker is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substance or health hazards, medical examinations are provided to that worker as soon as possible after the occurrence and as required by the attending physician.
3. These medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided to workers free of cost, without loss of pay, and at a reasonable time and place. In addition, the need to implement a more comprehensive medical surveillance program will be re-evaluated after any apparent over-exposure.

7.4.2 Medical Recordkeeping Procedures

Medical recordkeeping procedures are consistent with the requirements of 29 CFR 1910.1020 and are described in the company's overall safety and health program. A copy of that program is available at our Islandia, New York office.

The following items are maintained in worker medical records:

- Respirator fit test and selection
- Physician's medical opinion of fitness for duty (pre-placement, periodic, termination)
- Physician's medical opinion of fitness for respirator protection (pre-placement, periodic)
- Exposure monitoring results

7.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The Corporate Health and Safety Manager in coordination with the Human Resources Director is responsible for this review. At minimum, this review consists of:

- Review of accident and injury records and medical records to determine whether the causes of accidents and illness were promptly investigated and whether corrective measures were taken wherever possible;
- Evaluation of the appropriateness of required medical tests based on site exposures; and
- Review of emergency treatment procedures and emergency contacts list to ensure they were site-specific, effective, and current.

7.5 Personnel Protection

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices and PPE are used to protect employees. Appropriate personal protective equipment (PPE) shall be worn by Site personnel when there is a potential exposure to chemical hazards or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity and noise), as determined by the SHSO. The level of personal protection, type and kind of equipment selected will depend on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors will be made before work can be safely executed.

Roux maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. Roux's PPE program can be found within Appendix C. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General/Construction Industry) standards for minimum PPE requirements.

The minimum level of PPE for entry onto the Site is Level D. If evaluation of COCs or other physical hazards are present which require an upgrade in PPE please consult with the OHSM & CHSM on how to address. The following equipment shall be worn:

- Work uniform (long pants, sleeved shirt)
- Hard hat
- Steel or composite toe work boots
- Safety Glasses (must comply with one of the following ANSI/ISEA Z87.1-2010, ANSI Z87.1-2003, ANSI Z87.1-2003)
- Boot Covers (as needed)
- Hearing Protection (as needed)
- High visibility clothing (shirt/vest)
- Hand Protection (e.g., minimum cut resistance meeting ANSI 105-2000 Level 2)

Note that jewelry shall be removed or appropriately secured to prevent it from becoming caught in rotating equipment or unexpectedly snagged on a fixed object. (e.g., wrist watches bracelets, rings, chains and necklaces, open earrings). Do not wear loose clothing and all shoulder length hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within Appendix A, and any upgrades or downgrades of the level of protection (i.e., not specified in the JSA) must be approved by the PP and immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations.

7.5.1 Hearing Conservation

Hearing protection is made available when noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 dBA. Hearing protection is required when the 8-hour time weighted average sound level $\geq$ 90 dBA. Where noise exposure meets or exceeds this level, noise is listed as a physical hazard in the JSA for the tasks/operation, and hearing protection is included as one of the control measures (PPE).

7.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel, and the surrounding area. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of Site work including, but not limited to, monitoring wind direction (e.g. wind socks) and approximate temperature during all invasive Site activities. This survey will be conducted with the appropriate pre-calibrated air monitoring instrument(s), as warranted by the field activity. Once this survey has been complete, any changes in the type of PPE will be determined and relayed to those working on-Site.

Work zone air monitoring will be performed to verify that the proper level of PPE is used, and to determine if increased protection or work stoppage is required. The following equipment shall be used to monitor conditions:

- A Photoionization Detector (PID) with a lamp energy of 10.6 eV will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate. Concentrations shall be recorded during intrusive activities with the potential to encounter contaminant vapors.

Personal exposure monitoring utilizing activated charcoal tubes may be considered based on whether or not the area sample results are at or above half of the PEL. The decision to perform the monitoring will be made by, and under the control of, the CHSM.

Below are monitoring action levels for Site-specific chemicals of concern. In the event that PID readings above the thresholds identified below are sustained for 5 minutes in the breathing zone, worker protection will require upgrading following notification to the OHSM and applicable parties (e.g., client, board of health, regulators, etc.).

7.6.1 Action Levels for Air Monitoring

PPE can remain at Level D if breathing zone VOC concentrations are less than 5 ppm and benzene is non-detect. Personnel are required to evacuate the Site when breathing zone VOC readings exceed 25 ppm.

The following tables include summaries of the air monitoring, work practices, and action levels for the expected contaminants. The action levels to initiate testing with colorimetric tubes for airborne volatiles is 1 ppm (PID reading) and is based on the Permissible Exposure Limit (PEL) for benzene (1 ppm). The colorimetric tubes are used to confirm the presence or absence of specific constituents, and they do not provide a measured concentration.

Air Monitoring Summary and Action Levels Organic Vapors	
PID Reading in Breathing Zone (ppm)[1]	**Action**
0-1 ppm above background[2]	Continue monitoring
1-5 ppm sustained 60 seconds	Continue monitoring, if applicable initiate additional collection of benzene using colorimetric tubes.
<5 ppm and no presence of benzene	Continue Monitoring, ventilate space
≥ 5 ppm - ≤ 25 ppm and no presence of benzene	Ventilate space until PID reads < 5 ppm. If < 25 ppm cannot be achieved, upgrade to Level C[3].
≥ 25 ppm	Ventilate space and evacuate area.

1 Based on relative response/sensitivity of PID to benzene.

2 Background concentrations should be established at the beginning of each work day. It may be necessary to re-establish background concentrations and ambient conditions vary through the day.

3 Measured air concentrations of known organic vapors will be reduced by the respirator to one half of the PEL or lower, and the individual and combined compound concentrations shall be within the service limit of the respirator cartridge.

7.6.2 Air Monitoring Equipment and Calibration

A PID calibrated to an appropriate calibration mixture will be used to detect organic vapors in and around the work areas. Monitoring will be conducted in and around all work areas and at the workers breathing zone before activities commence to establish a background level, then at 15-minute intervals throughout the day. All equipment will be calibrated according to the manufacturer's recommendation. A calibration log will be maintained and will include the name of the person who performed the calibration, the date and time calibrated, and the instrument reading at the time of calibration. A manual bellows pump or equivalent with colorimetric tubes for formaldehyde will be utilized to determine the course of action related to upgrading or downgrading the level of respiratory protection, as applicable.

If air monitoring data indicate safe levels of potentially harmful constituents at consistent intervals (5-minute intervals), then monitoring can be conducted less frequently (every 30 minutes). This determination will be made by the onsite SHSO. Monitoring data, including background readings and calibration records, will be documented. Work to be performed on-Site will conform to Roux Associates' Standard Operating Procedures (SOPs). Conformance with these guidelines as well as the guidelines described in this HASP will aid in mitigating the physical and chemical hazards mentioned throughout this HASP.

7.7 Tailgate Safety Meetings

A designated Site worker will provide daily safety briefings (e.g., tailgate meetings) including, but not limited to, the following scenarios:

- When new operations are to be conducted;
- Whenever changes in work practices must be implemented; and
- When new conditions are identified and/or information becomes available.

Daily safety briefings shall be recorded on the Roux Daily Tailgate Health and Safety Meeting Log/Daily Site Safety Checklist, and all completed forms will become a part of the project file.

7.8 Spill Containment

Spill containment equipment and procedures should, at a minimum, meet the requirements of the facility's Spill Prevention, Control and Countermeasure Plan, if applicable. Otherwise, spill containment equipment and procedures must be considered depending on the task including, but no limited to, chemical/product transfer points and handling.

7.8.1 Initial Spill Notification and Response

Any worker who discovers a hazardous substance spill will immediately notify the Project Manager. The worker will, to his/her best ability, report the hazardous substance involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, and any associated injuries without compromising their own safety.

7.8.2 Spill Evaluation and Response

Project Manager, is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area will be isolated and demarcated to the extent possible. If necessary to protect nearby community members, notification of the appropriate authorities is made by the PM as appropriate. On-site response is limited to small spills (e.g., <10 gallons), large spills require external emergency responders who will be contacted by the SHSO.

7.9 Decontamination

The decontamination section of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This section also describes how residual waste from decontamination processes is disposed. The site decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants to clean areas of the site and off-site. They also extend the useful life of PPE by reducing the amount of time that contaminants contact and can permeate PPE surfaces. Decontamination is facilitated within the contamination reduction zone at this site.

7.9.1 Decontamination Procedures for Personnel and PPE

The following are general decontamination procedures established and implemented at this site.

1. Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the Support Zone only after undergoing the decontamination procedures described below in the next section.
2. Protective clothing is decontaminated, cleaned, laundered, maintained and/or replaced as needed to ensure its effectiveness.
3. PPE used at this site that requires maintenance or parts replacement is decontaminated prior to repairs or
4. PPE used at this site is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.

5. This site uses an off-site laundry for decontamination of PPE. The site has informed that facility of the hazards associated with contaminated PPE from this site.
6. The site requires and trains workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.
7. Procedures for disposal of decontamination waste meet applicable local, State, and Federal regulations.

7.9.2 Decontamination Procedures for Equipment

All tools, equipment, and machinery from the Exclusion Zone or CRZ are decontaminated in the CRZ prior to removal to the Support Zone. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure and to avoid cross-contamination and chemical incompatibilities.

General Equipment Decontamination Procedures:

1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the Support Zone only after undergoing the equipment decontamination procedures.
2. Vehicles that travel regularly between the contaminated and clean areas of the site are carefully decontaminated each time they exit the Exclusion Zone and the effectiveness of that decontamination is monitored to reduce the likelihood that contamination will be spread to other parts of the site.
3. Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.

The following items may be used to decontaminate equipment:

- Fresh water rinse;
- Non-phosphorus detergent wash;
- Distilled water rinse;
- Acetone rinse;
- Distilled water rinse; and
- A steam cleaner or pressure washer (heavy equipment only).

7.9.3 Monitoring the Effectiveness of Decontamination Procedures

Visual examination and sampling are used to evaluate the effectiveness of decontamination procedures. Visual examination is used to ensure that procedures are implemented as described and that they appear to control the spread of contaminants under changing site conditions. Visual examination is also used to inspect for signs of residual contamination or for contaminant permeation of PPE.

Personnel who work in contaminated areas of the site, either the Contamination Reduction Zone (CRZ) or the Exclusion Zone, are trained in the principles and practices of decontamination described in this section of the HASP and in related SOPs. If site procedures are changed as a result of inspection and monitoring, all affected employees are notified of these changes.

7.10 Confined Space Entry

There will be no confined space entry performed at the Site.

The following is a list of the safety requirements for confined space entry at the Site:

- **ROUX PERSONNEL ARE NOT AUTHORIZED TO ENTER AN OSHA PERMIT REQUIRED CONFINED SPACE;**
- Currently the scope of work **DOES NOT** require personnel to enter permitted confined space for this project; and
- Any changes to the field activities that may necessitate confined space entry will be reported to the Project Principal and OHSM.

Confined space is defined as any space, depression, or enclosure that:

- Has limited opening for entry and egress;
- Is large enough for and employee to enter and perform assigned work; and
- Is not intended for continuous occupancy.

A permit required confined space is one that meets the definition of a confined space and has one or more of the following characteristics:

- May contain or produce life-threatening atmospheres due to oxygen deficiency the presence of toxic, flammable, or corrosive contaminants;
- Contains a material that has the potential for engulfment;
- Has an internal configuration that may cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; and
- Contains any other serious safety or health hazards.

Although Roux personnel will not perform confined space entry, it is expected that subcontractors performing cleaning and mitigation and/or remedial measures activities may be required to enter structures that are considered to be a permit required confined space. Permitting of the confined space as well as hazard mitigation for entry will be completed by the subcontractor in accordance with 1910.146.

7.11 Client and Site-Specific

In addition to the OSHA-specific procedures discussed above, there may be client and site-specific safety procedures that must be adhered to during the performance of remedial activities at the Site.

7.12 Unusual or Significant Risks

Field activities that appear to have unusual or significant risks that cannot be adequately managed with existing risk tools such as LPS, HASPs, traffic safety plans, work permits, design and O&M practices, equipment HAZOPS or other safety tools must be referred to the CHSM to help with the assessment and management of the associated potential safety risks. Examples include the use of explosives for demolition, use of firearms to control wildlife, rappelling, demolition over water, etc.

7.13 Activity-Specific

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. An activity-specific JSA has been completed for each of the activities planned for the Site. JSAs are provided in Appendix A. In the event that new work activities or tasks are

planned, JSAs will be developed and implemented prior to performing the new activities. In the absence of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical SPSAs will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform SPSAs prior to and during the work.

7.13.1 Electrical and Other Utility Assessment and Accommodations

Roux shall perform a site walk to identify any potential overhead electrical or utility lines. All applicable guidelines will be followed in the vicinity of overhead power and utility lines (see Section 7.13.3 below).

Roux has also reviewed all available Site maps showing buried utility lines to identify potential hazards, which revealed that no underground hazards are known to exist in the vicinity of the areas of the Site pertinent to this HASP.

7.13.2 Subsurface Work

Subsurface work activities will require adherence to Roux's Corporate Subsurface Utility Clearance Management program found within Appendix C.

7.13.3 Heavy Equipment

Use of heavy equipment at the Site will require adherence to Roux's Corporate Heavy Equipment Exclusion Zone Management Program found within Appendix D. Additionally, operation of the drill rig/other heavy equipment will maintain clearances from overhead power lines in accordance with OSHA 29 CFR1926.1408 Table A Minimum Clearance Distances provided below.

Minimum Required Clearances for Energized Overhead Power Lines

Nominal System Voltage of Power Line (K V)	Minimum Required Clearance (feet)
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

1 kilovolt (KV) = 1,000 volts

7.14 Heat Stress

The National Oceanic and Atmospheric Administration records average minimum/maximum temperatures of 14 - 80 degrees Fahrenheit during the year in the area surrounding Troy, New York.

7.14.1 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment in hot weather environments. Heat cramps are brought on by prolonged

exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat stress are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion, often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment includes, but is not limited to, shade, rest, and fluid replacement. Typically, the individual should recover within one-half hour while being monitored constantly. If the individual has not improved substantially within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention.

7.14.2 Heat Exhaustion

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin to rid the body of excess heat through transference. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes, but is not limited to, cooling the victim, elevating the feet, and replacing fluids.

If the individual is not substantially improved within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention.

7.14.3 Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a MEDICAL EMERGENCY requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot red skin;
- Body temperature approaching or above 105 degrees F;
- Confusion, altered mental state, slurred speech;
- Seizures;
- Large (dilated) pupils; and
- Loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility. Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable) that prevents evaporative cooling is worn in hot weather environments.

7.15 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 60°F. A work/rest regimen will be initiated when ambient temperatures and protective clothing cause a stressful situation. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. The signs and symptoms of cold stress include the following:

- Severe shivering;
- Abnormal behavior;
- Slowing;
- Weakness;
- Stumbling or repeated falling;
- Inability to walk;
- Collapse; and/or
- Unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks and encourage activity such as walking, wrapped in a blanket.

8. Field Team Review

Each person performing work at or visiting this site shall sign this section after site-specific training is completed and before being permitted to access the CRZ or Exclusion Zone.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Project: BASF Rensselaer

Name & Company	Signature	Date

9. Approvals

By their signature, the undersigned certify that this HASP is approved and will be utilized at BASF Corporation Rensselaer Facility.

Wayne St. Clair – Site Health and Safety Officer	Date
Levi Curnutte - Office Health and Safety Manager (for high risk projects: Brian Hobbs, CIH, CSP – Corporate Health and Safety Manager must review)	Date
Allen Fok – Project Manager	Date
Nathan Epler – Project Principal	Date

TABLE

Toxicological Properties of Hazardous Substances Present at the Site

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Arsenic (As)	7440-38-2	0.01 mg/m^3	(ND)	10 µg/m^3	Dermal; inhalation; ingestion	Sensory irritant Lung & Skin Cancer Aplastic anemia Numbness	skin eyes lungs blood peripheral nervous system	Silver gray - tin white BP: sublimes
Benzene	71-43-2	1.6 mg/m^3 0.5 ppm	Ca (ND)	1 ppm	Dermal; inhalation ingestion	CNS depression Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid (solid below 42°F BP: 80.093°C flammable LEL: 1.4% UEL: 8.0%
Cadmium (Dust)	7440-43-9	0.01 mg/m^3	9 mg/m^3	0.005 mg/m^3	Inhalation; ingestion	Sensory irritant Lung injury Kidney disease Cancer	skin eyes kidneys bone	Silver-white/blue tinged BP: 1409°F Noncombustible
Chromium (VI)	7440-47-3	0.05 mg/m^3	(ND)	None	Dermal; inhalation; ingestion	Nasal and lung tumors Sensory irritant	lungs eyes skin	Red, rhombic crystals
Copper (dusts and mists as Cu)	7440-50-8	1 mg/m^3	100 mg/m^3	1 mg/m^3	Dermal; inhalation; ingestion	Sensory irritant GI irritation CNS depressant	skin eyes GI tract CNS	Reddish metal BP: 4730°F Powdered form may ignite
1,2-Dichloroethane (Ethylene dichloride)	107-06-2	40 mg/m^3 10 ppm	Ca (ND)	4.0 mg/m^3 1 ppm	Dermal; ingestion; inhalation	CNS depressant Liver neurosis Kidney damage Dermatitis	CNS liver kidneys skin	Colorless liquid BP: 83.5° LEL: 6.2% UEL: 15.9%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Ethylbenzene	100-41-4	434 mg/m^3 100 ppm	800 ppm (10% LEL)	435 mg/m^3 100 ppm	Dermal; inhalation; ingestion	Sensory irritant CNS depressant Narcosis Hematological disorders	eyes skin CNS respiratory system blood	Liquid aromatic odor BP: 277°F Fl.P: 59°F LEL: 1.2% UEL: 7.0%
Lead (as Pb)	7439-92-1	0.05 mg/m^3	100 mg/m^3	<0.1 mg/m^3	Dermal; inhalation ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP: 3164°F
Mercury vapor	7439-97-6	0.025	28 mg/m^3	0.05 (skin)	Dermal; inhalation; ingestion	Tremor Insomnia Chest pain GI disturbance Eye irritant Skin irritant	skin resp system CNS kidneys eyes	Silver, white, odorless liquid BP = 674°F
Nickel	7440-02-0	1.5 mg/m^3	Ca 10 mg/m^3	0.015 mg/m^3	Dermal; inhalation; ingestion	Pulmonary fibrosis Lung cancer Sinus cancer Sensory irritant GI irritation	lungs skin eyes GI tract	Silver-white metal BP: 2730°
Toluene	108-88-3	75 mg/m^3 20 ppm	500 ppm	200 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP: 110.4°C flammable LEL: 1.2% UEL: 7.1%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

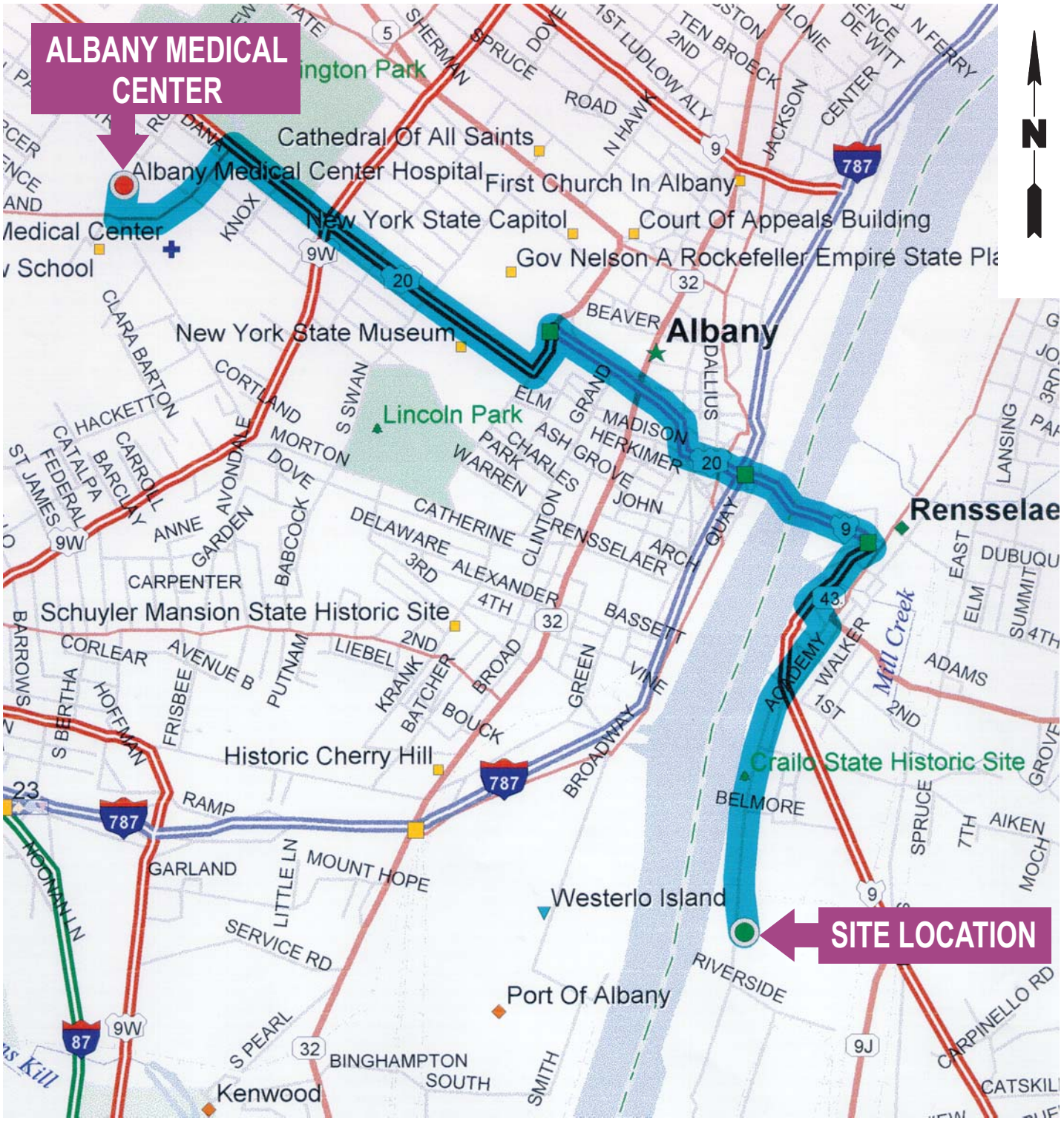
Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Xylene(s)	1330-20-7	434 mg/m^3 100 ppm	900 ppm	435 mg/m^3 100 ppm	Dermal; inhalation; ingestion	Sensory irritant Blood dyscrasia Bronchitis CNS depression	CNS eyes skin GI tract blood liver kidneys	Liquid Aromatic odor BP: 138.5° flammable LEL: 1.1% UEL: 7.0%
Zinc Oxide (dust)	7440-66-6	2 mg/m^3	None	10 5 resp.	Dermal; inhalation; ingestion	Skin irritant Cough	skin lungs	Bluish-white metallic element BP: 908°

Notes:
Ca – Carcinogen
TLV – Threshold Limit Value (ACGIH)
IDLH – Immediately Dangerous to Life and Health (OSHA)
PEL – Permissive Exposure Level (OSHA)
PPM – Parts per million
mg/m^3 – milligrams per cubic meter
Fl. Pt. – Flash point
LEL – Lower Explosive Level
UEL – Upper Explosive Level
BP – Boiling Point
NA – Not Available
ND – Not Determined

References:
Guide to Occupational Exposure Values, 2010. American Conference of Governmental Industrial Hygienists.
Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.
Occupational Safety and Health Administration, 1993. General Industry Air Contaminant Standard (2a CFR 1910.1000).
Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
Sax, N.I. and R.J. Lewis, 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
U.S. Department of Health and Human Services, 1997. NIOSH Pocket Guide to Chemical Hazards.

FIGURE

Routes to Urgent Care and Hospital



DIRECTIONS TO HOSPITAL

1. EXIT FACILITY AND HEAD NORTH ON RIVERSIDE AVENUE.
2. TURN LEFT ONTO ROUTE 20 AND CROSS DUNN MEMORIAL BRIDGE. STAY ON ROUTE 20.
3. TURN LEFT ONTO NEW SCOTLAND AVENUE. FOLLOW SIGNS TO EMERGENCY ROOM.

Title:

HOSPITAL ROUTE MAP

HEALTH AND SAFETY PLA
RENSSELAER, NEW YORK

Prepared for:

BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: M.R.	Date: 14FEB17
Prepared by: J.A.D.	Scale: AS SHOWN
Project Mgr.: M.R.	Project No.: 0251.0011Y052
File: 0251.0011Y558.01.CDR	

FIGURE 1

V:\CAD\PROJECTS\0251\Y0011Y\558\0251.0011Y558.01.CDR

APPENDICES

A. Job Safety Analysis (JSA) Forms
B. Personal Protective Equipment (PPE) Management Program
C. Subsurface Utility Clearance Management Program
D. Heavy Equipment Exclusion Zone Policy

APPENDIX A

Job Safety Analysis (JSA) Forms

JOB SAFETY ANALYSIS	Ctrl. No. GEN-007	DATE 8/6/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**General Site Activity**	**Driving**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Valerie Sabatasso	Staff Scientist	Brian Hobbs	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT: when outside vehicle ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES:when outside vehicle	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION ☒ SAFETY TOE BOOTS: when outside vehicle	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: high visibility vest, when outside vehicle	☒ GLOVES: Leather/ cut-resistant level 2 ☐ OTHER _____

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Motor Vehicle (i.e. car, truck, SUV)

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE: A 10' minimum exclusion zone will be maintained around motor vehicles when operating.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Driving to/leaving Site	**1a. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc. *Common factors that may lead to CONTACT incident, but not limited to: • distracted driving (cell phone, GPS, radio, billboards, "rubber necking") • lack of situational awareness • unfamiliarity with traffic patterns/road layout • weather conditions (wet/icy roads, hydroplaning, black ice) • weariness • high speeds • obstructed vision (solar glare, debris on windshield, blind spots) • changes in travel pathway (construction, snow banks, non-operational signals, potholes, detours, special events) • improper vehicle maintenance (non-operational signal light, worn tires, cracked windshield, ineffective wipers) • loose or unsecure objects	1a. PLAN AHEAD – review/make yourself familiar with maps and driving directions before beginning the drive to the Site. Do not attempt to drive and review maps/directions at the same time. Pull over and stop your vehicle before looking at maps/directions. 1a. Complete a basic vehicle inspection before driving. Verify Inspection and Registration are current, tires and wipers are in good condition, all lights are functional, all glass/mirrors are undamaged, the horn is functional, roof/hood/trunk are free from accumulated snow and visibility is not impaired due to snow/ice/frost/fog on windows. 1a. Do not hang items in car that can obstruct your view or become projectiles in a collision. 1a. Do not get distracted using touch screen radios or GPS units built into newer models. Keep your eyes on the road and stay alert. 1a. Follow posted speed limits and obey traffic signals and roadway signs. 1a. Always wear your seat belt and shoulder harness when driving. 1a. When driving around large vehicles and trucks, maintain extra space as these vehicles may not be able to see a smaller car too close. 1a. Follow the "Rules of the Road" including: using your turn signals, coming to a complete stop, and allowing vehicles the right of way (yield) when they are when traffic laws require. 1a. Apply the Smith Five Keys® of safe driving • Aim High in Steering® - Expand eye lead time to a minimum of 15 seconds • Get the Big Picture® - Maintain proper a 4 second minimum following distance at all times - Scan mirrors every 5-8 seconds to achieve a circle of awareness - Position your vehicle so you can see relevant/non-relevant objects • Keep Your Eyes Moving® - Try to maintain about 180 degrees of visibility - Avoid blank and fixed stares. Avoid focusing on one object for more than 2 seconds • Leave Yourself an Out® - Avoid traveling in traffic clusters - Surround yourself with space - Anticipate the actions of others

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Driving to/leaving Site (cont'd)	**1a. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc.	• Make Sure They See You® - Maintain eye contact with on-coming vehicles/pedestrians - Use warning devices (e.g., hand signals, high-lights, horns etc.) - Proper timing is essential 1a. Do not perform reconnaissance or inspections while driving. Your vehicle should be parked in a safe location when viewing or surveying the Site and vicinity 1a. Avoid sudden turns and stops. Don't drive recklessly – be in control of vehicle at all times. 1a. In inclement weather, first determine if work can be POSTPONED. Otherwise, plan according to weather conditions including checking forecast along entirety of travel route (especially, for long distances). Reduce speed as road conditions warrant. Travelling with winter car equipment, in the winter, is strongly recommended (i.e., shovel, scraper, brush, blanket, extra clothing, flashlight, bag of sand). If your vehicle has 4-wheel drive, review to operators manual and understand operating procedure prior to engaging 4-wheel drive. If at any point on your drive weather becomes too severe to proceed safely pull over if safe to do so or seek nearest cover (e.g., overpass) 1a. If feeling drowsy or sleepy, do not drive. Pull over in a safe place to rest if you experience any signs of drowsiness. Make sure to get adequate sleep the night before an early drive. 1a. Never operate a vehicle under the influence of alcohol or illegal substances or medications affecting your performance. 1a. Keep your eyes on the road. Do not call or talk on cellular phones. Pull over to a safe location if you must answer or make a call. (Legal requirement in: CA, CT, DE, D.C., HI, IL, LA*, MD, NV, NH*, NJ, NM, NY, OK*, OR, TX*, VT, WA, WV as of 01/20/15; per www.IIHS.org) * = Applicable to some drivers, situations or to be implemented in 2015 1a. When parking, pull-through when possible. If backing is required visually inspect area to ensure it is free from obstructions prior to backing in and relying solely on mirrors; use spotters when available.
2. Entering/Exiting Vehicle.	**2a. CAUGHT:** Personal injury (broken fingers/hand) while entering or exiting vehicles **2b. FALL:** Personal injury (twisted ankle, deep contusion, concussion, broken wrist/arm, etc.) from slip/fall on uneven or unstable or slippery surface while exiting/entering vehicle **2c. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc.	2a. Open and close doors slowly. Never put hands or feet in between door and vehicle to avoid pinch points. 2b. When exiting the vehicle make sure your feet are on firm footing and weight is evenly distributed before exiting/standing. In inclement weather use hands to support yourself, by holding the car door and/or steering wheel, when exiting the vehicle. 2c. Check both directions for traffic before opening door. Do not exit vehicle if traffic does not permit you to exit safely 2c. Check anticipated path of door prior to opening, do not open door into any obstructions (e.g., bollards, high curbing)

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-010	DATE 11/19/2019	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**Surveying**	**Elevation Surveying**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Mark M Emmons	Project Engineer	Brian Hobbs	Corporate Health & Safety Manager
Bjorn Wespestad	Senior Engineer		
William Hansen	Senior Engineer		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant or leather
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☒ OTHER: Long sleeve Shirt
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel-toe boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Surveying equipment (i.e., leveling rod/measuring ruler, tripod and autolevel).

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with Site manager/ property owner.	**1a. CONTACT/EXPOSURE/FALL:** Lack of communication could result in H&S incident.	1a. Inform Site personnel of work scope, timeline and location(s). 1a. Inquire about other activities taking place at the Site. 1a. If applicable, obtain General Work permit for the day.
2. Locate surveying position for instrument and rod and set-up work area	**2a. FALL:** Slip/trip hazards	2a. Inspect area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.) and obstructions prior to setting up at the survey location. Keep eyes engaged with walking surface while in movement. Remember "Walking is Working." 2a. Conduct housekeeping and maintain clear paths to walk in and remove debris as required.
	2b. CONTACT: Traffic (surveying locations could potentially be in parking areas and sidewalks)	2b. Be aware of oncoming traffic. Utilize a flagman / spotter for locations in streets or high-traffic areas. 2b. Place 42 inch cones around the work area and delineate work zone with caution tape, snow fencing or safety bars, if necessary. 2b. Wear appropriate PPE including long sleeve high visibility clothing and or reflective safety vest. 2b. Face traffic, maintain eye contact with oncoming vehicles and establish a safe exit route.
	2c. OVEREXERTION: Hazard due to carrying, lifting, and bending while transporting equipment	2c. Use proper body positioning and lifting techniques; keep back straight, lift with legs, keep load close to body, and never reach with a load. 2c. Avoid carrying too much equipment at one time and team-lift equipment that is more than 50 lb.
	2d. CAUGHT/CONTACT: Pinch Points / sharp edges associated with setting up the tripod	2d. Wear cut resistant gloves when handling the tripod and keep fingers away from pinch points located near moving parts of the tripod. Don't carry tripod by the pointed ends.
	2e. OVEREXERTION: Hazard due to bending awkwardly to look through the autolevel	2e. When practical, set the height of the autolevel optic as to minimize bending at the waist.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Open / close manhole cover to well that is being surveyed (if necessary).	**3a. OVEREXERTION:** Muscle strain	3a. See 1c. Bend knees when reaching to open well. Use manhole lifting hook or pry bar to avoid bending.
	3b. CAUGHT: Pinch points associated with removing / replacing manholes and working with hand tools	3b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 3b. Use proper tools (ratchet and crowbar or pry bar for well cover) and inspect before use. 3b. Do not put fingers under well cover.
	3c. EXPOSURE: To potentially hazardous vapors To biological hazards	3c. No open flames/heat sources. 3c. To minimize exposure to vapors, allow well to vent after opening it and before survey activities begin. 3c. Work on the upwind side of manhole/well. 3.c Use caution while opening lids to inspect work area for bees and insects inside of covers. 3c. Use insect/tick repellent as necessary.
	3d. CONTACT: With traffic	3d. See 2b.
4. Perform survey.	**4a. FALL:** Slip/trip hazards	4a. See 2a.
	4b. CONTACT: Traffic (surveying locations could be potentially located in parking areas and sidewalks)	4b. See 2b. 4b. Personnel using the scope will be devoting most of their attention to the surveying activity and shall be aware of vehicular and pedestrian traffic. Personnel holding the measuring stick should be extra vigilant of survey personnel and communicate any potential hazards to the instrument person via handheld radio or similar means. Ensure reflective safety vest is worn.
	4c. ENERGY SOURCES: Electrical shock from survey rod striking overhead electric lines or lights	4c. Prior to raising and extending the survey rod, personnel should thoroughly inspect the area above the measuring point. If overhead electrical lines are encountered within 20 feet of the measuring point; stop work and consult with the office health and safety officer.
5. Break down work area.	**5a. CONTACT:** Traffic (surveying locations can potentially be in parking areas and sidewalks)	5a. See 2b.
	5b. EXERTION: Hazard due to carrying, lifting, and bending while transporting equipment	5b. See 2c.
	5c. CONTACT: Personal injury or equipment damage by striking surroundings with an extended rod or unsecured tripod leg	5c. Ensure rod is entirely collapsed prior to mobilization / demobilization between survey points. 5c. Ensure tripod legs are fully collapsed and secured with strap prior to mobilization / demobilization between set-ups.

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[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-019	DATE: 8/6/2018	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Site Recon**	**Site Walk and Inspection**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Sara Barrientos	Staff Geologist	Brian Hobbs	Corporate Health and Safety Manager
		Joe Duminuco	Vice President

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: ear plugs as necessary ☒ SAFETY SHOES: Steel or composite toed	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: High-visibility vest or high-vis outerwear	☒ GLOVES: Leather/cut-resistant/chemical resistant ☒ OTHER: Tyvek and rubber boots as necessary, dust mask as necessary

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Site map, emergency contact list, documentation of urgent care/hospital routes and / or guide familiar with Site, operating cell phone or walkie-talkie if Site allows.

Commitment to Safety – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE (EZ): A minimum 10' exclusion zone will be maintained around equipment.

SITE SECURITY: Prior to site inspection verify appropriate method to address Site Security concerns as it relates to potential criminal activity, homeless population, and/or isolation concerns. Work with the Project Principal and/or Project Manager to address appropriately.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with Site contact.	**1a. CONTACT/EXPOSURE/FALL:** Personal injury caused by lack of site specific hazards.	1a. Inquire about hazards and other activities taking place at the Site. 1a. Inform Site contact of work scope, timeline and location(s). 1a. Discuss emergency evacuation procedures and muster points with Site contact.
2. Traversing the Site	**2a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles or unauthorized personnel at remote Sites.	2a. All equipment must be stowed and secured prior to moving. 2a. Maintain speed limit as posted on-site. 2a. When possible drive on established roadways. 2a. Yield to all pedestrians. 2a. Use pull-through spots or back into parking spots. 2a. Don high visibility clothing/safety vest. If working at remote Site, add orange accessories during hunting season.
	2b. FALL: Uneven terrain and weather conditions. Overgrown shrubs and vines. Equipment in the work zone.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 2b. When possible, use established pathways and walk on stable, secure ground. 2b. Communicate traversing hazards with others.
	2c. OVEREXERTION: Muscle strain while carrying equipment.	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment.
	2d. EXPOSURE: Biological hazards – ticks; bees/wasps; poison ivy; insects; (Ticks are most active any time the temperature is above freezing, typically from March to November.)	2d. Inspect area to avoid contact with biological hazards. 2d. Ticks: • Treat outer clothing including pants, shirts, socks, boots and hats the evening before with Permethrin (allowing at least two hours before use). • Apply DEET to exposed skin before travelling to the Site and reapply after two hours. • Check for ticks during and after work. 2d. Bees: • Use bee spray as appropriate to deter/eliminate bees. • Protect exposed skin with insect repellent. 2d. Poison Ivy:

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

	2e. EXPOSURE: Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	• Identify areas of poison ivy and spray with weed killer. Don Tyvek and rubber boots while traversing poison ivy areas. • If skin contacts poison ivy, wash skin thoroughly with soap and water. 2e. Wear sunscreen with SPF 15 or greater on exposed skin whenever 30 minutes or more of sun exposure is expected. 2e. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 2e. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 2e. Wear appropriate rain gear as needed. 2e. Take frequent breaks if tired, wet, or cold/hot. Drink water. 2e. If lightning is observed, wait 30 minutes after last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
3. Walking near heavy equipment and machinery.	**3a. CONTACT:** Personal injury from Site and roadway traffic. Personal injury from flying debris **3b. OVEREXERTION:** Personal injury from lifting/moving/rotating equipment. **3c. EXPOSURE:** Hearing damage from noise generating equipment/processes. Inhalation/exposure to hazardous vapors and or dust. **3d. EXPOSURE:** Working in a remote area.	3a. See 2a. 3a. Maintain an exclusion zone of at least 10'-25' feet from all engaged equipment. 3a. Keep body parts out of the line of fire of pinch points. 3a. Wear appropriate PPE always. 3b. See 2c. 3c. Wear hearing protection if >85 dBA. (i.e. noise levels which require you to raise your voice to communicate) 3c. Always wear leather gloves when handling any tools or equipment. 3c. Always wear appropriate PPE based off chemicals present. 3d. Use the "buddy system" whenever possible. If working alone, contact PM upon arrival/departure, as well as during work activities prior to commencing work if applicable. 3d. Always carry a communication (i.e., cell phone, walkie-talkie) or directional (i.e., map, compass, etc.) device when traversing remote areas.
4. Working in adverse weather conditions.	**4a. EXPOSURE:** Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	4a. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 4a. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 4a. Wear appropriate rain gear as needed. 4a. Take frequent breaks if tired, wet, or cold/hot. Drink water. 4a. If lightning is observed, wait 30 minutes after last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
5. Departing Site.	**5a. EXPOSURE:** Exposure to unnecessary hazards should personnel believe Roux is on-Site during an emergency and conduct a search.	5a. Sign out or notify Site contact and Roux Project Manager of your departure.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

APPENDIX B

Personal Protective Equipment (PPE) Management Program

PERSONAL PROTECTIVE EQUIPMENT MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/19**
REVISION NUMBER	:	**4**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program to establish guidelines for the selection of personal protective equipment (PPE) for use by Roux personnel performing field activities in hazardous environments. PPE is not meant to be a substitute for engineering, work practice, and/or administrative controls, but PPE should be used in conjunction with these controls to protect the employees in the work place. Clothing, body coverings, and other accessories designed to prevent worker exposure to workplace hazards are all types of PPE. To ensure adequate PPE employee-owned PPE is evaluated on a case-by-case basis to insure its adequacy, maintenance and sanitation.

2. SCOPE AND APPLICABILITY

These guidelines apply to all PPE selection decisions to be made in implementing the Roux program. The foundations for this program are the numerous Occupational Health and Safety Administration (OSHA) standards related to PPE cited in 29 CFR 1910 Subpart I, 29 CFR 1926 Subpart E, and the hazardous environment work employee protection requirements under the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and 1926.65. To ensure hazard assessments are documented the levels of protection, types of protection and tasks requiring protection are covered in site-specific Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs).

3. PROCEDURES

Due to the varied nature of site activities and the different potential hazards associated with different sites, several aspects must be considered when selecting PPE. The following text describes PPE selection logic and provides guidelines and requirements for the appropriate selection and use of PPE.

3.1 Introduction

To harm the body, chemicals must first gain entrance. The intact skin and the respiratory tract are usually the first body tissues attacked by chemical contaminants. These tissues provide barriers to some chemicals but in many cases, are damaged themselves or are highly permeable by certain chemical compounds. Personal protective equipment therefore is used to minimize or eliminate chemical compounds coming into contact with these first barrier tissues.

The proper selection of equipment is important in preventing exposures. The PM making the selection will have to take several factors into consideration. The level of protection, type and kind of equipment selected depends on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

3.2 Types of PPE

The type and selection of PPE must meet certain general criteria and requirements as required under OSHA 29 CFR 1910.132 and 1926.95. In addition to these general requirements, specific requirements and specifications exist for some types of PPE that form the basis of the protective clothing scheme. Following is a list of the common types of specific PPE and the specific requirements for the PPE type, where applicable:

1. Hard Hats - Regulated by 29 CFR 1910.135 and 1926.100; and, specified in ANSI Z89.1.

2. Face Shields and Safety Glasses - Regulated by 29 CFR 1910.133 and 1926.102; and, specified in ANSI Z87.1.
3. Respiratory Protection - Regulated by 29 CFR 1910.134 and 1926.103.
4. Hand Protection - Not specifically regulated.
5. Foot Protection - Regulated by 29 CFR 1910.136 and 1926.96; and, specified in ANSI Z41.1.
6. Protective Clothing (e.g., fully encapsulated suits, aprons) - Not specifically regulated.

3.3 Protective Clothing Selection Criteria

3.3.1 Chemicals Present

The most important factor in selecting PPE is the determination of what chemicals the employee may be exposed to. On field investigations, the number of chemicals may range from a few to several hundred. The exact chemicals or group of chemicals present at the site (certain groups tend to require similar protection) can be determined by collecting and analyzing samples of the air, soil, water, or other site media. When data are lacking, research into the materials used or stored at the site can be used to infer chemicals possibly on the site.

Once the known or suspected chemicals have been identified, and taking into consideration the type of work to be performed, the most appropriate clothing shall be selected.

Protective garments are made of several different substances for protection against specific chemicals. There is no universal protective material. All will decompose, be permeated by, or otherwise fail to protect under given circumstances. Fortunately, most manufacturers make guides to the use of their products (i.e., Dupont's Tyvek™ Permeation Guide). These guides are usually for gloves and coveralls and typically provide information regarding chemical degradation rates (failure of the material to maintain structural integrity when in contact with the chemical), and may provide information on the permeation rate (whether or not the material allows the chemical to pass through). When permeation tables are available, they shall be used in conjunction with degradation tables to determine the most appropriate protective material.

During most site work, chemicals are usually in mixed combinations and the protective materials are not in continuous contact with pure chemicals for long periods of time; therefore, the selected material may be adequate for the particular chemical and type of work being performed, yet not the "best" protecting material for all site chemicals and activities. Selection shall depend upon the most hazardous chemicals based on their hazards and concentrations. Sometimes layering, using several different layers of protective materials, affords the best protection.

3.3.2 Concentration of the Chemical(s)

One of the major criteria for selecting protective material is the concentration of the chemical(s) in air, liquid, and/or solid state. Airborne and liquid chemical concentrations should be compared to the OSHA standards and/or American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines to determine the level of skin or other absorptive surface (e.g., eyes) protection needed. While these standards are not designed specifically for skin exposed directly to the liquid, they may provide skin designations indicative of chemicals known to have significant skin or dermal absorption effects. For example, airborne levels of PCB on-site may be

low because it is not very volatile, so the inhalation hazard may be minimal; however, PCB-containing liquid coming in direct contact with the skin may cause overexposure. Thus, PCB has been assigned a skin designation in both the OSHA and ACGIH exposure limit tables.

3.3.3 Physical State

The characteristics of a chemical may range from nontoxic to extremely toxic depending on its physical state. Inorganic lead in soil would not be considered toxic to site personnel, unless it became airborne, since it is generally not absorbed through the intact skin. Organic lead in a liquid could be readily absorbed. Soil is frequently contaminated with hazardous materials. Concentrations will vary from a few parts per million to nearly one hundred percent. The degree of hazard is dependent on the type of soil and concentration of the chemical. Generally speaking, "dry" soils do not cause a hazard to site personnel if they take minimal precautions such as wearing some type of lightweight gloves.

3.3.4 Length of Exposure

The length of time a material is exposed to a chemical increases the probability of breakthrough. Determinations of actual breakthrough times for short-term exposures indicate that several different materials can be used which would be considered inadequate under long-term exposures. It should be kept in mind that during testing, a pure (100% composition) liquid is usually placed in direct contact with the material producing a worst-case situation.

3.3.5 Abrasion

When selecting protective clothing, the job the employee is engaged in must be taken into consideration. Persons moving drums or performing other manual tasks may require added protection for their hands, lower chest and thighs. The use of leather gloves and a heavy apron over the other normal protective clothing will help prevent damage to the normal PPE and thus reduce worker exposures.

3.3.6 Dexterity

Although protection from skin and inhalation hazards is the primary concern when selecting PPE, the ability to perform the assigned task must be maintained. For example, personnel cannot be expected to perform work that requires fine dexterity if they must wear a thick glove. Therefore, the PPE selection process must consider the task being performed and provide PPE alternatives or techniques that allow dexterity to be maintained while still protecting the worker (e.g., wearing tight latex gloves over more bulky hand protection to increase dexterity).

3.3.7 Ability to Decontaminate

If disposable clothing cannot be used, the ability to decontaminate the materials selected must be taken into consideration. Once a chemical contacts the material, it must be cleaned before it can be reused. If the chemical has completely permeated the material, it is unlikely that the clothing can be adequately decontaminated and the material should be discarded.

3.3.8 Climactic Conditions

The human body works best with few restraints from clothing. Protective clothing adds a burden by adding weight and restricting movement as well as preventing the natural cooling process. In severe situations, a modified work program must be used.

Some materials act differently when they are very hot and very cold. For example, PVC becomes almost brittle in very cold temperatures. If there are any questions about the stability of the protective materials under different conditions, the manufacturer should be contacted.

3.3.9 Work Load

Like climactic conditions, the type of work activity may affect work duration and the ability or personnel to perform certain tasks. Similarly, the amount of protective materials a person wears will affect their ability to perform certain tasks. For example, a person in a total encapsulating suit, even at 72 ^{o}F, cannot work for more than a short period of time without requiring a break.

The work schedule should be adjusted to maintain the health of the employees. Special consideration should be given to the selection of clothing that both protects and adds the least burden when personnel are required to perform strenuous tasks. Excessive bodily stress frequently represents the most significant hazard encountered during field work.

3.4 Types of Protective Materials

1. Cellulose or Paper
2. Natural and Synthetic Fibers
    a. Tyvek™
    b. Nomex™
3. Elastomers
    a. Polyethylene
    b. Saran
    c. Polyvinyl Chloride (PVC)
    d. Neoprene
    e. Butyl Rubber
    f. Viton

3.5 Protection Levels

3.5.1 Level A Protection

Level A protection (a fully encapsulated suit) is used when skin hazards exist or when there is no known data that positively rule out skin and other absorption hazards. Since Level A protection is extremely physiologically and psychologically stressful, the decision to use this protection must be carefully considered. At no time will Level A work be performed without the consent of the OM. The following conditions suggest a need for Level A protection:

- confined facilities where probability of skin contact is high;
- sites containing known skin hazards;
- sites with no established history to rule out skin and other absorption hazards;
- atmosphere immediately dangerous to life and health (IDLH) through the skin absorption route;
- site exhibiting signs of acute mammalian toxicity (e.g., dead animals, illnesses associated with past entry into site by humans);

- sites at which sealed drums of unknown materials must be opened;
- total atmospheric readings on the Photoionization Detector (PID), Flame Ionization Detector (FID), and similar instruments indicate 500 to 1,000 ppm of unidentified substances; and
- extremely hazardous substances (e.g., cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, suspected carcinogens and infectious substances) are known or suspected to be present and skin contact is possible.

The following items constitute Level A protection:

- open circuit, pressure-demand self-contained breathing apparatus (SCBA);
- totally encapsulated suit;
- gloves, inner (surgical type);
- gloves, outer;
- chemical protective;
- boots, chemical protective, steel toe and shank;
- radiation detector (if applicable); and
- communications.

3.5.2 Level B Protection

Level B protection is utilized when the highest level of respiratory protection is needed but hazardous material exposure to the few unprotected areas of the body is unlikely.

The following conditions suggest a need for Level B protection:

- the type and atmospheric concentration of toxic substances have been identified and they require the highest level of respiratory protection;
- IDLH atmospheres where the substance or concentration in the air does not present a severe skin hazard;
- the type and concentrations of toxic substances do not meet the selection criteria permitting the use of air purifying respirators; and
- it is highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of materials that will affect the skin of personnel.

Personal protective equipment for Level B includes:

- open circuit, pressure-demand SCBA;
- chemical protective clothing:
- overalls and long-sleeve jacket; or
- coveralls;
- gloves, inner (surgical type); gloves, outer, chemical protective;
- boots, chemical protective, steel toe and shank; and
- communications optional.

3.5.3 Level C Protection

Level C protection is utilized when both skin and respiratory hazards are well defined and the criteria for the use of negative pressure respirators have been fulfilled (i.e., known contaminants and contaminant concentrations, acceptable oxygen levels, approved filter/cartridge available, known cartridge service life, etc.). Level C protection may require carrying an emergency escape respirator during certain initial entry and site reconnaissance situations, or when applicable thereafter.

Personal protective equipment for Level C typically includes:

- full facepiece air-purifying respirator;
- emergency escape respirator (optional);
- chemical protective clothing:
  - overalls and long-sleeved jacket; or
  - coveralls;
- gloves, inner (surgical type);
- gloves, outer, chemical protective; and
- boots, chemical protective, steel toe and shank.

3.5.4 Level D Protection

Level D is the basic work uniform. Personal protective equipment for Level D includes:

- coveralls;
- safety boots/shoes;
- eye protection;
- hand protection;
- reflective traffic safety vest (mandatory for traffic areas or railyard);
- hard hat (with face shield is optional); and
- emergency escape respirator is optional.

3.5.5 Level E Protection

Level E protection is used when radioactivity above 10 mr/hr is detected at the site. Personal protective equipment for Level E includes:

- coveralls;
- air purifying respirator;
- time limits on exposure;
- appropriate dermal protection for the type of radiation present; and
- radiation dosage monitoring.

3.5.6 Additional Considerations

Field work will contain a variety of situations due to chemicals in various concentrations and combinations. These situations may be partially ameliorated by following the work practices listed below:

1. Some sort of foot protection is needed on a site. If the ground to be worked on is contaminated with liquid and it is necessary to walk in the chemicals, some sort of protective "booties" can be worn over the boots. This cuts down on decontamination requirements. They are designed with soles to help prevent them from slipping around. If non-liquids are to be encountered, a Tyvek™ bootie could be used. If the ground contains any sharp objects, the advantage of booties is questionable. Boots should be worn with either cotton or wool socks to help absorb the perspiration.

2. If the site situation requires the use of hard hats, chin straps should be used if a person will be stooping over where his/her hat may fall off. Respirator straps should not be placed over the hard hats. This will affect the fit of the respirator.

   Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under the protective clothing. Protective clothing should be removed prior to allowing a person "to get warm". Applying heat, such as a space heater, to the outside of the protective clothing may drive the contaminants through. In hot weather, under clothing will absorb sweat. It is recommended that workers use all cotton undergarments.

3. Body protection should be worn and taped to prevent anything from running into the top of the boot. Gloves should be worn and taped to prevent substances from entering the top of the glove. Duct tape is preferred, but masking tape can be used. When aprons are used, they should be taped across the back for added protection. However, this should be done in such a way that the person has mobility.

4. Atmospheric conditions such as precipitation, temperature, wind direction, wind velocity, and pressure determine the behavior of contaminants in air or the potential for volatile material getting into the air. These parameters should be considered in determining the need for and the level of protection.

5. A program must be established for periodic monitoring of the air during site operations. Without an air monitoring program, any changes would go undetected and might jeopardize response personnel. Monitoring can be done with various types of air pumps and filtering devices followed by analysis of the filtration media; personnel dosimeters; and periodic walk-throughs by personnel carrying real-time survey instruments.

6. For operations in the exclusion zone, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection should be based on the job function, reason for being in the area, and the potential for skin contact with, or inhalation of, the chemicals present.

7. Escape masks must be readily available when levels of respiratory protection do not include a SCBA and the possibility of an IDLH atmosphere exists. Their use can be made on a case-by-case basis. Escape masks could be strategically located at the site in areas that have higher possibilities of vapors, gases or particulates.

APPENDIX C

Subsurface Utility Clearance Management Program

SUBSURFACE UTILITY CLEARANCE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/19**
REVISION NUMBER	**:**	**2**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program for completing proper utility mark-outs and for conducting subsurface clearance activities. This establishes a method to ensure, to the greatest extent possible, that utilities have been identified and contact and/or damage to underground utilities and other subsurface structures will be avoided.

2. SCOPE AND APPLICABILITY

The Subsurface Utility Clearance Management Program applies to all Roux employees, its contractors and subcontractors. Employees are expected to follow this program for all intrusive work involving Roux or other personnel (e.g., contractors/subcontractors) working for Roux unless the client's requirements are more stringent. Deviation from the program regardless of the specific work activity or work location must be pre-approved based on client's site knowledge, site experience and client's willingness for the use of this program. Any and all exceptions shall be documented and pre-approved by the Project Principal and the Office Manager.

3. PROCEDURES

3.1 Before Intrusive Activities

During the project kick-off meeting for intrusive activities the PM will review the Roux Subsurface Utility Clearance Checklist and Utility Verification (Appendix C) / Site Walkthrough Record (Appendix D) and the below bullet points with the project field team:

(Please note that these are intended as general reminders only and should not be solely relied upon.)

- Ensure the Mark-out / Stake-out Request Information Sheet (or one-call report) is complete and accurate for the site including address and cross streets and review for missing utilities. (Note: utility mark-out organizations do not have contracts with all utilities and it is often necessary to contact certain utilities separately such as the local water and sewer authorities).
- Have written confirmation prior to mobilizing to the site that the firm or Roux personnel performing the intrusive activity has correctly completed the mark-out notification process including requesting mark-outs, waiting for mark-outs to be applied to ground surfaces at the site, and receiving written confirmation of findings (via fax or email) from utility operators for all known or suspected utilities in the proposed area of intrusive activity, and provided utility owner written confirmation to Roux personnel for review and project files documentation.
- Do not begin any intrusive activity until all utilities mark-out has been completed (i.e., did all utilities mark-out the site?) and any unresolved mark-out issues are finalized. Perform a site walk to review the existing utilities and determine if said utilities have been located by the utility locators.

  (Note: The Tolerance Zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside edge of any subsurface structure.)
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or other soft digging techniques) for the first 5-ft below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-Clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternative approaches will need to be pre-approved by the OM.

- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12" for first 5 feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes performed to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.
- In addition, the following activities should be conducted:
  - Review the work scope to be performed with the site owner/tenant to determine if it may impact any utilities;
  - Attempt to procure any utility maps or historic drawings of subsurface conditions of the site;
  - **Determine the need for utility owner companies to be contacted or to have their representatives on site**;
  - Where mark-outs terminate at the property boundary, consider the use of private utility locating / GPR / geophysical-type services which may be helpful in locating utilities. Use of private utility locating firms, however, does not eliminate the legal requirement for the Excavator firm to submit a request for Public Utility Mark-outs. Also, the information provided by the service may be inaccurate and unable to locate subsurface utilities and structures in urban areas, landfills, urban fill areas and below reinforced slabs, etc. They should not be relied upon as the only means of performing utility clearance;
  - Documented description of the dig site which is included in the projects Health and Safety Plan (HASP) and one call report will be maintained in the field and distributed amongst Roux personnel its contractors and subcontractors; and
  - Documentation of the actual placement of mark outs in the field shall be collected using dated pictures, videos and/or sketches with distance from markings to fixed objects. All documentation shall be maintained within the project file.

3.2 During Intrusive Activities

The PM, field team lead or personnel performing oversight is to:

- Ensure the mark-out remains valid. (In certain states there are limits regarding the duration of time after the mark-out was applied to the ground surface work can be started or interrupted.) Additionally, the mark-outs must be maintained, documented, and in many cases refreshed periodically to be considered valid, this will be accomplished through calls to the one call center.
- Ensure intrusive activities are only performed within the safe boundaries of the mark-out as detailed in the One-Call Report.
- Halt all work if intrusive activities have resulted in discovery of an unmarked utility. Roux personnel shall notify the facility owner/operator and the one call center. All incidents such as this will be reported as per Roux Incident Investigation and Reporting Management Program.
- Halt all work if intrusive activities must take place outside of the safe boundaries of a mark-out and only proceed after new mark-outs are performed.
- Halt the intrusive activities and immediately consult with the PP if an unmarked utility is encountered.
- Completing any subsurface utility clearance incident reports that are necessary.

- If a utility cannot be found as marked Roux personnel shall notify the facility owner/operator directly or through the one call center. Following notification, the excavation may continue, unless otherwise specified in state law.
- Contractors/subcontractors must contact the one-call center to refresh the ticket when the excavation continues past the life of the ticket. Ticket life shall be dictated by state law however at a maximum ticket life shall not exceed 20 working days.

3.3 Stop Work Authority

Each Roux employee has Stop Work Authority which he or she will execute upon determination of any imminent safety hazard, emergency situation, or other potentially dangerous situation, such as hazardous weather conditions. This Stop Work Authority includes subsurface clearance issues such as the adequacy of a mark-out or identification during intrusive operations of an unexpected underground utility. Authorization to proceed with work will be issued by the PM/PP after such action is reviewed and resolved. The PM will initiate and execute all management notifications and contact with emergency facilities and personnel when this action is appropriate.

Appendix A - Definitions

Intrusive Work Activities	All activities such as digging or scraping the surface, including but not limited to, excavation, test pitting or trenching, soil vapor sampling or the installation of soil borings, soil vapor monitoring points and wells, or monitoring wells, and drilling within the basement slab of a recently demolished building.
Mark-out / Stake Out	The process of contracting with a competent and qualified company to confirm the presence or absence of underground utilities and structures. This process will clearly mark-out and delineate utilities that are identified so that intrusive work activities can be performed without causing disturbance or damage to the subsurface utilities and structures. After utility mark-outs are completed the soft digging will be completed prior to intrusive work.
Tolerance Zone	Defined as two feet on either side of the designated centerline of an identified utility, plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct backs and other non-cylindrical utilities) of that utility and two feet from the outside edge of any subsurface structure.
Structure	For the purpose of this program a structure is defined as any underground feature that may a present potential source(s) of energy such as, but not limited to, utility vaults, bunkers, piping, electrical boxes, wires, conduits, culverts, utility lines, underground tanks and ducts.
Soft Digging	The safest way to remove material from unknown obstructions or services is by using tools such as a vactor or air knife, non-mechanical tools, or hand tools. The methods are clean and non-evasive and used for uncovering and exposing buried services, excavating and for providing a quick method of soil removal from sensitive areas.
Verification	Exploratory test-hole dug with hand tools within the Tolerance Zone to expose and verify the location, type, size, direction-of-run and depth of a utility or subsurface structure. Vacuum excavation (soft dig) methods can further facilitate exposure of a subsurface utility and accurately provide its location and identification prior to intrusive work approaching the Tolerance Zone.

Appendix B - Example of Completed One Call Report

Example Completed One-Call Report

New York 811

Send To: C_EMAIL Seq No: 744

Ticket No: 133451007 ROUTINE

Start Date: 12/16/13 Time: 7:00 AM Lead Time: 20

State: NY County: QUEENS Place: QUEENS
Dig Street: 46TH AVE Address:
Nearest Intersecting Street: VERNON BLVD
Second Intersecting Street: 11TH ST

Type of Work: SOIL BORINGS
Type of Equipment: GEOPROBE
Work Being Done For: ROUX

In Street: X On Sidewalk: X Private Property: Other:
On Property Location if Private: Front: Rear: Side:

Location of Work: MARK THE ENTIRE NORTH SIDE OF THE STREET AND SIDEWALK OF: 46TH AVE BETWEEN VERNON BLVD AND 11TH STREET

Remarks:

Nad: Lat: Lon: Zone:
ExCoord NW Lat: 40.7475399 Lon: -73.9534811 SE Lat: 40.7457406 Lon: -73.9493680

Company : ZEBRA ENVIROMENTAL Best Time: 6AM-5PM
Contact Name: DAVID VINES Phone: (516)596-6300
Field Contact: DAVID VINES Phone: (516)596-6300
Caller Address: 30 N PROSPECT AVE Fax Phone: (516)596-4422
LYNBROOK, NY 11563
Email Address: david@zebraenv.com

Additional Operators Notified:
ATTNY01 AT&T CORPORATION (903)753-3145
CEQ CONSOLIDATED EDISON CO. OF N.Y (800)778-9140
MCINY01 MCI (800)289-3427
PANYNJ01 PORT AUTHORITY OF NY & NJ (201)595-4841
VZQ VERIZON COMMUNICATIONS (516)297-1602

Link to Map for C_EMAIL: http://ny.itic.occinc.com/XGMZ-DF2-L23-YAY

Original Call Date: 12/11/13 Time: 1:15 PM Op: webusr
IMPORTANT NOTE: YOU MUST CONTACT ANY OTHER UTILITIES DIRECTLY

Appendix C - Roux Subsurface Utility Clearance Checklist

Roux Subsurface Utility Clearance Checklist ***Date of Revision – 12/3/14***

Work site set-up and work execution

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Daily site safety meeting conducted, SPSAs performed, JSAs reviewed, appropriate work permits obtained.				
HASP is available and reviewed by site workers / visitors.				
Subsurface Utility Clearance Procedure has been reviewed with all site workers.				
Work area secured; traffic control established as needed. Emergency shut-off switch located. Fire extinguishers / other safety equipment available as needed.				
Utility mark-outs (public / private) clear and visible. Provide Excavator's Stake-Out Reference Number / Request Date / Time.				
Tolerance zone work identified.				
Work execution plan reviewed and adhered to (ground disturbance methods, clearance depths, any special utility protection requirements, or any other execution requirements; especially for Tolerance Zone work).				
Verbal endorsement received from Roux PM for any required field deviations to work execution plan.				

Key reminders for execution:

The Subsurface Utility Clearance Protocol should be referenced to determine all requirements while executing subsurface work. The bullet points below are intended as general reminders only and should not be solely relied upon.

- Tolerance zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside of any subsurface structure.
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or vacuum excavation) must be performed for the first five feet below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternate approaches will need to be pre-approved by the OM.
- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft

digging around the perimeter). In these cases, dig in small lifts (<12" for first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.

Appendix D - Utility Verification/Site Walkthrough Record

Employee Name: _____

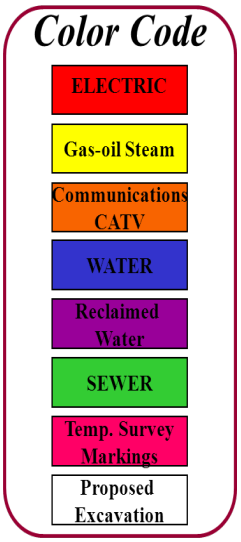
Date: _____

Instructions: For each utility suspected at the job site, indicate location on the job site, approximate burial depth, and means of detecting the utility. Leave blank if that utility is not believed to be present.

Utility	Description of Utility Location Identified Onsite	Approx. Depth (bls)	Method / Instrumentation used to determine Utility Location	Utility Owner Response (Date/Time)	Mark Out Indicates (Clear / Conflict)
Electrical Lines					
Gas Lines					
Pipelines					
Steam Lines					
Water Lines					
Sanitary and Stormwater Sewer lines					
Pressured Air-Lines					
Tank Vent Lines					
Fiber Optic Lines					
Underground Storage Tanks					
Phone Lines/ Other					

* bls - below land surface

Site Sketch Showing Utilities:



Other Comments / Findings:

Completed by: _____

Signature: _____ Date: _____

APPENDIX D

Heavy Equipment Exclusion Zone Policy

HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVISION NUMBER	:	**1**

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1. PURPOSE

The purpose of the Exclusion Zone Management Program is to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or equipment entering the Exclusion Zone while the equipment is in operation or moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment.

2. SCOPE AND APPLICABILITY

This Management Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") employees and their subcontractors who are performing field work and are potentially exposed to heavy equipment. For the purpose of this program, heavy equipment includes, but is not necessarily limited to: excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

3. PROCEDURES

As specified in the following sections of this Program, an Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on those personnel who are required to be working in the vicinity of the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (ex. movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

1. The Exclusion Zone must meet the following minimum requirements:
   - A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment;
   - Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment this may mean an exclusion zone distance larger than 20 feet);
   - Greater than the tip-over distance of the heavy equipment; and
   - Greater than the radius of blind spots.

   The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Safety Analysis (JSA).
2. The spotter (or another individual) should be assigned responsibility for enforcing the Exclusion Zone. The spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within his/her line of sight. If multiple pieces of equipment are being used, each piece of equipment must have its own Exclusion Zone and spotter. For large excavation and demolition projects the spotter should be in constant radio contact (not cell phone) with the machine driver.
3. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (ex. movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is

STOPPED, etc.), the operator must DISENGAGE THE CONTROLS and STOP and SIGNAL BY "SHOWING HIS HANDS". This signal will indicate that it is safe for the personnel to enter the limits of the Exclusion Zone to perform the required activity. The equipment must remain completely stopped/disengaged until all personnel have exited the limits of the Exclusion Zone and the designated Spotter has signaled by "SHOWING HIS HANDS" to the Equipment Operator that it is safe to resume operations.

4. When entering the limits of the Exclusion Zone, personnel must at a minimum:
   - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
   - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
   - Identify a travel path that is free of Slip/Trip/Fall hazards.
5. The Exclusion Zone should be delineated using cones with orange snow fence or solid poles between the cones, barrels, tape or other measures. For work in rights-of-way rigid barriers, such as Jersey barriers or temporary chain link fence should be used. For certain types of wide-spread or moving/mobile equipment operations, such delineation may not be practicable around pieces of equipment or individual work areas. In such instances, it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure security of the work zone.

All subcontractors who provide heavy equipment operations to field projects must implement a program that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis.

3.1 Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this program. Such activities may include certain excavation clearance tasks, drill crew activities or construction tasks. However, any such activity must be pre-planned with emphasis on limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal and client representative, if required, prior to implementation.

4. TRAINING

Many Roux projects have different requirements that are client-specific or site-specific in nature. It is the responsibility of the Project Principal (or Project Manager if delegated this responsibility by the Project Principal) to ensure that the workers assigned to his/her projects are provided orientation and training with respect to these client and/or site-specific requirements.

APPENDIX F

General Community Air Monitoring Plan for OU1

May 7, 2014

GENERAL COMMUNITY AIR MONITORING PLAN FOR OU1

Former BASF Manufacturing Plant
Riverside Avenue
Rensselaer, New York

Prepared for

BASF CORPORATION
100 Park Avenue
Florham Park, New Jersey

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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APPENDIX

A. Action Limit Report

1.0 INTRODUCTION

On behalf of the BASF Corporation ("BASF"), Remedial Engineering, P.C ("Remedial Engineering") has prepared this "General" Community Air Monitoring Plan ("CAMP") for the Main Plant (OU-1) Parcel (NYSDEC Site No. 4-42-027) of the Closed BASF Rensselaer Facility located in Rensselaer, New York, which is shown on Figures 1 and 2. Remedial Engineering is a New York State professional service corporation organized primarily for the purpose of providing engineering services for clients of Roux Associates, Inc. ("Roux Associates"). Site No. 4-42-027 is defined in the September 2003 Record of Decision ("ROD") issued by the New York State Department of Environmental Conservation ("NYSDEC"). The area subject to this CAMP is more fully described in Section 1.2 of the SMP.

1.1 Purpose

The site has been remediated for restricted industrial/commercial use. Any future intrusive work that will penetrate the composite cover system and expose underlying, residual contamination will be performed in compliance with this CAMP.

Compliance with this CAMP is required during all activities associated with soil excavation below the biota barrier that have the potential to generate airborne particulate matter or volatile organic compounds (VOCs). These activities include excavation of soils, stockpiling, loading, and backfilling. This CAMP has been prepared to ensure that remediation activities do not adversely affect passersby, residents, or workers in the area immediately surrounding the Site and to preclude or minimize airborne migration of construction-related contaminants to offsite areas.

This CAMP is consistent with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan, which is included as Appendix 1A of the New York State Department of Environmental Conservation (NYSDEC) "DER 10/Technical Guidance for Site Investigation and Remediation" dated May 3, 2010.

2.0 AIR MONITORING PROCEDURES

Metals are the primary constituents of concern at the Site. The appropriate method to monitor air for these constituents during remediation activities is through air particulate (dust) monitoring. VOCs are not anticipated at the Site, however, monitoring for these constituents during remediation activities should be conducted as a precaution.

2.1 Meteorological Data

At a minimum, wind direction will be evaluated at the start of each workday, noon of each workday, and the end of each workday. These readings will be utilized to position the monitoring equipment in appropriate upwind and downwind locations. In addition, a Davis Corporation instrument station, or equal, will be used periodically to collect meteorological monitoring data (i.e., wind speed, wind direction, temperature, rainfall, and barometric pressure). An appropriate site figure will be included on the contractor's daily sheet to record the wind direction and monitoring equipment locations. The location of air monitoring stations will be based on prevailing wind conditions. These locations will be adjusted on a daily or more frequent basis, as necessary, based on actual wind directions to provide an upwind and at least two downwind monitoring stations.

2.2 Particulate Monitoring

Air monitoring for particulates (i.e., dust) will be performed continuously during remediation activities using both air monitoring equipment and visual observation at upwind and downwind locations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM_{10}) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at upwind (i.e., background) and downwind locations, at heights approximately four to five feet above land surface (i.e., the breathing zone). Monitoring equipment will be MIE Data Ram monitors, or equivalent. The audible alarm on the particulate monitoring device will be set at 90 micrograms per cubic meter ($\mu g/m^3$). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of 100 $\mu g/m^3$ above background. The monitors will be calibrated at least once per day prior to work activities and recalibrated as needed thereafter. In addition, fugitive dust migration will be visually assessed during all intrusive work activities.

The following summarizes particulate action levels and the appropriate responses:

- If the downwind PM-10 particulate level is 100 µg/m^3 greater than background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 µg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 µg/m^3 above the upwind level, work must be stopped and an evaluation of activities initiated. Work can resume provided that dust suppression measures (as described in Section 2.3.1 below) and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 µg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report as shown in Appendix A will be completed.

2.2.1 Potential Particulate Suppression Techniques

If the integrated particulate level at the downwind location exceeds the upwind level by more than 100 µg/m^3 at any time during remediation activities, then dust suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive dusts:

- limiting the excavation size;
- backfilling the excavation;
- spraying water onto the excavation faces and equipment;
- covering soil stockpiles with 8-mil plastic sheeting;
- hauling waste materials in properly tarped containers; and/or
- limiting vehicle speeds onsite.

Work may continue with dust suppression techniques provided that downwind PM_{10} levels are not more than 150 µg/m^3 greater than the upwind levels.

There may also be situations where the dust is generated by remediation activities and migrates to downwind locations, but is not detected by the monitoring equipment at or above the action level. Therefore, if dust is observed leaving the working area, dust suppression techniques such as those listed above will be employed.

If dust suppression techniques do not lower particulates to below 150 $\mu g/m^3$, or visible dust persists, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

2.3 VOC Monitoring

During all remediation activities, VOCs will be monitored periodically at the upwind perimeter and continuously at the downwind perimeter of the designated work areas at monitoring stations described below. A portable hand-held PID will be used to periodically monitor conditions at the upwind location. Monitoring equipment capable of measuring total VOC concentrations (PID) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at the downwind location, at a height of approximately 4 to 5 feet above land surface (i.e., the breathing zone). The audible alarm on the PID will be set at 5 parts per million (ppm). Monitoring equipment will be MiniRAE 2000 portable VOC monitors or similar equipment.

Upwind VOC concentrations will be measured at the upwind perimeter of the work area, which will be determined based upon the meteorological data collected throughout the workday. All VOC monitoring will be performed using a PID calibrated at least once per day prior to work activities and recalibrated as needed thereafter. Downwind VOC concentrations will be measured at the downwind perimeter of the work area, which will be determined based upon the meteorological data collected throughout the workday. Both upwind and downwind monitoring stations are subject to change in response to evolving weather conditions.

The following summarizes VOC action levels and the appropriate responses:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps are performed, work activities can resume, provided the total organic vapor level 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure – whichever is less but in no case less than 20 feet – is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown, the source of vapors identified, and corrective measures taken to abate emissions, as described below in Section 2.2.1.

All readings will be recorded and made available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report, as shown in Appendix A, will be completed.

2.3.1 Potential Corrective Measures and VOC Suppression Techniques

If the 15-minute integrated VOC level at the downwind location persists at a concentration that exceeds the upwind level by more than 5 ppm but less than 25 ppm during remediation activities, then vapor suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive organic vapors:

- limiting the excavation size;
- backfilling the excavation;
- spraying water onto the excavation faces and equipment;
- covering soil stockpiles with 6-mil plastic sheeting;
- hauling waste materials in properly tarped containers; and/or
- applying vapor suppressant foam.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

APPENDIX A

Action Limit Report

ACTION LIMIT REPORT

Project Location: _____

Date: _____ Time: _____

Name: _____

Contaminant: PM-10: _____ VOC: _____

Wind Speed: _____ Wind Direction: _____

Temperature: _____ Barometric Pressure: _____

DOWNWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID #: _____ Location: _____ Level Reported: _____

UPWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID #: _____ Location: _____ Level Reported: _____

BACKGROUND CORRECTED LEVELS

ACTIVITY DESCRIPTION

CORRECTIVE ACTION TAKEN

APPENDIX G

Construction Contingency Plan for OU1

May 7, 2014

GENERAL CONSTRUCTION CONTINGENCY PLAN FOR OU1

Former BASF Manufacturing Plant
Riverside Avenue
Rensselaer, New York

Prepared for

BASF CORPORATION
100 Park Avenue
Florham Park, New Jersey

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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1.0 INTRODUCTION

On behalf of the BASF Corporation ("BASF"), Remedial Engineering, P.C ("Remedial Engineering") has prepared this "General" Construction Contingency Plan ("CCP") for the Main Plant (OU-1) Parcel (NYSDEC Site No. 4-42-027) of the Closed BASF Rensselaer Facility located in Rensselaer, New York, which is shown on Figures 1 and 2. Remedial Engineering is a New York State professional service corporation organized primarily for the purpose of providing engineering services for clients of Roux Associates, Inc. ("Roux Associates"). Site No. 4-42-027 is defined in the September 2003 Record of Decision ("ROD") issued by the New York State Department of Environmental Conservation ("NYSDEC"). The area subject to this CCP is more fully described in Section 1.2 of the SMP.

2.0 EMERGENCY AND GENERAL CONTACT LIST

The generic emergency and general contact list is provided in Table 4 of the SMP. This table will be updated on a project-specific basis, as warranted, for any future intrusive work that will penetrate the composite cover system and expose underlying, remaining contamination.

3.0 UNEXPECTED CONDITIONS

Unexpected conditions may include buried drums or grossly contaminated soils. Screening for unexpected conditions will be conducted under the direction of the Engineer during all intrusive activities. Screening procedures will include visual inspections for evidence of grossly contaminated soils and screening for organic vapors with a photo-ionization detector (PID) as described in the EWP. The following procedures will be coordinated by the designated personnel (typically the project-specific FPM) in the event unexpected conditions are encountered:

- Drums or grossly contaminated soil will be removed within the limits of the proposed excavation. Drums will be handled using methods and equipment specifically designed to minimize leakage or spillage to the maximum extent made possible by the condition of the drum. As drums are unearthed, the drum condition will be visually assessed to determine the best handling methods.

- Drums or grossly contaminated soil will be stockpiled in a lined staging area as described in the EWP and identified with suitable markers for delineation from other onsite soil or offsite fill material. Stockpiles of drums or grossly contaminated soil will be covered with 10-mil polyethylene sheeting.

- Drums or grossly contaminated soil will be sampled for waste characterization parameters in accordance with disposal facility requirements. Waste sampling of excavated drums/containers will be conducted by experienced personnel specifically trained for the task.

4.0 ON-SITE RELEASE

This section of the CCP discusses protocols to be followed for an on-site liquid or solid release.

4.1 Liquid Spill

Site personnel are required to report any onsite reportable spill or release of liquid to the Engineer and project-specific FPM, if applicable, and to commence an Incident Investigation.

For purposes of this CCP, a reportable spill is defined as a volume spilled that is greater than one (1) gallon. The use of conventional construction equipment during remediation activities (excavators, loaders, compactors, generators, etc.) presents the potential for spill scenarios. These include the leakage of fuel, motor oil, or hydraulic fluid during operation, refueling, and equipment maintenance. To prevent equipment leakage during operation, the following measures will be implemented during construction activities:

- Spill control and clean-up materials will be staged onsite in a known location and will be available for use in the event of a spill.
- Small spill control kits will be placed on each piece of equipment for use in the event of a spill.
- All leaks or spills, regardless of size, will be cleaned up immediately.
- All equipment used onsite be in good working condition and be inspected daily for leaks. Any equipment observed to be leaking when arriving onsite will be denied entry. Any equipment observed to be leaking while on site will immediately be relocated to a designated equipment staging area for repair.
- All absorbent material used to clean up leaks and spills shall be disposed of in accordance with applicable regulations.
- All collected liquids resulting from spills will be stored separately from construction waters for subsequent testing and disposal.

All spills of 1 gallon or larger will be reported to the Engineer. The *de minimis* criteria for reporting spills to the NYSDEC, **for petroleum only,** are (1) less than 5 gallons (2) onto an impervious surface and (3) cleaned up within two hours of discovery. If the spill does not meet all three of these criteria, the spill will be reported to NYSDEC Spill Hotline Number provided on Table 4 of the SMP and other appropriate agencies. Only Hazardous Waste Operations and

Emergency Response (HAZWOPER) trained personnel will be used to handle minor spills encountered during project construction activities.

4.2 Solid Spill

Spill clean-up procedures for truck spills that occur on site will include consolidation of spilled soil and reloading onto the truck. In the event of a spill, the incident will be promptly reported to the Engineer and the project-specific FPM, if applicable, and cleanup of the spilled soil will be performed immediately. Spilled materials will be recovered using hand tools, to the extent practicable. If a large spill occurs, a small front-end loader may be used. If a spill occurs in a high traffic area, traffic cones, flares, signs, and flag persons will be mobilized, as necessary, to direct and control traffic. The spill will be reported by contacting the NYSDEC Spill Hotline Number provided on Table 4 of the SMP within 2 hours of the incident. The report will provide details of the location, date, and time of the spill, the volume of soil spilled, the response actions taken, and precautions that will be implemented to avoid future spills. Depending on the amount of spilled material, appropriate notification to BASF and local emergency management personnel will be provided.

Spills or leaks that may occur within a lined staging area will be addressed by first inspecting the area for evidence of leaks or damages in the liner system. If the liner is damaged or leaking, material will no longer be added to the lined staging area and the leakage will be contained. If needed the liner system will be repaired or replaced.

5.0 OFF-SITE RELEASE

Prior to beginning transportation and disposal activities, transport drivers will be advised to strictly observe the designated transport route and immediately report any spills or soil accumulations attributable to site transport to the Engineer and the project-specific FPM, if applicable. Spill clean-up procedures for truck spills that occur during transport between the Site and the disposal facility will include the following:

- The transporter will secure the area, determine the extent of injuries, if any, and implement emergency first aid, if required;
- The transporter will notify local authorities, fire, police, etc., and the transporter's headquarters;
- The transporter will immediately dispatch a spills response contractor to the scene of the incident;
- A response contractor will mobilize to the scene of the incident;
- The transporter will notify appropriate federal and state authorities (EPA, USDOT) and notify the Engineer and the project-specific FPM, if applicable; and
- The NYSDEC and BASF will be appropriately notified within two hours of the incident.

6.0 SPILL CONTROL EQUIPMENT

The location of the spill control equipment will be discussed with site personnel during site orientation. In general, spill control equipment will be stored near the work zones and on the equipment for quick access. The following spill control equipment will be available on site:

- Sorbent Pads;
- Sorbent Booms;
- Oil-Dri;
- Spill Kits (in equipment);
- Over pack drums;
- Shovels; and
- Sand stockpile and unfilled sandbags in a quantity efficient to cover all solid material stockpiles.

In addition, to the above, on site spills of solid material may be managed with equipment such as loader and excavators.

7.0 FIRE PREVENTION

During site mobilization, the fire department will be briefed about potential hazards at the site and the location, nature, and identification of hazardous materials on site. In the event of a fire or explosion, the local fire department will be summoned immediately.

Fire protection, on site, in the form of portable fire extinguishers meeting or exceeding NFPA-10-1984 requirements will be provided. Fire extinguishers will be tested annually and inspected monthly. A Fire Extinguisher Monthly Inspection form will be used to document inspections.

In the event of a fire that cannot be controlled with available equipment on site, the local fire department will be summoned immediately by the Engineer or the project-specific FPM, if applicable. The fire department will be informed of the situation and any site hazards upon their arrival. If firefighters and/ or equipment enter areas with residual contamination, decontamination will be required upon leaving.

In the event of fire or explosion, or if vapor concentrations of explosive vapors or gases approach or exceed 10 percent of the LEL, if monitored, personnel will evacuate the area immediately.

8.0 SEVERE WEATHER CONDITIONS

The assessment of current weather conditions or severe weather report is the responsibility of the Contractor performing intrusive work. Weather extremes, such as high winds, cold temperatures, ice, snow, sleet, and freezing rain, present potential hazards to workers and equipment and therefore require special consideration. Weather reports will be monitored on a regular basis utilizing National Oceanic and Atmospheric Administration (NOAA) radio warnings, local forecasts and regional reports warnings of severe weather.

8.1 Extreme Temperatures

During the performance of intrusive work, hot and cold weather may be encountered. The project-specific HASP will address precautions and treatment of heat and cold stress.

8.2 Rainfall/ Snowfall Event

Rainfall and snow events will be closely monitored during the performance of intrusive work, when performed. Based on current conditions and the forecasted weather, a decision by 6:00 a.m. will be made whether to proceed with normal schedules, delay the day's operation, or cancel operations for the day. In some instances, the decision can be made the preceding afternoon or evening. One of the key factors will be whether associates will be able to travel safely to and from the job site.

Generally, snow and ice management operations will be implemented during major snowstorm activity or after the accumulation of one or more inches of snow and/ or a covering sheet of ice. This generic standard is subject to evaluation relative to the storm in progress at the time control operations are instituted.

In the event a significant rain or snow storm event is predicted, the following preparation activities will be implemented:

- Equipment will be removed and placed in the equipment staging area.
- Contaminated material stockpiles and drying agents will be covered with polyethylene sheeting and the sheeting will be secured in place with sand bags.
- Erosion controls (silt fence, silt curtains, sand bags) will be inspected to ensure they are securely in place and functional

The following activities will be implemented after a significant storm event:

- Erosion controls will be inspected within 24 hours of the rain/ snow event. Observations will be recorded and repairs made as needed
- On site roadways will be inspected for wash outs and other weather related damages. Repairs to the roadways will be made as needed.
- Staging area(s) will be inspected for water accumulation. If present, water will be pumped and managed in accordance with the protocols specified in the EWP.

8.3 Thunderstorms and Lightning

The 30 – 30 Rule for lightning safety will be followed, when applicable. When there is less than 30 seconds between a lightning flash and the following thunder, work will be suspended and personnel will seek shelter. Work will not resume until 30 minutes after the last lightning strike with an interval less than 30 seconds.

8.4 Tornado Related Weather

A tornado watch defines an area where tornadoes and other kinds of severe weather are possible in the next several hours. It does not mean tornadoes are imminent but that site personnel must be alert, and to be prepared to go to safe shelter if tornadoes do happen or a warning is issued. During this time the following procedures will be followed:

- Evacuation notification will be three (3) blasts on an air horn, or by verbal communication on radios;
- Keep upwind of smoke, vapors, or spill location;
- Perform personnel and equipment decontamination, if practical and in a timely manner;
- If the performance of personnel and equipment decontamination cannot occur in a practical or timely manner, site personnel should remove contaminated clothing once they are in a location of safety and leave it near the exclusion zone;
- Tune into NOAA radio;
- Verify location of fellow workers and subcontractors;
- Watch the sky;
- Ensure access to safe shelter is available; and
- Contact all site personnel so they are aware of the weather conditions.

A tornado warning means that a tornado has been spotted, or that Doppler radar indicates a thunderstorm circulation which can spawn a tornado. If a tornado warning is issued for the area, personnel will take immediate cover.

9.0 EVACUATION PROCEDURES

Evacuation procedures should be defined in the project-specific HASP. In general, evacuation should be conducted immediately, without regard to equipment under conditions of extreme emergency. The designated personnel (typically the project-specific FPM) must immediately report emergency situations and take appropriate measures to protect site personnel. Emergency evacuation routes will be established and presented to Site personnel during site orientation. In general, the following evacuation procedures will be implemented:

- The FPM will conduct a head count to ensure all personnel have been evacuated safely. In the event of an emergency site evacuation, all personnel should escape from emergency situation, decontaminate to the maximum extent practical, and meet at the pre-determined off-site location.
- Ensure that an evacuation drill is performed at the start of the project and every 6 months thereafter.

9.1 Evacuation Responsibilities

The designated personnel (typically the project-specific FPM) will coordinate the following:

- Take appropriate measures to protect personnel including:
  - Withdrawal from the exclusion zone.
  - Total evacuation and securing of the site.
  - Upgrading or downgrading the level of protective clothing and respiratory protection.
- Take appropriate measures to protect the public and the environment including:
  - Isolating and securing the site.
  - Preventing run-off to surface waters.
  - Ending or controlling the emergency to the extent possible.
- Ensure that appropriate federal, state, and local agencies are informed, and emergency response plans are coordinated.
- In the event of a fire or explosion, ensure the local fire department should be summoned immediately.
- In the event of an air release of toxic materials, ensure the local authorities should be informed in order to assess the need for evacuation.
- In the event of a spill, ensure sanitary districts may need to be alerted.

- Ensure that appropriate decontamination, treatment, or testing for exposed or injured personnel is obtained.
- Determine the cause of the incident and make recommendations to prevent the recurrence.
- Ensure that all necessary reports have been prepared.

APPENDIX H

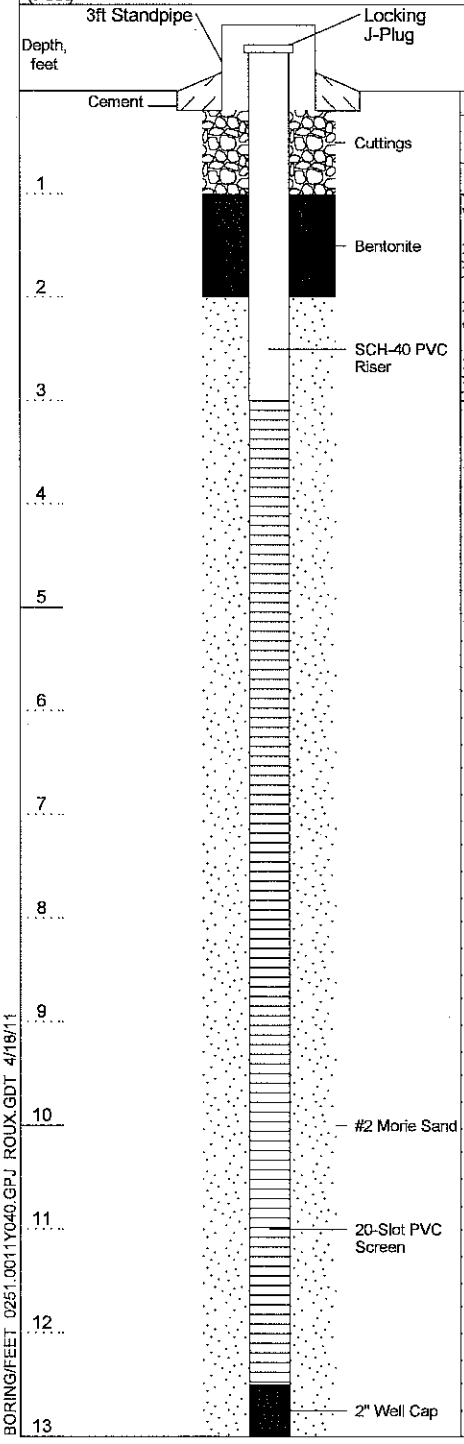
Monitoring Well Logs

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

WELL CONSTRUCTION LOG

WELL NO. **LF-MW-47R**	NORTHING **Not Measured**	EASTING **Not Measured**			
PROJECT NO./NAME **0251.0011Y040 / BASF Corporation**		LOCATION **Rensselaer Facility** **Rensselaer, New York**			
APPROVED BY	LOGGED BY **C. Roth**				
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / R. Buley**		GEOGRAPHIC AREA **Land Fill Area**			
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **Cuttings**	START-FINISH DATE **11/29/10-11/29/10**	
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**				
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
1		GRAVEL			
2		Brown, fine to coarse SAND, little Gravel and Silt; moist.			
3		Gray, fine to medium SAND and Silt, little Clay; wet.			
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

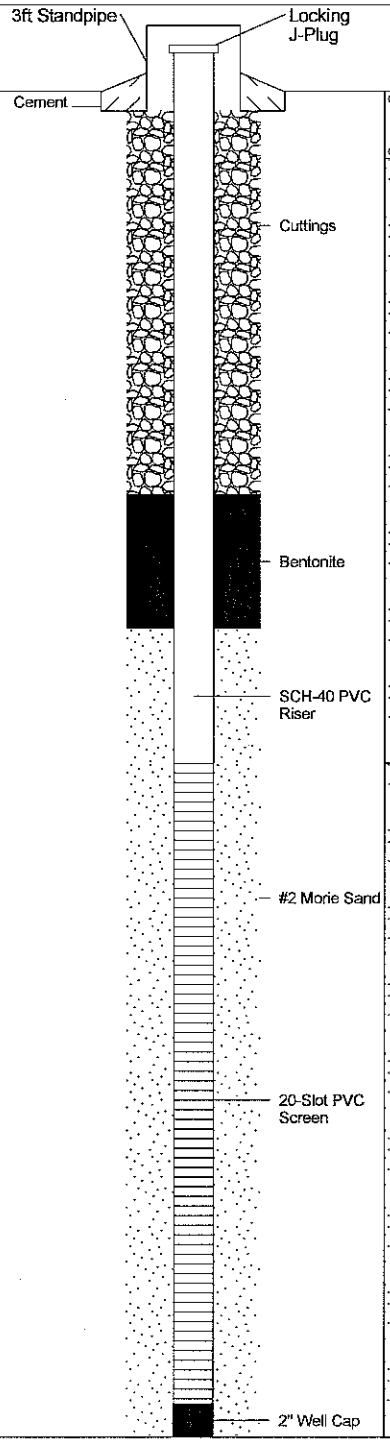
BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

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WELL CONSTRUCTION LOG

WELL NO.: **LG-MW-25**	NORTHING: **Not Measured**	EASTING: **Not Measured**		
PROJECT NO./NAME: **0251.0011Y040 / BASF Corporation**		LOCATION: **Rensselaer Facility, Rensselaer, New York**		
APPROVED BY	LOGGED BY: **C. Roth**			
DRILLING CONTRACTOR/DRILLER: **Aquifer Drilling and Testing / R. Buley**		GEOGRAPHIC AREA: **Lagoon Area**		
DRILL BIT DIAMETER/TYPE: **4.25-in. / Auger**	BOREHOLE DIAMETER: **8-inches**	DRILLING EQUIPMENT/METHOD: **CME-75 / HSA**	SAMPLING METHOD: **Cuttings**	START-FINISH DATE: **11/29/10-11/29/10**
CASING MAT./DIA.: **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**			
ELEVATION OF: (Feet) GROUND SURFACE — 3ft Standpipe	TOP OF WELL CASING	TOP & BOTTOM SCREEN: /	GRAVEL PACK SIZES: **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		CONCRETE			
		Brown, fine to coarse SAND, little Silt and Gravel; moist.			
5					5
10		Brown, fine to coarse SAND, little Silt and Clay, trace gravel; wet.			10
15					15
20					20

BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

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WELL CONSTRUCTION LOG

WELL NO.	NORTHING	EASTING
LG-MW-26	**Not Measured**	**Not Measured**

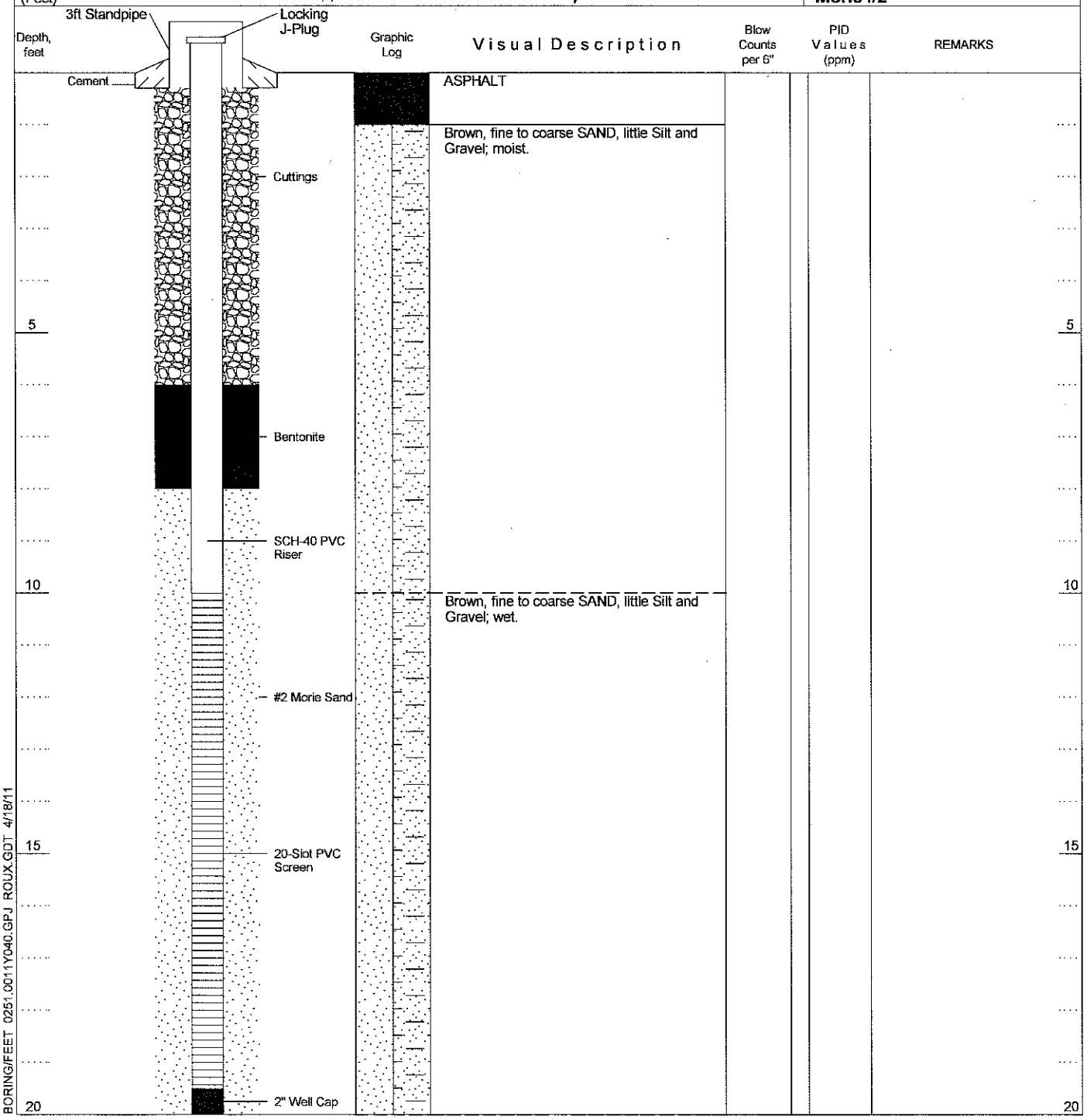
PROJECT NO./NAME	LOCATION
0251.0011Y040 / BASF Corporation	**Rensselaer Facility**
APPROVED BY	LOGGED BY
	C. Roth
	Rensselaer, New York

DRILLING CONTRACTOR/DRILLER	GEOGRAPHIC AREA
Aquifer Drilling and Testing / R. Buley	**Lagoon Area**

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
4.25-in. / Auger	**8-inches**	**CME-75 / HSA**	**Cuttings**	**11/29/10-11/29/10**

CASING MAT./DIA.	SCREEN:
SCH 40 PVC / 2-inch	TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**

ELEVATION OF:	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES
(Feet)	– 3ft Standpipe		/	**Morie #2**



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WELL CONSTRUCTION LOG

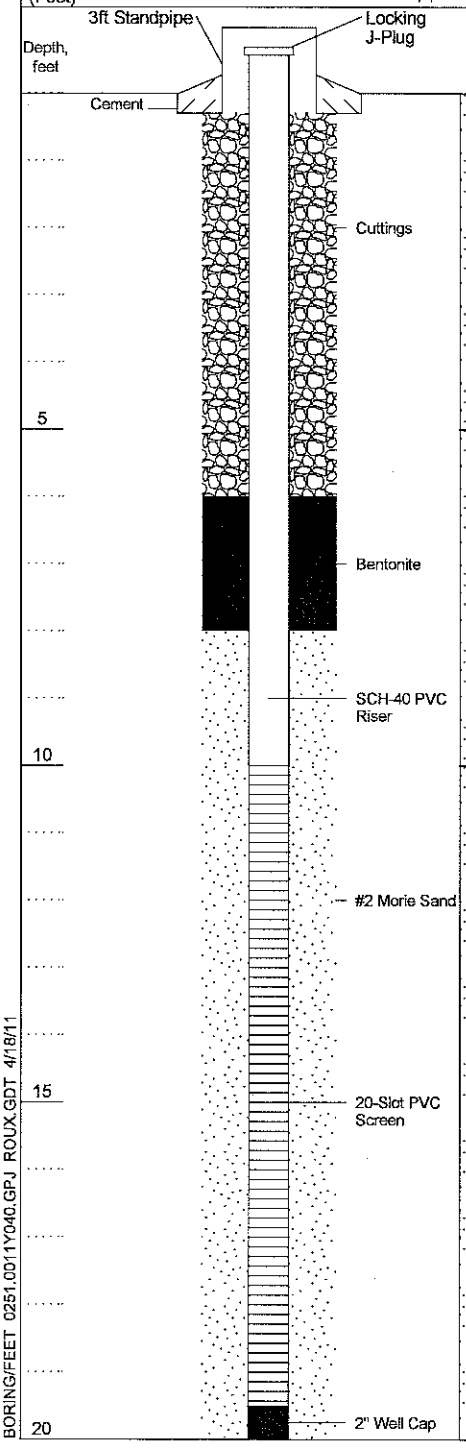
WELL NO.	NORTHING	EASTING
LG-MW-2R	Not Measured	Not Measured

PROJECT NO./NAME	LOCATION
0251.0011Y040 / BASF Corporation	Rensselaer Facility Rensselaer, New York
APPROVED BY:	LOGGED BY: C. Roth
DRILLING CONTRACTOR/DRILLER: Aquifer Drilling and Testing / L. Darrow	GEOGRAPHIC AREA: Lagoon Area

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
4.25-in. / Auger	8-inches	CME-75 / HSA	Cuttings	11/11/10-11/11/10

CASING MAT./DIA.	SCREEN:
SCH 40 PVC / 2-inch	TYPE Slotted MAT. SCH 40 PVC TOTAL LENGTH 10.0ft DIA. 2-inch SLOT SIZE 20-Slot

ELEVATION OF:	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES
(Feet)	– 3ft Standpipe		/	Morie #2



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0 – 5		Brown, fine to coarse SAND, little Silt and Gravel; moist.			
5 – 10		Brown to dark brown, fine to medium SAND, little Silt; moist.			
10 – 20		Dark brown to gray, fine SAND and Silt, little Clay; wet.			

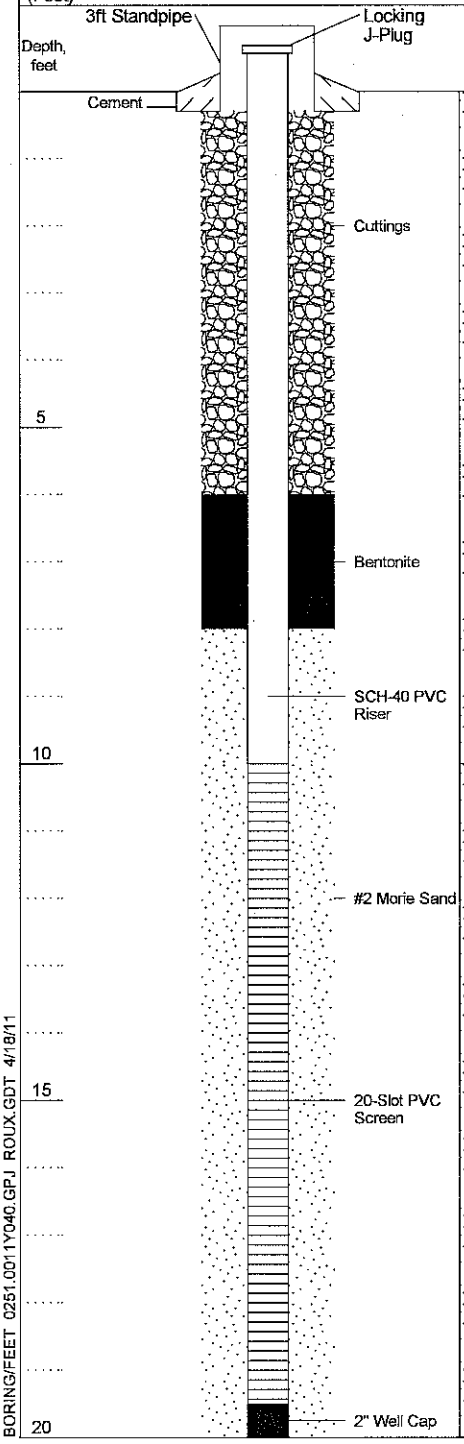
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WELL CONSTRUCTION LOG

WELL NO. **LG-MW-4R**	NORTHING **Not Measured**	EASTING **Not Measured**			
PROJECT NO./NAME **0251.0011Y040 / BASF Corporation**		LOCATION **Rensselaer Facility** **Rensselaer, New York**			
APPROVED BY	LOGGED BY **C. Roth**				
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA **Lagoon Area**			
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **Cuttings**	START-FINISH DATE **11/10/10-11/10/10**	
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC**	TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE – 3ft Standpipe	TOP OF WELL CASING /	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Dark brown, fine to coarse SAND, little Silt and Gravel; moist.			
10		Dark Brown, fine to medium SAND and Silt, little Clay; wet.			
20					

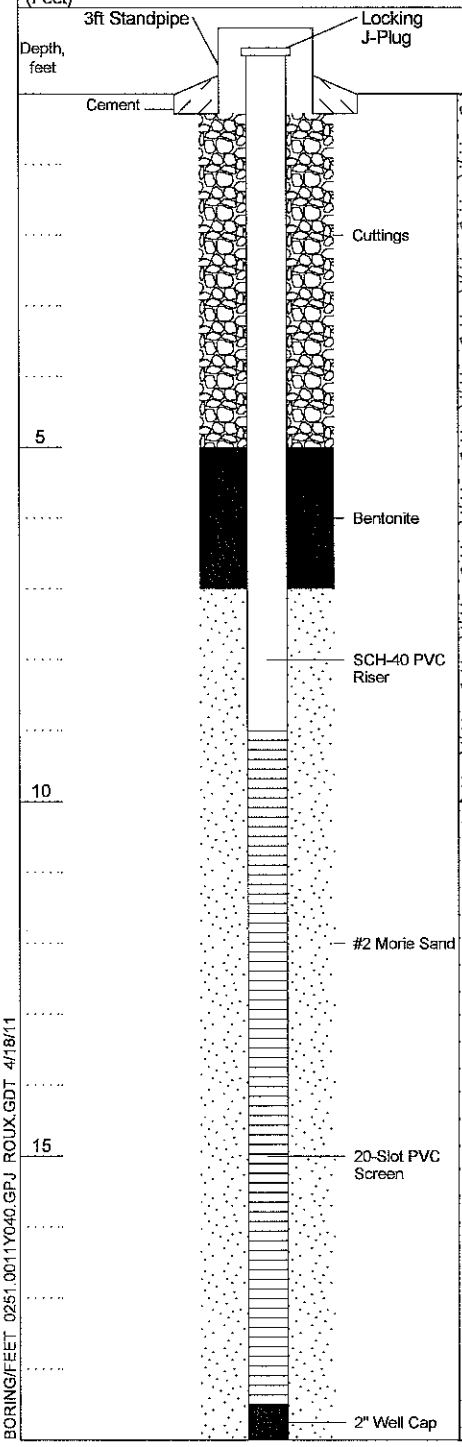
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WELL CONSTRUCTION LOG

WELL NO. **LG-MW-5R**	NORTHING **Not Measured**	EASTING **Not Measured**			
PROJECT NO./NAME **0251.0011Y040 / BASF Corporation**		LOCATION **Rensselaer Facility** **Rensselaer, New York**			
APPROVED BY	LOGGED BY **C. Roth**				
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA **Lagoon Area**			
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **Cuttings**	START-FINISH DATE **11/10/10-11/10/10**	
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC**	TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE – 3ft Standpipe	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to coarse SAND, little Gravel and Silt; moist.			
10		Dark brown, fine to medium SAND and Silt, little Clay; wet.			

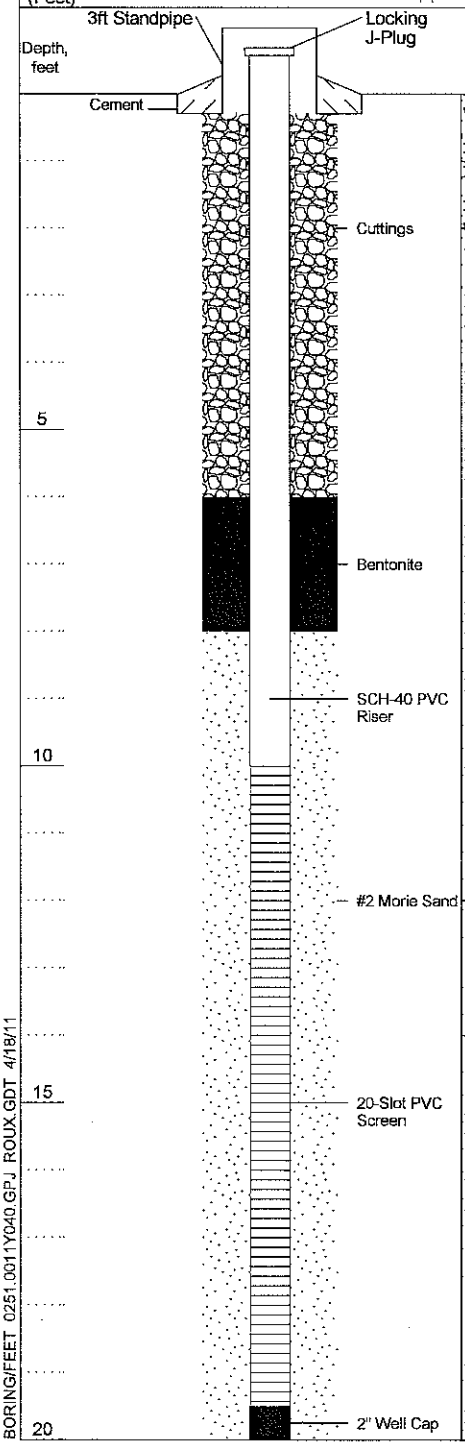
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WELL CONSTRUCTION LOG

WELL NO. **LG-MW-6R**	NORTHING **Not Measured**	EASTING **Not Measured**			
PROJECT NO./NAME **0251.0011Y040 / BASF Corporation**		LOCATION **Rensselaer Facility** **Rensselaer, New York**			
APPROVED BY	LOGGED BY **C. Roth**				
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA **Lagoon Area**			
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **Cuttings**	START-FINISH DATE **11/9/10-11/9/10**	
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC**	TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE – 3ft Standpipe	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to coarse SAND, little Gravel and Grass; moist.			
		Brown to gray, fine to coarse SAND, little Silt; moist.			
5					5
10					10
		Brown to gray, fine to medium SAND and Silt; wet.			
		Brown to gray-blue, fine to medium SAND and Silt and Clay; wet.			
15					15
20					20

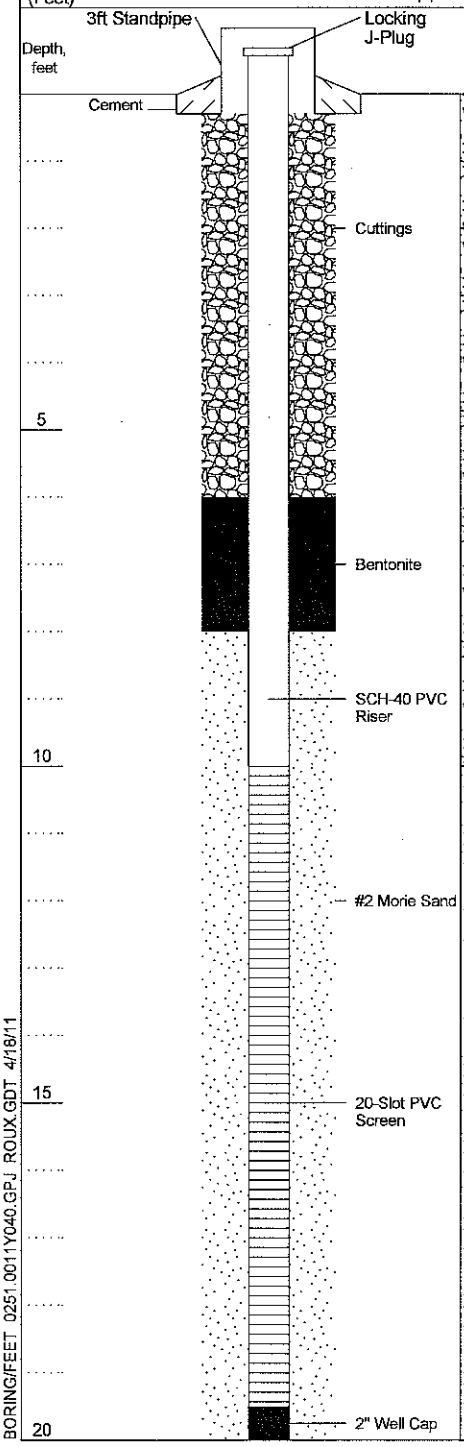
BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

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WELL CONSTRUCTION LOG

WELL NO.: **LG-PZ-10R**	NORTHING: **Not Measured**	EASTING: **Not Measured**		
PROJECT NO./NAME: **0251.0011Y040 / BASF Corporation**		LOCATION: **Rensselaer Facility, Rensselaer, New York**		
APPROVED BY:	LOGGED BY: **C. Roth**			
DRILLING CONTRACTOR/DRILLER: **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA: **Lagoon Area**		
DRILL BIT DIAMETER/TYPE: **4.25-in. / Auger**	BOREHOLE DIAMETER: **8-inches**	DRILLING EQUIPMENT/METHOD: **CME-75 / HSA**	SAMPLING METHOD: **Cuttings**	START-FINISH DATE: **11/9/10-11/9/10**
CASING MAT./DIA.: **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**			
ELEVATION OF: (Feet) GROUND SURFACE — 3ft Standpipe	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES: **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to coarse SAND, little Gravel and Grass; moist.			
5		Brown to gray, fine to coarse SAND, some Gravel; moist.			
10		Bluish gray, fine to medium SAND and Silt; wet.			
15					
20					

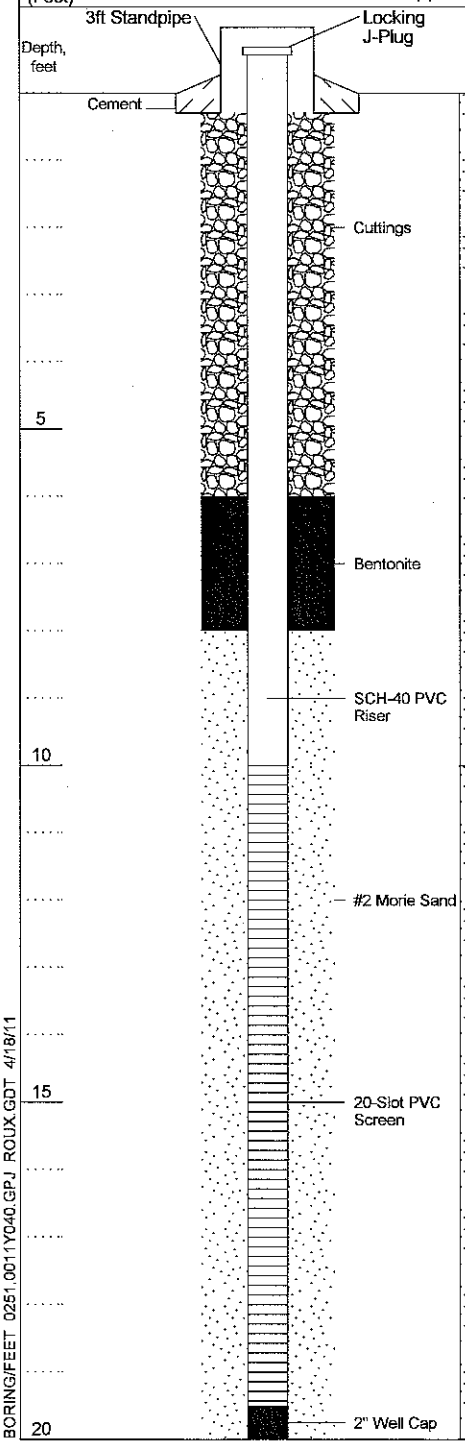
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WELL CONSTRUCTION LOG

WELL NO.: **LG-PZ-14R**	NORTHING: **Not Measured**	EASTING: **Not Measured**		
PROJECT NO./NAME: **0251.0011Y040 / BASF Corporation**		LOCATION: **Rensselaer Facility**		
APPROVED BY:	LOGGED BY: **C. Roth**	**Rensselaer, New York**		
DRILLING CONTRACTOR/DRILLER: **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA: **Lagoon Area**		
DRILL BIT DIAMETER/TYPE: **4.25-in. / Auger**	BOREHOLE DIAMETER: **8-inches**	DRILLING EQUIPMENT/METHOD: **CME-75 / HSA**	SAMPLING METHOD: **Cuttings**	START-FINISH DATE: **11/10/10-11/10/10**
CASING MAT./DIA.: **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE — 3ft Standpipe	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES: **Morie #2**



Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
Brown, fine to coarse SAND, little Silt and Gravel; moist.			
Brown, fine to coarse SAND, little Silt and Gravel; wet.			

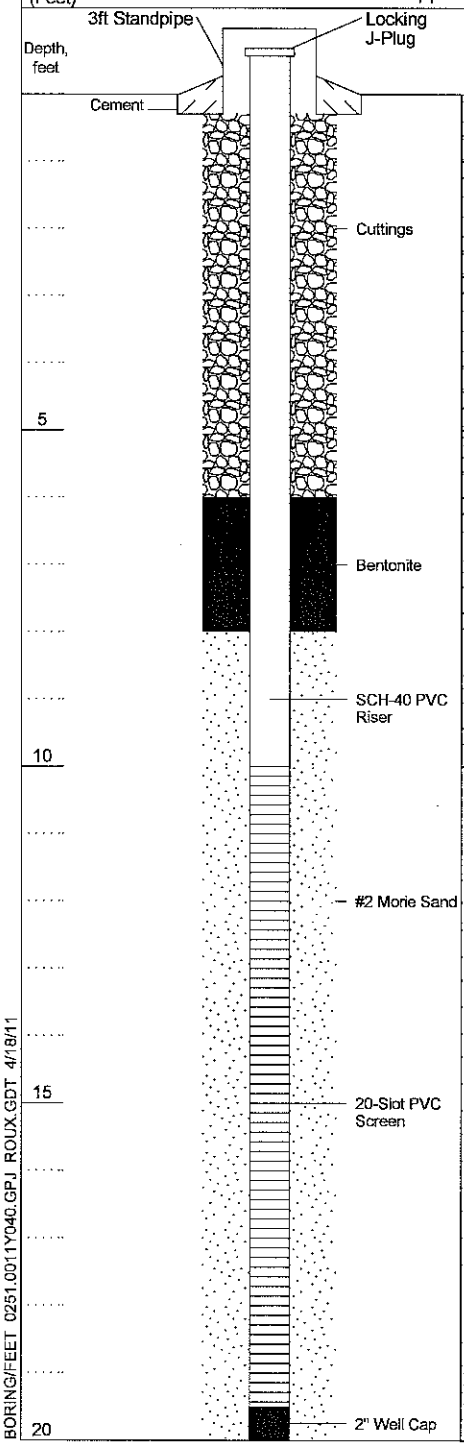
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WELL CONSTRUCTION LOG

WELL NO.: **LG-PZ-15R**	NORTHING: **Not Measured**	EASTING: **Not Measured**		
PROJECT NO./NAME: **0251.0011Y040 / BASF Corporation**		LOCATION: **Rensselaer Facility, Rensselaer, New York**		
APPROVED BY	LOGGED BY: **C. Roth**			
DRILLING CONTRACTOR/DRILLER: **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA: **Lagoon Area**		
DRILL BIT DIAMETER/TYPE: **4.25-in. / Auger**	BOREHOLE DIAMETER: **8-inches**	DRILLING EQUIPMENT/METHOD: **CME-75 / HSA**	SAMPLING METHOD: **Cuttings**	START-FINISH DATE: **11/10/10-11/10/10**
CASING MAT./DIA.: **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**			
ELEVATION OF: (Feet)	GROUND SURFACE – 3ft Standpipe	TOP OF WELL CASING /	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES: **Morie #2**



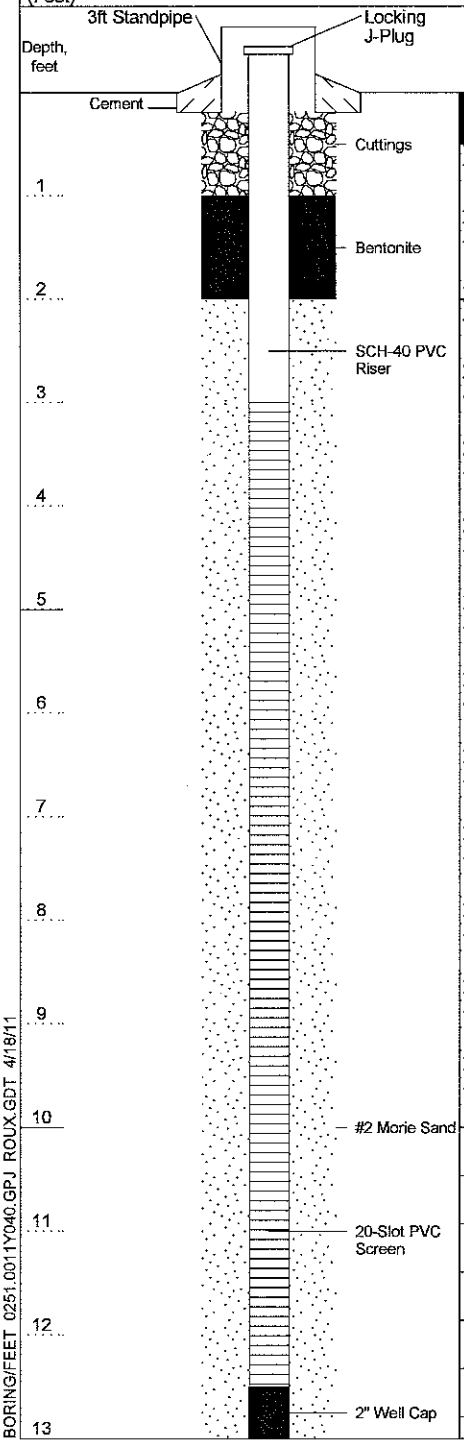
Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to medium SAND, little Gravel; moist.			
5		Brown, fine to medium SAND, little Gravel and Silt; moist.			
10		Dark brown, fine to medium SAND and Silt, little Gravel; wet.			
15					
20					

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WELL CONSTRUCTION LOG

WELL NO. **LG-PZ-24R**	NORTHING **Not Measured**	EASTING **Not Measured**			
PROJECT NO./NAME **0251.0011Y040 / BASF Corporation**		LOCATION **Rensselaer Facility** **Rensselaer, New York**			
APPROVED BY	LOGGED BY **C. Roth**				
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / L. Darrow**		GEOGRAPHIC AREA **Lagoon Area**			
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **Cuttings**	START-FINISH DATE **11/12/10-11/12/10**	
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted** (3ft Standpipe)	MAT. **SCH 40 PVC**	TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES **Morie #2**	



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		ASPHALT			
1–2		Brown, fine to coarse SAND, little Silt and Gravel; moist.			
2–10		Brown, fine to coarse SAND, little Silt and Clay; wet.			
10–13		Gray-blue SILT and Clay; wet.			

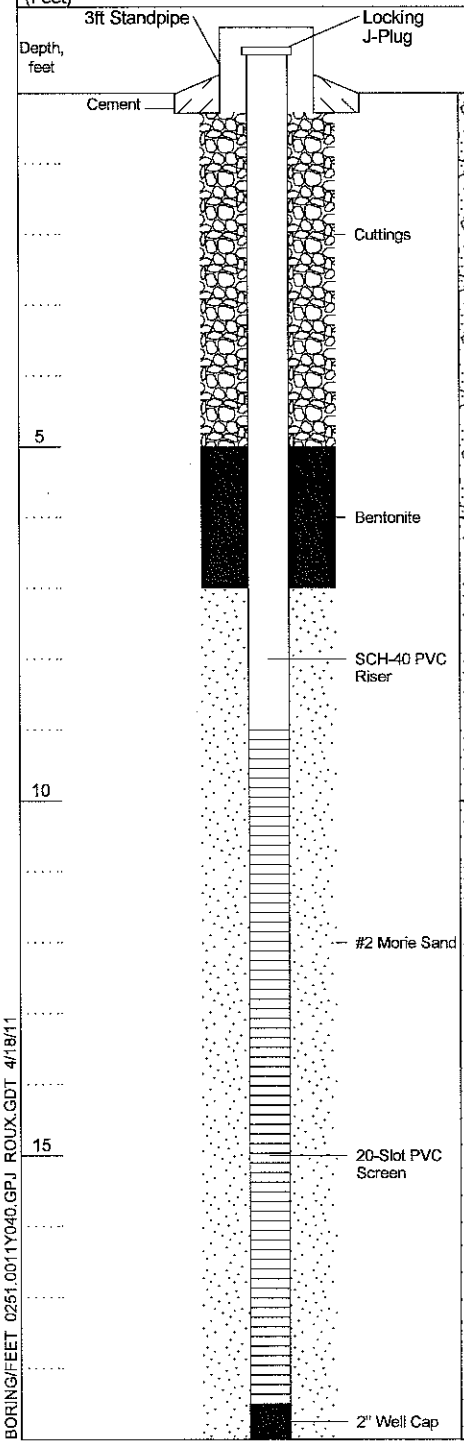
BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

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WELL CONSTRUCTION LOG

WELL NO.: LG-PZ-6R	NORTHING: Not Measured	EASTING: Not Measured		
PROJECT NO./NAME: 0251.0011Y040 / BASF Corporation		LOCATION: Rensselaer Facility, Rensselaer, New York		
APPROVED BY	LOGGED BY: C. Roth			
DRILLING CONTRACTOR/DRILLER: Aquifer Drilling and Testing / L. Darrow		GEOGRAPHIC AREA: Lagoon Area		
DRILL BIT DIAMETER/TYPE: 4.25-in. / Auger	BOREHOLE DIAMETER: 8-inches	DRILLING EQUIPMENT/METHOD: CME-75 / HSA	SAMPLING METHOD: Cuttings	START-FINISH DATE: 11/9/10-11/9/10
CASING MAT./DIA.: SCH 40 PVC / 2-inch	SCREEN: TYPE Slotted	MAT. SCH 40 PVC	TOTAL LENGTH 10.0ft	DIA. 2-inch SLOT SIZE 20-Slot
ELEVATION OF: (Feet)	GROUND SURFACE — 3ft Standpipe	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES: Morie #2



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to coarse SAND, little Gravel and Silt; moist.			
5		Brown to gray, fine to coarse SAND, little Silt; moist.			
10		Gray-blue, fine SAND and Silt, little Clay; wet.			
15					

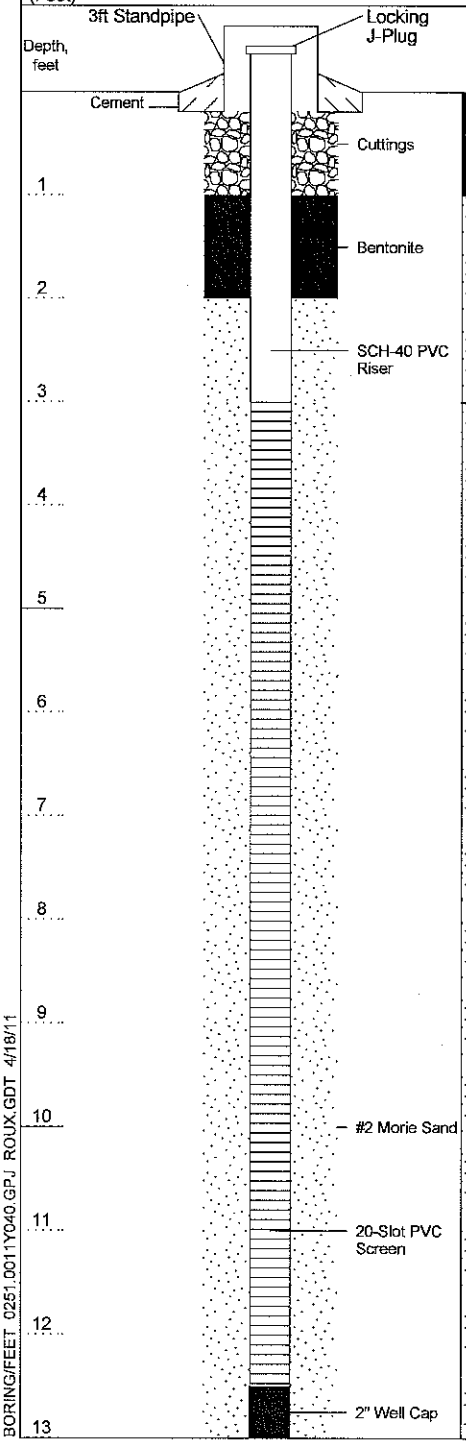
BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

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WELL CONSTRUCTION LOG

WELL NO. **MP-MW-108R**	NORTHING **Not Measured**	EASTING **Not Measured**		
PROJECT NO./NAME **0251.0011Y040 / BASF Corporation**		LOCATION **Rensselaer Facility** **Rensselaer, New York**		
APPROVED BY	LOGGED BY **C. Roth**			
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / R. Buley**		GEOGRAPHIC AREA **Main Plant Area**		
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **Cuttings**	START-FINISH DATE **11/30/10-11/30/10**
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: ~~3ft Standpipe~~ TYPE **Slotted**	MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES **Morie #2**



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		ASPHALT			
1		Brown, fine to coarse SAND, little Silt and Gravel; moist.			
3		Brown, fine to coarse SAND, little Silt and Clay; wet.			

BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

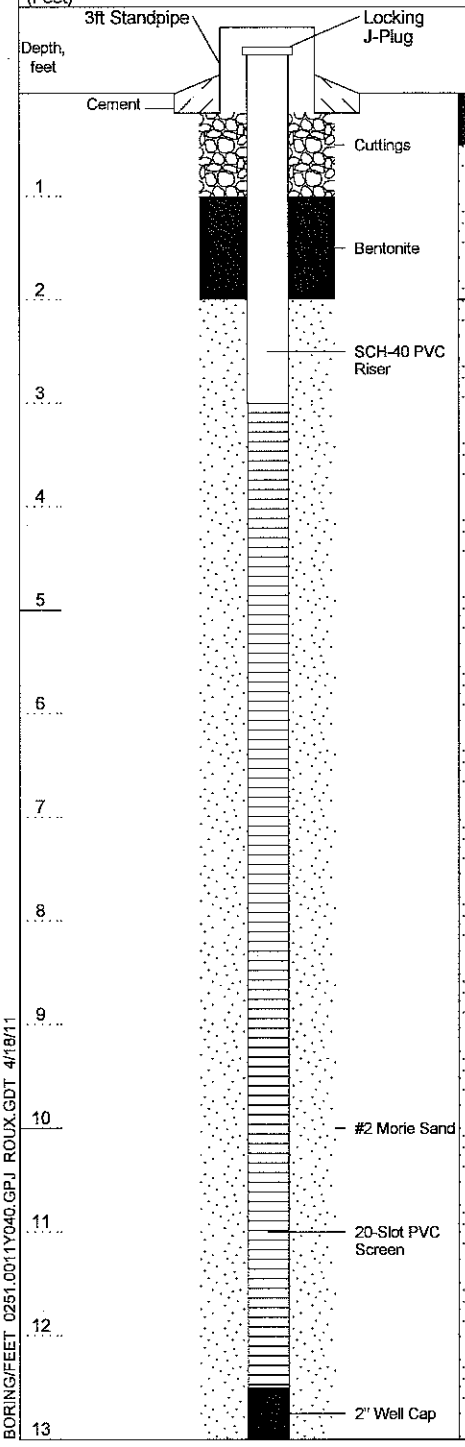
WELL CONSTRUCTION LOG

WELL NO.	NORTHING	EASTING
MP-MW-119R	Not Measured	Not Measured

PROJECT NO./NAME	LOCATION
0251.0011Y040 / BASF Corporation	Rensselaer Facility
APPROVED BY / LOGGED BY: C. Roth	Rensselaer, New York
DRILLING CONTRACTOR/DRILLER: Aquifer Drilling and Testing / L. Darrow	GEOGRAPHIC AREA: Main Plant Area

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
4.25-in. / Auger	8-inches	CME-75 / HSA	Cuttings	11/11/10-11/11/10

CASING MAT./DIA.: SCH 40 PVC / 2-inch
SCREEN: TYPE Slotted MAT. SCH 40 PVC TOTAL LENGTH 10.0ft DIA. 2-inch SLOT SIZE 20-Slot
ELEVATION OF: (Feet) GROUND SURFACE TOP OF WELL CASING TOP & BOTTOM SCREEN /
GRAVEL PACK SIZES: Morie #2



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		ASPHALT			
1		Brown, fine to medium SAND; moist.			
2		Dark brown, fine to medium SAND, little Silt; wet.			
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

WELL CONSTRUCTION LOG

WELL NO.	NORTHING	EASTING
MP-MW-120R	**Not Measured**	**Not Measured**

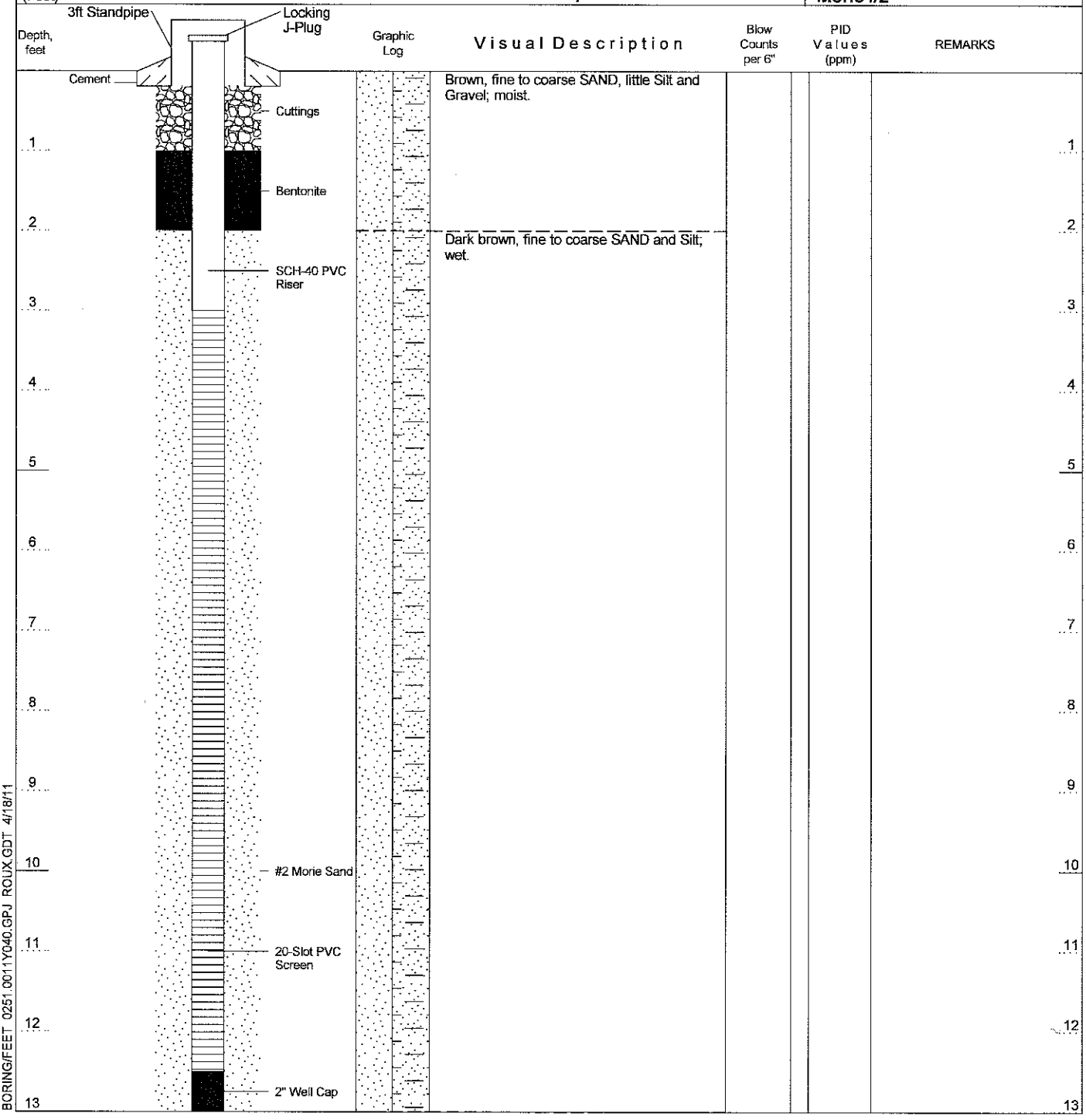
PROJECT NO./NAME	LOCATION
0251.0011Y040 / BASF Corporation	**Rensselaer Facility**
APPROVED BY	LOGGED BY
	C. Roth
	Rensselaer, New York

DRILLING CONTRACTOR/DRILLER	GEOGRAPHIC AREA
Aquifer Drilling and Testing / L. Darrow	**Main Plant Area**

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
4.25-in. / Auger	**8-inches**	**CME-75 / HSA**	**Cuttings**	**11/11/10-11/11/10**

CASING MAT./DIA.	SCREEN:
SCH 40 PVC / 2-inch	TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**

ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES
			/	**Morie #2**



BORING/FEET 0251.0011Y040.GPJ ROUX.GDT 4/18/11

FIGURE 3

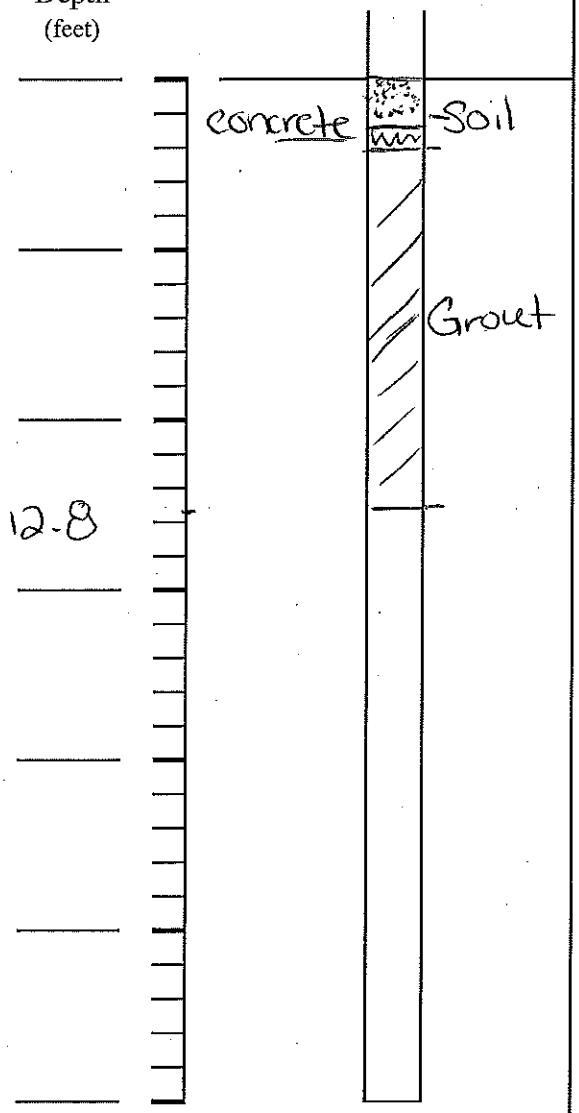
WELL DECOMMISSIONING RECORD

Site Name: BASF Rensselaer	Well I.D.: MW 47
Site Location: BASF 70 Riverside Ave	Driller: ADT
Drilling Co.: ADT	Inspector: John Frajamil
	Date: 2/6/17

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	2"pvc
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	Approx 4-5 Gals

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

FIGURE 3

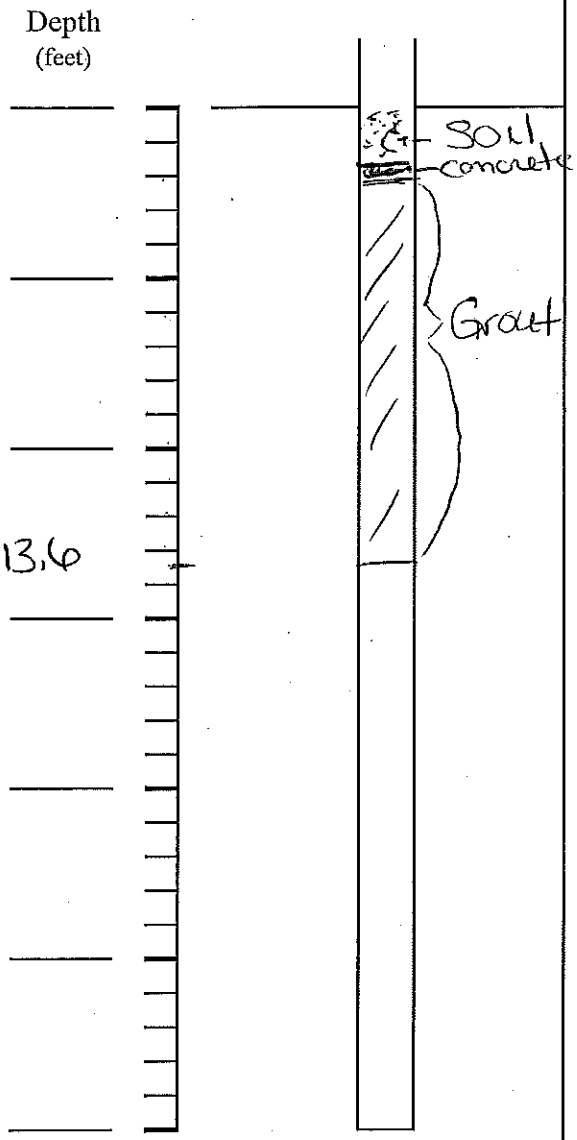
WELL DECOMMISSIONING RECORD

Site Name: BASF	Well I.D.: LFMW46
Site Location: Rens	Driller: ADT
Drilling Co.: ADT	Inspector: John Freijomi
	Date: 2/6/17

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	2"
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	Approx 9.5 gal

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

FIGURE 3

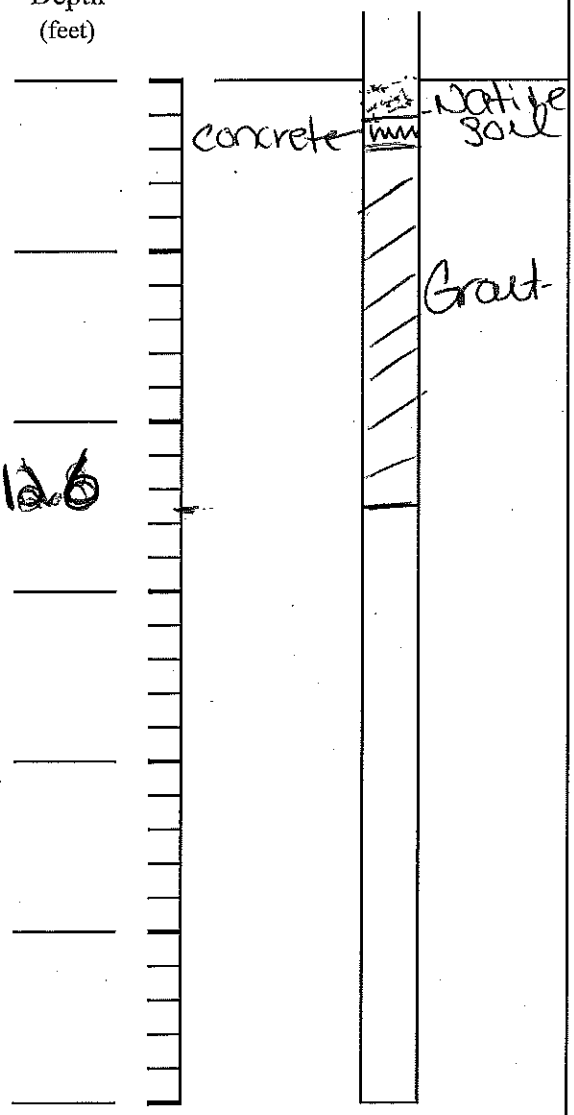
WELL DECOMMISSIONING RECORD

Site Name: BASF Rensselaer	Well I.D.: MW 108R
Site Location: ~~Be~~ 70 Riverside Ave	Driller: ~~[illegible]~~ ADT
Drilling Co.: ADT	Inspector: John Freijaul
	Date: 2/6/17

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	2" PVC
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	6-8
Volume of grout used (gal.)	Approx 6-8 Gal

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

FIGURE 3

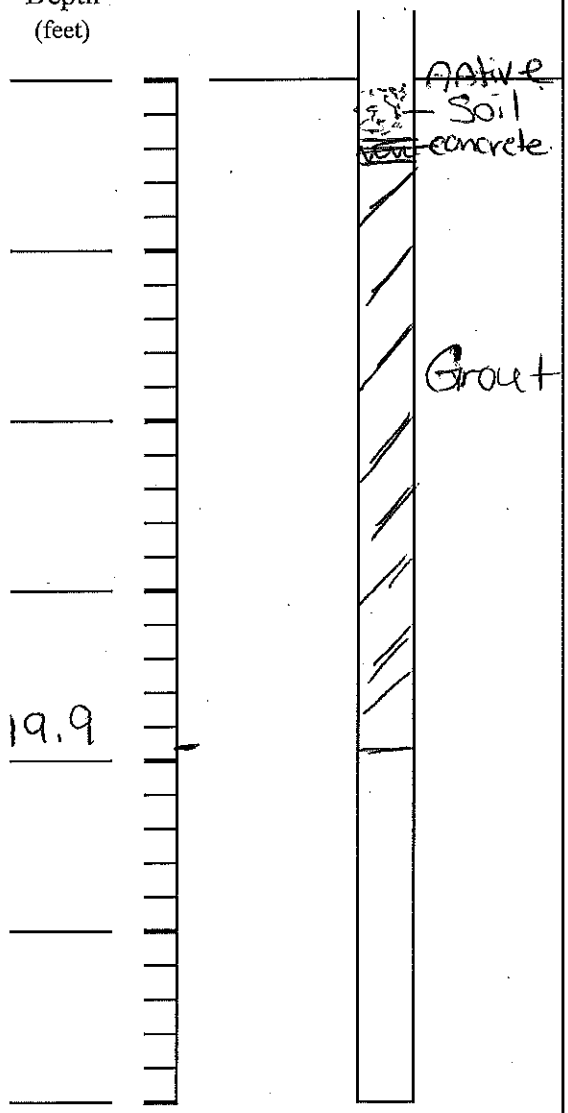
WELL DECOMMISSIONING RECORD

Site Name: BASF Rensselaer	Well I.D.: MW R4
Site Location: BASF Riverside Ave	Driller: ADT
Drilling Co.: ADT	Inspector: John Freijomil
	Date: 2/6/17

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	2" PVC
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	Approx 12 Gal

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

FIGURE 3

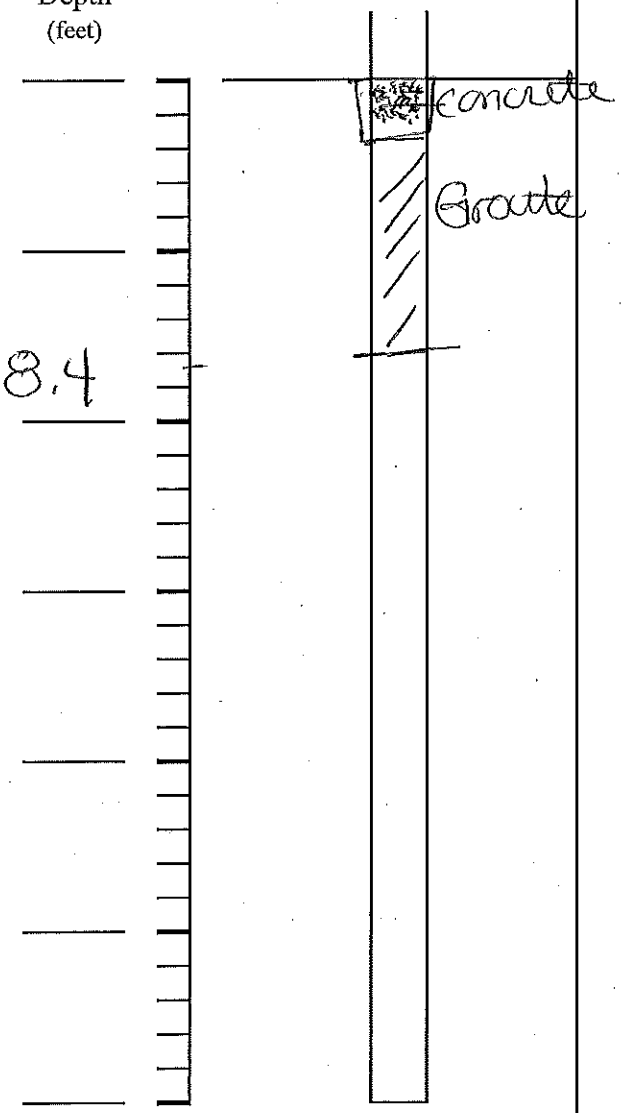
WELL DECOMMISSIONING RECORD

Site Name: BASF Rensselaer	Well I.D.: MW 119R
Site Location: BASF 70 Riverside Ave	Driller: ADT
Drilling Co.: ADT	Inspector: John Freijomil
	Date: 2/6/17

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	2" PVC
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	Approx 4 gal

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

FIGURE 3

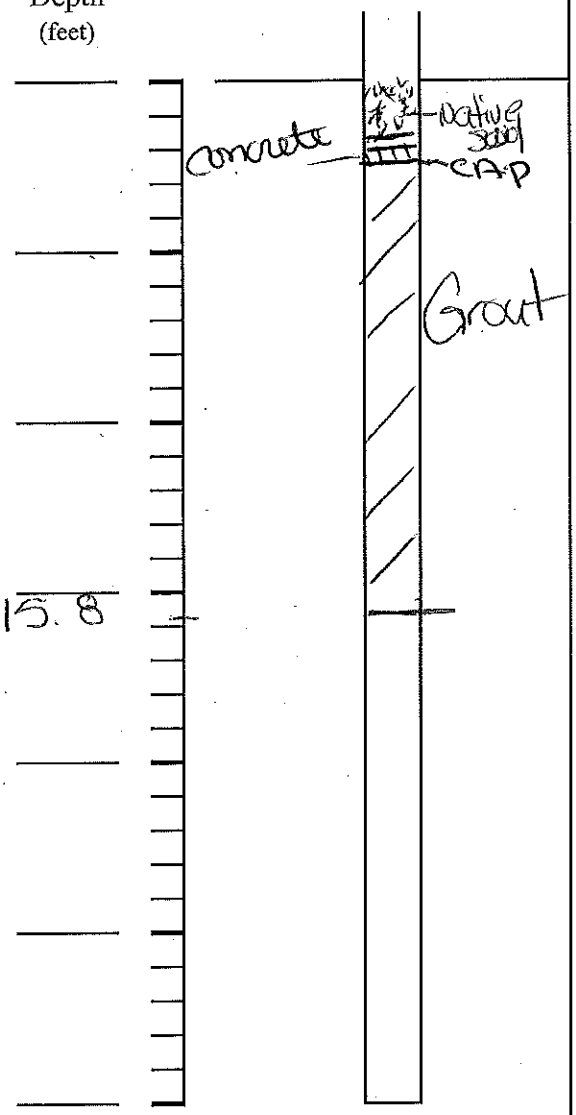
WELL DECOMMISSIONING RECORD

Site Name: BASF Rensselaer	Well I.D.: MW 120R
Site Location: BASF 70 Riverside Ave	Driller: Steve Zoob, ADT
Drilling Co.: ADT	Inspector: John Freijomil
	Date: 2/16/17

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	Approx 10gal

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Aquifer Drilling & Testing, Inc.

ADT JOB NO.: _____

NYC OFFICE
(800) 238-3745
(516) 616-6194 Fax

ALBANY
(518) 326-1441
(518) 326-1443 Fax

CONNECTICUT OFFICE
(860) 243-0352
(860) 243-8570 Fax

DAILY JOB & SITE INVESTIGATION REPORT

DAY: Monday
DATE: 2-6-17
JOB LOCATION: BASF
DESCRIPTION OF WORK: Remove standpipes, cut p.v.c 2ft. below grade, grout well.

CLIENT: Roux

DRILLER: R. Bailey
HELPER(S): Jason F / Marty B
RIG NO.: 525
SUPPORT TRK: 317

TEST BORING DATA & SITE GEOLOGY

BORING NO.	TOTAL DEPTH	SAMPLES SOIL	SAMPLES H2O	BL CT	DTW	GRAVL/CBLE/BLDER SAND/SILT/CLAY

DRILLING METHOD

HSA / AIR / MUD / SONIC

Footage _____ Size _____

CORING

Footage _____ Size _____

MISCELLANEOUS

Steam Clean (hr)	
Standby (hr)	
Stage Soils (hr)	
Well Develop (hr)	
Borehole Grout (ft)	83
Poly Tubing (ft)	
Concrete Cores (no.)	
Expend. Points (no.)	
Drums (no.)	
Sidewalk Permits (no.)	

TEMPORARY TEST POINTS

WELL NO.	SIZE	SCRN	RISER	DEPTH	SAND	CHIPS	CMT	BENT	SURF(M/S
MW4R	2			12.6					
MW7R	2			12.8					
MW4R	2			19.9					
10R	2			12.6					
19R	2			8.4					
MW102				15.8					

Arrive Shop@	Leave Shop@	Arrive Site @	Leave Site @	Arrive Shop @	Leave Shop @

PERSONNEL	SIGNATURE	AM SHOP	MOBE*	ON SITE	DEMOBE**	PM SHOP	TOTAL
R. Bailey		1/2	1/2	8			
Jason F		1/2	1/2	8			
Marty B		1/2	1/2	8			

APPROVED: _____ DATE: 2/6/17
CLIENT REPRESENTATIVE

PRINT NAME: John Freijomil Roux

Client's signature approves crews ON SITE hours.

* Indicate if Initial Mobilization

** Indicate if Final Demobilization

White (Client) Yellow (Accounting) Pink (Admin)

LAND Remediation, Inc. an environmental services company	**TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATE, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE**	DATE: 7/30/2018	☑ New Submittal ☐ Re-Submittal

SECTION I: REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (THIS SECTION WILL BE INITIATED BY THE CONTRACTOR)

TO: **AECOM**	FROM: **LAND REMEDIATION, Inc.**	SUBMITTAL NO.: 46
		PREVIOUS SUBMITTAL NO. AND DATE: NA
Specification Section No.: Field Order 4	Project Title: **BASF Corp. Rensselaer, NY**	

Item No.	Description of Item Submitted	Manufacturer or Contractor Catalog. Drawing or Brochure	No. of Copies	Spec. Paragraph No.	Drawing Sheet No.	Comments
1	Monitoring Well Abandonment Records	well logs	1	Field Order 4		see below\

Remarks:	**LAND REMEDIATION, INC.**	Signature:
See below	I hereby certify that I have carefully examined the enclosed submittal(s) and have determined and verified all field measurements, construction criteria, materials, catalog numbers and similar data, coordinated the submittal(s) with other submissions and the work of other trades and contractors, and to the best of my knowledge and belief, the enclosed submittal(s) is/are in full compliance with the Contract Documents, except as follows.	Title: Project Director Date: July 30, 2018
	☐ None ☐ As Equal	

Additional Notes:

1. Three monitoring wells were decommissioned on 07-06-2018 by SJB services according to Field Directive No. 4.
2. Well decommissioning records are attached for MW - LGPZ-10R, LGMW-26, and LGMW-25.
3. Survey Coordinates are as follows:
   MW-LGPZ-10R - N:1384262.357, E:693712.313, Elv: 14.415
   LGMW-26 - N:1384373.699, E:693725.079, Elv: 13.646
   LGMW-25 - N:1384495.652, E:693736.066, Elv: 10.459

FIGURE 3

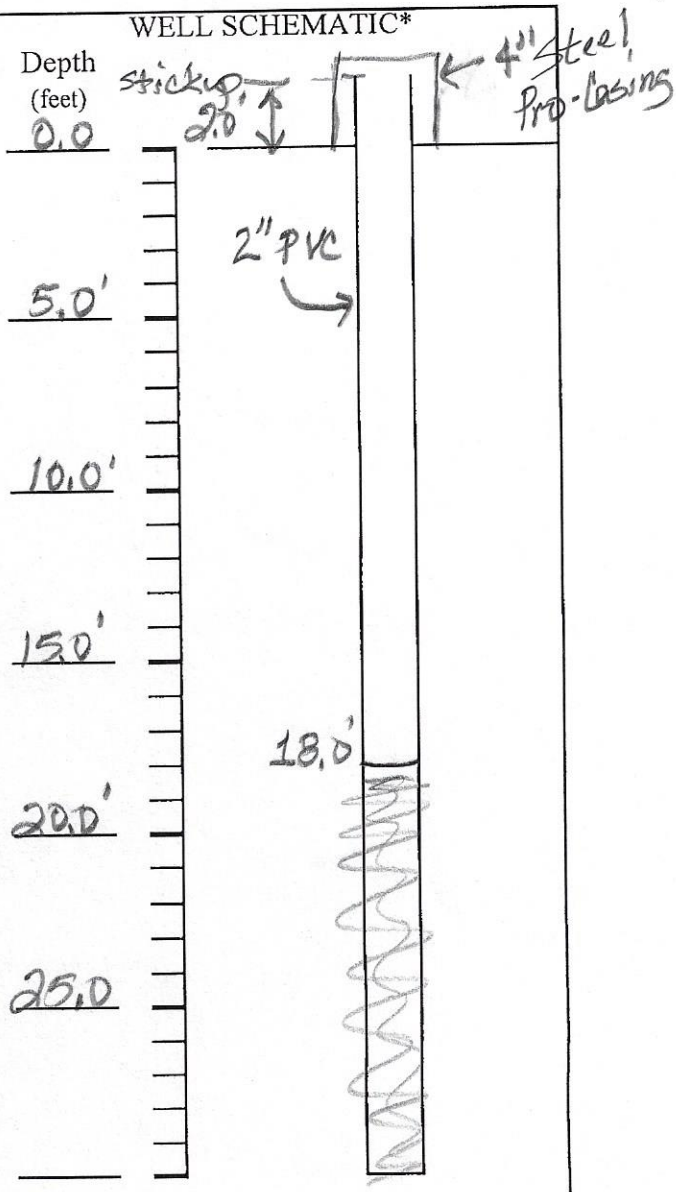
WELL DECOMMISSIONING RECORD

Site Name: BASF Plant - Site 442027	Well I.D.: LGPZ-10R
Site Location: 36 Riverside Ave. - Rensselaer, NY	Driller: Jim Vincent
Drilling Co.: SJB Services, Inc.	Inspector:
	Date: 7/6/18

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0 - 18.0'
# of batches prepared * See Note Below	1
For each batch record:	
Quantity of water used (gal.)	± 8 gals
Quantity of cement used (lbs.)	94 lbs
Cement type	I/II
Quantity of bentonite used (lbs.)	± 5 lbs
Quantity of calcium chloride used (lbs.)	—
Volume of grout prepared (gal.)	± 10 gals
Volume of grout used (gal.)	± 1 gal

WELL SCHEMATIC*



COMMENTS: * 1 batch of grout was used to decommission all three MW's (LGPZ-10R, LGMW-26, & LGMW-25). 4" Steel Pro-Casing was removed prior to grouting.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

James C. Vincent
Drilling Contractor

Department Representative

* ± 3.5 gals of grout used to grout in-place LGPZ-10R

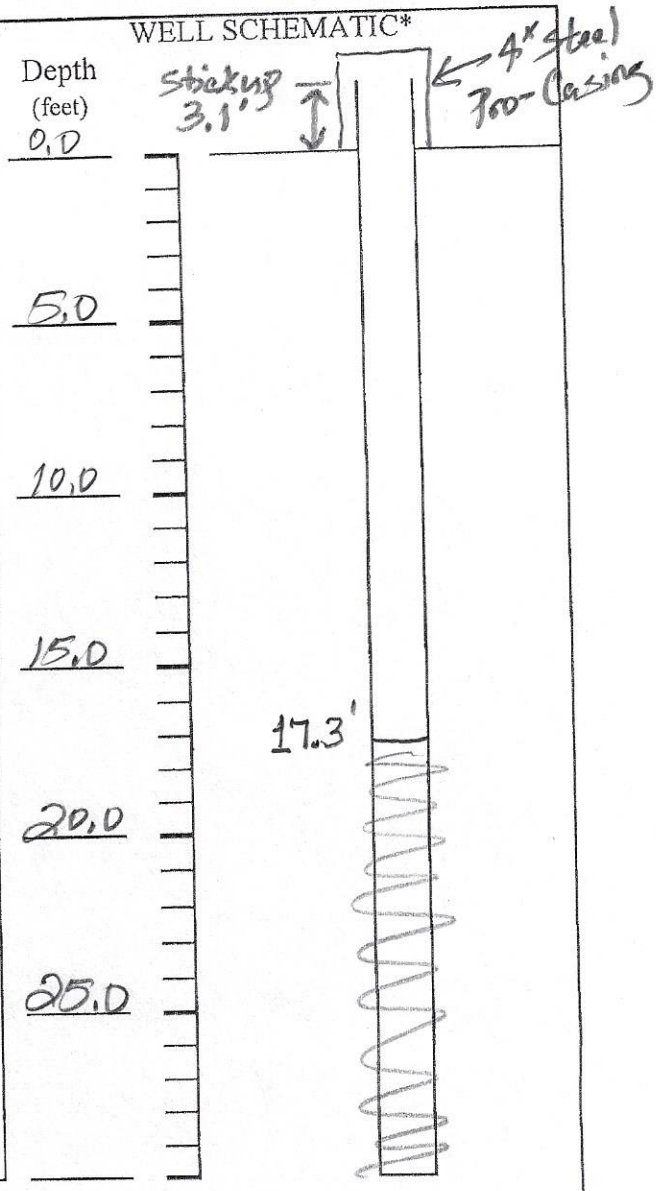
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: BASF Plant - Site 442027	Well I.D.: LGMW-26
Site Location: 36 Riverside Ave. - Rensselaer, NY	Driller: Jim Vincent
Drilling Co.: SJB Services, Inc.	Inspector:
	Date: 7/6/18

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-17.3'
# of batches prepared * See Note Below	1
For each batch record:	
Quantity of water used (gal.)	± 8 gals
Quantity of cement used (lbs.)	94 lbs
Cement type	I/II
Quantity of bentonite used (lbs.)	± 5 lbs
Quantity of calcium chloride used (lbs.)	—
Volume of grout prepared (gal.)	± 1 bags
Volume of grout used (gal.)	± 1 gal

WELL SCHEMATIC*



COMMENTS: * 1 batch of grout was used to decommission all three MWs (LGPZ-10R, LGMW-26, & LGMW-25). 4" Steel Pro-Casing was removed prior to grouting.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

James C. Vincent
Drilling Contractor

Department Representative

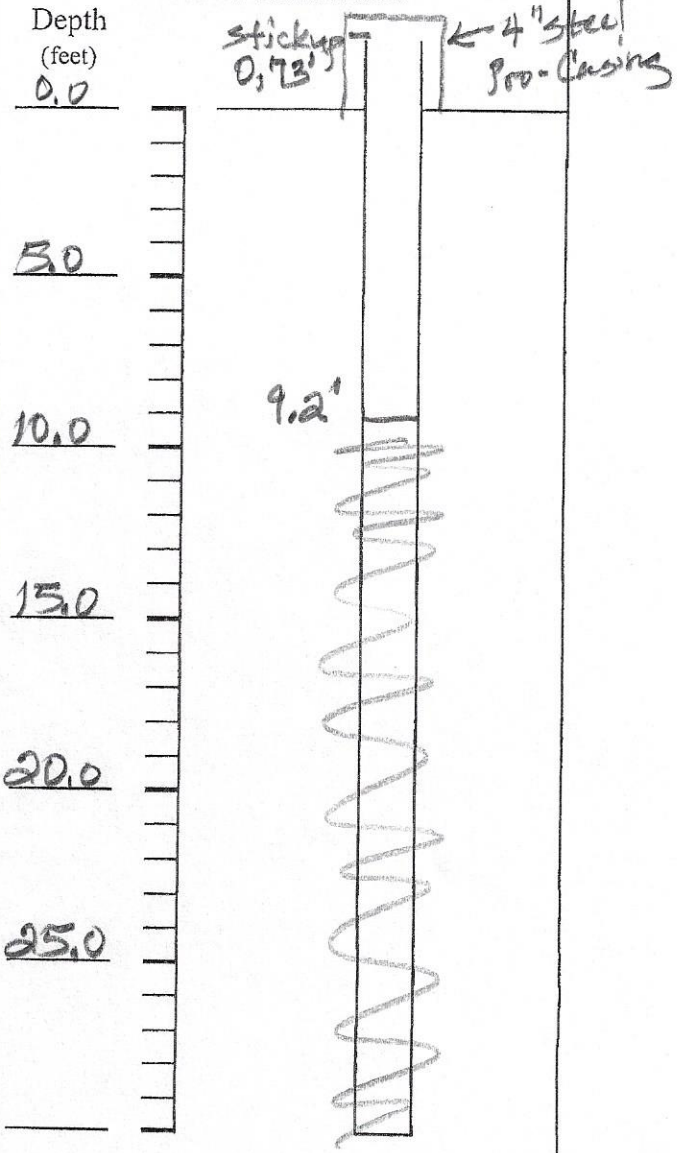
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: BASF Plant - Site 442029	Well I.D.: LGMW-25
Site Location: 36 Riverside Ave. - Rensselaer, NY	Driller: Jim Vincent
Drilling Co.: SJB Services, Inc.	Inspector:
	Date: 7/6/18

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0 - 9.2'
# of batches prepared * See Note Below	1
For each batch record:	
Quantity of water used (gal.)	± 8 gals
Quantity of cement used (lbs.)	94 lbs
Cement type	I/II
Quantity of bentonite used (lbs.)	± 5 lbs
Quantity of calcium chloride used (lbs.)	—
Volume of grout prepared (gal.)	± 1 Drum
Volume of grout used (gal.)	± 1 gal

WELL SCHEMATIC*



COMMENTS: * 1 batch of grout was used to decommission all three MW's (LGP2-10R, LGMW-26, & LGMW-25). 4" Steel Pro-Casing was removed prior to grouting.

James C. Vincent
Drilling Contractor

Department Representative

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

*

APPENDIX I

Groundwater Monitoring Well Sample Log Form

Well Sampling Data Form

Client: _____ **Project Number:** _____

Site Location: _____

Well No: _____ Weather: _____

Date: _____ Purge Water Disposal: _____

Sampled By: _____ Well Diameter / Type: _____

Depth of Well (ft): _____ Water Column (ft): 0

Depth to Water(ft): _____ Volume of Water in Well (gal) 0

Depth to Product (ft): _____ Volume of Water to Remove (gal): 0

well diameter:	1 in	**2 in**	4 in	6 in	8 in
gallons per foot:	0.041	**0.163**	0.653	1.469	2.611

Start Purging: _____ Purge Rate: _____

End Purging: _____ Volume of Water Removed (gal): _____

Method of Purge: _____ Method of Sampling: _____

Physical Appearance/ Comments: _____

Samples Collected: (analyses / no. bottles) _____

_____ Laboratory : _____

Field Measurements:

Time	**Volume** gal	**Dissolved O_2** mg/L	**ORP** mV	**Conductivity** **mS/cm** - S/m	**Turbidity** NTU	**pH** SU	**Temperature** **C°** - *F°*	**Salinity** %

APPENDIX J

Site Monitoring, Inspection, and Maintenance Form for OU1

ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.
MONTHLY SITE MONITORING, INSPECTION AND MAINTENANCE FORM

Client: **BASF Corp**
Location: **Rensselaer, NY**
Project Number: **0251.0011Y045**
Job: **OU-1 Cap**
Performed by: ( ) on ( )

Inspection of Existing Surface (Asphalt, gravel RR tracks, natural & landscaped areas):

Yes	No	
[ ]	[ ]	Woody shrubs/ trees observed in Asphalt areas greater than one-inch in diameter?
[ ]	[ ]	Signs of disturbance to asphalt areas ?
[ ]	[ ]	Other conditions (i.e., stressed vegetation, invasive plants, insect infestation, etc.) observed? If yes, refer to Page 3 for additional clarification.

Inspection of Main Plant Excavation Areas (Areas 2 and 4B -gravel top)

Yes	No	
[ ]	[ ]	Signs of disturbance to gravel areas ?
[ ]	[ ]	Woody shrubs/ trees observed greater than one-inch in diameter?
[ ]	[ ]	Other damage observed? If yes, refer to Page 3 for additional clarification.

Inspection of Former Buildings Clay Cap

Yes	No	
[ ]	[ ]	Significant rills or gullies observed?
[ ]	[ ]	Signs of settlement/ subsidence observed?
[ ]	[ ]	Significant animal burrows observed?
[ ]	[ ]	Significant bare spots observed?
[ ]	[ ]	Woody shrubs/ trees observed greater than one-inch in diameter?
[ ]	[ ]	Underlying orange demarcation barrier exposed?
[ ]	[ ]	Are soil caps sloped to allow for drainage away from the peak?
[ ]	[ ]	Other damage observed? If yes, refer to Page 3 for additional clarification.

Inspection of Former Buildings Concrete Caps

Yes	No	
[ ]	[ ]	Woody shrubs/ trees observed greater than one-inch in diameter?
[ ]	[ ]	Other damage observed? If yes, refer to Page 3 for additional clarification.

Inspection of Building 67 Elastocoat Cap

Yes	No	
[ ]	[ ]	Significant cracks, bubbles or flaking of the elastocoat?
[ ]	[ ]	Signs that the elastocoat is separating from the geotextile membrane underneath?
[ ]	[ ]	Other damage observed? If yes, refer to Page 3 for additional clarification.

ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.
MONTHLY SITE MONITORING, INSPECTION AND MAINTENANCE FORM

Client: **BASF Corp**
Location: **Rensselaer, NY**
Project Number: **0251.0011Y045**
Job: **OU-1 Cap**
Performed by: ( ) on ( )

Inspection of Lagoon Area Vegetative Soil Cap:

Yes	No	
[ ]	[ ]	Significant rills or gullies observed?
[ ]	[ ]	Signs of settlement/ subsidence observed?
[ ]	[ ]	Significant animal burrows observed?
[ ]	[ ]	Significant bare spots observed?
[ ]	[ ]	Underlying demarcation barrier exposed (i.e. biota barrier/recycled concrete aggregate (RCA)?
[ ]	[ ]	Other conditions (i.e., stressed vegetation, invasive plants, insect infestation, etc.) observed?
		If yes, refer to Page 3 for additional clarification.

Inspection of Main Plant Vegetative Soil Cap (stormwater detention areas and swales

Yes	No	
[ ]	[ ]	Significant rills or gullies observed in detention areas?
[ ]	[ ]	Signs of settlement/ subsidence observed?
[ ]	[ ]	Significant animal burrows observed?
[ ]	[ ]	Woody shrubs/ trees observed greater than one-inch in diameter?
[ ]	[ ]	Underlying demarcation barrier exposed (i.e. bottom of 6 to 12-inch topsoil demarcation layer exposed)?
[ ]	[ ]	Other conditions (i.e., stressed vegetation, invasive plants, insect infestation, etc.) observed?
		If yes, refer to Page 3 for additional clarification.

ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.
MONTHLY SITE MONITORING, INSPECTION AND MAINTENANCE FORM

Client: **BASF Corp**
Location: **Rensselaer, NY**
Project Number: **0251.0011Y042**
Job: **OU-1 Cap**
Performed by: ( ) on ( )

APPENDIX K

Quality Assurance Project Plan for OU1

May 7, 2014

QUALITY ASSURANCE PROJECT PLAN FOR OU1

Former BASF Manufacturing Plant
Riverside Avenue
Rensselaer, New York

Prepared for

BASF CORPORATION
100 Park Avenue
Florham Park, New Jersey

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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TABLES

1. Summary of Analytical Methods/Quality Assurance Samples
2. Summary of Preservation, Holding Times, and Sample Containers

1.0 INTRODUCTION

On behalf of the BASF Corporation ("BASF"), Remedial Engineering, P.C ("Remedial Engineering") has prepared this "General" Quality Assurance Project Plan ("QAPP") for the Main Plant (OU-1) Parcel (NYSDEC No. 4-42-027) of the Closed BASF Rensselaer Facility located in Rensselaer, New York, which is shown on Figures 1 and 2. Remedial Engineering is a New York State professional service corporation organized primarily for the purpose of providing engineering services for clients of Roux Associates, Inc. ("Roux Associates"). Site No. 4-42-027 is defined in the September 2003 Record of Decision ("ROD") issued by the New York State Department of Environmental Conservation ("NYSDEC"). The area subject to this QAPP is more fully described in Section 1.2 of the SMP.

1.1 Purpose

The QAPP specifically describes in detail the field sampling and quality assurance/quality control methods to be used during soil/ fill material management tasks.

The tasks covered by this QAPP are on-Site soil/ fill material re-use sampling, waste characterization sampling, and off-Site fill material sampling for soil.

This QAPP was prepared in accordance with the NYSDEC's "DER 10/Technical Guidance for Site Investigation and Remediation," dated May 3, 2010 (DER-10 Guidance Document) and provides guidelines and procedures to be followed by field personnel during performance of the post-remedial action sampling. Information contained in this QAPP relates to:

- Sampling objectives (Section 2);
- Sample media, sampling locations, analytical suites, sampling frequencies, and analytical laboratory (Section 3);
- Field sampling procedures (Section 4);
- Sample handling, sample analysis, and quality assurance/quality control (Section 5); and
- Site control procedures and decontamination (Section 6).

1.3 Project Organization and Responsibility

A general and generic summary of the overall management structure for field activities and associated responsibilities of the technical staff is provided below.

Project Manager: The Project Manager bears the primary responsibility for the successful completion of the work assignment within budget and schedule, provides overall management for the execution of the project, and directs the activities of the Site Manager and technical staff. The project manager performs technical review of all field activities, data review and interpretation and the report preparation. The Project Manager works closely with the analytical laboratory, data validation, and surveyors during the execution of the field program. Activities of the Project Manager are supported by senior management, the Project Quality Assurance Coordinator, and support staff.

Site Manager: The Site Manager bears the primary responsibility for the successful execution of the field program. The Site manager directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and report preparation. The Site Manager is responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors.

Field Technical Staff: Field technical staff consists of engineers, hydrogeologists, geologists, and technicians who will perform activities such as CAMP monitoring, soil/ fill material sampling, and preparation of any field documentation which may be necessary.

Site Health and Safety Officer: The Site Health and Safety Officer (SHSO) will be responsible for the implementation of the HASP. The SHSO will recommend revisions to the HASP if field conditions warrant. Any necessary revision to the HASP will be submitted to the Corporate Office Health and Safety Manager for approval.

Project Quality Assurance Coordinator: The Project Quality Assurance Coordinator (PQAC) provides technical quality assurance assistance; prepares, reviews, and approves the QAPP; oversees any contractor quality assurance activities to ensure compliance with contract specifications; and monitors field investigations, if necessary.

Laboratory Quality Assurance Officer: The Laboratory Quality Assurance Officer (LQAO) is identified by each laboratory contracted for analysis. The Laboratory Quality Assurance Officer will evaluate analytical results to ensure that the laboratory maintains a good performance and is responsible for the preparation of the analytical data package.

2.0 SAMPLING OBJECTIVES

The remedial action sampling program is designed to meet the data quality objectives (DQOs) set forth in the NYSDEC's DER-10 Guidance Document. Specifically, analytical parameters selected for each sample, as described in Section 3, are comprehensive and are intended to meet the following objectives:

- Analyze excavated fill materials for parameters required for on-Site re-use;
- Analyze excavated fill materials for parameters required by the selected disposal facility; and
- Analyze off-Site fill material for parameters required to evaluate their suitability for use on Site.

Sampling procedures are discussed in Section 4 of this QAPP. A discussion of the DQOs and quality assurance/quality control for the project is provided in Section 5.

3.0 SAMPLE MEDIA, LOCATIONS, ANALYTICAL SUITES, AND FREQUENCY

The media to be sampled may include soil or fill materials. A discussion of the potential types of soil/ fill material sampling that may be performed is provided below. Specifics regarding the collection of soil/ fill material samples is provided in Section 4 of this QAPP and summarized on Table 1.

3.1 Waste Characterization Sampling

As discussed in the excavation work plan (EWP), all excavated soil/ fill materials removed below existing demarcation layers that are not acceptable for re-use on Site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State, including 6NYCRR Part 360, and Federal regulations.

One sample per 500 cubic yards (or as required by disposal facility) of excavated material will be collected for waste characterization purposes. The samples will be collected and analyzed as required by the disposal facility selected based on a competitive bid.

QA/QC samples are not required for waste characterization samples.

3.2 On-Site Re-Use Sampling

As discussed in the EWP, all excavated soil/ fill materials removed below existing demarcation layers that are acceptable for re-use on Site will be placed below the final surface of the existing or modified composite cover system and will not be reused for any other purpose (i.e., within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines).

One set of composite samples will be collected and analyzed per 250 cubic yards of any excavated material proposed for on-Site re-use to confirm that all detected chemicals of concern are below the on-Site re-use criteria specified in Table 3 of the SMP for OU-1. Specifically, one composite sample will be collected and analyzed for SVOCs per USEPA Method 8270, Total Priority Metals per USEPA Methods 6010/7470A/7471A, Poly-Chlorinated Biphenyls (PCBs) per USEPA Method 8082 and Pesticides per USEPA Method 8081 and Herbicides per USEPA Method 8151. In addition, one representative grab sample will be collected and analyzed for VOCs per USEPA Method 8260.

QA/QC samples, including duplicates and MS/MSD will be collected at a 5 percent of normal sample frequency.

3.3 Backfill Sampling

When excavation and removal of any impacted fill material is complete, the excavation will be backfilled and compacted using off-Site clean fill material meeting the criteria identified in Table 3 of the SMP for OU-1. The backfill material will be provided from a virgin source, free of extraneous debris or solid waste and certified clean by the supplier. The clean fill certification will include information regarding past use of the Site, confirm that the source area background has been checked, and confirm its DOT certification, if applicable. If the source is not virgin, a project-specific request can be submitted to the NYSDEC for consideration and approval of the proposed non-virgin source.

Prior to sampling and importing any fill material to the Site, the material must meet the acceptance criteria identified above. Subsequent to this initial approval, one set of pre-qualification samples will be collected from the off-Site source and analyzed for grain size distribution per ASTM D-422, SVOCs per USEPA Method 8270, Total Priority Metals per USEPA Methods 6010/7470A/7471A, PCBs per USEPA Method 8082 and Pesticides per USEPA Method 8081 and Herbicides per USEPA Method 8151 as a composite sample and for VOCs per USEPA Method 8260 as a grab sample. All detected chemicals of concern for this pre-qualification sample must be below the criteria specified in Table 3 of the SMP for the OU-1. In addition, the grain size distribution for the imported sand should have 90% passing the No. 10 sieve. The Engineer, with the concurrence of the NYSDEC will review results of pre-qualification testing of off-Site fill materials and will be the sole judge as to acceptability of the material. Once approved, the following batches of fill material can be imported on Site for each approved source, staged in accordance with the requirements of Section 2.3 of the EWP and sampled (consistent with protocols used to collect and analyze the pre-qualification sample) to confirm compliance with the specified criteria:

- One set of samples from the first batch imported (0 to 250 cubic yards);
- One set of samples from the second batch imported (251 to 1,000 cubic yards);
- One set of samples from the third batch imported (1,001 to 2,500 cubic yards); and

- One set of samples from each 2,500 cubic yard batch thereafter.

Each off-Site fill material sample will be analyzed for the following parameters:

- VOCs by USEPA method SW-846-8260.
- SVOCs by USEPA method SW-846-8270.
- TAL metals by USEPA method SW-846-6010B//7470A/7471A.
- Pesticides and PCBs by USEPA methods SW-846-8081A/8082.
- Herbicides by USEPA method 8151.

QA/QC samples are not required for backfill samples.

3.4 Analytical Laboratory

Laboratory analyses will be performed by a NYSDOH ELAP certified laboratory in accordance with the July 2005 NYSDEC Analytical Services Protocol (ASP) using USEPA SW-846 Methods.

3.5 Laboratory Data Validation

If the NYSDEC requires validation for any sampling data, a third party data validator must conduct the work. This individual must submit a current resume outlining education and experience in data validation to DER for approval per the requirements of Appendix 2B of DER-10. The data reviewer will conduct a systematic review of the anomalous data for compliance with the established QC criteria based upon the spike, duplicate and blank results provided by the laboratory. A Data Usability Summary Report (DUSR) will be prepared by a party independent from the laboratory performing the analysis in accordance with Appendix 2B of DER-10.

The data reviewer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based upon the extent of the deficiencies and their importance in the overall context of the project.

4.0 FIELD SAMPLING PROCEDURES

This section provides a discussion of the field procedures to be used for sampling of soil/ fill material.

4.1 Soil/ Fill Material Sampling

All soil/ fill material samples will be collected using pre-cleaned stainless steel sampling tools (i.e., trowels, spatulas, etc.). As noted above, waste characterization samples will be collected as required by the selected disposal facility. In general, where composite samples are required for on-Site re-use samples or off-Site fill material samples, composite samples will be collected from a minimum of 4 locations across the stockpiled materials.

5.0 SAMPLE HANDLING AND ANALYSIS

To ensure quality data acquisition and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples, as well as sample packaging, shipping procedures, and quality assurance/quality control.

5.1 Field Sample Handling

A detailed discussion of the proposed number and types of samples to be collected during each task, as well as the analyses to be performed can be found in Section 3.0 of this QAPP.

5.2 Sample Custody Documentation

The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable).

Each individual collecting a sample is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. The technical staff will review all field activities with the Field Team Leader to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

All samples being shipped off Site for analysis must be accompanied by a properly completed chain of custody form. The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person and/or to/from a secure storage area and/or to the shipper, and/or to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

5.3 Sample Shipment

Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix and are designed to provide optimum protection for the samples and the public. All samples will be shipped within 24 hours of collection and will be preserved appropriately from the time of sample collection.

5.4 Quality Assurance/Quality Control

The primary DQO for any sampling performed is that data be accurate and precise and, hence, representative of the actual Site conditions. Accuracy refers to the ability of the laboratory to obtain a true value (i.e., compared to a standard) and is assessed through the use of laboratory quality control (QC) samples, including laboratory control samples and matrix spike samples, as well as through the use of surrogates, which are compounds not typically found in the environment that are injected into the samples prior to analysis. Precision refers to the ability to replicate a value and is assessed through both field and laboratory duplicate samples. Field MS/MSD and field duplicate samples will only be collected for on-Site re-use samples. They are not required for the waste characterization or backfill samples.

Sensitivity is also a critical issue in generating representative data. Laboratory equipment must be of sufficient sensitivity to detect target compounds and analytes at levels below NYSDEC standards and guidelines whenever possible. Equipment sensitivity can be decreased by field or laboratory contamination of samples and by sample matrix effects. Assessment of instrument sensitivity is performed through the analysis of reagent blanks, near-detection-limit standards, and response factors. Potential field and/or laboratory contamination is assessed through use of trip blanks, method blanks, and equipment rinse blanks (also called “field blanks”). Field blanks will only be collected for on-Site re-use samples. Field blanks are not required for the waste characterization or backfill samples.

All soil/ fill material sample analyses will be performed in accordance with the July 2005 NYSDEC ASP using USEPA SW-846 methods.

On-Site re-use, waste characterization, and off-Site backfill characterization laboratory data are to be reported in NYSDEC ASP Category A deliverables, unless validation is requested by NYSDEC and Category B deliverables would be required.

6.0 SITE CONTROL PROCEDURES

Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities at the Site. In order to accomplish this objective, the QAPP addresses three main considerations:

- The establishment of discrete work zones in the work area;
- The decontamination of field equipment; and
- The handling and disposal of all remediation-derived waste.

All personnel who come into designated work areas, including contractors and observers, will be required to adhere strictly to the conditions imposed herein and to the provisions of the contractor's Site-Specific Health and Safety Plan (HASP), which will be submitted under separate cover as part of the notification and approval process for future intrusive work performed at the Site.

6.1 Field Work Zones

Field work zones will be defined in the project-specific HASP, but will, at a minimum, be limited to areas where excavation, stockpiling, and soil/ fill material sampling is being conducted for the soil/ fill material handling. Access to these areas will be limited in accordance with the HASP. Control of work zone access will be the responsibility of the individual(s) designated as a Site Health and Safety Manager. At the completion of each working day, all loose equipment (e.g., sampling equipment, coolers, etc.) will be secured. Heavy equipment, such as the excavator, may remain on Site within an established, secured zone.

6.2 Decontamination

In an attempt to avoid the spread of contamination, all excavation and sampling equipment must be decontaminated at a reasonable frequency in accordance with the requirements of the EWP.

6.3 Waste Handling and Disposal

All impacted fill material excavated from the Site and other remediation-derived waste will be transported and disposed of in accordance with all applicable federal, state, and local regulations at

an approved disposal facility as described in the EWP. The remediation-derived waste that will be generated during the construction activities include:

- Impacted fill material from the Site (non-hazardous);
- Personal Protective Equipment (PPE); and
- Decontamination water, if any is generated.

Haul vehicles for fill materials will be secured with appropriate covers prior to exiting the construction area to prevent release of waste.

PPE generated during the implementation of the remedial action will be consolidated and stored in appropriate bulk containers (drums, etc.) and temporarily staged at a waste storage area within the Site limits. Any full or partially filled containers will be appropriately labeled after the completion of the work.

Decontamination water, if any, will be collected and disposed off Site at an approved disposal facility.

Table 1. Summary of Analytical Methods / Quality Assurance Samples
Parcel OU-1 of the Closed BASF Rensselaer Facility, Rensselaer, New York

Sample Medium	Sample Parameters	Field Samples	Duplicates[1]	Field Blanks[2]	Matrix Spikes[1]	Spike Duplicates[1]	Trip Blanks
Soil (Waste Characterization)[3]	VOCs SVOCs Pesticides and PCBs TAL Metals	1 per 500 cubic yards[3]	0	0	0	0	0
Soil (On-site Reuse)	VOCs SVOCs Pesticides and PCBs TAL Metals	1 per 250 cubic yards	5%	1 per day	5%	5%	0
Soil (Offsite Backfill Material)	VOCs SVOCs Pesticides and PCBs TAL Metals	• Initial Pre-Qualification Batch • Follow-up Post-Qualification Batches - 1st batch imported (0 to 250 cubic yards) - 2nd batch imported (251 to 1,000 cubic yards) - 3rd batch imported (1,001 to 2,500 cubic yards) - All other batches imported (2,500 cubic yard batch thereafter)	0	0	0	0	0

[1] - Based on 1 per 20 samples

[2] - Based on 1 per day

[3] - To be determined by disposal facility - assumed parameter and frequency

SDG - Sample delivery group

VOCs - Volatile organic compounds

SVOCs - Semivolatile organic compounds

TAL - USEPA Contract Laboratory Program Target Analyte List

Table 2. Summary of Preservation, Holding Times and Sample Containers
Parcel OU-1 of the Closed BASF Rensselaer Facility

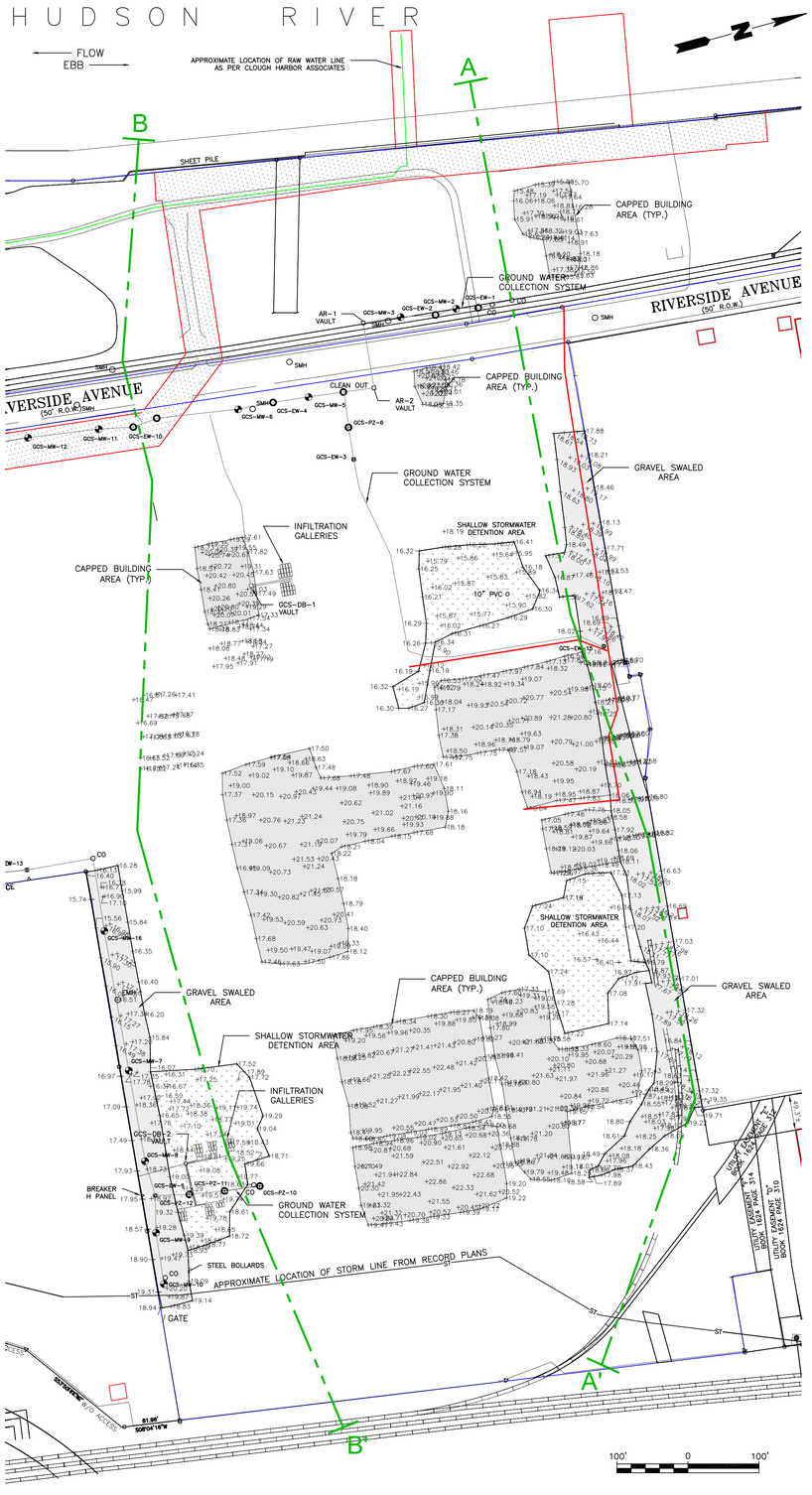
Analysis	Bottle Type	Preservation[(1)]	Holding Time[(2)]
Soil			
Volatile Organic Compounds (VOCs) SW-846 8260B	2 oz. wide-mouth glass w/teflon lined cap	Cool to 4°C	14 days
Semivolatile Organic Compounds (SVOCs) SW-846 8270C	Wide-mouth glass w/teflon lined cap	Cool to 4°C	10 days to extract 40 days for analysis
Metals SW-846 6010/7471	Wide-mouth plastic or glass	Cool to 4°C	6 months, except mercury (28 days)
Pesticide and PCB Organic Compounds SW-846 8081A/8082	4 oz. wide-mouth glass w/ teflon lined cap	Cool to 4°C	10 days to extract 40 day for analysis
Herbicides SW-846 8151	4 oz. wide-mouth glass w/ teflon lined cap	Cool to 4°C	10 days to extract 40 day for analysis

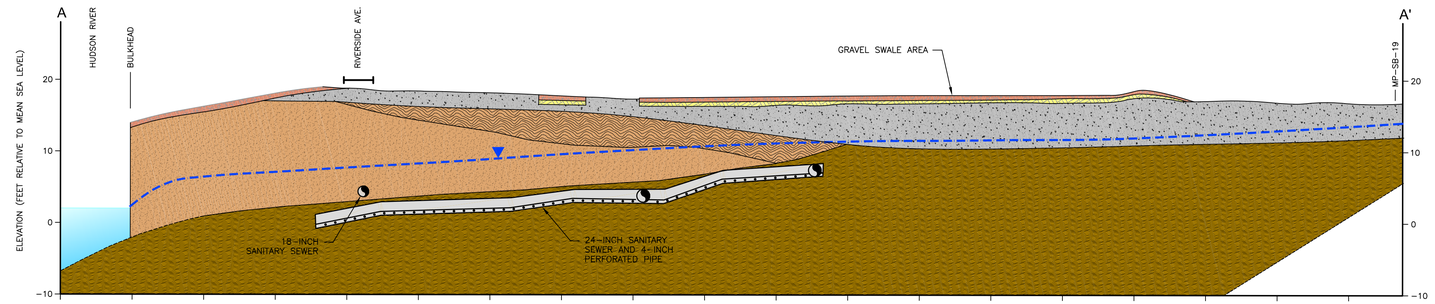
[(1)] All samples to be preserved in ice during collection and transport

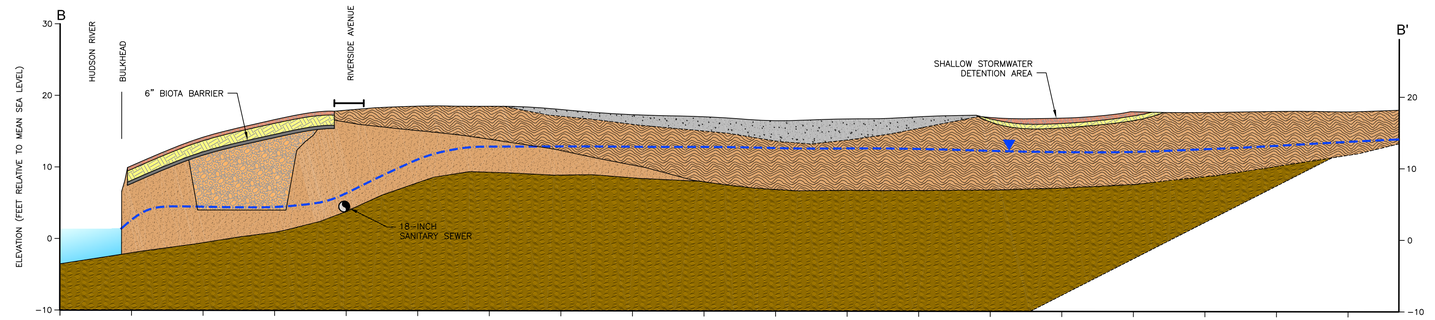
[(2)] Days from Extraction.

PLATES

1. Geologic Cross Sections
2. Groundwater Elevations and Groundwater Quality Data, June 2007
3. Metals Detected in Soil Exceeding TAGM 4046 RSCOs during Remedial Investigation
4. VOCs Detected in Soil Exceeding TAGM 4046 RSCOs during Remedial Investigation
5. SVOCs Detected in Soil Exceeding TAGM 4046 RSCOs during Remedial Investigation
6. Summary of Constituents of Concern Detected Above TAGM 4046 RSCOs in Main Plant Soil during Additional Remedial Investigation Activities
7. Metals Detected in Groundwater Exceeding NYS AWQS during Remedial Investigation
8. VOCs Detected in Groundwater Exceeding NYS AWQS during Remedial Investigation
9. SVOCs Detected in Groundwater Exceeding NYS AWQS during Remedial Investigation
10. Summary of Constituents of Concern Detected above NYS AWQS in Groundwater during Additional Remedial Investigation Activities
11. Groundwater Collection System Site Plan
12. Sewer Closure and Interim Stormwater Management Plan
13. Site Plan with Composite Cover System
14. Cap Cross Sections
15. Performance Monitoring Network and Groundwater Quality Data, December 2010 through December 2011







LEGEND

- TOPSOIL
- COMMON FILL
- RECYCLED CONCRETE AGGREGATE (RCA)
- BROWN SAND, GRAVEL, SILT, BRICK, CRUSHED STONE, AND WOOD (FILL)
- BROWN SILT WITH SOME TO TRACE SAND AND GRAVEL (FILL)
- FINE TO COARSE SAND WITH LITTLE GRAVEL (ALLUVIUM)
- GRAY/BROWN CLAY WITH TRACE SILT (LACUSTRINE)
- CONCEPTUAL PROJECTION OF APPROXIMATE ELEVATION OF 24-INCH SANITARY SEWER AND PERFORATED PIPE REPLACED BY BASF IN 1995
- CAPPED BUILDING AREA (TYPICAL)
- SHALLOW STORMWATER DETENTION AREA
- GRAVEL SWALED AREA
- —S— SANITARY LINE
- — —ST— — STORM LINE LINE
- —W— WATER LINE
- —R— RAW WATER LINE
- GCS-EW-14 LOCATION AND DESIGNATION OF EXTRACTION WELL WITH 5X5 CONC. VAULT
- GCS-EW-10 LOCATION AND DESIGNATION OF EXTRACTION WELL
- GCS-MW-17 LOCATION AND DESIGNATION OF MONITORING WELL
- GCS-EW-6 LOCATION AND DESIGNATION OF PIEZOMETER
- EMH ELECTRIC MANHOLE
- VZ163 UTILITY POLE
- CO CLEAN OUT
- +17.86 SPOT ELEVATION
- A LINE OF CROSS SECTION
- WATER TABLE
- APPROXIMATE LOCATION OF 24-INCH SANITARY SEWER AND PERFORATED PIPE

NOTES

1. INVERTS FOR SANITARY SEWER OBTAINED FROM SANITARY SEWER RECORD PLAN RE-1255-D SHEET 220, C.T. MALE ASSOCIATES, P.C.
2. INFORMATION ON LOWER BOUNDARY OF LACUSTRINE CLAY OBTAINED FROM THE FOLLOWING REPORTS:
   a. "HYDROGEOLOGICAL INVESTIGATION OF INDUSTRIAL WASTE DISPOSAL AREA" BASF WYANDOTTE CORP., RENSSELAER, N.Y. DAMES & MOORE 1979
   b. "GROUND WATER CONTAINMENT AND COLLECTION SYSTEM DESIGN, STERLING DRUG INC. RENSSELAER, NY." DAMES & MOORE 1984.
3. BASE MAP BASED ON SURVEY PROVIDED BY C.T. MALE ASSOCIATES, P.C. DATED OCTOBER 9, 2012.

10' 5' 0
0' 50' 100'
VERTICAL EXAGGERATION = 10x

Title:

GEOLOGIC CROSS SECTIONS

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: D.M.H.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	1
Project Mgr: D.M.H	Project: 0251.0011Y045	
File: 0251.0011Y592.09.DWG		

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MP–MW–105R	6/19/2007
Analyte	
VOCs	
1,2–Dichloroethane	160,000
Chlorobenzene	4,200
SVOCs	
1,2–Dichlorobenzene	4.9
Metals (Filtered)	
Arsenic	29
Beryllium	7.7
Nickel	270
Zinc	9,700

LG–MW–2	6/19/2007
All Analytes	ND*

* = Filtered Metals

LG–PZ–15	6/19/2007
All Analytes	ND*

* = Filtered Metals

ST–MW–12	6/4/2007
Analyte	
VOCs	
Toluene	9.2
Metals (Unfiltered)	
Arsenic	345

MP–MW–120	6/19/2007
Analyte	
VOCs	
Benzene	2.5
Chlorobenzene	41
Metals (Filtered)	
Zinc	2,700

MP–MW–108	6/19/2007
Analyte	
VOCs	
1,2,4–Trichlorobenzene	960
1,2–Dichlorobenzene	12
1,3–Dichlorobenzene	980
1,4–Dichlorobenzene	390
Benzene	890
Chlorobenzene	950
Methylene Chloride	25
SVOCs	
1,2,4–Trichlorobenzene	420
1,2–Dichlorobenzene	5.1
1,3–Dichlorobenzene	370
1,4–Dichlorobenzene	150
4–Chloroaniline	42

LF–MW–46	6/19/2007	6/19/2007
Analyte		
VOCs		
1,2–Dichloroethane	18	19

GCS EXTRACTION WELL FLOW RATES (GALLONS PER MINUTE)	
EW–3	2.6
EW–6	3.4
EW–8	6.3
EW–12	6.6
EW–14	4.8
EW–15	2.0
TOTAL	25.7

LEGEND

LOCATION PREFIXES
- LG – LAGOON
- MP – MAIN PLANT
- LF – LANDFILL
- ST – ALBANY MOLECULAR PROPERTY (FORMERLY ORGANICHEM)
- OS – OFFSITE

EXISTING BUILDING AS OF 2007

FORMER BUILDING AS OF 2007

STORM SEWER GRATE

MP–MW–15 — MONITORING WELL LOCATION AND DESIGNATION

MP–PZ–107 — PIEZOMETER LOCATION AND DESIGNATION

GCS–EW–14 — GCS EXTRACTION WELL SUMP LOCATION AND DESIGNATION

MP–PW–1 — PUMPING WELL LOCATION AND DESIGNATION

MP–PP–4 — PERFORATED PIPE RISER LOCATION AND DESIGNATION

LG–MH–6 — MANHOLE LOCATION AND DESIGNATION

11.39 — WATER–LEVEL ELEVATION IN FEET RELATIVE TO MEAN SEA LEVEL

NM — WATER–LEVEL NOT MEASURED

NA — WELL NOT AVAILABLE

* — WATER LEVEL NOT USED IN MAP CONSTRUCTION

14 — CONTOUR OF EQUAL WATER LEVEL ELEVATION IN FEET RELATIVE TO MEAN SEA LEVEL (DASHED WHERE INFERRED)

INFERRED DIRECTION OF FLOW

INFERRED LOCATION OF GROUNDWATER DIVIDE

GROUNDWATER CONTAINMENT SYSTEM TRENCH

BARBED WIRE FENCE

CHAINLINK FENCE

WELL DESIGNATION — DATE SAMPLED

LF–MW–46	6/19/2007	6/19/2007
Analyte	–	DUP
VOCs	–	–
1,2–Dichloroethane	18	19

DUPLICATE

CONCENTRATIONS IN MICROGRAMS PER LITER

ANALYTE

ND – NOT DETECTED

NOTES

1. BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)
2. WATER LEVELS MEASURED ON JUNE 18, 2007.
3. ONLY DETECTIONS OF SITE SPECIFIC COMPOUNDS ABOVE NYSDEC AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES ARE SHOWN. ONLY RESULTS FOR FILTERED METALS SAMPLES ARE SHOWN.
4. WATER LEVELS FOR WELLS LOCATED ON THE STERLING DRUG SITE WERE PROVIDED BY ALBANY MOLECULAR.
5. WATER QUALITY DATA FOR ST–MW–12 PROVIDED IN THE BI–ANNUAL GROUNDWATER SAMPLING AND ANALYSIS REPORT (JUNE 2007), STERLING SITE 1, RENSSELAER, NY (SAIC, 2007).

100' 0 100'

Title:

GROUNDWATER ELEVATIONS AND GROUNDWATER QUALITY DATA JUNE 2007

SITE MANAGEMENT PLAN

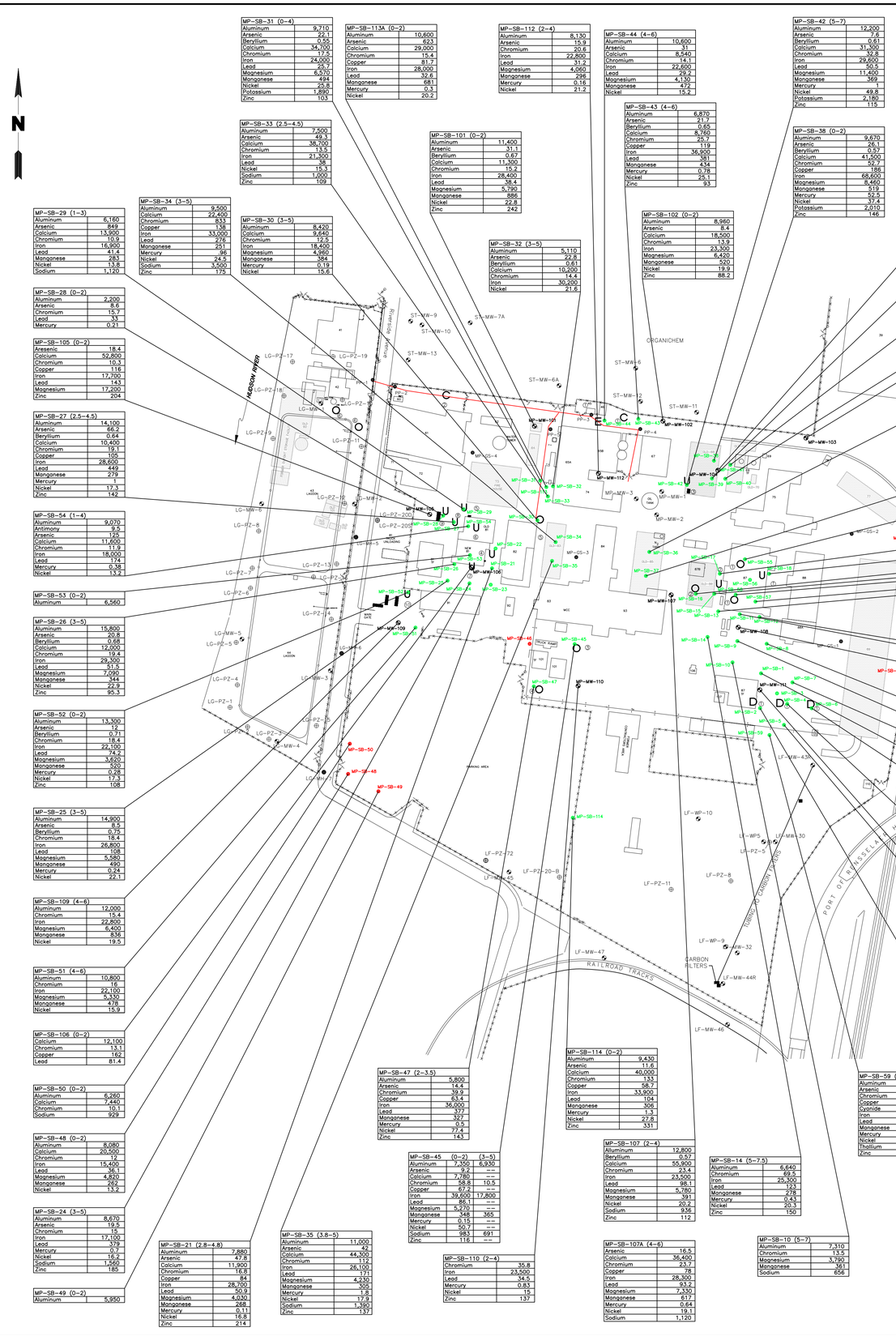
Prepared For:

BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 17DEC12	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	2
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.11.DWG		

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Analyte	TAGM 4046 RSCOs * (mg/kg)
Aluminum	7,600
Antimony	ND
Arsenic	7.5
Barium	300
Beryllium	0.16
Cadmium	1
Calcium	6,800
Chromium	10
Cobalt	30
Copper	58
Cyanide	ND
Iron	16,700
Lead	25
Magnesium	3,600
Manganese	230
Mercury	0.1
Nickel	13
Potassium	1,700
Sodium	930
Thallium	ND
Zinc	87

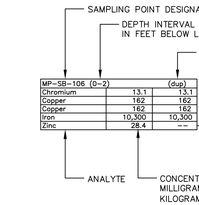
* – HIGHER OF AVERAGE SITE BACKGROUND OR TAGM 4046 RSCO'S
ND – Non Detect

LEGEND

LOCATION PREFIXES

LG – LAGOON
MP – MAIN PLANT
LF – LANDFILL
ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

EXISTING BUILDING
FORMER BUILDING
FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT
C E O U D — DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3-1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998
STORM SEWER GRATE
OVERHEAD UTILITY SUPPORTS
BARBED WIRE FENCE
CHAINLINK FENCE
APPROXIMATE LOCATION OF PERFORATED PIPE
MP-SB-113 — LOCATION AND DESIGNATION OF SOIL BORING
MP-SB-19 — LOCATION AND DESIGNATION OF SOIL AND GROUNDWATER SCREENING SAMPLE
MP-MW-101 — LOCATION AND DESIGNATION OF MONITORING WELL WHERE SOIL SAMPLE WAS OBTAINED FROM PILOT BOREHOLE
MP-GS-1 — LOCATION AND DESIGNATION OF GROUNDWATER SCREENING SAMPLE (NOT SAMPLED)
MP-PP-5 — LOCATION AND DESIGNATION OF PERFORATED PIPE SAMPLING POINT (NOT SAMPLED)
LF-PZ-5 — LOCATION AND DESIGNATION OF PIEZOMETER (NOT SAMPLED)
LG-MH-7 — LOCATION AND DESIGNATION OF SEWER BEDDING SAMPLING POINT (NOT SAMPLED)
LG-MW-4 — LOCATION AND DESIGNATION OF MONITORING WELL (NOT SAMPLED)
TAGM 4046 RSCOs — TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM 4046 RECOMMENDED SOIL CLEANUP OBJECTIVES



NOTES

BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)

ALL ANALYTES FROM SAMPLING LOCATIONS WITH NO DATA WERE EITHER NOT DETECTED OR DETECTED BELOW TAGM 4046 RSCOs.

150' 0 150'

Title:

METALS DETECTED IN SOIL EXCEEDING TAGM 4046 RSCOs DURING REMEDIAL INVESTIGATION

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:

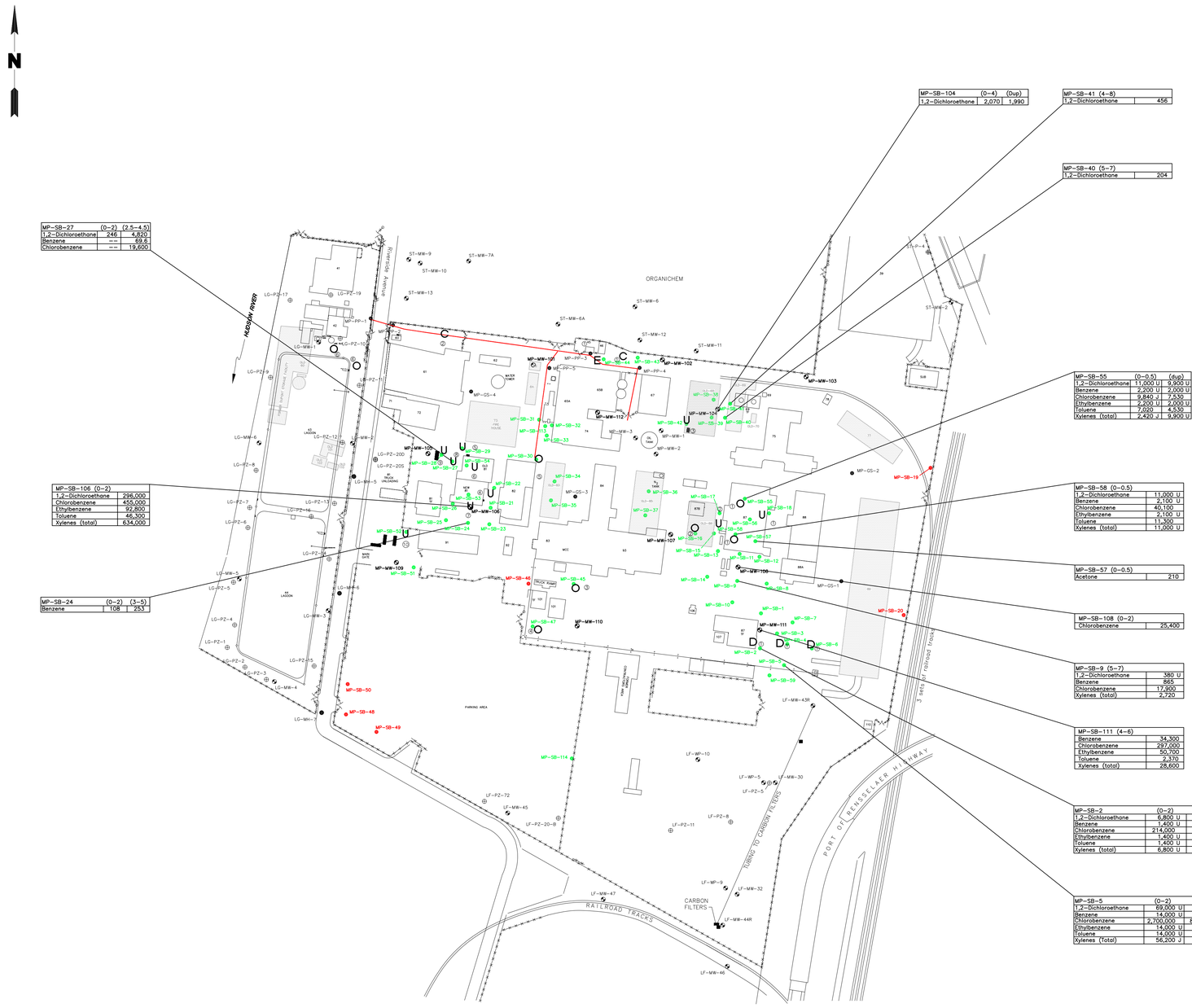
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	3
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.13.DWG		

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Analyte	TAGM 4046 RSCOs (ug/kg)
1,2-Dichloroethane	100
Acetone	200
Benzene	60
Chlorobenzene	1,700
Ethylbenzene	5,500
Toluene	1,500
Xylene (total)	1,200



LEGEND

LOCATION PREFIXES

LG – LAGOON
MP – MAIN PLANT
LF – LANDFILL
ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

EXISTING BUILDING

FORMER BUILDING

FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT

C E O U D — DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3-1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998

STORM SEWER GRATE

OVERHEAD UTILITY SUPPORTS

BARBED WIRE FENCE

CHAINLINK FENCE

APPROXIMATE LOCATION OF PERFORATED PIPE

MP-SB-113 — LOCATION AND DESIGNATION OF SOIL BORING

MP-MW-101 — OBTAINED FROM PILOT BOREHOLE MONITORING WELL WHERE SOIL SAMPLE WAS LOCATION AND DESIGNATION OF

MP-SB-19 — LOCATION AND DESIGNATION OF SOIL AND GROUNDWATER SCREENING SAMPLE

MP-PP-5 — LOCATION AND DESIGNATION OF PERFORATED PIPE SAMPLING POINT (NOT SAMPLED)

MP-GS-1 — GROUNDWATER SCREENING SAMPLE (NOT SAMPLED) LOCATION AND DESIGNATION OF

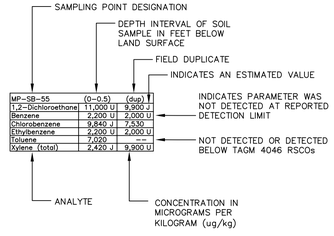
LF-PZ-5 — LOCATION AND DESIGNATION OF PIEZOMETER (NOT SAMPLED)

LG-MH-7 — LOCATION AND DESIGNATION OF SEWER BEDDING SAMPLING POINT (NOT SAMPLED)

LF-MW-43R — LOCATION AND DESIGNATION OF MONITORING WELL (NOT SAMPLED)

TAGM 4046 RCOs — TECHNICAL AND ADMINISTRATIVE GUIDANCE 4046 RECOMMENDED SOIL CLEANUP OBJECTIVES

VOCs — VOLATILE ORGANIC COMPOUNDS



NOTES

1. BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)
2. ALL ANALYTES FROM SAMPLING LOCATIONS WITH NO DATA WERE EITHER NOT DETECTED OR DETECTED BELOW TAGM 4046 RSCOs.

150' 0 150'

Title:

VOCs DETECTED IN SOIL EXCEEDING TAGM 4046 RSCOs DURING REMEDIAL INVESTIGATION

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:

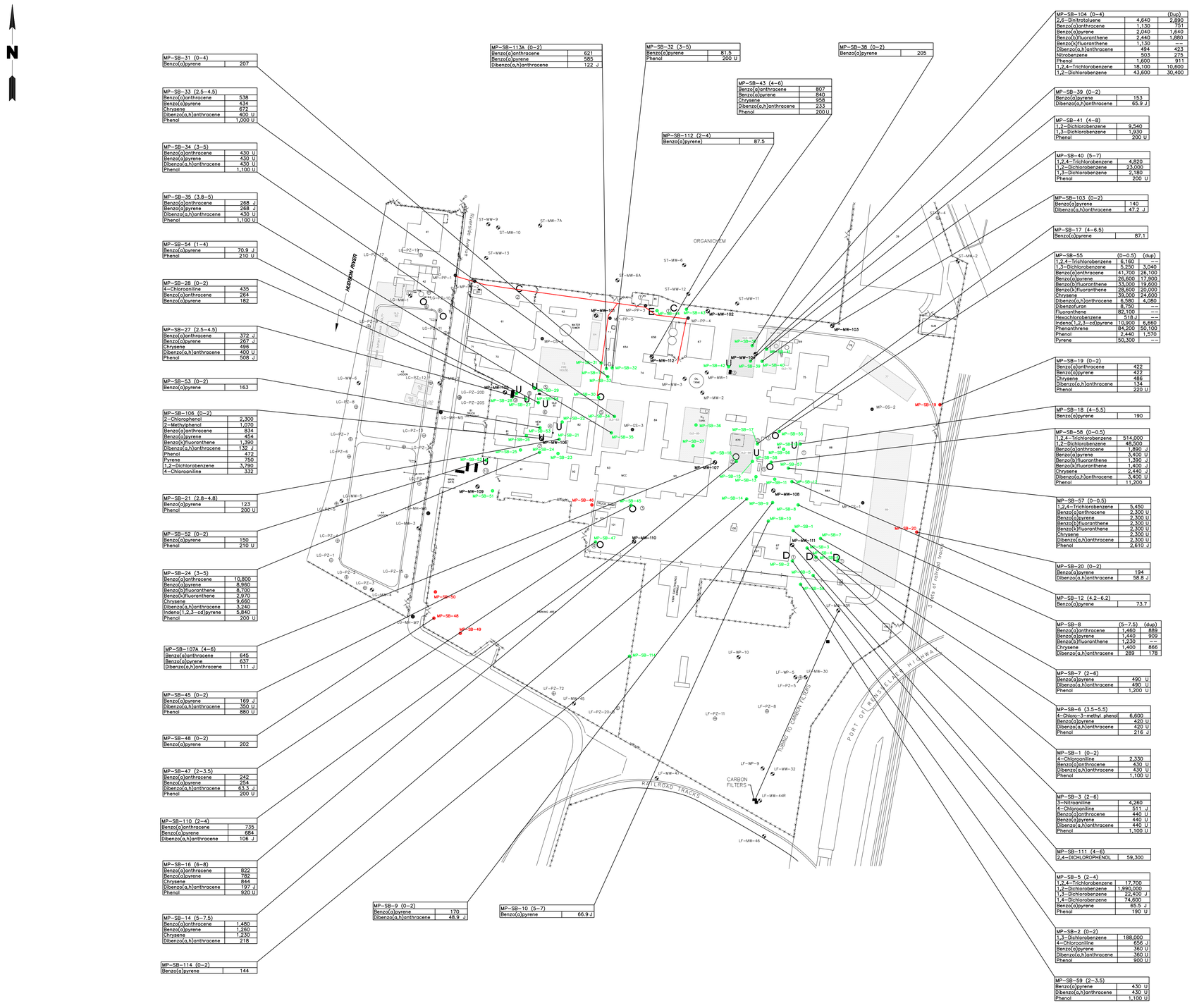
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	4
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.14.DWG		

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Analyte	TAGM 4046 RSCOs (ug/kg)
1,2,4–Trichlorobenzene	3,400
1,2–Dichlorobenzene	7,900
1,3–Dichlorobenzene	1,600
1,4–Dichlorobenzene	8,500
2,4–Dichlorophenol	400
2,6–Dinitrotoluene	1,000
2–Chlorophenol	800
2–Methylphenol	100
3–Nitroaniline	500
4–Chloro–3–methyl phenol	240
4–Chloroaniline	220
Benzo(a)anthracene	224
Benzo(a)pyrene	61
Benzo(b)fluoranthene	1,100
Benzo(k)fluoranthene	1,100
Chrysene	400
Dibenzo(a,h)anthracene	14
Dibenzofuran	6,200
Fluoranthene	50,000
Hexachlorobenzene	410
Indeno(1,2,3–cd)pyrene	3,200
Nitrobenzene	200
Phenanthrene	50,000
Phenol	30
Pyrene	50,000



LEGEND

LOCATION PREFIXES

LG – LAGOON
MP – MAIN PLANT
LF – LANDFILL
ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

EXISTING BUILDING

FORMER BUILDING

FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT

$C_{①}E_{①}O_{①}U_{①}D_{①}$ DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3–1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998

STORM SEWER GRATE

OVERHEAD UTILITY SUPPORTS

BARBED WIRE FENCE

CHAINLINK FENCE

APPROXIMATE LOCATION OF PERFORATED PIPE

MP–SB–113 LOCATION AND DESIGNATION OF SOIL BORING

MP–MW–101 OBTAINED FROM PILOT BOREHOLE MONITORING WELL WHERE SOIL SAMPLE WAS LOCATION AND DESIGNATION OF

MP–SB–19 LOCATION AND DESIGNATION OF SOIL AND GROUNDWATER SCREENING SAMPLE

MP–PP–5 LOCATION AND DESIGNATION OF PERFORATED PIPE SAMPLING POINT (NOT SAMPLED)

MP–GS–1 GROUNDWATER SCREENING SAMPLE (NOT SAMPLED) LOCATION AND DESIGNATION OF

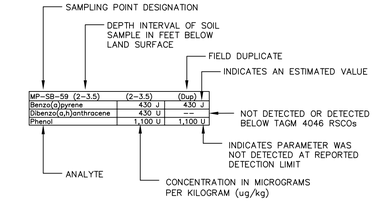
LF–PZ–5 LOCATION AND DESIGNATION OF PIEZOMETER (NOT SAMPLED)

LG–MH–7 LOCATION AND DESIGNATION OF SEWER BEDDING SAMPLING POINT (NOT SAMPLED)

LF–MW–43R LOCATION AND DESIGNATION OF MONITORING WELL (NOT SAMPLED)

TAGM 4046 RCOs TECHNICAL AND ADMINISTRATIVE GUIDANCE 4046 RECOMMENDED SOIL CLEANUP OBJECTIVES

SVOCs SEMIVOLATILE ORGANIC COMPOUNDS



NOTES

1. BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)
2. ALL ANALYTES FROM SAMPLING LOCATIONS WITH NO DATA WERE EITHER NOT DETECTED OR DETECTED BELOW TAGM 4046 RSCOs.

150' 0 150'

Title:

SVOCs DETECTED IN SOIL EXCEEDING TAGM 4046 RSCOs DURING REMEDIAL INVESTIGATION

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:

BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	
Project Mgr: N.E.	Project: 0251.0011Y045	5
File: 0251.0011Y592.15.DWG		

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MP-SB-71	0 – 2	4 – 6
Arsenic	161	494
Chromium	19.1 E	12.6 E
Lead	49.7	60.9
Mercury	0.16	––
1,2,4–Trichlorobenzene	7700 U	––
Benzo[a]anthracene	2300 U	2600
Benzo[a]pyrene	7700 U	2500
Dibenzo[a,h]anthracene	7700 U	410
Phenol	2300 U	120 U

MP-SB-72	0 – 2	8 – 10
Arsenic	27.7	497
Chromium	30.6	20.7
Lead	175	––
Mercury	0.98	––
Zinc	381	––
Benzo[a]anthracene	1100	––
Benzo[a]pyrene	1300 J	350 U
Dibenzo[a,h]anthracene	250 J	350 U
Phenol	540 U	100 U

MP-SB-73	0 – 2	0 – 2 DUP	6 – 8
Arsenic	25.4	NA	563
Chromium	45.4	NA	14
Lead	261	NA	
Mercury	0.13	NA	
Zinc	601	NA	
Benzo[a]anthracene	1300	1100	––
Benzo[a]pyrene	1200 J	1100 J	370 U
Dibenzo[a,h]anthracene	2000 U	2000 U	370 U
Phenol	590 U	590 U	110 U

MP-SB-74	0 – 2	8 – 10
Arsenic	129	90.2
Chromium	9.4	17.5
Mercury	0.31	––
Zinc	––	107
Benzo[a]pyrene	160 J	420 U
Dibenzo[a,h]anthracene	370 U	420 U
Phenol	110 U	130 U

MP-SB-69	0 – 2	4 – 6
Arsenic	16.4	
Chromium	15.3	17.9
Mercury	0.22	0.21
Zinc	––	106
Benzo[a]pyrene	––	370 U
Dibenzo[a,h]anthracene	350 U	370 U
Phenol	110 U	110 U

MP-SB-65	0 – 2	6 – 8
Arsenic	29.3	––
Chromium	23.9	24.1
Lead	58.1	660
Mercury	0.45	––
1,2–Dichloroethane	––	110
Benzo[a]anthracene	1000 U	1000 U
Benzo[a]pyrene	3400 U	3400 U
Dibenzo[a,h]anthracene	3400 U	3400 U
Phenol	1000 U	1000 U

MP-SB-70	0 – 2	4 – 6
Arsenic	51.1	546
Chromium	24.7 E	18.1 E
Lead	60.4	261
Mercury	0.31	0.42
Zinc	––	118
1,2,4–Trichlorobenzene	7300 U	––
Benzo[a]anthracene	940 J	––
Benzo[a]pyrene	780 J	400 U
Dibenzo[a,h]anthracene	7300 U	400 U
Phenol	2200 U	120 U

LG–SB–125	8 – 10
1,2–Dicloroethane	270 U
Benzene	270 U

MP-SB-68	0 – 2	0 – 2 DUP	2 – 4
Arsenic	39.5	50.8	305
Chromium	15.7 E	17.7	10.6 E
Lead	38.8	38.8	121
Mercury	0.11 B	––	0.13
Zinc	––	87.6	––
1,2,4–Trichlorobenzene	3500 U	NA	––
Benzo[a]anthracene	1000 U	NA	240
Benzo[a]pyrene	3500 U	NA	280 J
Dibenzo[a,h]anthracene	3500 U	NA	390 U
Phenol	1000 U	NA	120 U

LG–SB–124	6 – 8
1,2–Dicloroethane	290 U
Benzene	290 U

LG–SB–123	6 – 8
1,2–Dicloroethane	340 U
Benzene	340 U

MP-SB-67	0 – 2	0 – 2 DUP	2 – 4
Arsenic	1120	NA	1530
Chromium	30.9 E	NA	
Lead	166	NA	491
Mercury	0.38	NA	0.16
Zinc	243	NA	157
1,2,4–Trichlorobenzene	3800 U	3800 U	
Benzo[a]anthracene	3900	1200	
Benzo[a]pyrene	4100	1200 J	130 J
Dibenzo[a,h]anthracene	3800 U	3800 U	380 U
Phenol	1200 U	1100 U	120 U

MP-SB-66	0 – 2	4 – 6
Arsenic	12.4	301
Zinc	––	174
1,2,4–Trichlorobenzene	3600 U	––
Benzo[a]anthracene	1100 U	––
Benzo[a]pyrene	3600 U	––
Dibenzo[a,h]anthracene	3600 U	370 U
Phenol	1100 U	110 U

MP-SB-64	0 – 2
Arsenic	7.8 E
Chromium	41.5
Mercury	0.11
Zinc	256

MP-SB-75	0 – 2	4 – 6
Arsenic	11.4	
Chromium	180	147000
Lead	49.5	901
Mercury	0.42	0.74
Zinc	93.4	89.5
1,2–Dichloroethane	––	27000 U
Benzene	––	27000 U
Chlorobenzene	––	27000 U
Toluene	––	27000 U
Xylenes (total)	––	27000 U
1,2,4–Trichlorobenzene	––	630000
1,2–Dichlorobenzene	––	86000 U
Benzo[a]anthracene	710	26000 U
Benzo[a]pyrene	660 J	86000 U
Dibenzo[a,h]anthracene	1700 U	86000 U
Phenol	530 U	26000 U

MP-SB-76	0 – 2	4 – 6
Arsenic	1260	149
Chromium	101	46.1
Lead	395	71.7
Mercury	0.33	0.55
Zinc	135	228
Benzene	––	560
Chlorobenzene	––	4000 E
1,2,4–Trichlorobenzene	––	10000 U
1,2–Dichlorobenzene	––	10000 U

MP-SB-61	0 – 2	4 – 6
Arsenic	107 E	––
Chromium	73.4	2960
Lead	42.7	47.4
Mercury	0.17	0.19 B
Zinc	––	3950

MP-SB-60	4 – 6
Arsenic	7.6 E
Chromium	809
Lead	32.6
Mercury	0.21
Zinc	1520

MP-SB-62	0 – 2	2 – 4	4 – 6
Arsenic	51.1 E	––	411 E
Chromium	349	––	2030
Lead	106	––	667
Mercury	1.4	––	4.9
Zinc	2540	––	15200
1,2–Dichloroethane	––	––	510 U
Benzene	––	210	13000 D

MP-SB-63	0 – 2	2 – 4
Arsenic	43.8 E	51.6 E
Chromium	255	598
Lead	257	331
Mercury	3.3	3.7
Zinc	576	602

TAGM 4046 Recommended Soil Cleanup Objectives (RSCOs)	
Arsenic	7.5
Chromium	10
Lead	24.75
Mercury	0.1
Zinc	87
1,2–Dichloroethane	100
Benzene	60
Chlorobenzene	1700
Toluene	1500
Xylenes (total)	1200
1,2,4–Trichlorobenzene	3400
1,2–Dichlorobenzene	7900
Benzo[a]anthracene	224
Benzo[a]pyrene	61U
Dibenzo[a,h]anthracene	14U
Phenol	30 U

LEGEND

LOCATION PREFIXES

LG – LAGOON
MP – MAIN PLANT
LF – LANDFILL
ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

EXISTING BUILDING
FORMER BUILDING
FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT
$C_U E_U O_U U_U D_U$ DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3–1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998
STORM SEWER GRATE
OVERHEAD UTILITY SUPPORTS
BARBED WIRE FENCE
CHAINLINK FENCE
MP–SB–1 LOCATION AND DESIGNATION OF SOIL BORING SAMPLED DURING RI AND SUPPLEMENTAL RI
LG–MH–7 LOCATION AND DESIGNATION OF SEWER BEDDING GROUNDWATER SAMPLING POINT
LG–MW–1 LOCATION AND DESIGNATION OF MONITORING WELL
MP–PP–5 LOCATION AND DESIGNATION OF PERFORATED PIPE RISER
LF–PZ–5 LOCATION AND DESIGNATION OF PIEZOMETER
MP–SB–61 LOCATION AND DESIGNATION OF SOIL BORING

VOCs VOLATILE ORGANIC COMPOUNDS DESIGNATION OF SOIL BORING
SAMPLE DEPTH IN FEET BELOW LAND SURFACE
ANALYTE

MP–SB–70	0 – 2	4 – 6
Arsenic	51.1	546
Chromium	24.7 E	18.1 E
Lead	60.4	261
Mercury	0.31	0.42
Zinc	––	118
1,2,4–Trichlorobenzene	7300 U	––
Benzo[a]anthracene	940 J	––
Benzo[a]pyrene	780 J	400 U
Dibenzo[a,h]anthracene	7300 U	400 U
Phenol	2200 U	120 U

E – ESTIMATED CONCENTRATION
U – NOT DETECTED; DETECTED LIMIT SHOWN
J – ESTIMATED CONCENTRATION
D – DILUTED SAMPLE
DUP – DUPLICATE
NA – NOT ANALYZED

NOTES

1. CONSTITUENTS OF CONCERNS IDENTIFIED FOR SOILS ARE SUMMARIZED IN THE REPORT TEXT.
2. BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)
3. ONLY CONSTITUENTS OF CONCERN WITH DETECTIONS OR DETECTION LIMITS ABOVE TAGM 4046 RSCOs ARE SUMMARIZED ON THIS PLATE.

100' 0 100'

Title:
SUMMARY OF CONSTITUENTS OF CONCERN DETECTED ABOVE TAGM 4046 RSCOs IN MAIN PLANT SOIL DURING ADDITIONAL REMEDIAL INVESTIGATION ACTIVITIES

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	
Project Mgr: N.E.	Project: 0251.0011Y045	6
File: 0251.0011Y592.16.DWG		

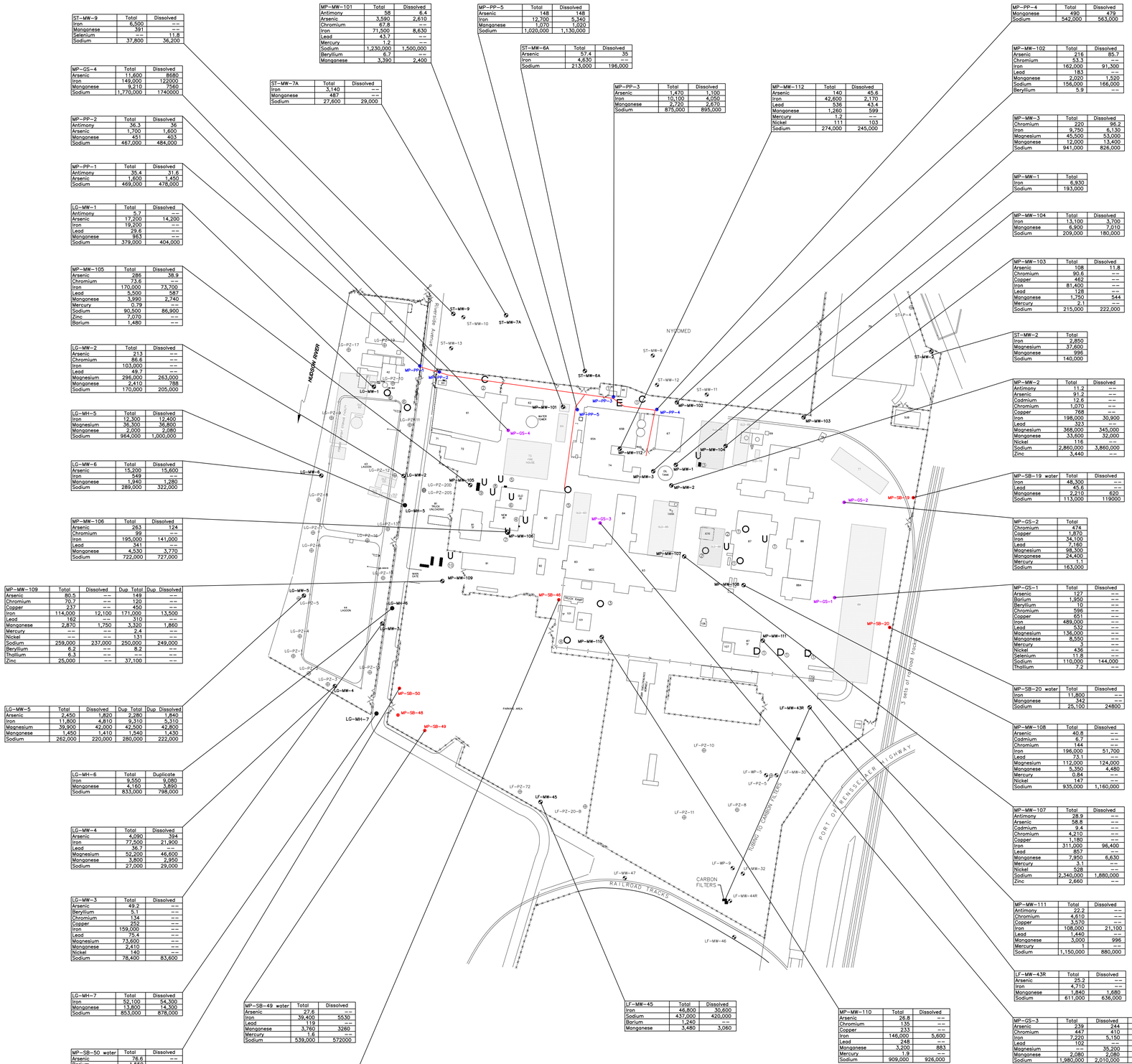
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Analyte	NYS AWQS (ug/L)
Antimony	3
Arsenic	25
Barium	1,000
Beryllium	3
Cadmium	5
Chromium	50
Copper	200
Iron	300
Lead	25
Magnesium	35,000
Manganese	500
Mercury	1
Nickel	100
Selenium	10
Sodium	20,000
Thallium	1
Zinc	2,000

LEGEND

LOCATION PREFIXES
LG – LAGOON
MP – MAIN PLANT
LF – LANDFILL
ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

EXISTING BUILDING
FORMER BUILDING
FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT
DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3-1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998
STORM SEWER GRATE
OVERHEAD UTILITY SUPPORTS
BARBED WIRE FENCE
CHAINLINK FENCE
APPROXIMATE LOCATION OF PERFORATED PIPE
MP-CS-1 LOCATION AND DESIGNATION OF GROUNDWATER SCREENING SAMPLE
MP-SB-19 LOCATION AND DESIGNATION OF SOIL AND GROUNDWATER SCREENING SAMPLE
MP-PP-5 LOCATION AND DESIGNATION OF PERFORATED PIPE SAMPLING POINT
MP-MW-101 LOCATION AND DESIGNATION OF MONITORING WELL
LG-MH-7 SEWER BEDDING SAMPLING POINT LOCATION AND DESIGNATION OF
LF-PZ-5 LOCATION AND DESIGNATION OF PIEZOMETER (NOT SAMPLED)
ST-MW-6 LOCATION AND DESIGNATION OF MONITORING WELL (NOT SAMPLED)
NYS AWQS NEW YORK STATE AMBIENT WATER QUALITY STANDARDS



ST-MW-9	Total	Dissolved
Iron	6,500	--
Manganese	391	--
Selenium	--	11.8
Sodium	37,800	36,200

MP-CS-4	Total	Dissolved
Arsenic	11,600	8680
Iron	149,000	122000
Manganese	9,210	7560
Sodium	1,770,000	1740000

MP-PP-2	Total	Dissolved
Antimony	36.3	36
Arsenic	1,700	1,600
Manganese	451	403
Sodium	467,000	484,000

MP-PP-1	Total	Dissolved
Antimony	35.4	31.6
Arsenic	1,600	1,450
Sodium	469,000	478,000

LG-MW-1	Total	Dissolved
Antimony	5.7	--
Arsenic	17,200	14,200
Iron	19,200	--
Lead	29.6	--
Manganese	983	--
Sodium	379,000	404,000

MP-MW-105	Total	Dissolved
Arsenic	286	38.9
Chromium	73.6	--
Iron	170,000	73,700
Lead	5,500	587
Manganese	3,990	2,740
Mercury	0.79	--
Sodium	90,500	86,900
Zinc	7,070	--
Barium	1,480	--

LG-MW-2	Total	Dissolved
Arsenic	213	--
Chromium	86.6	--
Iron	103,000	--
Lead	49.7	--
Magnesium	295,000	263,000
Manganese	2,410	788
Sodium	170,000	205,000

LG-MH-5	Total	Dissolved
Iron	12,300	12,400
Magnesium	36,300	36,800
Manganese	2,000	2,080
Sodium	964,000	1,000,000

LG-MW-6	Total	Dissolved
Arsenic	15,200	15,600
Iron	549	--
Manganese	1,940	1280
Sodium	289,000	322,000

MP-MW-106	Total	Dissolved
Arsenic	263	124
Chromium	99	--
Iron	195,000	141,000
Lead	341	--
Manganese	4,530	3,770
Sodium	722,000	727,000

MP-MW-109	Total	Dissolved	Dup. Total	Dup. Dissolved
Arsenic	80.5	--	149	--
Chromium	70.7	--	120	--
Copper	237	--	450	--
Iron	114,000	12,100	171,000	13,500
Lead	162	--	310	--
Manganese	2,870	1,750	3,320	1,860
Mercury	--	--	2.4	--
Nickel	--	--	131	--
Sodium	259,000	237,000	250,000	249,000
Beryllium	6.2	--	8.2	--
Zinc	25,000	--	37,100	--

LG-MW-5	Total	Dissolved	Dup. Total	Dup. Dissolved
Arsenic	2,450	1,820	2,280	1,840
Iron	11,800	4,810	9,310	5,310
Magnesium	39,900	42,000	42,500	42,800
Manganese	1,450	1,410	1,540	1,430
Sodium	262,000	220,000	280,000	222,000

LG-MH-6	Total	Duplicate
Iron	9,550	9,080
Manganese	4,160	3,890
Sodium	833,000	798,000

LG-MW-4	Total	Dissolved
Arsenic	4,090	394
Iron	77,500	21,900
Lead	36.7	--
Magnesium	52,200	46,600
Manganese	3,800	2,950
Sodium	27,000	29,000

LG-MW-3	Total	Dissolved
Arsenic	49.2	--
Beryllium	5.1	--
Chromium	134	--
Copper	252	--
Iron	159,000	--
Lead	75.4	--
Magnesium	73,600	--
Manganese	2,410	--
Nickel	140	--
Sodium	78,400	83,600

LG-MH-7	Total	Dissolved
Iron	52,100	54,300
Manganese	13,800	14,300
Sodium	853,000	878,000

MP-SB-50 water	Total	Dissolved
Arsenic	76.6	--
Barium	1,550	--
Beryllium	6.9	--
Chromium	188	--
Copper	340	--
Iron	225,000	--
Lead	222	--
Magnesium	48,200	--
Manganese	16,200	3410
Nickel	178	--
Selenium	10.6	--
Sodium	1,140,000	1,180,000
Zinc	2,600	--

MP-SB-49 water	Total	Dissolved
Arsenic	27.6	--
Iron	39,400	5530
Lead	119	--
Manganese	3,760	3260
Mercury	1.6	--
Sodium	539,000	572000

MP-SB-46 water	Total	Dissolved
Iron	19,400	6100
Lead	50.4	--
Manganese	1,750	1510
Sodium	1,150,000	1130000

LF-MW-45	Total	Dissolved
Iron	46,800	30,600
Sodium	437,000	420,000
Barium	1,240	--
Manganese	3,480	3,060

MP-MW-110	Total	Dissolved
Arsenic	26.8	--
Chromium	135	--
Copper	233	--
Iron	146,000	5,600
Lead	248	--
Manganese	3,200	883
Mercury	1.9	--
Sodium	909,000	926,000

MP-PP-3	Total	Dissolved
Arsenic	1,470	1,100
Iron	10,100	4,050
Manganese	2,720	2,670
Sodium	875,000	895,000

ST-MW-7A	Total	Dissolved
Iron	3,140	--
Manganese	487	--
Sodium	27,600	29,000

ST-MW-6A	Total	Dissolved
Arsenic	57.4	35
Iron	4,630	--
Sodium	213,000	196,000

MP-PP-5	Total	Dissolved
Arsenic	148	148
Iron	12,700	5,340
Manganese	1,070	1,020
Sodium	1,020,000	1,130,000

MP-MW-101	Total	Dissolved
Antimony	58	6.4
Arsenic	3,590	2,610
Chromium	67.8	--
Iron	71,500	8,630
Lead	43.7	--
Mercury	1.2	--
Sodium	1,230,000	1,500,000
Beryllium	6.7	--
Manganese	3,390	2,400

MP-MW-112	Total	Dissolved
Arsenic	140	45.6
Iron	42,600	2,170
Lead	536	43.4
Manganese	1,260	599
Mercury	1.2	--
Nickel	111	103
Sodium	274,000	245,000

MP-PP-4	Total	Dissolved
Manganese	490	479
Sodium	542,000	563,000

MP-MW-102	Total	Dissolved
Arsenic	216	85.7
Chromium	53.3	--
Iron	162,000	91,300
Lead	183	--
Manganese	2,020	1,520
Sodium	156,000	166,000
Beryllium	5.9	--

MP-MW-3	Total	Dissolved
Chromium	220	96.2
Iron	9,750	6,130
Magnesium	45,500	53,000
Manganese	12,000	13,400
Sodium	941,000	826,000

MP-MW-1	Total
Iron	6,930
Sodium	193,000

MP-MW-104	Total	Dissolved
Iron	13,100	3,700
Manganese	6,900	7,010
Sodium	209,000	180,000

MP-MW-103	Total	Dissolved
Arsenic	108	11.8
Chromium	90.6	--
Copper	482	--
Iron	81,400	--
Lead	128	--
Manganese	1,750	544
Mercury	2.1	--
Sodium	215,000	222,000

ST-MW-2	Total
Iron	2,850
Magnesium	37,600
Manganese	996
Sodium	140,000

MP-MW-2	Total	Dissolved
Antimony	11.2	--
Arsenic	91.2	--
Cadmium	12.6	--
Chromium	1,070	--
Copper	768	--
Iron	198,000	30,900
Lead	323	--
Magnesium	368,000	345,000
Manganese	33,600	32,000
Nickel	116	--
Sodium	2,860,000	3,860,000
Zinc	3,440	--

MP-SB-19 water	Total	Dissolved
Iron	48,300	--
Lead	45.6	--
Manganese	2,210	620
Sodium	113,000	119000

MP-CS-2	Total
Chromium	474
Copper	1,870
Iron	34,100
Lead	7,160
Magnesium	98,300
Manganese	24,400
Mercury	1.1
Sodium	163,000

MP-CS-1	Total	Dissolved
Arsenic	127	--
Barium	1,950	--
Beryllium	10	--
Chromium	596	--
Copper	651	--
Iron	489,000	--
Lead	332	--
Magnesium	136,000	--
Manganese	8,550	--
Mercury	3	--
Nickel	436	--
Selenium	11.8	--
Sodium	110,000	144,000
Thallium	7.2	--

MP-SB-20 water	Total	Dissolved
Iron	11,800	--
Manganese	342	--
Sodium	25,100	24800

MP-MW-108	Total	Dissolved
Arsenic	40.8	--
Cadmium	6.7	--
Chromium	144	--
Iron	196,000	51,700
Lead	73.1	--
Magnesium	112,000	124,000
Manganese	5,350	4,480
Mercury	0.84	--
Nickel	147	--
Sodium	935,000	1,160,000

MP-MW-107	Total	Dissolved
Antimony	28.9	--
Arsenic	58.8	--
Cadmium	9.4	--
Chromium	4,210	--
Copper	1,180	--
Iron	311,000	96,400
Lead	857	--
Manganese	7,950	6,630
Mercury	3.1	--
Nickel	528	--
Sodium	2,340,000	1,880,000
Zinc	2,660	--

MP-MW-111	Total	Dissolved
Antimony	22.2	--
Chromium	4,610	--
Copper	3,570	--
Iron	108,000	21,100
Lead	1,440	--
Manganese	3,000	996
Mercury	1	--
Sodium	1,150,000	880,000

LF-MW-43R	Total	Dissolved
Arsenic	25.2	--
Iron	4,710	--
Manganese	1,840	1,680
Sodium	611,000	636,000

MP-CS-3	Total	Dissolved	Dup. Total	Dup. Dissolved
Arsenic	239	244	223	244
Chromium	447	410	464	403
Iron	7,220	5,150	10,100	5,280
Lead	102	--	175	--
Magnesium	--	35,200	--	35,400
Manganese	2,080	2,080	2040	2080
Sodium	1,980,000	2,010,000	1940000	2120000

SAMPLING POINT DESIGNATION
FIELD DUPLICATE
NOT DETECTED OR DETECTED BELOW NYS AWQS
ANALYTE
CONCENTRATION IN MICROGRAMS PER LITER (ug/L)

NOTES

1. BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)
2. "DISSOLVED" INDICATES SAMPLES WERE FILTERED WITH A 0.45 MICRON FILTER.

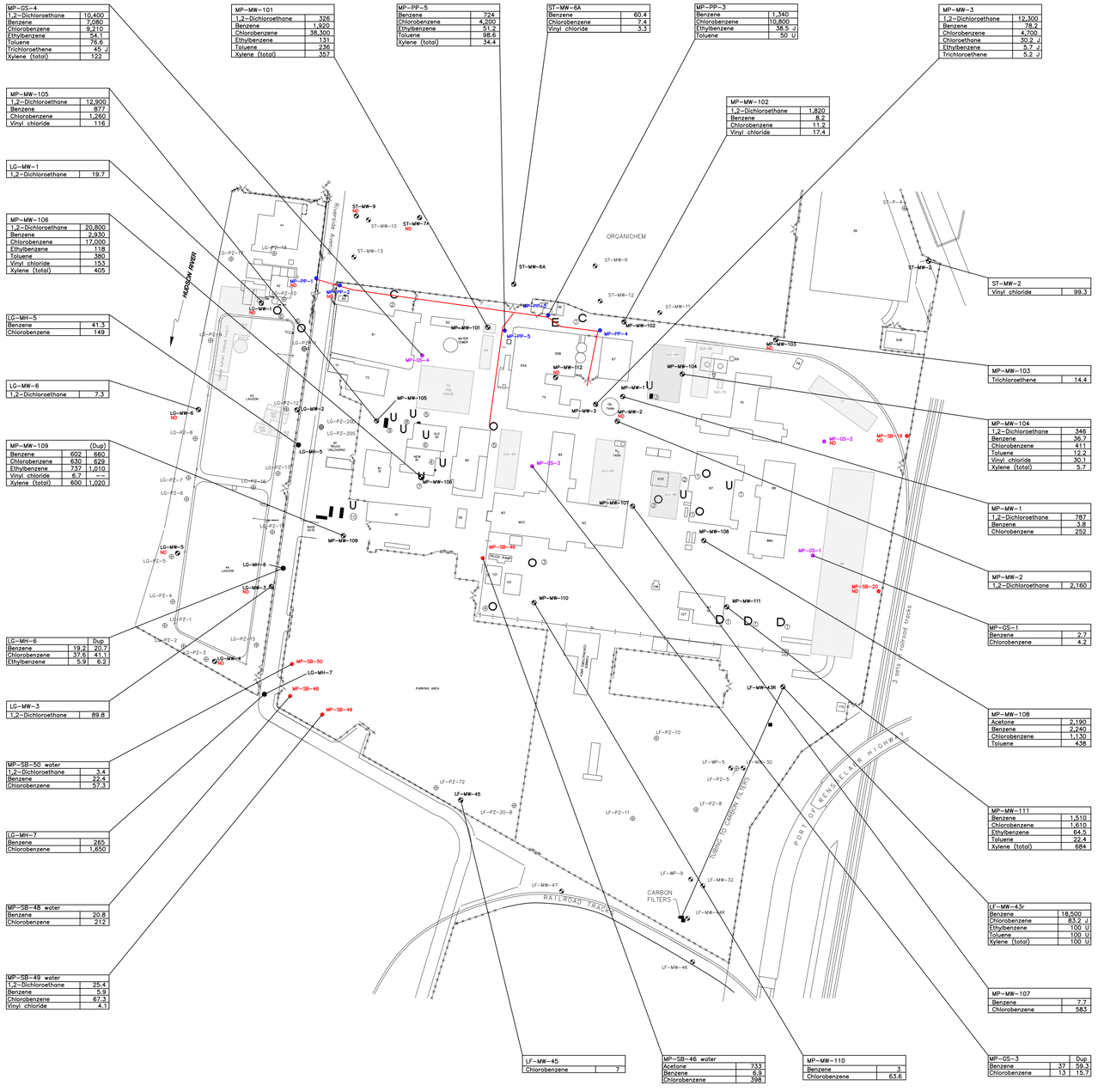
150' 0 150'

Title:
METALS DETECTED IN GROUNDWATER EXCEEDING NYS AWQS DURING REMEDIAL INVESTIGATION

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PAR

Analyte	NYS AWQS (ug/L)
1,2-Dichloroethane	0.6
Acetone	50
Benzene	1
Chlorobenzene	5
Chloroethane	5
Ethylbenzene	5
Toluene	5
Trichloroethene	5
Vinyl chloride	2
Xylenes (total)	5



LEGEND

LOCATION PREFIXES

- LG – LAGOON
- MP – MAIN PLANT
- LF – LANDFILL
- ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

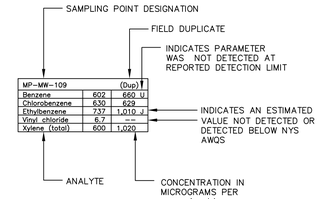
- EXISTING BUILDING
- FORMER BUILDING
- FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT
- C(1) E(2) O(1) U(2) D(1) DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3-1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998
- STORM SEWER GRATE
- OVERHEAD UTILITY SUPPORTS
- BARBED WIRE FENCE
- CHAINLINK FENCE
- APPROXIMATE LOCATION OF PERFORATED PIPE
- MP-GS-1 LOCATION AND DESIGNATION OF GROUNDWATER SCREENING SAMPLE
- MP-SB-19 LOCATION AND DESIGNATION OF SOIL BORING AND GROUNDWATER SCREENING SAMPLE
- MP-PP-5 LOCATION AND DESIGNATION OF PERFORATED PIPE SAMPLING POINT
- MP-MW-101 LOCATION AND DESIGNATION OF MONITORING WELL
- LG-MH-7 LOCATION AND DESIGNATION OF SEWER BEDDING SAMPLING POINT
- LF-MW-32 LOCATION AND DESIGNATION OF MONITORING WELL (NOT SAMPLED)
- LF-PZ-5 LOCATION AND DESIGNATION OF PIEZOMETER (NOT SAMPLED)

NYS AWQS NEW YORK STATE AMBIENT WATER QUALITY STANDARDS

NOT DETECTED

BTEX BENZENE, TOLUENE, ETHYLBENZENE AND XYLENES.

VOCs VOLATILE ORGANIC COMPOUNDS



NOTE

BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)

150' 0 150'

Title:

VOCs DETECTED IN GROUNDWATER EXCEEDING TAGM NYS AWQS DURING REMEDIAL INVESTIGATION

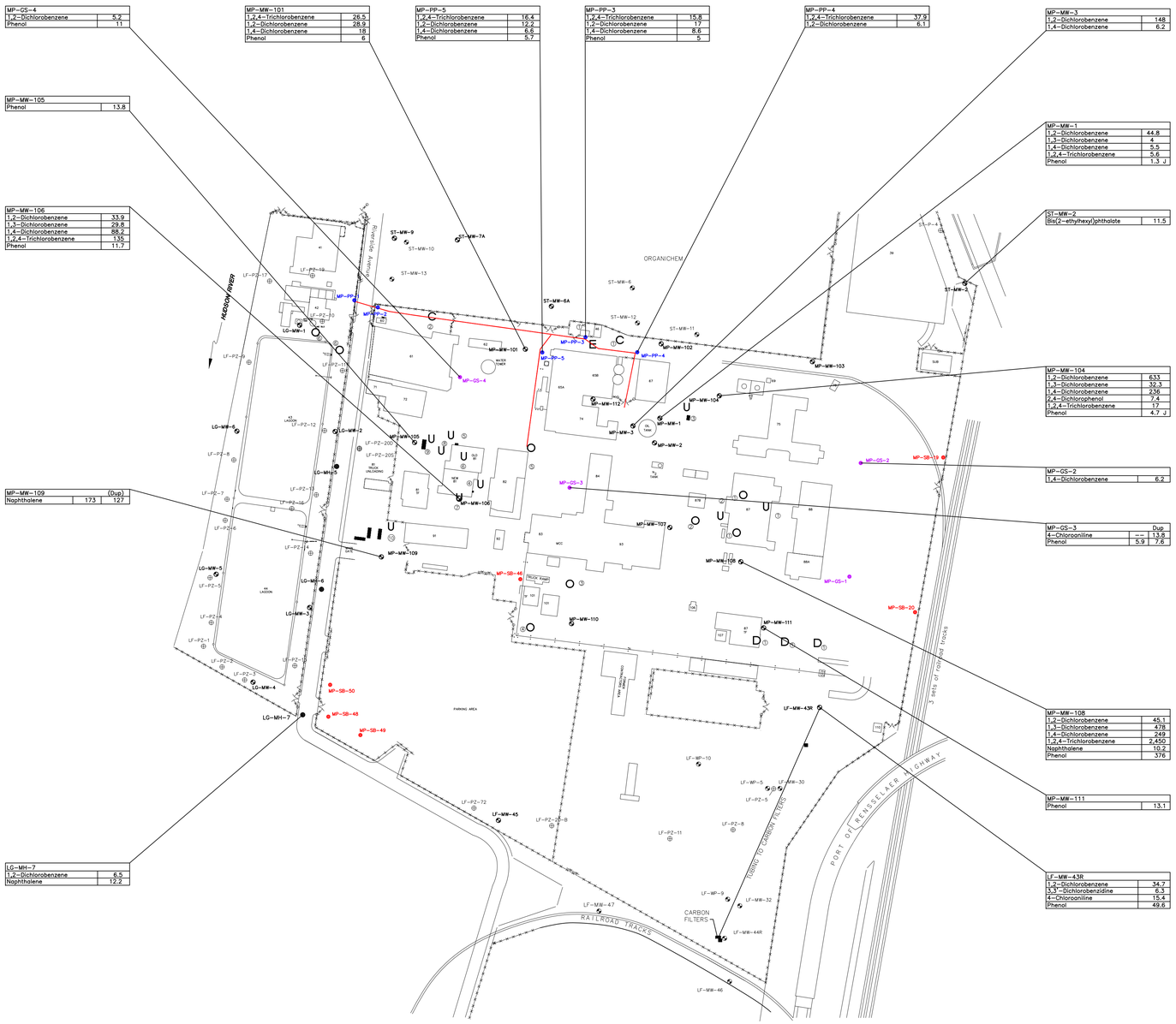
SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 27DEC12	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	8
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.18.DWG		

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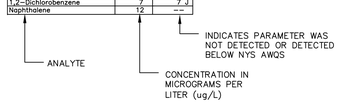
Analyte	NYS AWQS (ug/L)
1,2,4-Trichlorobenzene	5
1,2-Dichlorobenzene	3
1,3-Dichlorobenzene	3
1,4-Dichlorobenzene	3
2,4-Dichlorophenol	5
3,3'-Dichlorobenzidine	5
4-Chloroaniline	5
Bis(2-ethylhexyl)phthalate	5
Naphthalene	10
Pentachlorophenol	1*
Phenol	1*

* - Applies to the sum of these analytes

LEGEND

LOCATION PREFIXES
LG - LAGOON
MP - MAIN PLANT
LF - LANDFILL
ST - ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

- EXISTING BUILDING
- FORMER BUILDING
- FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT
- C E O U D - DESIGNATES POTENTIAL AREA OF INTEREST, TABLE 3-1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOM PIRNIE, INC., 1998
- STORM SEWER GRATE
- OVERHEAD UTILITY SUPPORTS
- BARBED WIRE FENCE
- CHAINLINK FENCE
- APPROXIMATE LOCATION OF PERFORATED PIPE
- MP-GS-1 - LOCATION AND DESIGNATION OF GROUNDWATER SCREENING SAMPLE
- MP-SB-19 - LOCATION AND DESIGNATION OF SOIL BORING AND GROUNDWATER SCREENING SAMPLE
- MP-PP-5 - LOCATION AND DESIGNATION OF PERFORATED PIPE SAMPLING POINT
- MP-MW-101 - LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
- LF-PZ-5 - LOCATION AND DESIGNATION OF EXISTING PIEZOMETER
- LG-MH-7 - LOCATION AND DESIGNATION OF SEWER BEDDING SAMPLING POINT
- LF-MW-44R - LOCATION AND DESIGNATION OF EXISTING MONITORING WELL (NOT SAMPLED)
- LG-PZ-10 - LOCATION AND DESIGNATION OF EXISTING PIEZOMETER (NOT SAMPLED)
- NYS AWQS - NEW YORK STATE AMBIENT WATER QUALITY STANDARDS
- SVOCs - SEMIVOLATILE ORGANIC COMPOUNDS



NOTES

1. BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)
2. ALL ANALYTES FROM SAMPLING LOCATIONS WITH NO DATA WERE EITHER NOT DETECTED OR DETECTED BELOW NYS AWQS.

150' 0 150'

Title:
SVOCs DETECTED IN GROUNDWATER EXCEEDING NYS AWQS DURING REMEDIAL INVESTIGATION

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: N.E.	Date: 27DEC12	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	9
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.19.DWG		

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Analtye	NYS AWQS (ug/L)
1,2–Dichloroethane	0.6
Benzene	1
Chlorobenzene	5
Ethylbenzene	5
Toluene	5
Xylenes (total)	5
1,2,4–Trichlorobenzene	5
1,2–Dichlorobenzene	3
1,4–Dichlorobenzene	3
Phenol	1
Arsenic	25

NYS AWQS – New York State Ambient Water Quality Standards

ug/L – Micrograms per liter

LEGEND

LOCATION PREFIXES

LG – LAGOON
MP – MAIN PLANT
LF – LANDFILL
ST – ORGANICHEM PROPERTY (FORMERLY STERLING ORGANICS)

EXISTING BUILDING

FORMER BUILDING

FORMER OR EXISTING ALLEGED UNDERGROUND TANK OR PIT

C① E① O① U① D① TABLE 3–1 "REMEDIAL INVESTIGATION WORKPLAN" MALCOLM PIRNIE, INC., 1998

STORM SEWER GRATE

OVERHEAD UTILITY SUPPORTS

BARBED WIRE FENCE

CHAINLINK FENCE

MP–MW–103 LOCATION AND DESIGNATION OF MONITORING WELL (NOT SAMPLED DURING ADDITIONAL RI ACTIVITIES)

LF–PZ–5 LOCATION AND DESIGNATION OF PIEZOMETER (NOT SAMPLED DURING ADDITIONAL RI ACTIVITIES)

LG–MH–7 LOCATION AND DESIGNATION OF SEWER BEDDING GROUNDWATER SAMPLING POINT

LG–MW–1 LOCATION AND DESIGNATION OF MONITORING WELL

MP–PP–5 LOCATION AND DESIGNATION OF PERFORATED PIPE RISER

LF–PZ–5 LOCATION AND DESIGNATION OF PIEZOMETER

MP–MW–114 LOCATION AND DESIGNATION OF MONITORING WELL (LOWER AQUIFER)

MP–MW–111	Unfiltered	Unfiltered Duplicate	Filtered
1,2–Dichloroethane	100 U	NA	NA
Benzene	360	NA	NA
Chlorobenzene	3,100	NA	NA
Ethylbenzene	100 U	NA	NA
Toluene	100 U	NA	NA
Xylenes (total)	100 U	NA	NA
1,2,4–Trichlorobenzene	10 U	––	NA
1,2–Dichlorobenzene	10 J	35	NA
Phenol	21	––	NA
Arsenic	404	NA	––

CONCENTRATIONS IN ug/L

U – NOT DETECTED WITH DETECTION LIMIT ABOVE NYS AWQS; DETECTION LIMIT SHOWN

J – ESTIMATED CONCENTRATION

E – EXCEEDED CALIBRATION RANGE

NA – NOT ANALYZED

–– – NOT DETECTED OR DETECTED BELOW NYS AWQS

MP–MW–106 CHLOROBENZENE CONCENTRATION IN ug/L

NOT SAMPLED

CHLOROBENZENE NOT DETECTED WITH DETECTION LIMIT GREATER THAN 10x NYS AWQS

CONCENTRATIONS NOT INCLUDED IN CONTOURING BECAUSE WELL DOES NOT SCREEN THE FILL MATERIAL

NOTE

BASE MAP ADAPTED FROM PLATE 1, "REMEDIAL INVESTIGATION WORKPLAN" (MALCOLM PIRNIE, INC., 1998)

125' 0 125'

LG–PZ–101	Unfiltered	Duplicate Unfiltered
1,2–Dichloroethane	5 U	5 U
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA

LG–PZ–102	Unfiltered	Filtered
1,2–Dichloroethane	5 U	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	3,480	308

MP–MW–105	Unfiltered	Filtered
1,2–Dichloroethane	16,000	NA
Benzene	800	NA
Chlorobenzene	970	NA
Ethylbenzene	500 U	NA
Toluene	500 U	NA
Xylenes (total)	500 U	NA
Arsenic	123	––

MP–PZ–106	Unfiltered	Unfiltered Duplicate	Filtered
1,2–Dichloroethane	5 U	5 U	NA
Benzene	3	3 J	NA
Chlorobenzene	9	9	NA
Arsenic	2,160	NA	1,620

ST–MW–6A	Unfiltered	Filtered
1,2–Dichloroethane	4 J	NA
Benzene	18	NA
1,2–Dichlorobenzene	5U	NA
Phenol	2U	NA
Arsenic	31.2	27.5

MP–MW–102	Unfiltered	Filtered
1,2–Dichloroethane	70	NA
Chlorobenzene	13	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	46.3	28.5

MP–MW–3	
1,2–Dichloroethane	3,500
Benzene	60
Chlorobenzene	3,100
Ethylbenzene	100 U
Toluene	100 U
Xylenes (total)	100 U
1,2–Dichlorobenzene	120
1,4–Dichlorobenzene	5
Phenol	2 U

LG–PZ–103	Unfiltered	Filtered
1,2–Dichloroethane	5 U	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	9,830	378

MP–PZ–104	
1,2–Dichloroethane	5 U

MP–MW–101	Unfiltered	Filtered
1,2–Dichloroethane	210 J	NA
Benzene	1,000	NA
Chlorobenzene	27,000	NA
Ethylbenzene	1000 U	NA
Toluene	1000 U	NA
Xylenes (total)	220 J	NA
1,2,4–Trichlorobenzene	80	NA
1,2–Dichlorobenzene	73	NA
1,4–Dichlorobenzene	45	NA
Phenol	10 U	NA
Arsenic	1,410	1,200

MP–MW–106	Unfiltered	Filtered
1,2–Dichloroethane	20,000	NA
Benzene	2,900	NA
Chlorobenzene	9,400	NA
Ethylbenzene	1,000 U	NA
Toluene	1,000 U	NA
Xylenes (total)	1,000 U	NA
1,2,4–Trichlorobenzene	120	NA
1,2–Dichlorobenzene	14	NA
1,4–Dichlorobenzene	35	NA
Phenol	22	NA
Arsenic	88.6	81.3

MP–MW–1	
1,2–Dichloroethane	170
Chlorobenzene	86
1,2–Dichlorobenzene	18
Phenol	2 U

MP–MW–104	
1,2–Dichloroethane	200
Benzene	7
Chlorobenzene	22
1,2–Dichlorobenzene	50
1,4–Dichlorobenzene	9
Phenol	2 U

MP–MW–2	Unfiltered	Filtered
1,2–Dichloroethane	68	
1,2–Dichlorobenzene	5 U	
1,4–Dichlorobenzene	5 U	
Phenol	2 U	
Arsenic	9.7	62.5

MP–PZ–121	
1,2–Dichloroethane	5 U
Benzene	3
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

MP–PZ–120	
1,2–Dichloroethane	76 J
Benzene	92
Chlorobenzene	3,700
Ethylbenzene	200 U
Toluene	200 U
Xylenes (total)	200 U
1,2,4–Trichlorobenzene	660 E
1,2–Dichlorobenzene	98
1,4–Dichlorobenzene	18
Phenol	63

MP–MW–107	Unfiltered	Filtered
1,2–Dichloroethane	25 U	
Benzene	6	
Chlorobenzene	620	
Ethylbenzene	25 U	
Toluene	25 U	
Xylenes (total)	25 U	
1,2–Dichlorobenzene	5 U	
1,4–Dichlorobenzene	5 U	
Phenol	2	
Arsenic	40.8	––

MP–MW–108	
1,2–Dichloroethane	52 J
Benzene	1,400
Chlorobenzene	1,200
Ethylbenzene	100 U
Toluene	140
Xylenes (total)	100 U
1,2,4–Trichlorobenzene	1,500
1,2–Dichlorobenzene	40 J
1,4–Dichlorobenzene	210
Phenol	580

MP–MW–111	Unfiltered	Unfiltered Duplicate	Filtered
1,2–Dichloroethane	100 U	NA	NA
Benzene	360	NA	NA
Chlorobenzene	3,100	NA	NA
Ethylbenzene	100 U	NA	NA
Toluene	100 U	NA	NA
Xylenes (total)	100 U	NA	NA
1,2,4–Trichlorobenzene	10 U	––	NA
1,2–Dichlorobenzene	10 J	35	NA
Phenol	21	––	NA
Arsenic	404	NA	––

MP–PZ–114	
1,2–Dichloroethane	5 U
Benzene	10
Chlorobenzene	58
1,2–Dichlorobenzene	6
1,4–Dichlorobenzene	5 U
Phenol	2 U

LF–MW–43R	Unfiltered	Filtered
1,2–Dichloroethane	500 U	NA
Benzene	15,000	NA
Chlorobenzene	500 U	NA
Ethylbenzene	500 U	NA
Toluene	500 U	NA
Xylenes (total)	500 U	NA
Arsenic	171	––

MP–PZ–113	
1,2–Dichloroethane	7,500 U
Benzene	3,200
Chlorobenzene	170,000
Ethylbenzene	7,500 U
Toluene	7,500 U
Xylenes (total)	7,500 U
1,2,4–Trichlorobenzene	150 J
1,2–Dichlorobenzene	130 J
1,4–Dichlorobenzene	150 U
Phenol	92 J

MP–PZ–112	
1,2–Dichloroethane	5 U
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LG–MW–3	
1,2–Dichloroethane	5 U
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LG–MW–4	Unfiltered	Unfiltered Duplicate	Filtered	Filtered Duplicate
1,2–Dichloroethane	5 U	5 U	NA	NA
1,2–Dichlorobenzene	5 U	NA	NA	NA
1,4–Dichlorobenzene	5 U	NA	NA	NA
Phenol	2 U	NA	NA	NA
Arsenic	7,220	3,240	5,680	3,360

LG–MH–5 (Sewer Bedding)	
1,2–Dichloroethane	2 J
Benzene	7
Chlorobenzene	100
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LG–MW–6	Unfiltered	Filtered
1,2–Dichloroethane	5 U	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	11,300 E	10,600 E

MP–MW–113		Duplicate
1,2–Dichloroethane	5 U	1 J
1,2–Dichlorobenzene	5 U	5 U
1,4–Dichlorobenzene	5 U	5 U
Phenol	2 U	2 U

MP–MW–109	Unfiltered	Filtered
1,2–Dichloroethane	300	NA
Benzene	200	NA
Chlorobenzene	350	NA
Ethylbenzene	1,800	NA
Toluene	75 U	NA
Xylenes (total)	3,000	NA
Arsenic	32.3	––

LG–MW–5	Unfiltered	Filtered
1,2–Dichloroethane	5 U	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	1,570 E	985 E

LG–MH–6 (Sewer Bedding)	
1,2–Dichloroethane	8
Benzene	22
Chlorobenzene	48
Ethylbenzene	12
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LG–PZ–1	Unfiltered	Filtered
1,2–Dichloroethane	5 U	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	125	98.7

LG–PZ–2	Unfiltered	Filtered
1,2–Dichloroethane	5 U	NA
1,2–Dichlorobenzene	5 U	NA
1,4–Dichlorobenzene	5 U	NA
Phenol	2 U	NA
Arsenic	115	112

LG–MH–7 (Sewer Bedding)	
1,2–Dichloroethane	120 U
Benzene	130
Chlorobenzene	2,600
Ethylbenzene	120 U
Toluene	120 U
Xylenes (total)	120 U
1,2–Dichlorobenzene	9
1,4–Dichlorobenzene	4 J
Phenol	2 U

MP–PZ–108	
1,2–Dichloroethane	5 U
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

MP–MW–114	
1,2–Dichloroethane	5 U
Benzene	2
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

MP–PZ–109	
1,2–Dichloroethane	1 J
Benzene	4
Chlorobenzene	180

MP–MW–110	
1,2–Dichloroethane	1 J
Chlorobenzene	12
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LF–MW–45	
1,2–Dichloroethane	5 U
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

MP–PZ–111	
1,2–Dichloroethane	5 U

MP–PZ–110	
1,2–Dichloroethane	5 U

LF–PZ–115	
1,2–Dichloroethane	5 U
Benzene	10
Chlorobenzene	420 E
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LF–PZ–116	
1,2–Dichloroethane	25 U
Benzene	11
Chlorobenzene	640
Ethylbenzene	25 U
Toluene	25 U
Xylenes (total)	25 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LF–PZ–117	
1,2–Dichloroethane	50 U
Benzene	7 U
Chlorobenzene	1,100
Ethylbenzene	50 U
Toluene	50 U
Xylenes (total)	50 U
1,2–Dichlorobenzene	5 U
1,4–Dichlorobenzene	5 U
Phenol	2 U

LF–PZ–118	
1,2–Dichloroethane	25 U
Benzene	110
Chlorobenzene	640
Ethylbenzene	11 J
Toluene	25 U
Xylenes (total)	15 J
1,2,4–Trichlorobenzene	11 J
1,2–Dichlorobenzene	25 U
1,4–Dichlorobenzene	25
Phenol	10 U

MP–PZ–107	
1,2–Dichloroethane	40 U
Benzene	340
Chlorobenzene	310
Ethylbenzene	810
Toluene	40 U
Xylenes (total)	91
Phenol	2 U

ORGANICHEM

HUDSON RIVER

Riverside Avenue

RAILROAD TRACKS

PORT OF IRRINGTON LACKAWANNA RAILROAD

3 sets of railroad tracks

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Title:
SUMMARY OF CONSTITUENTS OF CONCERN DETECTED ABOVE NYS AWQS IN GROUNDWATER DURING ADDITIONAL REMEDIAL INVESTIGATION ACTIVITIES

SITE MANAGEMENT PLAN

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

Compiled by: N.E.	Date: 27DEC12	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	10
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.20.DWG		

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LEGEND

- EXISTING BUILDING
- FORMER BUILDING
- FORMER, EXISTING OR ALLEGED UNDERGROUND/ABOVE GRADE TANK OR PIT
- BARBED WIRE FENCE
- CHAINLINK FENCE
- GUARDRAIL
- RAILROAD
- COUNTY OF RENSSELAER SEWER (ASSUMED SANITARY)
- CITY OF RENSSELAER STORM SEWER (ARROWS INDICATE DIRECTION OF FLOW)
- TOWN OF EAST GREENBUSH STORM SEWER (ARROWS INDICATE DIRECTION OF FLOW)
- CITY OF RENSSELAER SANITARY SEWER (ARROWS INDICATE DIRECTION OF FLOW)
- PLANT SANITARY SEWER (DASHED WHERE REPLACED) (ARROWS INDICATE DIRECTION OF FLOW)
- HYD — HYDRANT
- SMH — SEWER MANHOLE
- SHRUB
- TREE
- EXISTING PERFORATED PIPING LOCATED ALONG THE NORTHERN LIMITS OF THE PROPOSED NEWSPRINT RECYCLING FACILITY TO BE INCORPORATED AS PART OF THE AREA 1 GROUNDWATER COLLECTION SYSTEM (GCS).
- EXISTING PERFORATED PIPING LOCATED BENEATH THE PROPOSED NEWSPRINT RECYCLING FACILITY TO BE INCORPORATED AS PART OF THE AREA 1 GCS.
- EXISTING COLLECTION TRENCH
- GCS-EW-1 — LOCATION AND DESIGNATION OF EXTRACTION WELL
- GCS-MW-1 — LOCATION AND DESIGNATION OF MONITORING WELL
- GCS-PZ-1 — LOCATION AND DESIGNATION OF PIEZOMETER
- MP-PP-4 — LOCATION AND DESIGNATION OF EXISTING PERFORATED PIPE RISER TO BE USED AS AN EXTRACTION LOCATION

100' 0 100'

Title:
GROUNDWATER COLLECTION SYSTEM SITE PLAN

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: D.M.H.	Date: 27DEC12	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	11
Project Mgr: D.M.H.	Project: 0251.0011Y045	
File: 0251.0011Y592.06.DWG		

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HUDSON RIVER

EXISTING PRE-TREATMENT PLANT (SEE DETAIL BELOW)

30"ø COUNTY SEWER

EXISTING SEWER MANHOLE MH-14A
RIM 18.64'
INV IN = 1.34'
INV OUT = 1.20'
(SEE NOTE 5)

PROPOSED SILT FENCE

APPROXIMATE SIZE AND LOCATION OF PROPOSED GRASSED SHALLOW STORMWATER DETENTION AREAS (SEE DETAIL 3 ON DWG. 2)

24"ø

18"ø

EXISTING SEWER MANHOLE MH-11
RIM 18.20'
INV IN = 1.76'
INV OUT = 2.50'
(SEE NOTE 5)

PROPOSED VEGETATED DRAINAGE SWALE

EXISTING GRAVEL AREA (TYP) (SEE NOTE 4)

ELEV. 17'

ELEV. 17.5'

EXISTING GRAVEL AREA (TYP) (SEE NOTE 4)

PROPOSED LAGOON MODIFICATION (TO BE PERFORMED BY OTHERS)

PROPOSED GRASSED SHALLOW DETENTION AREA (SEE NOTE 6)

RIVERSIDE AVENUE

GUARDRAILS (TO BE REMOVED)(TYP)

PROPOSED SILT FENCE

PROPOSED LOCATION FOR FUTURE CULVERT TO RETENTION BASIN IN SOUTH LAGOON (CULVERT NOT IN THIS CONTRACT)

MAIN PLANT

HOT BOXES (TO BE REMOVED)

DRUM CRUSHER (TO BE REMOVED)

ALL EXISTING CATCH BASINS TO BE ABANDONED (SEE DETAIL 4 ON DWG. 2)

EXISTING GRAVEL AREA TO BE GRASSED AND SLOPED TO SWALE

EXISTING DRUM STORAGE STRUCTURE (TO BE REMOVED)

EXISTING ABOVEGROUND STEAM LINE (TO BE REMOVED)

PROPOSED VEGETATED FILTER STRIP (SEE DETAIL 2 ON DWG. 2)

60' (SEE NOTE 7)

EXISTING STEEL TRESTLE (TO BE REMOVED)

OVERFLOW SWALE. PROVIDE TRENCH DRAIN ACROSS RAMP TO EXISTING GROUNDWATER TREATMENT SYSTEM, LENGTH = 12 FEET (SEE DETAIL 5 ON DWG. 2)

EXISTING GROUNDWATER TREATMENT SYSTEM

PROPOSED VEGETATED DRAINAGE SWALE (SEE DETAIL 1 ON DWG. 2)

EXISTING UNPAVED AREA (SEE NOTE 4)

INV. EL. 16'

PROPOSED SILT FENCE

PROPOSED VEGETATED FILTER STRIP (SEE DETAIL 2 ON DWG. 2)

60' (SEE NOTE 7)

FORMER LANDFILL

EXISTING CATCH BASIN TO REMAIN ACTIVE

PROPOSED ROAD TO PROPOSED EDUCATION CENTER (TO BE BUILT BY OTHERS)

FORT ACCESS HIGHWAY

61 62 65A 65B 67 72 74 75 OLD 81 NEW 81 82 84 87 88 91 92 83 93 101 41

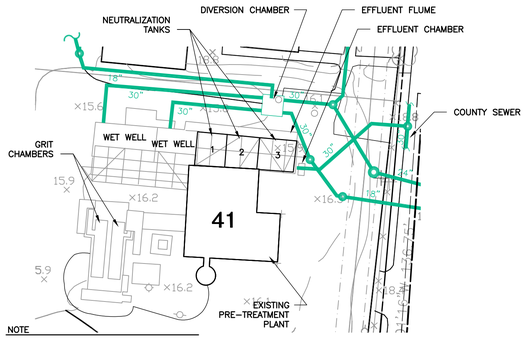
LEGEND

- PROPOSED VEGETATED DRAINAGE SWALE WITH FLOW DIRECTION
- APPROXIMATE LOCATION OF GROUNDWATER COLLECTION SYSTEM
- APPROXIMATE LOCATION OF STORM SEWER
- APPROXIMATE LOCATION OF CATCH BASIN TO BE ABANDONED IN SECOND PHASE
- APPROXIMATE LOCATION OF MANHOLE
- PROPOSED SILT FENCE
- LOCATION OF GRASSED AREAS
- LOCATION OF GRAVEL/UNPAVED AREAS
- PROPOSED VEGETATED DETENTION AREA WITH PROPOSED GRADE ELEVATION

NOTES

1. THE CONTRACTOR SHALL LOCATE AND VERIFY LOCATIONS OF EXISTING CATCH BASINS.
2. THE PROPOSED DRAINAGE SWALES TO BE A MINIMUM 10 FT WIDE AND MINIMUM BOTTOM WIDTH OF 3 FT.
3. THE PROPOSED VEGETATED DRAINAGE SWALES TO HAVE 2:1 SIDE SLOPES WITH EROSION MATS. SWALES TO HAVE MINIMUM LONGITUDINAL SLOPES TO MEET DETENTION AREA GRADES.
4. ALL EXISTING GRAVEL/UNPAVED AREAS, EXCEPT FOR LAGOON AREA, SHALL BE GRADED TO ENCOURAGE RUNOFF AWAY FROM PROPERTY BOUNDARY. ALL GRAVEL/UNPAVED AREAS SHALL BE COMPLETED WITH 6 INCHES OF TOPSOIL AND SEED PER SPECIFICATIONS.
5. EXISTING MANHOLES MH-14A AND MH-11 TO BE PLUGGED AND GROUTED TO STOP FLOW TO THE EXISTING PRE-TREATMENT PLANT. REFER TO SPECIFICATIONS FOR SEWER AND PRE-TREATMENT PLANT CLOSURE.
6. REMOVE ASPHALT WITHIN EXISTING LOW LYING AREA AND EXTEND GRASSED DETENTION AREA OUT BEYOND THE PROPOSED ABANDONMENT OF THE TWO EXISTING CATCH BASINS. THE DETENTION AREA SHALL BE GRADED AS REQUIRED AND COMPLETED WITH 6-INCHES OF TOPSOIL AND SEED AS PER SPECIFICATIONS.
7. MAINTAIN SETBACK OF 60 FEET FOR VEGETATED FILTER STRIPS.

80' 0 80'



NOTE
REFER TO SPECIFICATIONS FOR STRUCTURE CLEANING AND CLOSURE REQUIREMENTS.

PRE-TREATMENT PLANT DETAIL
SCALE: 1" = 40'

Title:
SEWER CLOSURE AND INTERIM STORMWATER MANAGEMENT PLAN

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: G.N.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	12
Project Mgr: N.E.	Project: 0251.0011Y045	
File: 0251.0011Y592.22.DWG		

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LEGEND

- CAPPED BUILDING AREA (TYPICAL)
- SHALLOW STORMWATER DETENTION AREA
- GRAVEL SWALED AREA
- —S— SANITARY LINE
- —ST— STORM LINE LINE
- —W— WATER LINE
- —W— RAW WATER LINE
- GCS-EW-14 LOCATION AND DESIGNATION OF EXTRACTION WELL WITH 5X5 CONC. VAULT
- GCS-EW-10 LOCATION AND DESIGNATION OF EXTRACTION WELL
- GCS-MW-17 LOCATION AND DESIGNATION OF MONITORING WELL
- GCS-EW-6 LOCATION AND DESIGNATION OF PIEZOMETER
- EMH ELECTRIC MANHOLE
- VZ163 UTILITY POLE
- CO CLEAN OUT
- 17.86 + SPOT ELEVATION

MAP NOTES

1. NORTH ORIENTATION AND COORDINATE DATUM ARE BASED ON THE EAST ZONE OF THE NEW YORK STATE PLANE COORDINATE SYSTEM AS ESTABLISHED BY DIFFERENTIAL G.P.S. METHODS ORIGINATING FROM MONUMENTS VAN RENSSELAER AND LANDSING (NAD 27).
2. SITE PLAN BASED ON SURVEY PROVIDED BY C.T. MALE ASSOCIATES, P.C. AND DATED OCTOBER 9, 2012.

100' 0 100'

Title:

SITE PLAN WITH COMPOSITE COVER SYSYEM

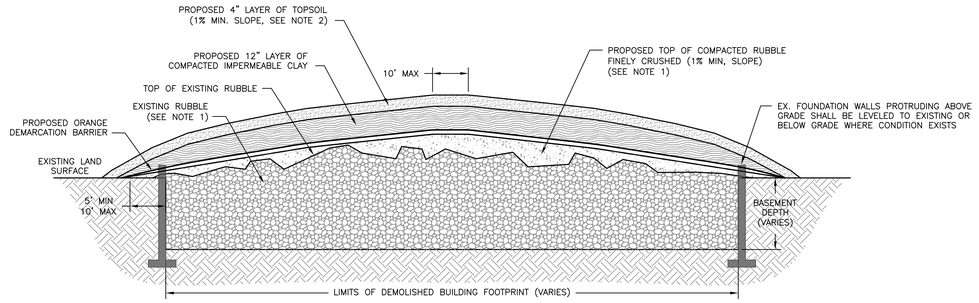
SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared For:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: D.M.H.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	
Project Mgr: D.M.H	Project: 0251.0011Y045	13
File: 0251.0011Y592.09.DWG		

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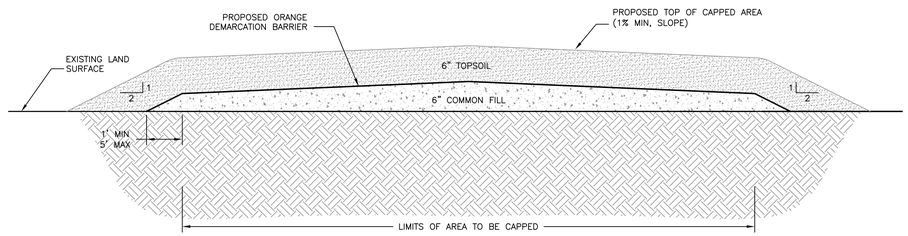


NOTES

1. SEVERAL FORMER MAIN PLANT AREA BUILDINGS WERE RECENTLY DEMOLISHED AND CURRENTLY CONSIST OF RUBBLE WITHIN THEIR FOOTPRINT AREA AND WITHIN THEIR FOUNDATION. THE CONTRACTOR SHALL FILL VOID SPACES WITH ON SITE MATERIAL FROM EXISTING RUBBLE PILES LOCATED THROUGH OUT THE SITE. CONTRACTOR SHALL THEN INSTALL A LAYER OF FINELY CRUSHED RUBBLE TO FILL SMALLER VOID SPACES. THE CONTRACTOR SHALL FINISH THE FINAL GRADE OF THE CAP SURFACE WITH ORANGE DEMARCATION LAYER, LAYER OF COMPACTED IMPERMEABLE CLAY AND TOPSOIL. THE TOPSOIL SHALL BE HYDROSEEDED UPON COMPLETION OF THE FINAL CAP GRADE.
2. THE CONTRACTOR SHALL ALSO FINISH THE CAP SURFACE WITH A MINIMUM GRADE OF 1 PERCENT TO ENSURE POSITIVE DRAINAGE FROM CAP AREA.
3. THE CONTRACTOR WILL NOT NEED TO MAKE ARRANGEMENTS FOR PREPARATION OF SURFACE IF A CONCRETE SLAB IS ENCOUNTERED AT GRADE IN THE SELECTED CAP AREAS.

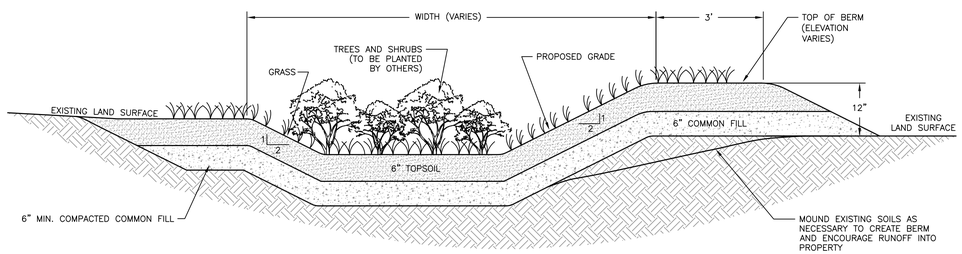
1 TYPICAL BUILDING CAP SURFACE DETAIL

SCALE: NOT TO SCALE



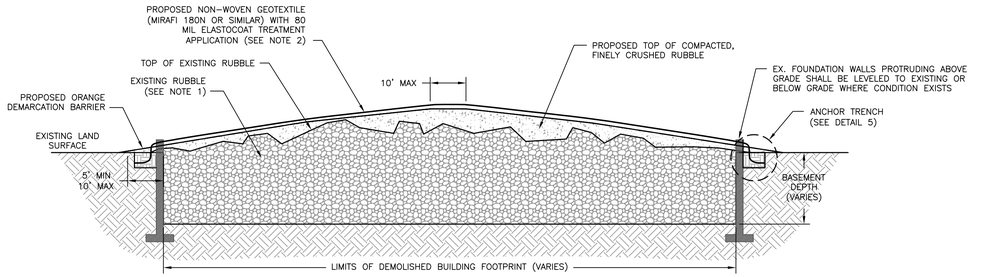
2 TYPICAL GRASSED SOIL CAP DETAIL

SCALE: NOT TO SCALE



3 TYPICAL GRASSED SHALLOW STORMWATER DETENTION AREA DETAIL

SCALE: 1/2" = 1'

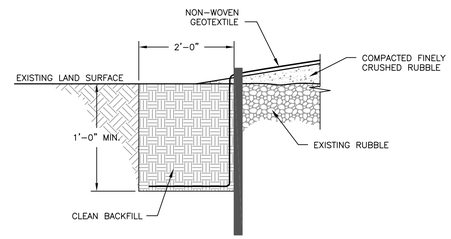


NOTES

1. BUILDING 67 CAP SURFACE SHALL BE PREPARED WITH RUBBLE AS FURTHER DESCRIBED IN DETAIL 1, NOTE 1. A LAYER OF NON-WOVEN GEOTEXTILE SHALL BE INSTALLED ABOVE THE COMPACTED RUBBLE AND ANCHORED BELOW GRADE IN A TRENCH 2 FEET WIDE BY 1 FOOT DEEP ON ALL SIDES OF THE BUILDING FOOTPRINT.
2. THE CONTRACTOR SHALL FINISH THE CAP SURFACE BY APPLYING AN ELASTOCOAT SURFACE TREATMENT TO THE NON-WOVEN GEOTEXTILE. THE SURFACE TREATMENT SHALL BE PRODUCT XS-310 OR XS-350 AS PROVIDED BY LINE-X AND SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

4 BUILDING 67 CAP SURFACE DETAIL

SCALE: NOT TO SCALE



5 NON-WOVEN GEOTEXTILE ANCHOR TRENCH DETAIL

SCALE: NOT TO SCALE

Title:

CAP CROSS SECTIONS

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

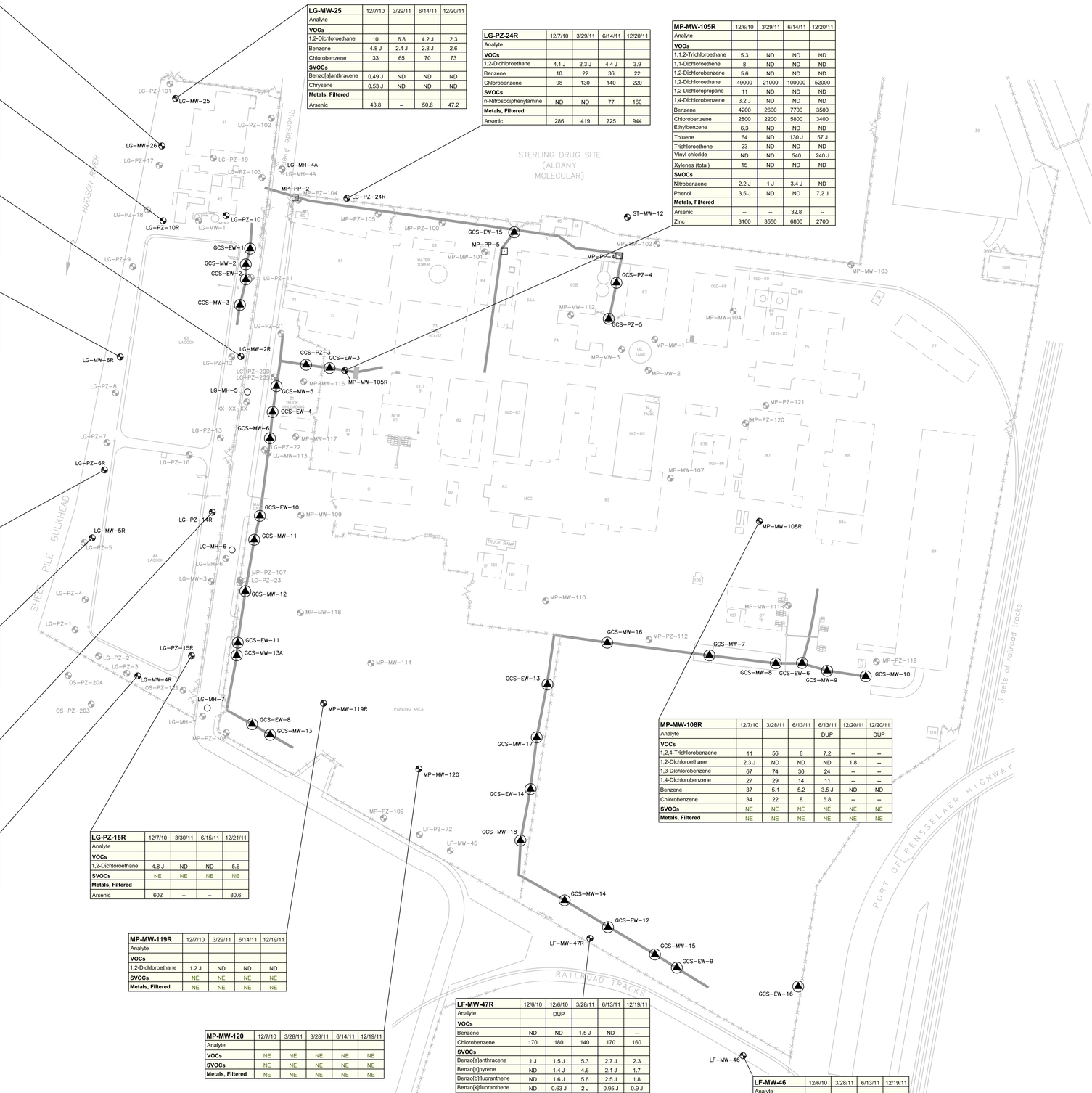
Prepared For:

BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: D.M.H.	Date: 01MAR13	PLATE
Prepared by: J.A.D.	Scale: AS SHOWN	14
Project Mgr: D.M.H.	Project: 0251.0011Y045	
File: 0251.0011Y592.08.DWG		

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LG-MW-26	12/7/10	3/29/11	6/14/11	12/21/11
Analyte				
VOCs	NE	NE	NE	NE
SVOCs				
Pentachlorophenol	41	6.2 J	6.7 J	ND
Metals, Filtered				
Arsenic	103	40.2	28.9	45.7

LG-MW-25	12/7/10	3/29/11	6/14/11	12/20/11
Analyte				
VOCs				
1,2-Dichloroethane	10	6.8	4.2 J	2.3
Benzene	4.8 J	2.4 J	2.8 J	2.6
Chlorobenzene	33	65	70	73
SVOCs				
Benzo[a]anthracene	0.49 J	ND	ND	ND
Chrysene	0.53 J	ND	ND	ND
Metals, Filtered				
Arsenic	43.8	--	50.6	47.2

LG-PZ-24R	12/7/10	3/29/11	6/14/11	12/20/11
Analyte				
VOCs				
1,1-Dichloroethane	4.1 J	2.3 J	4.4 J	3.9
Benzene	10	22	36	22
Chlorobenzene	98	130	140	220
SVOCs				
n-Nitrosodiphenylamine	ND	ND	77	160
Metals, Filtered				
Arsenic	286	419	725	944

MP-MW-105R	12/6/10	3/29/11	6/14/11	12/20/11
Analyte				
VOCs				
1,1,2-Trichloroethane	5.3	ND	ND	ND
1,1-Dichloroethene	8	ND	ND	ND
1,2-Dichlorobenzene	5.6	ND	ND	ND
1,2-Dichloroethane	49000	21000	100000	52000
1,2-Dichloropropane	11	ND	ND	ND
1,4-Dichlorobenzene	3.2 J	ND	ND	ND
Benzene	4200	2600	7700	3500
Chlorobenzene	2800	2200	5800	3400
Ethylbenzene	6.3	ND	ND	ND
Toluene	64	ND	130 J	57 J
Trichloroethene	23	ND	ND	ND
Vinyl chloride	ND	ND	540	240 J
Xylenes (total)	15	ND	ND	ND
SVOCs				
Nitrobenzene	2.2 J	1 J	3.4 J	ND
Phenol	3.5 J	ND	ND	7.2 J
Metals, Filtered				
Arsenic	--	--	32.8	--
Zinc	3100	3550	6800	2700

LG-PZ-10R	12/7/10	3/29/11	6/14/11	12/20/11
Analyte				
VOCs				
1,2-Dichloroethane	0.76 J	ND	ND	ND
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	7480	4380	5730	10000

LG-MW-2R	12/7/10	3/30/11	6/15/11	12/21/11
Analyte				
VOCs				
1,2-Dichloroethane	ND	ND	ND	0.82 J
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	93.6	32.5	81.1	124

LG-MW-6R	12/7/10	3/30/11	6/14/11	12/20/11
Analyte				
VOCs				
1,2-Dichloroethane	0.82 J	ND	2.2 J	ND
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	13100	7820	6600	7320

LG-PZ-6R	12/7/10	3/30/11	6/15/11	12/20/11
Analyte				
VOCs	NE	NE	NE	NE
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	700	556	491	660

LG-MW-5R	12/7/10	3/29/11	6/15/11	12/21/11
Analyte				
VOCs				
1,2-Dichloroethane	0.85 J	ND	ND	ND
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	680	295	432	217

LG-PZ-14R	12/7/10	3/30/11	6/15/11	12/21/11
Analyte				
VOCs				
1,2-Dichloroethane	3.5 J	3.1 J	2 J	1.4
Chlorobenzene	15	5.6	5.9	7.6
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	270	121	158	224

LG-MW-4R	12/7/10	3/29/11	6/15/11	12/21/11
Analyte				
VOCs				
1,2-Dichloroethane	5.7	ND	ND	3.8
SVOCs	NE	NE	NE	NE
Metals, Filtered	NE	NE	NE	NE

LG-PZ-15R	12/7/10	3/30/11	6/15/11	12/21/11
Analyte				
VOCs				
1,2-Dichloroethane	4.8 J	ND	ND	5.6
SVOCs	NE	NE	NE	NE
Metals, Filtered				
Arsenic	602	--	--	80.6

MP-MW-119R	12/7/10	3/29/11	6/14/11	12/19/11
Analyte				
VOCs				
1,2-Dichloroethane	1.2 J	ND	ND	ND
SVOCs	NE	NE	NE	NE
Metals, Filtered	NE	NE	NE	NE

MP-MW-120	12/7/10	3/28/11	3/28/11	6/14/11	12/19/11
Analyte					
VOCs	NE	NE	NE	NE	NE
SVOCs	NE	NE	NE	NE	NE
Metals, Filtered	NE	NE	NE	NE	NE

LF-MW-47R	12/6/10	12/6/10	3/28/11	6/13/11	12/19/11
Analyte		DUP			
VOCs					
Benzene	ND	ND	1.5 J	ND	--
Chlorobenzene	170	180	140	170	160
SVOCs					
Benzo[a]anthracene	1 J	1.5 J	5.3	2.7 J	2.3
Benzo[a]pyrene	ND	1.4 J	4.6	2.1 J	1.7
Benzo[b]fluoranthene	ND	1.6 J	5.6	2.5 J	1.8
Benzo[k]fluoranthene	ND	0.63 J	2 J	0.95 J	0.9 J
Chrysene	0.98 J	1.4 J	5	2.4 J	ND
Indeno[1,2,3-cd]pyrene	ND	ND	ND	1.2 J	0.61 J
Naphthalene	25	28	--	11	ND
Phenol	1.3 J	1.4 J	ND	2.2 J	ND
Metals, Filtered					
Arsenic	25.1	--	--	31.8	--

LF-MW-46	12/6/10	3/28/11	6/13/11	12/19/11
Analyte				
VOCs				
1,2-Dichloroethane	13	ND	9.9	11
SVOCs	NE	NE	NE	NE
Metals, Filtered	NE	NE	NE	NE

MP-MW-108R	12/7/10	3/28/11	6/13/11	6/13/11	12/20/11	12/20/11
Analyte				DUP		DUP
VOCs						
1,2,4-Trichlorobenzene	11	56	8	7.2	--	--
1,2-Dichloroethane	2.3 J	ND	ND	ND	1.8	--
1,3-Dichlorobenzene	67	74	30	24	--	--
1,4-Dichlorobenzene	27	29	14	11	--	--
Benzene	37	5.1	5.2	3.5 J	ND	ND
Chlorobenzene	34	22	8	5.8	--	--
SVOCs	NE	NE	NE	NE	NE	NE
Metals, Filtered	NE	NE	NE	NE	NE	NE

Parameter (Concentrations in µg/L)	Standards* (µg/L)
VOCs	
1,1,2-Trichloroethane	1
1,1-Dichloroethene	5
1,2,4-Trichlorobenzene	5
1,2-Dichlorobenzene	3
1,2-Dichloroethane	0.6
1,2-Dichloropropane	1
1,3-Dichlorobenzene	3
1,4-Dichlorobenzene	3
Acetone	50
Benzene	1
Chlorobenzene	5
Ethylbenzene	5
Methylene chloride	5
Toluene	5
Trichloroethene	5
Vinyl chloride	2
Xylenes (total)	5
SVOCs	
Benzo[a]anthracene	0.002
Benzo[a]pyrene	0
Benzo[b]fluoranthene	0.002
Benzo[k]fluoranthene	0.002
Chrysene	0.002
Indeno[1,2,3-cd]pyrene	0.002
Naphthalene	10
Nitrobenzene	0.4
n-Nitrosodiphenylamine	50
Pentachlorophenol	1
Phenol	1
Metals	
Arsenic	25
Lead	25
Mercury	0.7
Zinc	2000

Monitoring Well	Justification	Status
LF-MW-46R	Located Downgradient of GCS Area 6	Decommissioned February 6, 2017
LF-MW-47R	Located Downgradient of GCS Area 6	Decommissioned February 6, 2017
LG-MW-2R	Located downgradient of GCS Area 3 and for Lagoon Area Arsenic in Groundwater Remediation Monitoring	Not currently being sampled
LG-MW-4R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Decommissioned February 6, 2017
LG-MW-5R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Not currently being sampled
LG-MW-6R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Active
LG-PZ-10R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Decommissioned July 6, 2018
LG-PZ-14R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Not currently being sampled
LG-PZ-15R	Downgradient of GCS Area 5	Not currently being sampled
LG-PZ-24R	Downgradient of GCS Area 1 (Western Portion)	Active
LG-PZ-6R	Lagoon Area Arsenic in Groundwater Remediation Monitoring	Active
MP-MW-105R	Downgradient of AOC-1 and Re-injection Gallery	Active
MP-MW-108R	Downgradient of AOC-2 and Re-Injection Gallery	Decommissioned February 6, 2017
MP-MW-119R	Requested by the NYSDEC	Decommissioned February 6, 2017
MP-MW-120	Requested by the NYSDEC	Decommissioned February 6, 2017
ST-MW-12	Downgradient of GCS Area 1 (Eastern portion)	Active

LEGEND

- FORMER BUILDING
- STORM SEWER GRATE
- ST-MW-12 — WELL IN THE GCS PERFORMANCE MONITORING NETWORK
- GCS-EW-14 — GCS EXTRACTION WELL SUMP LOCATION AND DESIGNATION
- MP-PP-4 — PERFORATED PIPE RISER LOCATION AND DESIGNATION
- LG-MH-6 — MANHOLE LOCATION AND DESIGNATION
- GROUNDWATER CONTAINMENT SYSTEM TRENCH
- BARBED WIRE FENCE
- CHAINLINK FENCE

LOCATION PREFIXES

LG	LAGOON
MP	MAIN PLANT
LF	LANDFILL
ST	ALBANY MOLECULAR PROPERTY (FORMERLY ORGANICHEM)

DATA BOX KEY

MP-MW-108R	12/7/10	3/28/11	6/13/11	6/13/11
Analyte				DUP
VOCs				
1,2,4-Trichlorobenzene	11	56	8	7.2
1,2-Dichloroethane	2.3 J	ND	ND	ND
1,3-Dichlorobenzene	67	74	30	24
1,4-Dichlorobenzene	27	29	14	11
Benzene	37	5.1	5.2	3.5 J
Chlorobenzene	34	22	8	5.8
SVOCs	NE	NE	NE	NE
Metals, Filtered	NE	NE	NE	NE

WELL DESIGNATION — DATE SAMPLED — DUPLICATE — CONCENTRATIONS IN MICROGRAMS PER LITER — ANALYTE

CONCENTRATIONS IN MICROGRAMS PER LITER

µg/L – MICROGRAMS PER LITER

*NYSDEC AWQSGVS – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION AMBIENT WATER-QUALITY STANDARDS AND GUIDANCE VALUES

ND – NOT DETECTED ABOVE NYSDEC AWQSGVS

B – FOUND IN LABORATORY BLANK

J – ESTIMATED VALUE

DUP – DUPLICATE SAMPLE

VOCS – VOLATILE ORGANIC COMPOUNDS

SVOCS – SEMIVOLATILE ORGANIC COMPOUNDS

NE – NO EXCEEDANCES

-- – SAMPLE WAS DETECTED BUT DID NOT EXCEED NYSDEC AWQSGVS

NOTE

1. ONLY DETECTIONS OF SITE SPECIFIC COMPOUNDS ABOVE NYSDEC AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES ARE SHOWN. ONLY RESULTS FOR FILTERED METALS SAMPLES ARE SHOWN.

100' 0 100'

Title:

PERFORMANCE MONITORING NETWORK AND GROUNDWATER QUALITY DATA DECEMBER 2010 THROUGH DECEMBER 2011

SITE MANAGEMENT PLAN
RENSSELAER, NEW YORK

Prepared for:
BASF CORPORATION
FLORHAM PARK, NEW JERSEY

ROUX

Compiled by: K.S.	Date: 21OCT19
Prepared by: G.M.	Scale: AS SHOWN
Project Mgr: K.S.	Project: 0251.0011Y045
File: 0251.0011Y592.21.DWG	

PLATE 15

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