FEBRUARY 2020

New York State Department of Environmental Conservation

Division of Environmental Remediation

Franklin Cleaners Site

Site No. 130050

Site Management Plan

D&B Engineers and Architects, P.C.

CERTIFICATIONS

I, Matthew R. DeVinney, certify that I am currently a New York State 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).

085452	2-27-20	Matthew R DeVinney
NYS Professional Engineer #	Date	Signature

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1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 Introduction

This Site Management Plan (SMP) is required as an element of the remedial program for the Franklin Cleaners (the Site) under the New York State Inactive Hazardous Waste Disposal Site Remedial Program administered by the New York State Department of Environmental Conservation (NYSDEC). The Site is a NYSDEC Class 2 Inactive Hazardous Waste Site and is listed on the New York State Registry of Inactive Hazardous Waste Sites (Site No. 130050). As described below and as per the requirements of the NYSDEC Record of Decision (ROD), dated March 1998, on-site and off-site remedial actions have been completed at and downgradient of the Site in order to remediate chlorinated-solvent contamination associated with the historical use of the Site as a dry cleaner. A Site location map depicting the locations of the on-site and off-site remedial areas is provided as Figure 1-1.

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FRANKLIN CLEANERS SITE
VILLAGE OF HEMPSTEAD, NEW YORK
SITE LOCATION MAP

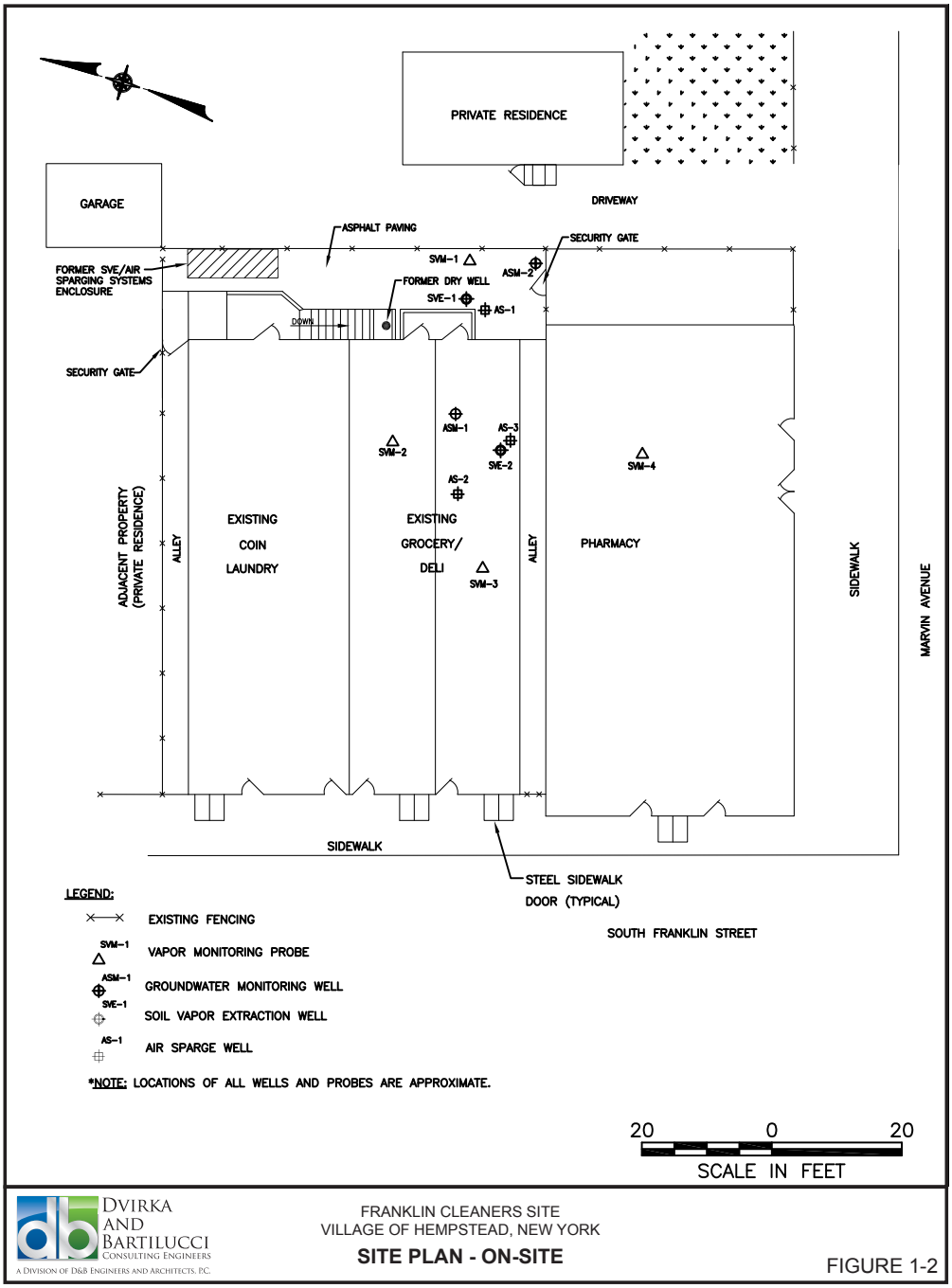
SOURCE: GOOGLEARTH.COM

FIGURE 1-1

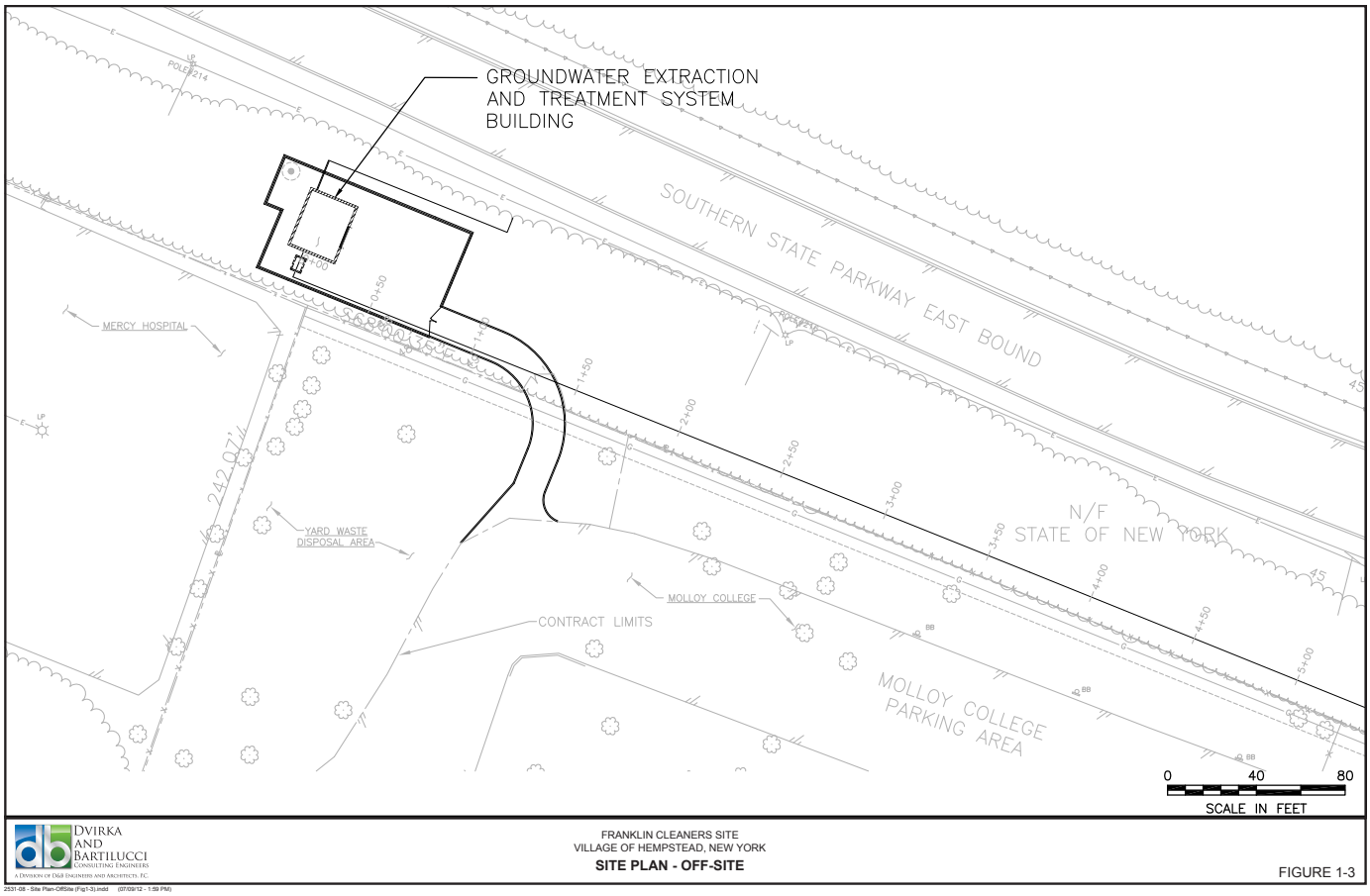
This SMP was prepared by D&B Engineers and Architects, P.C., under NYSDEC Work Assignment No. D004446-1.2, in accordance with the requirements provided in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010, revised in February 2020. This SMP was prepared to manage any residual contamination located at and downgradient of the Site in perpetuity or until extinguishment, and is designed to address the means for implementing any required Institutional Controls (ICs) and Engineering Controls (ECs). All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

1.1.1 General

The Site is located at 206-208B South Franklin Street in the Incorporated Village of Hempstead, Nassau County. A Site plan is provided as Figure 1-2. As described above, the Site operated as a dry cleaner and laundromat from 1957 through 1991 and is reported to be the source of the chlorinated solvent contamination identified at the Site, as well as the groundwater plume extending from the Site. As summarized in further detail below, the "source area" contamination at the Site was remediated via a soil vapor extraction and air sparging (SVE/AS) system, which operated from November 2003 to August 2004. The SVE/AS system was shut down in August 2004 based on contaminant concentrations below NYSDEC guidelines.



In addition, a groundwater extraction and treatment system (GWE&TS) was installed at 1000 Hempstead Avenue in the Incorporated Village of Rockville Centre, Nassau County, New York, approximately 1 mile downgradient of the Site, in order to capture and treat the chlorinated solvent groundwater plume. The GWE&TS system was operated from September 2004 to July 2017 when it was shut down as the operational and performance data for the system, as configured, may be approaching asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted. A Site plan of the GWE&TS is provided as Figure 1-3.



1.1.2 Purpose

As detailed below, the March 1998 Record of Decision (ROD) for the Site includes several ECs to provide proper management of remaining documented and potential residual contamination associated with the Site to ensure protection of public health and the environment. As described above, remediation of the Site "source area" soil and groundwater contamination was completed in August 2004 via the operation of a SVE/AS system. Additionally, the GWE&TS was installed to capture and treat the remaining groundwater contamination plume extending from the Site. In July 2017, the GWE&TS was shut down as the operational and performance data set for the system, as configured, was reaching asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted. This SMP specifies the methods necessary to ensure compliance with the ECs and ICs specified in the March 1998 ROD. Compliance with this SMP is required by the NYSDEC and its successors and assigns and may only be revised per the NYSDEC.

This SMP provides detailed descriptions of all procedures required to manage the remaining contamination associated with the Site, as follows:

- An IC/EC Plan for implementation and management of all required IC/ECs;
- A Monitoring and Sampling Plan;
- An Operation and Maintenance (O&M) Plan for the operation and maintenance of the GWE&TS (if returned to operation);
- A Site Management Reporting Plan for submittal of data, site activities logs, recommendations and certifications to the NYSDEC; and
- Criteria for possible Site closure;

It is important to note that:

- This SMP details the site-specific management procedures that are required to be properly implemented at the Site, as per the NYSDEC; and
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6 NYCRR Part 375 and the ROD for the Site, and thereby subject to applicable penalties.

1.1.3 Revisions

This document is the first revision of the original SMP that was dated January 2015. Any required revisions to this SMP must be approved by the NYSDEC. Upon revision of the SMP, the NYSDEC will append the revisions to the SMP and retain such in its files.

1.2 Site Background

1.2.1 Site Location and Description

The Site is a former dry cleaning facility located at 206-208B South Franklin Avenue in the Incorporated Village of Hempstead, Nassau County, New York. The Site is bordered by Marvin Avenue to the south, private residences to the north and east, and commercial buildings and South Franklin Street to the west (see Figure 1-2). The Site is approximately 0.25 acre in size and currently includes a two-story building with a coin-operated laundromat and delicatessen on the first floor, residential apartments on the second floor and a full basement. Portions of the first floor and basement were utilized by the former dry cleaning facility.

The GWE&TS is located at 1000 Hempstead Avenue in the Village of Rockville Centre, Nassau County, New York, approximately 1 mile downgradient of the Site. The downgradient GWE&TS is located on an approximately 1/4-acre property bounded by the Southern State Parkway to the north, Molloy College to the south, Hempstead Avenue to the east, and Mercy Medical Center to the west. The GWE&TS layout and components are described in Section 1.3.1.

1.2.2 Geologic Conditions

Regional Geology

In general, the geology underlying the Site consists of a southeastward thickening wedge of unconsolidated deposits overlying crystalline bedrock. The bedrock is characterized as muscovite-biotite schist, gneiss or granite, present approximately 1,000 feet below land surface (Smolensky, et al., 1989).

The following general summary of the unconsolidated deposits in the vicinity of the Site is derived from Smolensky, et al., 1989. The Lloyd Sand Member of the Raritan Formation directly overlying the bedrock beneath the Site is Late Cretaceous age, and is approximately 300 feet thick in this area of Long Island. The Lloyd Sand Member is comprised primarily of sand and gravel with some clay lenses. The Raritan Clay directly overlies the Lloyd Sand Member with a thickness of approximately 200 feet. The Magothy aquifer overlies the Raritan Formation with a thickness of approximately 500 feet. The Magothy aquifer generally consists of alternating layers of fine sand, silt and clay, with the silt and clay layers typically associated with the upper portion of the aquifer. The shallowest unconsolidated deposit is the Pleistocene-aged Upper Glacial aquifer, which overlies the Magothy aquifer. This formation generally consists of very fine to coarse sand and gravel.

Regional Hydrogeology

The saturated sands and gravels of the Lloyd, Magothy and lower portion of the Upper Glacial deposits form Long Island's three major aquifers. These aquifers constitute Long Island's Sole Source Aquifer, as designated by the Environmental Protection Agency (EPA) pursuant to Section 1424(e) of the Safe Drinking Water Act. A Sole Source Aquifer is defined as one which supplies at least 50% of the drinking water consumed in the area overlying the aquifer and which has no reasonably available alternative sources of water should the aquifer become contaminated.

The Upper Glacial aquifer is approximately 80 feet thick beneath the Site and consists primarily of glacial outwash, which is generally fine to coarse sand and gravel with thin local lenses of clay. Hydraulic conductivity values average about 250 ft/day; however, this does not imply that groundwater contaminants will travel at this rate. Regional groundwater flow is predominantly south-southwest.

The Magothy aquifer ranges from 300 to 600 feet thick. The unit consists mostly of fine to medium sand to clayey sand interbedded with lenses and layers of coarse sand, and sandy to solid clay. Gravel is common in the basal zone and discontinuous layers of gray lignitic clay are common in the upper zone. Hydraulic conductivities average 50 and 60 ft/day and may range as high as 190 ft/day in the basal zone. Groundwater flow is predominantly south southwest.

The most recent depth to water measurements have indicated that the water table is located approximately 15 feet below grade beneath the Site (December 2008) and approximately 18 feet below grade beneath the GWE&TS (January 2020).

1.2.3 Site History

The Site is a NYSDEC Class 2 Inactive Hazardous Waste Site and is listed on the New York State Registry of Inactive Hazardous Waste Sites (Site No. 130050). The Site was operated as a dry cleaner and laundromat from 1957 through 1991 and is reported to be the source of the chlorinated solvent contamination identified at the Site, as well as the groundwater plume extending from the Site. As summarized in further detail below, the "source area" contamination at the Site was remediated via a soil vapor extraction and air sparging (SVE/AS) system, which operated from November 2003 to August 2004. The SVE/AS system was shut down in August 2004 based on contaminant concentrations below NYSDEC guidelines. Further details regarding the "source area" remediation are provided in the draft Final Remediation Report for the Franklin Cleaners On-site SVE/AS, dated June 2009.

In addition, a GWE&TS was installed approximately 1 mile downgradient of the Site, at 1000 Hempstead Avenue in the Incorporated Village of Rockville Centre, Nassau County, New York, to capture and treat the chlorinated solvent groundwater plume. This system was part of the selected remedy for the Site, but was shut down in July 2017 as the operational and performance data indicated that the system, as configured, was reaching asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted.

Specific details regarding the remedial history of the Site are provided below.

1.3 Summary of Remedial Investigations and Actions

In March 1990, the Nassau County Department of Health (NCDOH) investigated a complaint of tainted drinking water from a private residence, located approximately 100 feet southwest and downgradient of the Site. The residence was found to have a drinking water well (approximately 45 feet deep) and an irrigation well (approximately 32 feet deep), with concentrations of tetrachloroethene (PCE) of 5,500 micrograms per liter (ug/l) and 29,000 ug/l, respectively.

In order to investigate the PCE concentrations detected in groundwater described above, the NCDOH performed an inspection of the Site in April 1990. As part of this inspection, soil samples were collected from surface soil exposed at cracks and gaps within the building basement and from surface soil at the rear of the Site. Soil samples collected from building basement exhibited PCE concentrations of as high as 9,400 ug/kg. In addition, soil samples collected from the rear of the property exhibited PCE concentrations as high as 650,000 ug/kg, trichloroethene (TCE) concentrations as high as 1,700 ug/kg and dichloroethene (DCE) concentrations as high as 680 ug/kg.

Several additional investigations were completed at the Site in order to further investigate the extents of soil and groundwater contamination. In addition, several interim remedial measures (IRMs) were completed at the Site in an effort to mitigate/reduce the potential for exposure to the elevated concentrations of chlorinated solvents within the on-site soil and groundwater.

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site:

Preliminary Site Assessment (March 1993)

Based on the results of the NCDOH groundwater and soil investigations detailed above, a Preliminary Site Assessment was performed by the Nassau County Department of Public Works (NCDPW) between April 1992 and December 1992. As part of this investigation, four groundwater monitoring wells were installed as follows: monitoring well FC-1 was installed upgradient of the Site to a depth of 40 feet below ground surface and monitoring wells FC-2, FC-3 and FC-4 were installed downgradient of the Site, each to a depth of 37 feet below ground surface. Groundwater samples were subsequently collected from this groundwater monitoring well network for volatile organic compound (VOC) analysis. Groundwater monitoring well FC-2 exhibited PCE at a concentration of 83 ug/l, in exceedance of its Class GA Groundwater Standard of 5.0 ug/l. However, upgradient groundwater monitoring well FC-1 and downgradient groundwater monitoring wells FC-3 and FC-4 did not exhibit exceedances of PCE.

Remedial Investigation Feasibility Study (December 1996 through April 1997)

A Remedial Investigation and Feasibility Study (RI/FS) was performed by Dvirka and Bartilucci Consulting Engineers (D&B) between December 1996 and April 1997. The goals of the RI/FS were to identify the source of groundwater contamination at the Site, further characterize the nature and extent of the on-site groundwater contamination and develop an IRM to remediate the source of contamination at the Site. A draft RI/FS report was issued in October 1997 and the final RI/FS was issued in November 1998. The results of the RI/FS are briefly summarized below:

- Elevated concentrations of PCE of up to 280 mg/kg were detected in soil beneath the basement floor slab, as well as within surface and subsurface soil located in the rear portion of the Site;
- Elevated concentrations of PCE in exceedance of 1,000 ug/l were detected in shallow groundwater in the immediate vicinity of the Site;
- Elevated concentrations of PCE and its associated breakdown products, including TCE, 1,1-dichloroethene (1,1-DCE) and 1,2-DCE, were detected in exceedance of 5 ug/l in shallow groundwater at depths of 20 to 26 feet below grade and up to 3,000 feet downgradient of the Site;

- Elevated concentrations of PCE and its associated breakdown products were detected in deeper groundwater samples at depths of 33 to 87 feet below grade and as far as 4,500 feet downgradient of the Site; and
- Elevated concentrations of PCE were detected in ambient air samples collected from within the Site building (e.g. basement, 1st floor commercial areas and 2nd floor residential areas), and from commercial and residential properties immediately adjacent to the Site.

Based on these results, several remedial actions were recommended to remediate the identified Site "source area" soil and groundwater contamination and associated downgradient groundwater contamination plume, including:

"Source Area" Remedial Actions

- Installation of an SVE/AS system, to remediate elevated concentrations of chlorinated VOCs within Site soil and groundwater;
- Installation of asphalt in the rear of the Site and patching of targeted areas of the building basement floor with concrete to limit short circuiting of the SVE/AS system and the migration of soil vapor; and
- Use of the existing groundwater monitoring well network (and possible installation of additional wells) to provide a system to monitor the effectiveness of the SVE/AS system.

Downgradient Remedial Actions

- Installation of a GWE&TS, approximately 1 mile downgradient of the Site; and
- Use of any existing groundwater monitoring wells (and possible installation of additional wells) to provide a system to monitor the effectiveness of the GWE&TS.

Interim Remedial Measure (January 1998)

An IRM was conducted at the Site in January 1998 to address the elevated concentrations of PCE detected in the ambient air samples collected from the basement and 1st and 2nd floors of the on-site building. As part of this IRM, fans with integrated particulate and granular activated carbon (GAC) filters, designed to recirculate and filter air to remove particulates and VOCs, were installed within the Site building. In addition, a wall was constructed to isolate the portions of the basement where the former dry cleaner "cooker" was located and where elevated PCE concentrations were detected in soil immediately beneath the basement floor slab.

Record of Decision

Based on the findings of the RI/FS, the NYSDEC issued a Record of Decision (ROD) in March 1998. In order to eliminate or mitigate threats to human health and the environment, the NYSDEC selected the following ECs/ICs to be implemented at the Site:

- Soil vapor extraction (SVE) of PCE-contaminated soils with on-site treatment of contaminated vapors using a vapor phase granular activated carbon (GAC) treatment system;
- Air sparging of shallow on-site groundwater and capture of PCE vapors by the SVE system;
- Extraction of contaminated groundwater at the leading edge of the contaminant plume for up to 20 years and treatment of water through the use of chemical precipitation and filtering of metals and air stripping of VOCs along with GAC treatment of off gasses, if necessary;
- Off-site disposal of all spent GAC at a Toxic Substance Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA)-permitted incinerator;

- Installation of a deep irrigation/monitoring well located at Molloy College, downgradient of the Site to replace an existing irrigation well at Molloy College in the Upper Glacial aquifer;
- Long-term groundwater monitoring and groundwater use restrictions, as necessary; and
- Control of indoor air contamination using air purifying, ventilation and vapor barrier systems along with a monitoring program until the "source area" remediation has been effectively completed.

Pre-Design Investigation (July 1999 through December 2000)

A pre-design investigation (PDI) was completed by D&B between July 1999 and December 2000 to aid in the design and construction of the downgradient GWE&TS. The results of the PDI are detailed in the Franklin Cleaners GWE&TS Design Report, dated December 2000. Based on the results of the PDI, the groundwater contamination plume emanating from the Site was determined to be approximately 400 feet wide at the shoulder of the east-bound Southern State Parkway, and was concentrated at a depth of approximately 80 to 95 feet below ground surface, immediately above a clay layer.

As part of the PDI a pilot extraction well was installed along the leading edge of the groundwater plume to establish parameters for the design of the GWE&TS (e.g. hydraulic conductivity, radius of influence and drawdown, etc). Several pump tests were completed utilizing the pilot extraction well at various flow rates for the purpose of developing capture zone modeling scenarios. The pump tests and groundwater flow/capture zone modeling determined that a minimum required flow rate of 20 gallons per minute (gpm), utilizing a one or two-well pumping scenario, would be sufficient for plume containment.

Based on the recommendations provided in the Design Report, D&B prepared remedial construction drawings and specifications for the construction of a downgradient GWE&TS to capture the leading edge of the groundwater plume.

Remedial Construction (June 2002 through September 2003)

On-site remedial activities and the construction of the on-site SVE/AS system were completed in November 2003, and included the following:

- Site preparation;
- Construction of Site fencing and gates;
- Remedial excavation and restoration of a contaminated dry well;
- Installation of an awning at the rear of the building to control site drainage;
- Installation of the SVE/AS system and associated soil vapor extraction and air sparge wells;
- Installation of several soil vapor monitoring probes and groundwater monitoring wells;
- Repair and sealing of basement flooring cracks within the building and asphalt paving at the rear of the property;
- Start-up and performance testing of the SVE/AS system;
- Operation and maintenance of the SVE/AS system; and
- Removal and decommissioning of the SVE/AS system and associated temporary utilities.

The AS/SVE system operated from November 2003 to August 2004, at which point it was shut down based on concentrations of PCE below 5 ug/l in on-site groundwater monitoring wells and nondetectable concentrations of PCE in soil vapor

extracted from the SVE wells. Further details of the "source area" remediation are provided in the draft Final Remediation Report for the Franklin Cleaners On-Site SVE/AS System, dated June 2009.

In addition, a subslab depressurization system (SSDS) was installed within the Site building basement in January 2007 to address concentrations of chlorinated VOCs that were detected in soil gas immediately beneath the basement floor slab following the decommissioning of the AS/SVE system. The SSDS consists of four suction points installed through the building floor slab, connected to centrifugal fans and piping, which discharge through an exhaust stack to the atmosphere above the building. Based on available records, the operation of the SSDS is the responsibility of the property owner; however, inspection and maintenance of the SSDS are being managed by the NYSDEC under a separate state-wide program. Maintenance and inspection procedures and schedules are described in the Generic Work Plan prepared by HDR, Inc., dated July 2009. Based on a February 14, 2012 site inspection, the SSDS is operating as designed.

On-Site and Downgradient Groundwater and Soil Vapor Investigations (December 2008, March 2009 and September 2011)

Following the decommissioning of the SVE/AS system, the NYSDEC has completed several groundwater and soil vapor investigations in the vicinity and downgradient of the Site pursuant to reclassifying the Site's current Class 2 designation. Results of these groundwater investigations show a general decline in PCE concentrations from December 2008 to September 2011.

PCE was detected in three out of nine groundwater samples collected during the December 2008 groundwater monitoring well sampling round. PCE was detected at a concentration of 29 ug/l, exceeding its Class GA Standard of 5.0 ug/l, in one monitoring well: MW-2S, located approximately 300 feet downgradient of the Site. An additional round of groundwater samples was collected from the nine groundwater monitoring wells in March 2009 in order to confirm the results of the December 2008 sampling event. PCE was again detected in exceedance of its Class GA Standard of 5.0 ug/l in monitoring well MW-2S; though PCE was detected at a less elevated concentration of 7.8 ug/l during this round of sampling.

A geoprobe groundwater investigation was completed along the centerline of the groundwater plume in September 2011. Groundwater grab samples were collected from 20 geoprobe locations extending to a distance of up to approximately 3,600 ft downgradient of the Site and from four existing groundwater monitoring wells immediately downgradient of the Site. PCE was not detected in exceedance of its Class GA Standard of 5.0 ug/l in any collected groundwater sample, including a sample collected from groundwater monitoring well MW-2S.

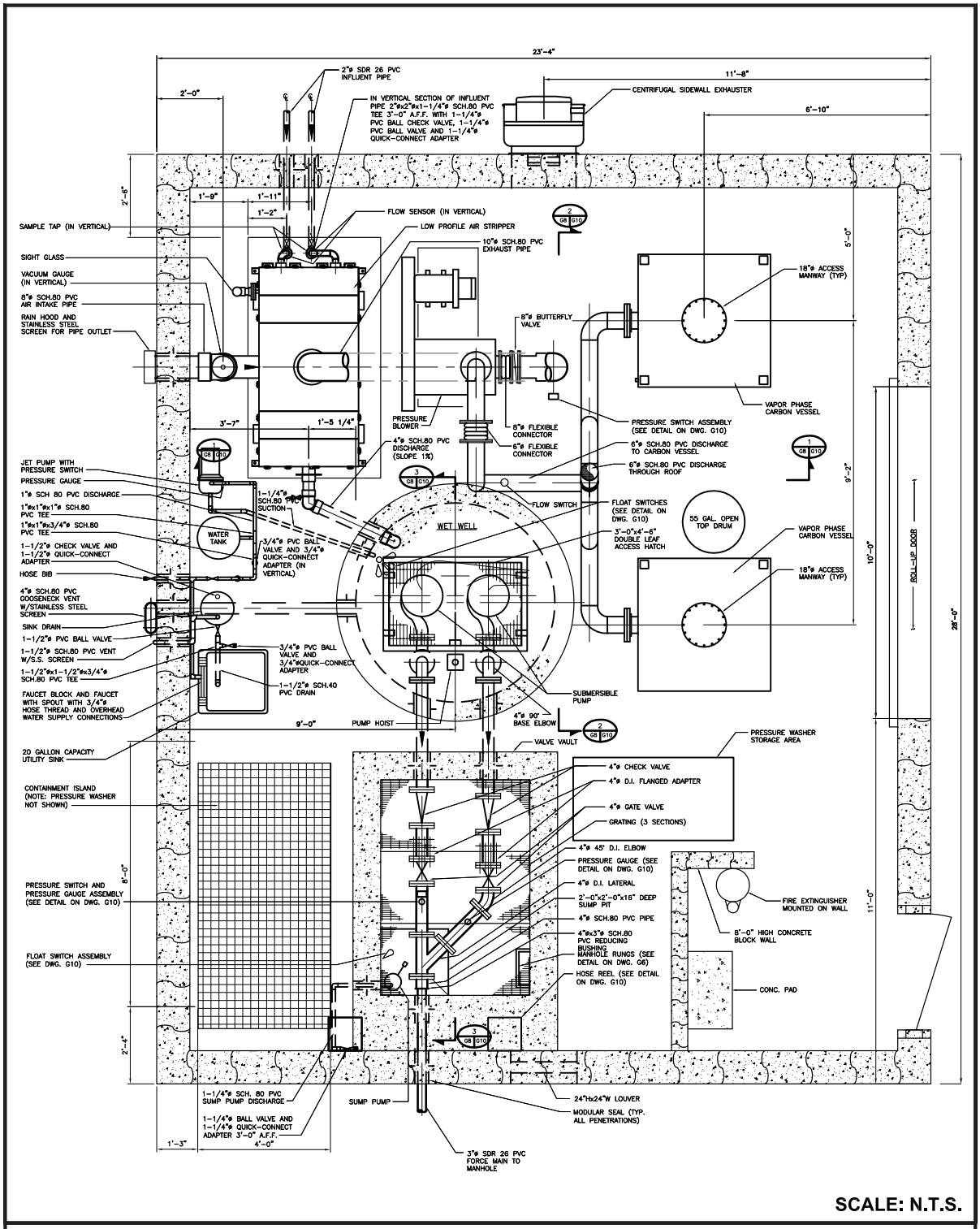
The NYSDEC concluded from these investigations that the existing groundwater plume "has all but disappeared" within the areas investigated and "is not considered a source of vapors."

1.3.1 Summary of GWE&TS

As detailed above, the construction of the GWE&TS was completed in September 2003. A GWE&TS layout is provided as Figure 1-4. "As-built" drawings for the GWE&TS are provided in Appendix A. Start-up/routine system operation of the GWE&TS was initiated in September 2004. GWE&TS system details are provided below.

As further detailed in Section 2.3.1, the GWE&TS is designed to capture and treat the groundwater plume and discharge all treated water in accordance with all applicable discharge standards.

In order to monitor the effectiveness of the GWE&TS, a monitoring well network was installed in the vicinity and downgradient of the GWE&TS. A routine groundwater monitoring sampling program was initiated following construction of the GWE&TS and associated groundwater monitoring well network, and is



SCALE: N.T.S.

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FRANKLIN CLEANERS SITE
VILLAGE OF HEMPSTEAD, NEW YORK

"AS-BUILT" TREATMENT SYSTEM LAYOUT

FIGURE 1-4

further detailed in Section 3.3. The GWE&TS was shut down in July 2017 as the operational and performance data for the system, as configured, may be approaching asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted. Prior to system shutdown, the NYSDEC Remedial Services Contractor conducted a complete round of Operation and Maintenance (O&M) activities per the 2003 O&M Manual and performed the shutdown activities as described in the July 7, 2017 System Shutdown Memorandum (Appendix I).

1.3.2 Remaining Contamination

As detailed above, the Site "source area" soil and groundwater contamination were remediated utilizing a SVE/AS system, which was shut down in August 2004. In addition, based on a September 2011 groundwater investigation conducted at and extending approximately 3,600 feet downgradient of the Site, the NYSDEC concluded that the existing groundwater plume "has all but disappeared" within the areas investigated and "is not considered a source of vapors."

However, Site-related groundwater contamination is still present further downgradient of the Site. Concentrations of PCE have been detected above the NYSDEC Class GA groundwater standard of 5.0 ug/l at concentrations of up to 670 ug/l (detected in December 2003). The highest concentrations of PCE have consistently been detected in groundwater samples from monitoring well ASMW-1 and extraction well EW-2. During the time period where the system was running from September 2004 to July 2017, concentrations of PCE steadily decreased and exhibited concentrations ranging from approximately 39 ug/l to a maximum of 370 ug/l in extraction well EW-2; and from approximately non-detect to a maximum of 510 ug/l in ASMW-1. Following the system shutdown in July 2017, concentrations of PCE have steadily decreased in extraction well EW-2 with concentrations ranging from a maximum of 110 ug/l in July 2017 to 18 ug/l in July 2019. Concentrations in ASMW-1 exhibited a general increasing trend from July 2017 to January 2019; however, PCE concentrations decreased from 74 ug/l to 24 ug/l from January 2019 to January 2020 (see below Figures 1-5a and 1-5b).

FIGURE 1-5a
MONITORING WELL ASMW-1
TETRACHLOROETHENE CONCENTRATIONS

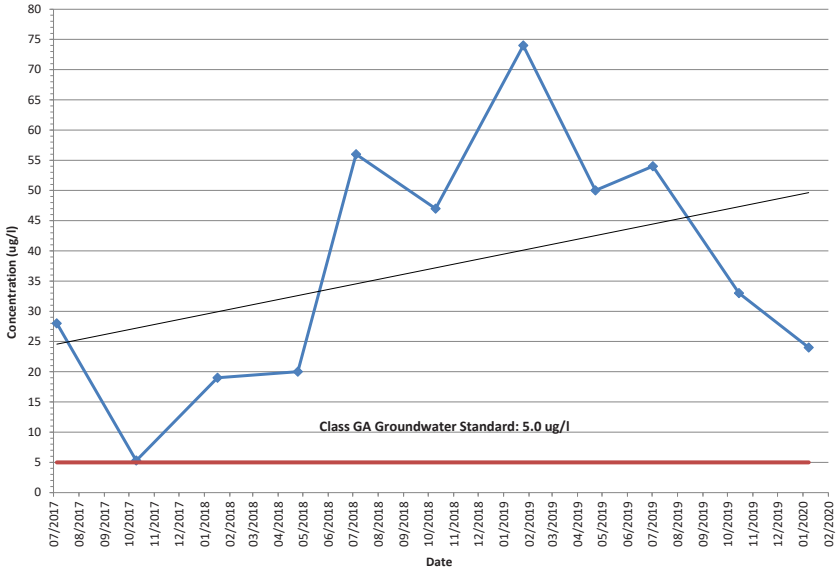
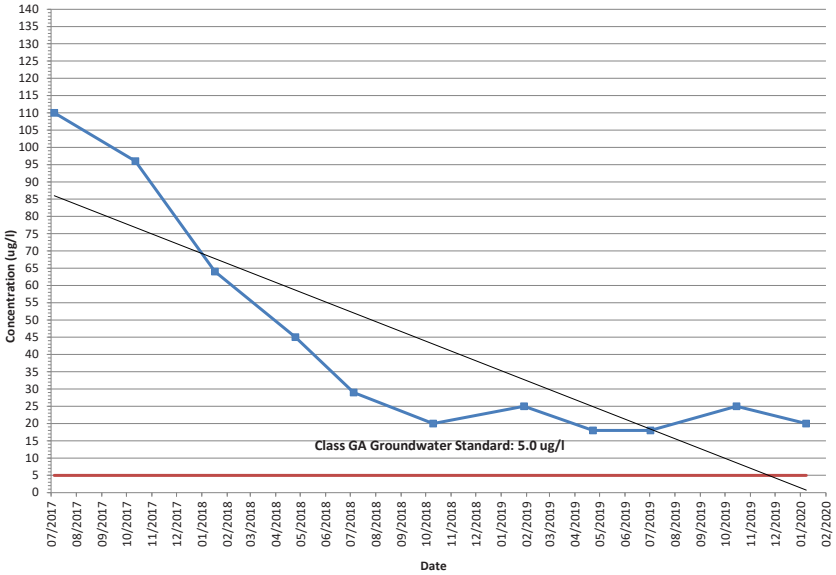


FIGURE 1-5b
EXTRACTION WELL EW-2
TETRACHLOROETHENE CONCENTRATIONS



2.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

2.1 Introduction

Since remaining groundwater contamination exists downgradient of the Site, Institutional and Engineering Controls (ICs/ECs) are required to be implemented to protect human health and the environment. This IC/EC Plan describes the procedures required for implementation and management of all ICs/ECs associated with the Site.

2.1.1 General

Remedial activities associated with Site-related contamination were completed in accordance with the ROD, dated March 1998. The remedial goals include compliance with all Standards, Criteria and Guidelines (SCGs) for soil, groundwater and soil vapor. A summary of the Institutional Controls/Engineering Controls (IC/ECs) implemented at the Site, as required by the March 1998 ROD, are provided below:

- Construction and operation of an on-site SVE/AS system to remediate contaminated subsurface soil and shallow groundwater on-site as well as mitigate the potential for soil vapor intrusion within the existing on-site building; It should be noted that the SVE/AS system was shut down in August 2004 based on contaminant concentrations below NYSDEC guidelines.
- Construction and operation of a downgradient GWE&TS to capture and remediate the leading edge of the groundwater contamination plume and prevent the plume from impacting the Village of Rockville Centre public drinking water wells; It should be noted that the GWE&TS was put into prolonged shut down in July 2017 as the operational and performance data set indicates that the system, as configured, may be approaching asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted.
- Installation of a deep irrigation/monitoring well at Molloy College (ASMW-07);
- Off-site disposal of all spent GAC at a Toxic Substance Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA)-permitted incinerator. However, note that GAC is no longer utilized at the Site, as the GAC vessels were bypassed in June 2011 based on low contaminant concentrations in the vapor-phase effluent;
- Long-term groundwater monitoring and groundwater use restrictions, as necessary; and
- Control of indoor air contamination using air purifying, ventilation and vapor barrier systems along with a monitoring program until the Site “source area” remediation has been effectively completed, via the SVE/AS system.

2.1.2 Purpose

The purpose of this IC/EC Plan is to provide:

- A description of all ICs and ECs for the Site;
- The basic operation and intended role of each EC implemented at the Site;
- A description of the items to be evaluated during each periodic inspection and compliance certification period;
- A description of plans and procedures to be followed for implementation and/or operation of ECs, such as the GWE&TS; and
- Any other provisions necessary to identify or establish methods for implementing the ECs required by the Site remedy, as determined by the NYSDEC.

2.2 Institutional Controls

This SMP is part of the remedy for the Site and acts as an IC.

Additional ICs are not required by the March 1998 ROD as an element of the remedy. Therefore, ICs such as land or groundwater use restrictions are not currently implemented at the Site. However, note that the Site's inclusion in the New York State Registry of Inactive Hazardous Waste Sites as a Class 2 Inactive Hazardous Waste Site (Site No. 130050) acts as an IC for the Site. In general, such Sites go through a process of investigation, evaluation, cleanup and monitoring in several distinct phases, which are recorded and maintained by New York State. The information recorded and maintained by New York State typically includes the Site name, identification number, description, cleanup status, types of cleanup, owner information, types and quantities of contaminants, and an assessment of health and environmental issues.

Based on the successful remediation of Site "source area" soil and groundwater contamination utilizing a SVE/AS system, and based on the results of the NYSDEC's September 2009 groundwater sampling event, land use restrictions are not warranted at and downgradient of the Site at this time.

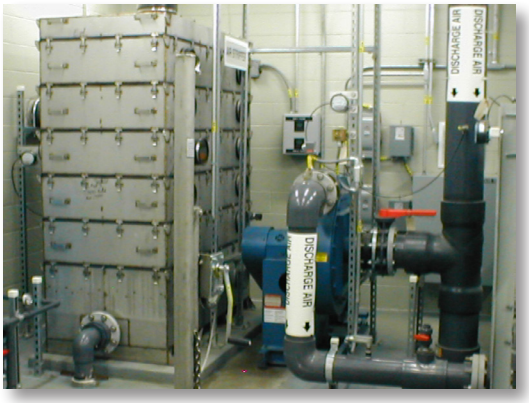
In addition, groundwater is not currently nor planned to be utilized for any purpose at or downgradient of the Site. Based on the availability of public water at and downgradient of the Site, it is not anticipated that groundwater will be utilized for any purpose in these areas for the foreseeable future. In addition, Molloy College, located immediately downgradient of the leading edge of the plume, is serviced by a public water supply. As detailed in Section 2.3.2, and as part of the requirements of the March 1998 ROD, a deep irrigation well (MCOL-2) was installed at Molloy College to replace shallow irrigation well (MCOL-1), which had the potential to become contaminated with PCE based on its depth and location downgradient of the groundwater plume. In addition, groundwater monitoring well ASMW-7, located generally downgradient of irrigation well MCOL-2, could also be used to supplement irrigation water for Molloy College, if needed. Note that, based on available information, ASMW-07 has never been used by Molloy College due to the availability of public water and it is not anticipated that Molloy College will utilize this well for the foreseeable future. Sampling of ASMW-7 was completed on a quarterly basis until February 2020 when the NYSDEC determined that sampling would be conducted every fifth quarter as part of routine groundwater monitoring activities, and since sampling of the well began in 2004, all VOCs have been observed at non-detect concentrations.

Based on the above evaluation, groundwater use restrictions are not warranted to be implemented at or downgradient of the Site at this time.

2.3 Engineering Controls

Below is a brief summary of all ECs currently implemented for the Site:

2.3.1 GWE&TS



The GWE&TS, installed at the leading edge of the groundwater plume approximately 1 mile downgradient of the Site, consists of two 6-inch diameter extraction wells (EW-1 and EW-2) screened at a depth of 70-90 and 75-90 feet below grade, respectively. When the system is operating, extracted groundwater is conveyed via underground piping to a low-profile stacked-tray air stripper located in the GWE&TS building. Treated groundwater is discharged from the air stripper to a wet well. Two alternating submersible pumps convey the treated water via underground piping to a Nassau County Department of Public Works storm sewer manhole in accordance with all applicable discharge standards. Exhaust gas from the air stripper was initially treated utilizing two 1,000 lb GAC vessels, configured in series. However, based on historically low contaminant concentrations detected in the air stripper vapor-phase discharge, the air stripper exhaust piping was reconfigured to bypass the GAC vessels and discharge exhaust gas directly to the atmosphere

in June 2011, per the direction of the NYSDEC. The GWE&TS is equipped with instrumentation and controls which allow for automated start-up and operation, and an autodial alarm notification system. “As-built” drawings for the GWE&TS are provided in Appendix A.

Based on extraction scenario modeling completed during the PDI utilizing either one or two well pumping scenarios, the minimum required pumping rate for a one or two well pumping scenario is 20 gpm. However, since the extraction scenario modeling was based on a simplification of actual Site conditions and utilized several assumptions, extraction wells EW-1 and EW-2 operated at flow rates ranging from approximately 22 to 41 gpm and 2 to 7 gpm, respectively, since system start-up in September 2004 in order to provide a factor of safety. The lower operating flow rate of extraction well EW-2 is the result of a silty clay soil unit located within the well screen zone. Note, due to the relatively high concentrations of VOCs detected in samples collected from the screened interval of the well during installation, the NYSDEC decided to keep the extraction well at this location and depth, and required the well to be pumped at its maximum yield. In July 2017, the GWE&TS was put into prolonged shut down as the operational and performance data set indicates that the system, as configured, may be approaching asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted. Since the GWE&TS shutdown, quarterly groundwater monitoring has been performed to assess if operation of the system should resume. Based on the data from these quarterly groundwater sampling events, it was determined in February 2020 to reduced the frequency of the groundwater sampling events to every fifth quarter.

2.3.2 Molloy Deep Irrigation Well

In accordance with the March 1998 ROD, a deep irrigation well (MCOL-2) was installed at Molloy College to replace shallow irrigation well (MCOL-1), which had the potential to become contaminated with PCE, based on its depth and location downgradient of the groundwater plume.

Although irrigation well MCOL-1 is not sampled as part of the routine groundwater sampling activities, all VOCs have been observed at non-detect concentrations in all downgradient monitoring wells, with the exception of sporadic slight PCE detections in monitoring well ASMW-4.

It should be noted that the Molloy College deep irrigation well EC is not listed on the current IC/EC certification form; therefore, it has been recommend that the NYSDEC revise the form to include this EC.

2.3.3 Long-Term Groundwater Monitoring

In accordance with the March 1998 ROD, routine long-term groundwater monitoring has been completed in association with the GWE&TS since system start-up in September 2004 in order to monitor the system’s effectiveness, and continues since the prolonged system shutdown to assess the need to restart the system. A network of monitoring wells (ASMW-1 through ASMW-7) were installed to monitor both groundwater conditions upgradient and downgradient of the GWE&TS. Groundwater monitoring wells ASMW-1 through ASMW-3 are located in the vicinity of the GWE&TS to monitor groundwater contaminant concentration trends at the leading edge of the groundwater plume. Groundwater monitoring wells ASMW-4 through ASMW-7 are located downgradient of the GWE&TS and upgradient of the Village of Rockville Centre water supply wells in order to act as early warning or ‘sentinel’ wells for the Village’s supply wells and

ensure the GWE&TS is effectively capturing the groundwater contamination plume. Routine groundwater monitoring is performed on an every fifth quarter basis, and is further detailed in Section 3.3.

2.3.4 Subslab Depressurization System

Though not required as an engineering control component of the selected remedy per the March 1998 ROD, a subslab depressurization system (SSDS) was installed at the Site in January 2007 to address residual concentrations of chlorinated VOCs that were detected in soil gas immediately beneath the Site building basement floor slab following the decommissioning of the SVE/AS system. The SSDS consists of four suction points installed through the building floor slab, connected to centrifugal fans and piping, which discharge through an exhaust stack to the atmosphere above the building. Operation of the SSDS is the responsibility of the property owner; however, inspection and maintenance of the SSDS are being managed by the NYSDEC under a separate state-wide program. Maintenance and inspection procedures and schedules are described in the Generic Work Plan prepared by HDR, Inc., dated July 2009. Based on a February 14, 2012 site inspection, the SSDS is operating as designed.

2.4 Criteria for Completion of Remediation/Termination of Remedial System

Generally, remedial processes are considered completed when monitoring and sampling results indicate that the remedy has achieved the remedial action objectives identified by the decision document. The various ECs currently implemented at the Site and their associated criteria for completion are listed below:

2.4.1 GWE&TS

Conditions that warrant discontinuing the GWE&TS include the following:

- The GWE&TS has achieved the remedial action objectives identified in the ROD, dated March 1998;
- The GWE&TS has achieved the bulk reduction of groundwater contamination;
- Contaminant concentrations in groundwater have become asymptotic, as approved by the NYSDEC. Asymptotic contaminant concentrations will be confirmed by the continued operation and "pulsing" of the GWE&TS; or
- The NYSDEC has determined that the GWE&TS has reached the limit of its effectiveness.

The above conditions will be evaluated based on contaminant concentrations detected in groundwater collected from the extraction wells and monitoring well network located in the vicinity and downgradient of the GWE&TS. In the event that the above conditions are achieved, monitoring data indicates that the GWE&TS is no longer required, the NYSDEC will initiate shut-down procedures for the GWE&TS.

Following approval of a GWE&TS shut-down, a system shut-down plan, including a shut-down sequence and provisions for routine groundwater sampling and/or monitored natural attenuation (MNA), if warranted, will be submitted to the NYSDEC for review and approval. In addition, and in accordance with the March 1998 ROD, groundwater use restrictions can be implemented at the Site, if warranted.

In July 2017, the GWE&TS was reconfigured for long term shutdown as the performance was deemed to have reached asymptotic conditions. Data will continue to be reviewed to determine if the GWE&TS system needs to be restarted. No maintenance or modifications to the system are required until full-time operation resumes. As the system was anticipated to be shut down for a prolonged period, the following items were completed to ensure the successful start up of the system, if necessary:

The current PLC program was downloaded from the PLC to ensure that a backup is available in the event that it is corrupted or lost during the shutdown period; this backup has been provided to NYSDEC.

- A full round of maintenance and lubrication was completed for all major system components in accordance with the 2003 O&M Manual;
- All major system components were cleaned, drained and winterized;
- All free liquids were removed from the system building and the building was broom swept;
- All major system components were deenergized; however, the heating and ventilation system remains operational, as well as the building lighting.

In addition, the following should continue:

- General facility housekeeping should be completed at a minimum once a quarter;
- Landscaping activities should continue on a bi-weekly basis during the growing season;
- Snow removal activities should be completed, as needed, to ensure facility access and access for site monitoring and sampling; and,
- All other site monitoring and sampling unrelated to the GWE&TS should continue to be performed in accordance with the SMP requirements.

2.4.2 Subslab Depressurization System

As described above, the active SSDS was installed as a preventative measure to address residual concentrations of chlorinated VOCs that were detected in subsurface vapor samples following the decommissioning of the SVE/AS system. Conditions that warrant terminating the SSDS at the Site include the following:

- Residual contamination in subsurface vapors is not affecting indoor air quality when the active SSDS is turned off; and
- There is no “rebound” effect observed, for which additional mitigation efforts would be appropriate, when the SSDS is turned off for a prolonged period of time.

The above conditions will be evaluated based upon sampling results from co-located indoor air and sub-slab vapor samples collected from the basement of the Site building and from an adjacent off-site residential structure. A concurrent outdoor ambient air sample will also be collected. The sampling will be conducted during the heating season after the SSDS has been turned off for at least ten (10) days. In the event that the above conditions are achieved and sampling data indicates that the SSDS is no longer required, the NYSDEC will decommission the SSDS.

Should sampling data indicate that the SSDS is still required, the system will be turned back on. Based on an evaluation of the off-site residential structure sampling results, mitigative actions will be taken, if necessary.

2.5 Excavation Work Plan

Excavations are not planned to be completed within the limits of the Site or the downgradient GWE&TS facility for the foreseeable future. In addition, site-related contamination is not expected to be encountered at or downgradient of the Site during any future excavation activities based on the following:

- Site “source area” contamination was successfully remediated via the operation of a SVE/AS system at the Site, which operated from November 2003 to August 2004;
- Groundwater is located at approximately 15 feet below grade beneath the Site and approximately 18 feet below grade beneath the GWE&TS; and
- Site-related contamination in groundwater is located (approximately 80 to 95 feet below grade) in the vicinity of the downgradient GWE&TS.

Therefore, an Excavation Work Plan is not required to perform any future excavation work at or downgradient of the Site.

2.6 Soil Vapor

Soil vapor is not expected to be encountered at or downgradient of the Site based on the following:

- Site "source area" contamination was successfully remediated via the operation of a SVE/AS system at the Site, which operated from November 2003 to August 2004;
- A SSDS was installed within the Site building basement in January 2007. The SSDS is currently operating as designed;
- Based on a September 2011 groundwater investigation conducted at and extending approximately 3,600 feet downgradient of the Site, the NYSDEC concluded that the existing groundwater plume "has all but disappeared" within the areas investigated and "is not considered a source of vapors;" and
- Site-related contamination in groundwater is located (approximately 80 to 95 feet below grade) in the vicinity of the downgradient GWE&TS.

2.7 Inspections and Notifications

2.7.1 Inspections

A Site inspection shall be completed at the Site and GWE&TS on an annual basis. These inspections will determine and document the following:

- General Site conditions;
- Inspect emergency lighting and fire extinguisher monthly;
- If the in-place controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP, site-specific effluent limits and O&M Plan;
- Achievement of remedial performance criteria;
- Sampling and analysis of appropriate media during monitoring events;
- The completeness and accuracy of Site records; and
- Changes, or needed changes, to the remedial or monitoring system;

As detailed in Section 5.0, the results from these inspections will be documented on a IC/EC Evaluation form, as provided in Appendix B. Site Management Reports (SMRs) will be completed annually and they will indicate when the next sampling event will be conducted. Site inspections will be summarized in Periodic Review Reports (PRRs), which will be completed every five years. This frequency can be modified by the NYSDEC as needed based on future groundwater sampling events. However, annual site-wide inspections will also be completed.

In the event of an emergency, such as any situation or control failure arising from sudden and reasonably unforeseeable events beyond the control of the owner and/or operator of a facility, including acts of God, an inspection of the Site shall be conducted within 24 hours of the event to verify the effectiveness of the ECs by a qualified environmental professional, as determined by the NYSDEC.

In addition, inspections and monitoring of all remedial components installed as part of the remedial action are conducted at the frequency specified in the Monitoring Plan provided in Section 3.0 of this SMP.

2.7.2 Notifications

Notifications of emergencies or changes in Site usage/ownership shall be submitted to the NYSDEC, as follows:

- The NYSDEC shall be notified by the property owner in writing of the proposed change no less than 60-days in advance of such changes. This notification will include a certification that the prospective purchaser has been provided with a copy of the Record of Decision and all associated NYSDEC-approved work plans and reports, including this SMP; and
- The NYSDEC shall be provided notification by the property owner of transfer of ownership of all or part of the Site, the new owner's name, contact representative and contact information in writing within 15 days of the transfer of ownership of all or part of the Site.
- The NYSDEC shall be notified by its O&M contractor within 48-hours of any damage or defect to the GWE&TS foundations and/or structures. The NYSDEC shall accordingly be notified of any action to be taken to mitigate the damage or defect.
- The NYSDEC shall be notified by its O&M contractor within 48-hours of any emergency, such as a fire, flood, or earthquake, including a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

Additionally, the following will be performed when the GWE&TS is operating:

- The NYSDEC shall be provided verbal notice by its O&M contractor by noon of the following day of any emergency, any situation or control failure arising from sudden and reasonably unforeseeable events beyond the control of the owner and/or operator of a facility, including acts of God, that reduces or has the potential to reduce the effectiveness of the GWE&TS. In addition, written confirmation shall be provided to the NYSDEC by its O&M contractor within 7 days of the emergency event, which will include a summary of the actions taken, or to be taken, and the potential impact to the environment and the public;
- The NYSDEC shall be provided follow-up status reports by its O&M contractor regarding actions taken to respond to any emergency event requiring ongoing responsive action. These reports shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the GWE&TS.

3.0 MONITORING AND SAMPLING PLAN

3.1 Introduction

The Monitoring and Sampling Plan for the GWE&TS is detailed below:

3.1.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the contaminated groundwater plume extending from the Site. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC.

3.1.2 Purpose and Schedule

This Monitoring and Sampling Plan describes the methods utilized to complete the following tasks:

- Sampling and analysis of all appropriate media;
- Assessing achievement of the remedial performance criteria;
- Assessing compliance with the NYSDEC groundwater standards;
- Assessing the condition of all implemented ECs;
- Evaluating Site information periodically to confirm that the GWE&TS can continue to remain in a prolonged shut down status; and
- Preparing the necessary reports for the various monitoring activities.

To effectively complete the tasks outlined above, this Monitoring and Sampling Plan provides information regarding:

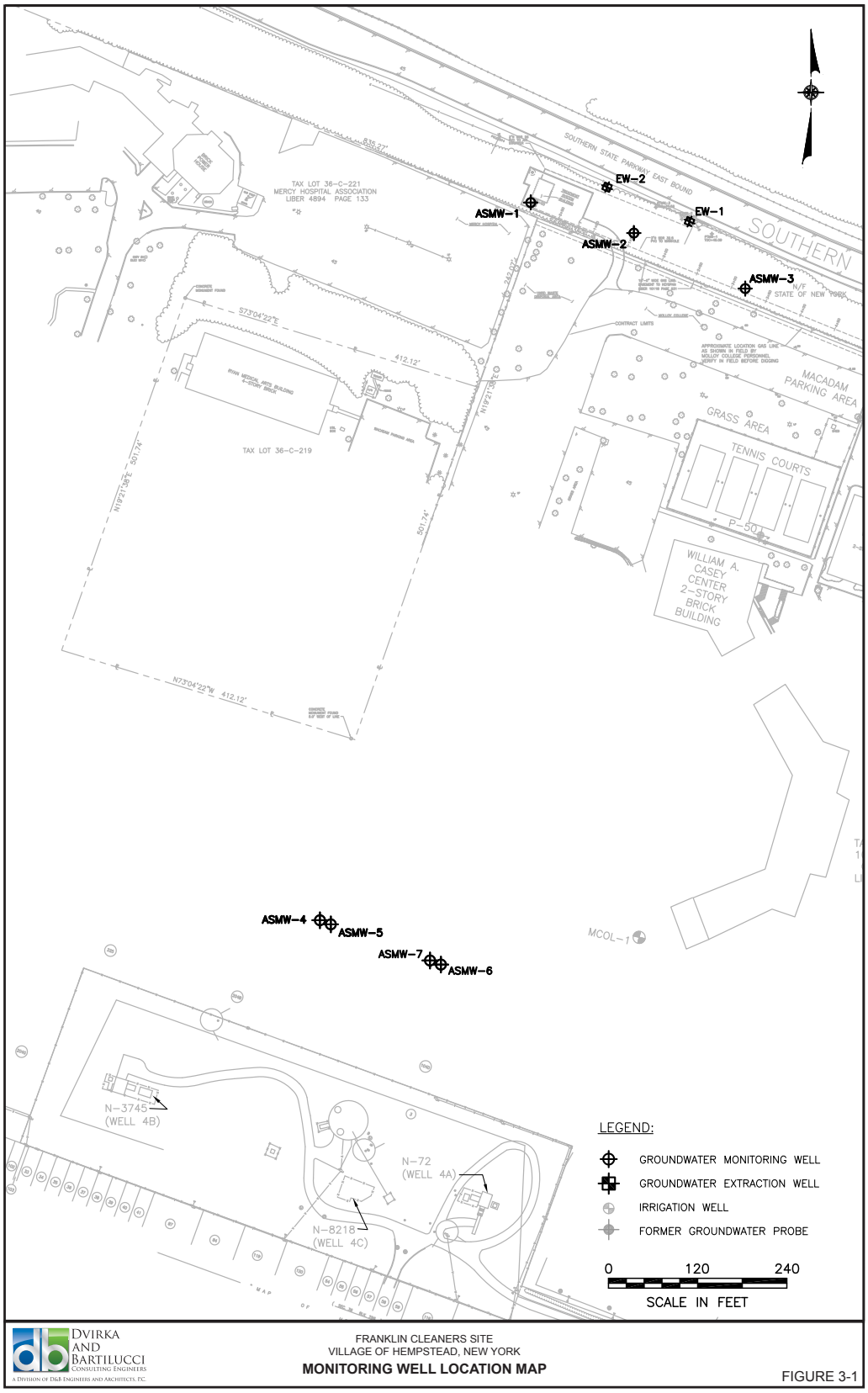
- Sampling locations, protocol and frequency;
- Information regarding all designed monitoring systems (e.g., well construction and boring logs);
- Analytical sampling program requirements;
- Reporting requirements;
- Quality Assurance/Quality Control (QA/QC) requirements;
- Inspection and maintenance requirements;
- Monitoring well decommissioning procedures; and
- Inspection and reporting requirements.

Inspection of the concrete/asphalt cover and Site fencing is to be completed on an annual basis. In the event that the GWE&TS is restarted, Table 3-1 should be followed to ensure it is operating correctly.

Table 3-1: Weekly Routine Monitoring Summary

GWE&TS Component	Monitoring Item
Extraction Wells	Flow Rate (gpm)
	Total Flow (gallons)
	Pump Runtime (hrs)
	Depth to Water Measurement (feet)
	Operating Frequency (Hz)
Low Profile Stacked-Tray Air Stripper	Sump Level (inches)
	Fresh Air Inlet Vacuum (inches H_2O)
	Exhaust Flow Rate (scfm)
	Exhaust Temperature (°F)
Pressure Blower	Blower Suction (inches H_2O)
	Blower Discharge (inches H_2O)
	Blower Runtime (hrs)
Wet Well	Pump No. 1 Runtime (hrs)
	Pump No. 2 Runtime (hrs)
Effluent Valve Vault	Pump No. 1 Operating Pressure (psi)
	Discharge Line No. 2 Back Pressure (psi)
	Pump No. 1 Flow Rate (gpm)
	Pump No. 2 Operating Pressure (psi)
	Discharge Line No. 1 Back Pressure (psi)
	Pump No. 2 Flow Rate (gpm)
Flow Meter Vault	Total Flow (gallons)
Jet Pump	Status
	Line Pressure (psi)

As detailed on Table 3-1, monitoring of the GWE&TS should be completed on a weekly basis if the system is turned on. Sampling of the GWE&TS process water would need to be completed on a monthly basis, while the monitoring well network would continue to be sampled on a quarterly basis. Vapor-phase discharge sampling utilizing a handheld photoionization detector (PID) is completed on a weekly basis, while sampling of the vapor-phase discharge via laboratory analysis is completed on a semi-annual basis. Sampling frequencies for the GWE&TS and groundwater monitoring network are provided on Table 3-2.



DVIRKA AND BARTILUCCI CONSULTING ENGINEERS
A DIVISION OF D&B ENGINEERS AND ARCHITECTS, P.C.

FRANKLIN CLEANERS SITE
VILLAGE OF HEMPSTEAD, NEW YORK
MONITORING WELL LOCATION MAP

FIGURE 3-1

Table 3-2a: Groundwater Sampling Summary (GWE&TS System Off)

Sampling Location	Every Fifth Quarter	VOC (EPA Method 8260)	PFOS (EPA Method 537 Modified)	1,4 - Dioxane (EPA Method 8270 SIM)
Extraction Well No. 1 Influent	✓	✓	✓	✓
Extraction Well No. 2 Influent	✓	✓	✓	✓
Groundwater Monitoring Wells ASMW-1, ASMW-2, ASMW-4	✓	✓	✓	✓
Groundwater Monitoring Wells ASMW-3 and ASMW-5 through ASMW-7	✓	✓	✓	✓

Table 3-2b: Treatment System and Groundwater Sampling Summary (GWE&TS System On)

Sampling Location	Monthly	Quarterly	Semi-Annually	VOC (EPA Method 8260)	VOC (EPA Method TO-15)	PFOS (EPA Method 537 Modified)	Iron & Manganese (EPA Method 6010)	pH (Field Screening)
Extraction Well No. 1 Influent	✓			✓		✓		
Extraction Well No. 2 Influent	✓			✓		✓		
Air Stripper Aqueous-phase Effluent	✓			✓			✓	✓
Air Stripper Vapor-phase Effluent	✓(1)		✓		✓			
Groundwater Monitoring Wells ASMW-1, ASMW-2, ASMW-4		✓		✓		✓		
Groundwater Monitoring Wells ASMW-3 and ASMW-5 through ASMW-7			✓	✓		✓		

(1) Monthly effluent vapor samples are to be analyzed utilizing tedlar bags and a hand-held photoionization detector (PID).

Trends in contaminant concentrations shall be evaluated to determine if the GWE&TS can continue to be in a prolonged shutdown or if it needs to be restarted.

3.2 GWE&TS Monitoring and Sampling Program

Section 3.2 is to be followed only in the event that operation of the GWE&TS resumes:

3.2.1 GWE&TS Monitoring and Sampling

The GWE&TS is monitored in order to evaluate the efficiency of the overall GWE&TS and its major components. Pressure, temperature and flow rate data are collected from the major GWE&TS components on a weekly basis, as appropriate. A complete list of monitoring parameters is provided on Table 3-1. A copy of the routine System Monitoring Log to be completed during each monitoring event is provided in Appendix C. In the event that any parameter is observed outside its typical operating range, any equipment is observed to be malfunctioning or the GWE&TS is not performing within specifications, maintenance and/or repair are required immediately, and the NYSDEC should be immediately notified.

Aqueous-phase and vapor-phase process samples are collected from the GWE&TS in order to evaluate the overall efficiency of the GWE&TS and its various components, while at the same time, ensuring that all GWE&TS discharges are below applicable standards and/or site-specific limits. Site-specific sampling locations, frequencies and analytical parameters are summarized on Table 3-2. The GWE&TS discharge is authorized by the NYSDEC under a State Pollution Discharge Elimination System (SPDES) permit equivalency, which provides for site-specific effluent limits. A copy of the SPDES permit equivalency is provided in Appendix D. Sampling of the aqueous-phase influent and effluent is completed on a biweekly basis. Vapor-phase discharge sampling utilizing a handheld photoionization detector (PID) is completed on a weekly basis, while sampling of the vapor-phase discharge via laboratory analysis is completed on a semi-annual basis.

Monitoring and sampling frequencies are subject to change with the approval of the NYSDEC. In addition, unscheduled monitoring and/or sampling may take place when a suspected failure of the GWE&TS and/or its components has been reported or an emergency occurs that is deemed likely to affect the operation of the GWE&TS.

3.2.2 GWE&TS Sampling Event Protocol

As detailed on Table 3-1, sampling of the GWE&TS aqueous-phase influent and effluent is completed on a biweekly basis. During each sampling event, one sample is collected from each of the two extraction well influent sample taps (EW-1 and EW-2) and one sample is collected from the air stripper liquid discharge sample tap (AS-1). Sample tap locations are identified on the “as built” drawings provided in Appendix A. All samples selected for laboratory analysis are collected within laboratory supplied sampling bottles. Each sample tap is purged for a short duration prior to sampling to flush out any accumulated sediments. Each influent sample is analyzed for target compound list (TCL) VOCs by Method 624 and the effluent samples are analyzed for TCL VOCs by Method 624 and iron and manganese by Method 6010. In addition, a sample is collected for field analysis of pH from the wet well on a weekly basis.

Sampling of the GWE&TS carbon vessel vapor-phase influent and effluent was initially completed on a weekly basis. However, based on historically low contaminant concentrations detected in the air stripper vapor-phase discharge, the air stripper exhaust piping was reconfigured to bypass the GAC vessels and discharge exhaust gas directly to the atmosphere in June 2011, per the direction of the NYSDEC. As such, samples are no longer collected from the GAC vessels. However, in order to evaluate the vapor-phase effluent discharged by the GWE&TS, the vapor-phase VOC concentrations in vapor-phase discharge are monitored form a sample port within the effluent piping on a weekly basis utilizing a photoionization detector (PID) and on a semi-annual basis for laboratory analysis. During each semi-annual sampling event, a sample will be collected via SUMMA canister for laboratory analysis of VOCs by Method TO-15. Each SUMMA canister is pre-cleaned and supplied under vacuum by the analytical laboratory.

All samples for laboratory analysis will be collected within laboratory-supplied sample containers and labeled with the following information:

- Site identification code;
- Sample type (media) identification code;
- Sample location identification code and field quality control identification code (if applicable);
- Date and time of collection;
- Type of preservative added (if applicable); and
- Initials of sampling technician.

All samples are placed in an ice-filled cooler (with the exception of samples collected in SUMMA canisters) from the time of sample collection and are shipped within 24 hours under appropriate Chain of Custody (COC) procedures to the analytical laboratory.

3.3 Groundwater Monitoring and Sampling Program

3.3.1 Groundwater Monitoring and Sampling

As detailed on Table 3-2, monitoring and sampling of the GWE&TS groundwater monitoring well network is performed on a fifth quarter basis. Groundwater monitoring wells ASMW-1 through ASMW-3 have been installed in the vicinity of the GWE&TS to monitor groundwater conditions immediately downgradient of the leading edge of the groundwater plume.

Groundwater monitoring wells ASMW-4 through ASMW-7 have been installed downgradient of the GWE&TS and upgradient of the Village of Rockville Centre water supply wells in order to act as early warning or 'sentinel' wells for the village's supply wells and ensure the GWE&TS is effectively capturing the groundwater plume. A figure showing the location of the monitoring wells is provided as Figure 3-1. Monitoring well construction logs, including total depth and screened intervals, are included in Appendix E.

All samples collected from the groundwater monitoring well network are collected on an every fifth quarter basis and are analyzed for TCL VOCs via Method 8260C, for per-fluorinated alkyl substances by Method 537 (modified) and 1-4 dioxane by method 8270 SIM. The sampling frequency may be modified with the approval of the NYSDEC and the SMP will be modified to reflect the approved modifications.

3.3.2 Groundwater Sampling Event Protocol

All groundwater monitoring and sampling activities (e.g., water levels, groundwater quality readings, etc.) shall be recorded in a dedicated field book. Other observations (e.g., well condition, etc.) shall be noted on the Monitoring Well Field Inspection Log. The template, provided in Appendix F, shall serve as the inspection form for the groundwater monitoring well network.

Sample bottles, labels, shipping containers and trip blanks are provided by the analytical laboratory.

Groundwater samples shall be collected as follows:

- Sample collection procedures for PFAS will be performed in accordance with NYSDEC "Guidelines for Sampling and

Analysis of PFAS" (NYSDEC, 2020)

- The depth of water level within the well is measured in reference to the top of the PVC casing in order to calculate the liquid volume necessary for well purging. Water level measurements are obtained using a decontaminated electronic water level indicator.
- A decontaminated submersible pump and dedicated tubing is then inserted into the well, within the area of the well screen.
- The wells are purged until a minimum of three to five well volumes have been removed. Purge water is discharged to the ground surface in the vicinity of the well.
- Purge water is monitored for conductivity, dissolved oxygen, pH, temperature and turbidity using a water quality meter and flow through cell attached to the well tubing. Results of the monitoring are recorded in a dedicated field book.
- Purging shall continue until the pH, temperature and conductivity have stabilized in conformance with the USEPA Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.
- Once the well has stabilized, the flow through cell is disconnected and the groundwater samples are collected. Samples are transferred directly to the laboratory-supplied sample containers.
- Sample containers to be submitted for laboratory analysis shall be labeled with the following information:
    - Site name;
    - Sample type (media);
    - Sample location;
    - Date and time of collection;
    - Field handling (e.g., filtration), if applicable;
    - Type of preservative added, if applicable; and
    - Initials of sampling technician.
- Quality assurance/quality control (QA/QC) samples are collected consistent with the requirements of Section 3.4 of this SMP. QA/QC samples are to be identified as follows:
    - Matrix Spike and Matrix Spike Duplicate (MS/MSD); and
    - Trip Blank (TB).

All samples will be placed in an ice-filled cooler from the time of sample collection and are shipped within 24 hours under appropriate Chain of Custody (COC) procedures to the analytical laboratory.

3.3.3 Monitoring Well Repairs, Replacement and Decommissioning

If biofouling or silt accumulation impedes the performance of the monitoring wells, the wells shall be rehabilitated/redeveloped by physically agitating/surging the affected well. Additionally, monitoring wells will be properly decommissioned and replaced in the event a monitoring well is damaged or rendered unusable.

Repairs and/or replacement of wells in the groundwater monitoring well network will be performed based on assessments of structural integrity and overall performance of the well.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells, and any well repair or decommissioning and replacement activities shall be documented in Site Management Report and Periodic Review Reports (PRRs) for each respective reporting period. Well decommissioning without replacement shall not be completed without the prior approval of the NYSDEC. Monitoring wells that are decommissioned because they are unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC. Well abandonment shall be performed in accordance with

NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures."

3.4 Quality Assurance/Quality Control

Sample analysis, data quality requirements and assessments shall be conducted in accordance with the New York State Department of Environmental Conservation Analytical Services Protocol (ASP). The following Quality Assurance and Quality Control (QA/QC) requirements shall be conducted as part of each sampling event:

- Sample containers are properly washed, decontaminated and appropriate preservative is added prior to their use by the analytical laboratory. The preservative used is noted on the sample container.
- Sample holding times are in accordance with the NYSDEC ASP requirements. All samples are shipped to the analytical laboratory within 24 hours of sample collection.
- Field QC samples are collected during groundwater monitoring events. This includes one MS/MSD sample collected at a frequency of once per every 20 groundwater samples. In addition, one TB, as supplied by the analytical laboratory, will accompany all shipments to the analytical laboratory within each cooler where samples for aqueous-phase VOCs are to be analyzed.
- Samples are shipped in laboratory-supplied coolers with ice to ensure they are kept at a temperature of 4°F. A laboratory supplied Chain of Custody form is also included with all sample shipments.
- All field analytical equipment (PID, water quality analyzer, etc.) is calibrated immediately prior to each use. Calibration procedures conform to manufacturer's standard instructions.
- The laboratory follows 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 are in accordance with the NYSDEC July 2005 ASP, or latest revision.
- Data validation checklists are prepared for each set of samples collected which will include 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.

3.5 Monitoring Reporting Requirements

Forms and any other information generated during each monitoring and inspection event shall be kept on file. All forms, and other relevant reporting formats used during the monitoring/inspection events, shall be: (1) subject to approval by the NYSDEC; (2) submitted upon request of the NYSDEC; and (3) summarized in each respective PRR, as specified Section 5.0 of this SMP.

All monitoring results shall be reported on an every fifth quarter basis in Site Management Reports, as detailed in Section 5.1. In addition and as detailed in Section 5.2, a PRR shall be completed for the Site every five years. The frequency of the Periodic Review process and submittal of the associated PRR may be altered by the NYSDEC, as appropriate.

As required by the NYSDEC, all analytical sample data will be submitted to the NYSDEC in an acceptable EQuIS electronic data deliverable (EDD) format for inclusion in the NYSDEC's Environmental Information Management System (EIMS) within 30 days of receipt of the data.

4.0 OPERATION AND MAINTENANCE PLAN

4.1 Introduction

This plan should be used in the event that operation of the GWE&TS resumes. In July 2017, the GWE&TS was reconfigured and placed into long term shutdown, except as follows:

- Providing snow removal services on an as-needed basis;
- Replacement of bulbs for emergency and area lighting on an as-needed basis;
- Cleaning of building louver inlet vent screen on an as-needed basis; and
- Removal of on-site overgrown vegetation on an as-needed basis.

There is no need for additional maintenance or modifications to the system unless full-time operation resumes. This Operation and Maintenance (O&M) Plan summarizes the measures necessary to operate and maintain the GWE&TS located downgradient of the Site.

This portion of the SMP is not to be used as a stand-alone document, but as a component document of the SMP, and is not intended to replace the existing October 2003 O&M Plan, which provides specific details regarding the operation and maintenance of the GWE&TS. A copy of the October 2003 O&M Plan is provided in Appendix G. In addition a copy of the October 2003 O&M Plan, along with a copy of this SMP, will be provided for reference at the Site.

Note that the SSDS is not included in this O&M plan as the operation of the SSDS is the responsibility of the property owner; however, inspection and maintenance are being managed by the NYSDEC.

The below O&M Plan for the GWE&TS includes:

- The steps necessary to allow individuals unfamiliar with the Site to operate and maintain the GWE&TS;
- An O&M contingency plan; and
- Provisions to be periodically updated, as necessary, to reflect changes in Site conditions or the manner in which the GWE&TS is operated and maintained.

4.2 GWE&TS Operation and Maintenance

4.2.1 Scope

The O&M scope of services for the GWE&TS consists of general facility maintenance activities, routine GWE&TS maintenance activities and non-routine GWE&TS maintenance activities. The following subsections detail the O&M activities required for the GWE&TS.

4.2.2 General Facility Maintenance

General facility maintenance work items are those tasks which involve the maintenance and upkeep of the GWE&TS facility, as well as maintenance of the GWE&TS property. The scope of services for general facility maintenance activities includes, but is not limited to, the following:

- Providing snow removal services on an as-needed basis;
- Replacement of bulbs for emergency and area lighting on an as-needed basis;
- Cleaning of air stripper inlet vent screen on an as-needed basis;

- Cleaning of building louver inlet vent screen on an as-needed basis;
- Removal of on-site overgrown vegetation on an as-needed basis;
- Replenishment of expendable O&M supplies on an as-needed basis; and
- Providing general facility housekeeping on an as-needed basis.

4.2.3 System Start-Up and Testing

Start-Up

The following procedure shall be followed as part of the system start-up following any shut-downs or maintenance activities:

- Check the circuit breaker panel in the motor control center (MCC) to be sure all breakers are "ON." Any tripped breakers should be noted in the operating log and investigated.
- Check the trip switches to be sure all switches are in the "ON" position.
- Inspect each of the major process vessels to ensure they are free of leaks.
- Identify online and standby equipment. Verify that valves associated with the online equipment are online (open) and valves associated with standby equipment are offline (closed).
- Check submersible wet well pump control panel and ensure Pump #1, Pump #2 and alternation selector switches are set to "AUTO."
- At the main control panel, verify that the pressure blower, extraction well Pump #1 and extraction well Pump #2 switches are set to "AUTO."
- Once all the above has been completed, turn the GWE&TS switch to "AUTO" on the main system control panel.

System Testing

If, prior to start-up of the GWE&TS, there is evidence of damage to any major system component or any other problem is noted, the following shall be completed for each major system component to verify proper operation.

- Main System Control Panel
  - Switch the power disconnect to the "OFF" position and open the inner control panel door. Verify that the inner door disconnect is in the off position.
  - Switch on the main incoming power to the panel. CAUTION! – The disconnect now has power.
  - Confirm that incoming power is 240V on all three phases. If the incoming power has a "high leg" (a four-wire delta system), measure the voltage from each leg to ground. It is critical that L1 and L3 to ground be 120V. Power for the control panel is taken from either L1 or L3. If the high leg (usually L2, 208V) is wired in the L1 or L3 position, the panel may be damaged.
  - Record the following operating conditions within the maintenance log book: L1 to ground; L2 to ground; L3 to ground; L1 to L2; L1 to L3; and L2 to L3.
  - Be sure that all circuit protectors are reset.
  - Close the inner control panel door. Make sure that all of the green HAND-OFF-AUTO (HOA)- switches are in the "OFF" position. Turn the inner disconnect to the "ON" position. The panel should have power. All of the alarm lights may be lit depending on the panel. If so, press the "RESET" button. If the alarms lights will not reset, an alarm may

be tripped.

- Rotation needs to be verified on only one motor. To do so, bump any motor holding the HOA in the "HAND" position for no more than a second (rotation arrows are located on most pieces of equipment). If rotation is backwards, have an electrician exchange the incoming power leads L1 and L3. Be sure to lock out and tag the main incoming power. Verify that there is no power with a multimeter.

- Extraction Well Pumps

  - Verify that all pump effluent connections have been made and open all valves downstream of the pump. Close all sample taps.
  - Bump the pump to verify rotation by holding the PUMP HOA in the "HAND" position. The pump will work with any rotation. Correct rotation can be verified by monitoring the flow rate and back pressure of the pump. If the flow rate is 50% or less of the performance curve, then the rotation is backwards. If rotation is backwards, have an electrician exchange two of the power leads. Be sure to lock out and tag the main incoming power. Verify that there is no power with a multimeter.
  - If there is no flow, then the pump is above the water level. Do not run the pump for an extended length of time without water. The pump height should be reevaluated.
  - Put the PUMP HOA in the "AUTO" position. Throttle the pump to the desired flow. Record the following operating conditions with the maintenance log book: PUMP motor amp draw; PUMP pressure; PUMP flow rate; and deadhead pressure (pressure w/pump effluent valve closed).
  - Extraction well EW-1 has operated at an average pumping rate of approximately 37 gpm since system start-up in September 2004, and currently is set to operate at an average pumping rate of approximately 30 gpm. Extraction well EW-2 has operated at an average pumping rate of approximately 5 gpm since system start-up in September 2004, and currently is set to operate at an average pumping rate of approximately 7 gpm.

- Pressure Blower

  - Verify that all influent and effluent connections have been made and open all inlet, outlet and bleed valves to ensure that there are no restrictions on the blower. Close all sample taps.
  - Verify that the panel is operational and installed correctly (see panel start-up procedures).
  - Bump the blower to verify rotation by holding the STAT blower HOA in the "HAND" position. Rotation arrows are located on the blower to signify proper rotation. If rotation is backwards, have an electrician exchange two of the power leads. Be sure to lock out and tag the main incoming power. Verify that there is no power with a multimeter.
  - Once rotation has been confirmed to be correct, put the STAT blower HOA in the "AUTO" position to start the blower. Let the blower run with no load for a few minutes. If the system has a bleed valve, close the bleed valve.
  - Introduce water into the system.
  - Once the system has reached operating conditions, record the following operating conditions: STAT motor amp draw; STAT back pressure; air flow rate; and water flow rate.

- The pressure blower has operated at an average of approximately 650 cfm since system start-up in September 2004.

The system testing described above shall be conducted if, in the course of the GWE&TS lifetime, significant changes are made to the system, and the system must be restarted.

4.2.4 Routine Maintenance

The routine operating procedures are those tasks which involve scheduled inspection and maintenance of the GWE&TS equipment and appurtenances, and to document its performance while, at the same time, ensuring that all GWE&TS components are maintained in accordance with the manufacturer's operations and maintenance manuals, and service bulletins. The scope of services for the routine operating activities includes, but is not limited to, the following:

- Weekly performance monitoring of system equipment (extraction well pumps, low profile stacked-tray air stripper, pressure blower, etc.);
- Weekly inspection of all equipment, piping, flanges, valves, instruments, etc. for leakage, unusual noise and proper working condition;
- Bimonthly inspection and routine preventive maintenance of the pressure blower unit;
- Annual inspection and maintenance of the wet well pumps;
- Annual inspection and maintenance of the pressure washer and containment island assembly;
- Annual inspection and as-needed maintenance of the stainless steel screens in the utility sink system;
- Annual inspection and as-needed maintenance of the PVC strainer in the wet well;
- Annual inspection and as-needed maintenance of the strainer located in the aqueous-phase effluent piping within the flow meter vault, immediately south of the treatment system building;
- As-needed disassembly, cleaning and reassembling of the low-profile air stripper unit based on total pressure loss through the air stripper (differential pressure in exceedance of 45 inches of water); and
- As-needed removal and replacement of the GAC in the carbon adsorption vessels based on total VOC readings with a PID at the vessel outlets. As detailed above, the GAC vessels are no longer being utilized due to low contaminant concentrations in vapor-phase discharge.

A summary of the routine GWE&TS inspection and maintenance services and their typical frequency of completion are provided on Table 4-1. Copies of all manufacturer's O&M manuals can be found in the October 2003 O&M Plan. The following subsections provide the procedures to be completed as part of the Routine Operations and Maintenance events for the major system components:

Table 4-1: Routine Operation and Maintenance Services Schedule	
Inspection/Maintenance Item	**Frequency***
EW-1 Inspection	Weekly
EW-2 Inspection	Weekly
Air Stripper Inspection	Weekly
Vapor Phase Carbon Inspection	Weekly
Wet Well Inspection	Weekly
Valve Vault Inspection	Weekly
Flow Meter Vault Inspection	Weekly
Jet Pump Inspection	Weekly
Blower Maintenance	Bimonthly
Air Stripper Maintenance	As needed
GAC Removal and Maintenance/Replacement	As needed
Utility Sink Screen	Annual
Wet Well PVC Strainer	Annual
Flow Meter Vault Effluent Screen	Annual
Wet Well Pump Maintenance	Annual
Pressure Washer/Containment Island Inspection and Maintenance	Annual

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

Pressure Blower

The following shall be performed as part of each Pressure Blower Inspection and Maintenance Event:

- Inspect the fan wheel for any wear or corrosion;
- Inspect the fan wheel for buildup of materials and clean the fan wheel, as required;
- Inspect V-belt drive for proper alignment and tension, adjust as necessary, and replace worn belts;
- Lubricate motor bearings and fan bearings, and replace worn seals, as required and in accordance with manufacturer's recommendations; and
- Inspect all setscrews and bolts for tightness. Tighten as necessary.

If replacement of the fan wheel is required, the replacement fan wheel shall be a standard pressure blower wheel as manufactured by New York Blower Company, Willowbrook, Illinois and shall conform to the following specification:

Material:	Steel
Wheel Diameter (inches):	25
Inlet Flange (inches):	8
Outlet Size (inches):	6
Weight (pounds):	50

Static pressure (inches H2O):	44
Capacity (CFM):	600
Max Airstream Temperature (°F):	70

Low Profile Stacked-Tray Air Stripper

The following shall be performed as part of each Air Stripper Inspection and Maintenance Event:

- Disassemble the aeration trays via the clips provided at the ends of the air stripper;
- Power wash each aeration tray within the area of the containment island;
- Cleaning the air stripper sump and demister sections;
- Once all trays have been cleaned, clean the containment island screens and oil skimmer catch pan;
- Reassemble and start-up the GWE&TS. Verify that all equipment has been properly installed and check for water and air leaks;
- The reservoir of the containment island shall be replenished with water after each air stripper maintenance event; and
- All wastewater and sediment generated from the cleaning of the air stripper shall be containerized in 55-gallon drums. Wastewater shall not be returned to the air stripper. All waste shall be removed from the Site for proper off-site disposal within 14 calendar days after the date of waste generation.

Granular Activated Carbon Vessels

The following shall be performed as part of each Granular Activated Carbon Inspection and Maintenance Event:

- A third party company shall be responsible for delivery, removal and disposal of any spent GAC;
- All GAC shall be shipped to and from the Site in appropriate trucks which are designed, licensed and permitted to transport GAC on public roadways and equipped to discharge same at the facility;
- The GAC shall be PNV 1100 granular activated carbon as manufactured by Nichem Company, Irvington, New Jersey, or approved equal, and conform to the following specification:

U.S. Mesh Size:	4 x 10
Greater than 4 mesh (wt. %)	0-5
Less than 10 mesh (wt. %)	0-3
CCl4 Activity (wt. %)	60
Butane Activity	23.8 (minimum)
Hardness	95 (minimum)
Moisture as packed (wt. %)	2 (maximum)
Mean Particle Diameter (mm)	3.7
Apparent Density (pounds/ft^3)	27.5-31

- The supplier of the GAC shall provide documentation certifying compliance with the material specifications; and
- All GAC and condensate generated from the replacement shall be containerized in appropriately sized containers. All waste shall be removed from the Site for proper off site disposal within 14 calendar days after the date of waste generation.

Wet Well Pumps

The following shall be performed as part of each Wet Well Pump Inspection and Maintenance Event:

- Wet well pump maintenance shall only be performed by an ITT Flygt Corporation authorized Contractor. Documentation stating that the selected Contractor is authorized by ITT Flygt Corporation shall be maintained with a copy of the Maintenance Report;
- The permanently installed hand-operated hoist shall be used for the proper hoisting and removal of each submersible pump from the wet well;
- The following shall be performed by the Contractor as part of the maintenance event:
  - Check electrical condition of insulation on power cable and all phases of motor.
  - Check for any loose or faulty electrical connections within the pump control panel.
  - Check voltage supply between all phases of the electrical control panel.
  - Check voltage balance between all phases on the local side of the pump control with pump on.
  - Check amperage draw on all phases of the pump motor.
  - Check condition and operation of motor thermal protectors control system.
  - Check condition of upper shaft seals (inspect condition of motor housing).
  - Check condition and operation of leakage detector.
  - Check lower shaft seals (inspect condition of oil).
  - Change oil.
  - Check for worn or loose impeller.
  - Check all impeller wear rings.
  - Check for noisy upper and lower bearings.
  - Physically check for damage to pump and power cable.
  - Clean, reset and check operation of the level sensors.
  - Check for correct shaft rotation.
  - Test pump operation cycle.
- All waste oil generated from the maintenance event shall be containerized in appropriate sized containers. All waste shall be removed from the site for proper off site disposal within 14 calendar days after the date of waste generation.

All routine maintenance events shall be documented in site activities logs. An example of a site activities log is provided in Appendix H. In addition, all routine maintenance events shall be detailed in each respective Site Management Report, as well as the PRR for that respective reporting period.

4.2.5 Non-Routine Maintenance

Non-routine GWE&TS maintenance activities are those tasks which involve out-of-scope maintenance and upkeep of the GWE&TS equipment. Non-routine maintenance activities are commonly conducted in response to GWE&TS shutdown conditions or as a result of decreased equipment performance. All non-routine maintenance events must be documented in site activities logs. An example of a site activities log is provided in Appendix H. In addition, all non-routine maintenance events shall be detailed in each respective Site Management Report, as well as the PRR for that respective reporting period. Following the completion of any non-routine maintenance event, the start-up procedures as documented in Section 4.2.3 above, shall be completed to confirm normal system operation.

4.2.6 System Alarms

The GWE&TS is equipped with an alarm notification system to indicate when the system is not operating properly, as well as an autodialer which is programmed to call-out a predetermined sequence of phone numbers to notify technicians in the event of an alarm. The following is a list of the current alarms for the system:

- Alarm #1 – Temperature Alarm
- Alarm #2 – Building Entry Alarm
- Alarm #3 – General System Alarm
- Alarm #4 – General Failure Submersible Pump (Wet Well) Alarm
- Alarm #5 – General Failure EW-1/EW-2 Alarm
- Alarm #6 – Pressure Blower Failure Alarm
- Alarm #7 – High Level Air Stripper Sump Alarm
- Alarm #8 – High Level Valve Vault Sump Alarm

In the event that a system alarm is activated, the appropriate maintenance and repairs shall then be conducted (usually within 48 hours), as specified in the October 2003 O&M Plan, and the GWE&TS restarted. A Site Activities Log will be maintained to document the GWE&TS shutdown date/time, system start-up date/time, a general description of the alarm condition and a summary of the actions performed to address the alarm condition. Operational problems will be noted in the respective Site Management Report, as well as the PRR for each respective reporting period.

4.3 Maintenance Reporting Requirements

As described above, site activities logs for routine and non-routine maintenance will be generated during routine and non-routine operations and maintenance operations at the Site. An example of a site activities log is provided in Appendix H. As specified in the Section 5.0 of this SMP, all completed Site activities logs shall be included in each Site Management Report and Periodic Review Report (PRR), for each respective reporting period. In addition, all Site activities logs shall be maintained in the project file.

Information to be documented on the site activities log includes, but is not be limited to, the following:

- Date of activity;
- Name, company and position of person(s) conducting maintenance activities;
- Maintenance or repair activities conducted, along with descriptions of any leaks, malfunctions, etc.;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc. (attached to the Site activities log), as necessary.

4.4 Contingency Plan

This Contingency Plan has been developed in order to provide a general framework of actions to be completed in the event of a Site emergency. Emergencies include any situation or control failure arising from sudden and reasonably unforeseeable events beyond the control of the owner and/or operator of a facility, including acts of God, or environmental release.

4.4.1 Emergency Response Procedures

In the event of a Site emergency, the Site Safety Representative or Field Operations Manager will, without delay:

- Assess the situation and, if safe, take action to remove or otherwise minimize the cause of the emergency, such as powering down equipment;
- Assess the need for evacuation from the Site, if warranted. If evacuation is deemed necessary, all on-site workers will evacuate the Site and meet at a pre-determined "muster location," which is to be determined by the Site Safety Representative or Field Operations Manager during the safety briefing preceding the initiation of any work activities;
- Account for and evaluate the condition of all on-site workers;
- Contact the appropriate emergency response services (medical, fire, police etc.), as listed on Table 4-2; and
- Alert the proper regulatory agencies.

4.4.2 Emergency Telephone Numbers

In the event of a Site emergency, appropriate emergency response personnel shall be contacted, as per Table 4-2. Prompt contact should also be made to the NYSDEC. The emergency contact list provided below shall be maintained in an easily accessible location at the Site.

Table 4-2: Emergency Contact Numbers

Agency	*Phone Number*
Medical, Fire and Police	911
Fire Department/HAZMAT Unit	(516) 486-0012
Mercy Hospital	(516) 705-2525
One-Call Center	(800) 272-4480
Long Island Poison Control Center	(516) 542-2323
Pollution Toxic Chemical Oil Spills	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362
NYSDEC Division of Environmental Remediation	(518) 402-9768
D&B Engineers and Architects, P.C.	(516) 364-9890
D&B Engineers and Architects, P.C. Medical Assistance	(516) 822-2541

4.4.3 Directions and Map to Nearest Hospital

GWE&TS Site Address: 1000 Hempstead Avenue, Rockville Centre, NY

Nearest Hospital Name: Mercy Hospital

Nearest Hospital Address: 1000 N Village Ave, Rockville Centre, NY

Nearest Hospital Telephone No.: (516) 705-2525

Directions to Mercy Hospital:

1. Proceed to Molloy College Exit and make a right on to South Franklin Street (Hempstead Avenue).
2. Proceed on South Franklin Street (Hempstead Avenue) to Atkinson Road.
3. Turn right on to Atkinson Road and follow to North Village Avenue.

4. Turn right on to North Village Avenue and follow to Mercy Hospital on the right-hand side.

Total Distance: 1.0 mile

Total Estimated Time: 4 minutes

A map identifying the route to the hospital is provided as Figure 4-1.

DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

FRANKLIN CLEANERS SITE
VILLAGE OF HEMPSTEAD, NEW YORK
ROUTE TO HOSPITAL MAP

FIGURE 4-1

5.0 SITE MANAGEMENT REPORTING AND CERTIFICATION PLAN

Results from all completed GWE&TS monitoring, sampling and maintenance events shall be detailed in the Site Management Report, as well in the Periodic Review Report (PRR) for each respective reporting period, as detailed below. Site Management Reports shall be submitted to the NYSDEC on an annual basis and PRRs shall be submitted to the NYSDEC every five years. The frequency of Periodic Review process and submittal of the associated SMR and PRR may be altered by the NYSDEC, as appropriate. Each PRR will be submitted within 45 days of the end of the reporting period. The PRRs will be prepared in accordance with the May 2010 NYSDEC DER-10 "Technical Guidance for Site Investigation and Remediation" requirements.

In addition, all analytical sample data will be submitted to the NYSDEC in an acceptable EQuIS electronic data deliverable (EDD) format within 30 days of receipt of the data.

5.1 Site Management Reports

All monitoring/sampling results and maintenance activities generated during the O&M of the GWE&TS every fi shall be reported to the NYSDEC in the Site Management Reports on an annual basis. The Site Management Reports shall include, at a minimum:

- Description of the monitoring and sampling activities performed during each reporting period;
- Site and sample location figures;
- Regulatory requirements and cleanup goals;
- Extraction well sampling results in comparison to appropriate standards/criteria;
- A table summarizing contaminant of concern concentrations at each groundwater monitoring well, with a comparison to appropriate standards/criteria;
- An evaluation of all data generated;
- A graph depicting the historical contaminants of concern for each well;
- Copies of all field forms completed during the reporting period (e.g., monitoring well inspection forms, site activities logs, emergency lighting and fire extinguisher inspection forms, etc.);
- Data validation checklists;
- A reclassification/delisting evaluation; and
- Any additional observations, conclusions and recommendations.

In the event that operation of the GWE&TS resumes, the following will also be included in the Reports in addition to the information listed above:

- Date of routine maintenance, non-routine maintenance, alarms and other pertinent events;
- Influent and effluent aqueous-phase flow totals, averages and graphs of extraction well performance versus time;
- Contaminant removal efficiencies throughout the reporting period;
- A review of the VOC removal costs for the reporting period;
- A description and total hours of any downtime;
- Vapor-phase sampling results in comparison to the site-specific effluent limits; and
- A schedule of maintenance events completed during the reporting period and a schedule for the following reporting period.

As detailed above, the Site Management Reports will be summarized in each PRR for each respective reporting period.

5.2 Periodic Review Reports

All monitoring/sampling results and maintenance activities detailed in the Site Management Reports will be summarized in each PRR for each respective reporting period. A PRR shall be completed on a five year basis. The frequency of the Periodic Review process and submittal of the associated PRR may be altered by the NYSDEC, as appropriate. Each PRR will be submitted within 45 days of the end of the reporting period. The PRRs will be prepared in accordance with the NYSDEC May 2010 DER-10 "Technical Guidance for Site Investigation and Remediation" requirements.

Each PRR will include, but not be limited to, the following:

- Results from Site inspections, including the following:
  - The condition and operation of the Site and GWE&TS, including identification of any needed repairs or modifications;
  - All inspection forms and other records generated for the Site during the reporting period;
  - The results of the Fire Extinguisher and Emergency Lighting inspections:
  - Results of the required annual Site inspections and severe weather inspections, if applicable;
  - An analysis of the remedy to ensure it continues to be protective of public health and the environment and is performing in compliance with the ROD;
  - Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the specified reporting period in a NYSDEC-approved format;
  - Data summary tables and graphical representations of contaminants of concern by media, which include a listing of all compounds analyzed, along with their applicable standards and an evaluation of contaminant concentration trends;
  - A review and analysis of the Monitoring Plan, with respect to the GWE&TS monitoring and performance requirements and compliance status, and a groundwater monitoring well network evaluation;
  - Comments, conclusions and recommendations regarding any proposed changes to the remedy and/or Monitoring Plan;
  - Any new conclusions or observations regarding Site contamination based on inspections, monitoring and sampling; and
  - An evaluation of all IC/ECs to ensure the ICs/ECs are in place, performing properly and remain effective. In addition, an IC/EC certification form will be included.

The following will in included in the event that the GWE&TS returns to operation:

- A performance summary for the GWE&TS during the respective reporting period, including information such as:
  - The average flow rates of the extraction wells;
  - A summary of any discharge monitoring data and/or information generated during the reporting period;
  - The contaminant mass removals for the reporting period;
  - A description of downtime/alarm conditions and associated repairs along with an explanation of any significant downtime; and
  - A description of the resolution of any performance problems.
- O&M Plan requirements and the GWE&TS compliance status.
- A green remediation evaluation, summarizing a qualitative review of the environmental impacts of the GWE&TS; and
- An evaluation of all costs associated with the GWE&TS during the respective reporting period.

5.3 Certification of Institutional and Engineering Controls

As detailed in Section 2.0 of this SMP, ICs/ECs have been implemented at the Site. Following the final inspection/monitoring event conducted each reporting period, an IC/EC evaluation form will be completed and included in each PRR for each respective reporting period. The IC/EC evaluation form is provided in Appendix B of this SMP. A Professional Engineer licensed to practice in New York State shall sign and certify the IC/EC evaluation form. The IC/EC evaluation form will include the following:

- ICs/ECs are unchanged from the date the controls were put in-place, or last approved by the NYSDEC;
- ICs/ECs, such as the GWE&TS, remain in place and are effective;
- Nothing has occurred that would impair the ability of the controls to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with the this SMP for any IC/EC;
- Access is available to the Site for the NYSDEC to evaluate the continued maintenance of such controls;
- An inspection of the Site to confirm the effectiveness of the ICs/ECs was performed under the direction of the individual signing the certification;
- To the best of their knowledge and belief, the work and conclusions described in the certification are in accordance with the requirements of the Site remedial program; and
- The information presented is accurate and complete.

5.4 EQuIS Electronic Data Deliverables

As detailed above, all analytical sample data will be submitted to the NYSDEC in an acceptable EQuIS electronic data deliverable (EDD) format for inclusion in the NYSDEC's Environmental Information Management System (EIMS) within 30 days of receipt of the data. In addition, all data will be appropriately summarized and reported in each respective Site Management Report and PRR for each respective reporting period.

5.5 Corrective Measures Work 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 IC/EC, a Corrective Measures Work Plan (CMWP) shall be developed in conjunction with the NYSDEC. This CMWP shall identify the reason or cause for any deficiencies in certification and shall include scheduling of activities as well as detailed cost information in a proposed budget. The CMWP will be subject to final review and, unless an emergency condition exists, must be approved by the NYSDEC before any work included in the CMWP shall commence.

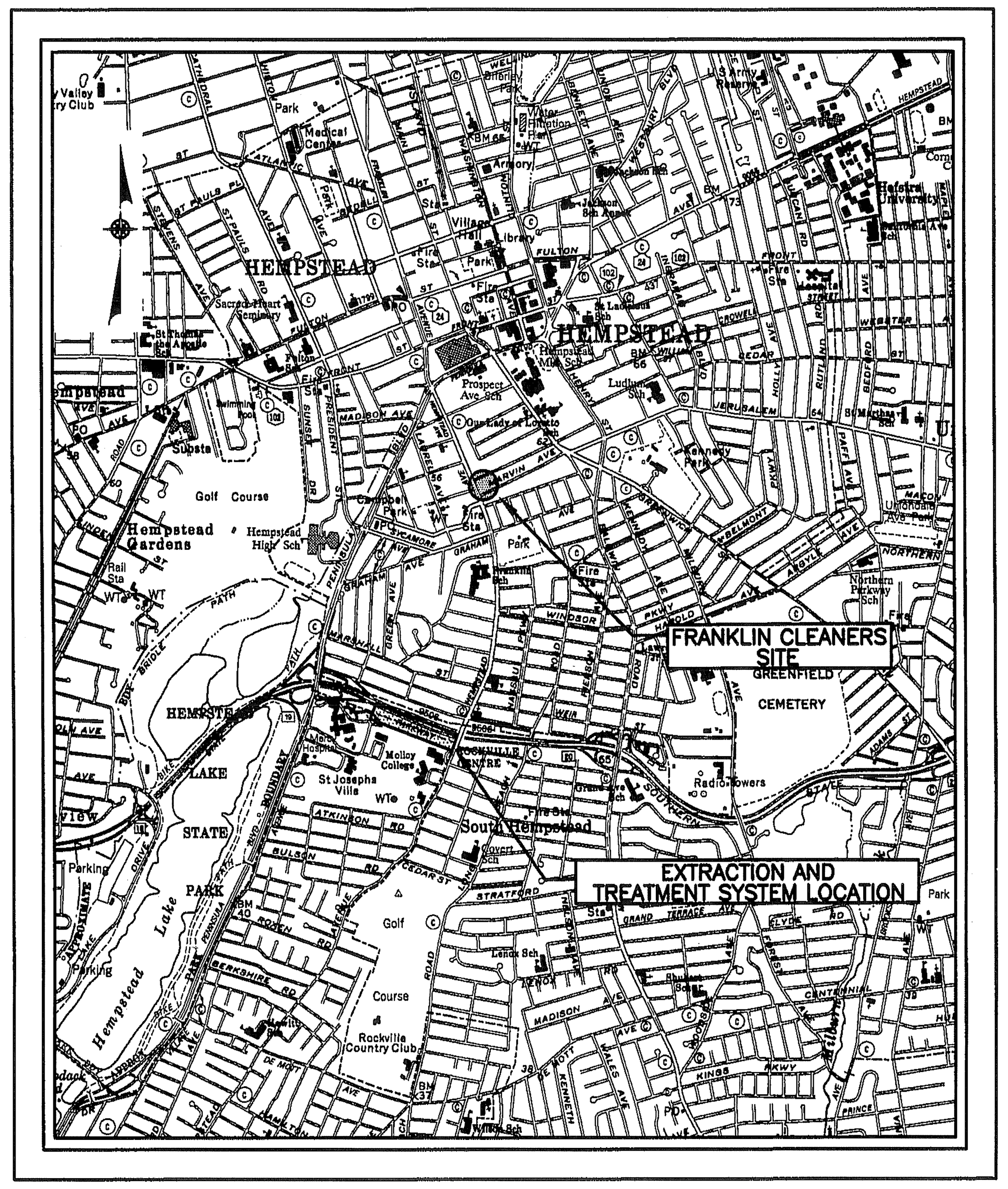
APPENDIX A

GWE&TS "AS-BUILT" DRAWINGS

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GENERAL CONSTRUCTION CONTRACT NO. D004264

FRANKLIN CLEANERS SITE
HEMPSTEAD, NEW YORK
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

SITE NO. 1-30-050



LOCATION MAP

AS–BUILT RECORD DRAWINGS
MAY 2004

LIST OF AS–BUILT DRAWINGS

DRAWING NO.	DESCRIPTION
L1	SYMBOLS AND ABBREVIATIONS
G1	NOT USED
G2	YEC INC. FINAL CONDITIONS SURVEY AS OF APRIL 5, 2004
G2A	YEC INC. DISCHARGE PIPE PROFILE
G2C	MASSAND ENGINEERING EXISTING CONDITIONS INITIAL SURVEY SEPT. 12, 2002
G3	MISCELLANEOUS SITE DETAILS
G4	ARCHITECTURAL ELEVATIONS
G5	STRUCTURAL PLAN, SECTIONS AND DETAILS
G6	ARCHITECTURAL/STRUCTURAL DETAILS
G7	ROOF FRAMING PLAN, SECTIONS AND DETAILS
G8	MECHANICAL PLAN
G9	NOT USED
G10	MECHANICAL SECTIONS, SCHEMATICS AND FLOW METER VAULT
G10A	SCHEMATICS AND VALVE SCHEDULE
G11	MECHANICAL DETAILS
G12	EXTRACTION WELLS, WELL VAULT PLAN, SECTIONS AND DETAILS

PROJECT RECORD

URS
WAYNE, NEW JERSEY

NO.	DATE	REVISION	INT.
1	11/4/02	ORIGINAL DRAWINGS BY DVIRKA AND BARTILUCCI–REVISED BY URS	
2	10/9/03	AS–BUILT	
3	MAY 2004	FINAL AS–BUILT	

STATE OF NEW YORK · ANNE H. FUNG · No. 076237 · LICENSED PROFESSIONAL ENGINEER

WED, FEB 14, 2001 04:16 P KC G:\1640\GW_DESIGN\1640–COV.DWG

K:\Cadd\2e04592 (FRANKLIN CLEANERS)\FRANKLIN CLEANERS\AS BUILT SEPT 30, 2003\1640-COV.dwg, 05/21/2004 09:30:04 AM

ABBREVIATIONS

ADD'L	ADDITIONAL	GC	GENERAL CONTRACTOR
AFF	ABOVE FINISHED FLOOR	GS	GALVANIZED STEEL
ALUM	ALUMINUM	HDPE	HIGH DENSITY POLYETHYLENE
@	AT	HP	HORSEPOWER
&	AND	H.P.	HIGH POINT
B,BOT	BOTTOM	ID	INSIDE DIAMETER
BLW	BLOWOFF	INF	INFLUENT
BM	BEAM	INT	INTERIOR
BP	BASE PLATE	INV. EL./I.E.	INVERT ELEVATION
C.I.	CAST IRON	IJ	ISOLATION JOINT
CJ	CONSTRUCTION JOINT	LBS, #	POUNDS
CL.	CLEARANCE	LF	LINEAR FEET
℄	CENTERLINE	LP	LOW POINT
CMU	CONCRETE MASONRY UNIT	MCJ	MASONRY CONTROL JOINT
C.O.	CLEAN OUT	MAX	MAXIMUM
COL	COLUMN	MECH	MECHANICAL
CONC	CONCRETE	MFTR	MANUFACTURER
CONN	CONNECTION	MIN	MINIMUM
CONT	CONTINUE,CONTINUOUS	MH	MANHOLE
CU	COPPER	MOC	MATERIAL OF CONSTRUCTION
D	DRAIN	MO	MASONRY OPENING
DET	DETAIL	NO/#	NUMBER
D.I./D.I.P.	DUCTILE IRON/D.I. PIPE	NTS	NOT TO SCALE
DIS	DISCHARGE	OC	ON CENTER
DIA./ø	DIAMETER	OPNG	OPENING
DWG(S)	DRAWING(S)	OVR	OVERFLOW
DWLS	DOWELS	℄	PLATE/PROPERTY LINE
EXIST.	EXISTING	PRESS.	PRESSURE
EA	EACH	PVC	POLYVINYL CHLORIDE PIPE
EC	ELECTRICAL CONTRACTOR	RCP	REINFORCED CONCRETE PIPE
EE	EACH END	REC	RECIRCULATION
EF	EACH FACE	REINF	REINFORCE, REINFORCING
EL,ELEV	ELEVATION	REQ'D	REQUIRED
EQ	EQUAL	RPZ	REDUCED PRESSURE BACKFLOW PREVENTER
EQUIP	EQUIPMENT	S	SANITARY
ES	EACH SIDE	SCH	SCHEDULE
ETC	ET CETERA	SDR	STANDARD DIMENSION RATIO
EW	EACH WAY	SP	SUMP PUMP DISCHARGE
EJ	EXPANSION JOINT	SPECS	SPECIFICATIONS
EXP	EXPANSION	SQ.	SQUARE
EXT	EXTERIOR	SQ. FT.	SQUARE FEET
FBO	FURNISHED BY OTHERS	STN. STL./S.S.	STAINLESS STEEL
FDN	FOUNDATION	STD	STANDARD
F.F./FIN. FL.	FINISHED FLOOR	STRUCT	STRUCTURAL
FL	FLOOR	SUC	SUCTION
FRP	FIBERGLASS REINFORCED PLASTIC	T	TOP
FS	FLOW SWITCH	T&B	TOP AND BOTTOM
FTG	FOOTING	TOF	TOP OF FINISHED FLOOR
GALV	GALVANIZED	TOS	TOP OF STEEL
		TOW	TOP OF WALL
		TYP	TYPICAL
		V	VENT
		VERT,V	VERTICAL
		W/	WITH
		WS	WATER SERVICE
		WWF	WELDED WIRE FABRIC

GENERAL CONSTRUCTION

- E — EXISTING ELECTRICAL CONDUIT
- E — NEW ELECTRICAL CONDUIT
- G — EXISTING GAS MAIN
- G — NEW GAS MAIN
- S — SANITARY SEWER
- D — EXISTING DRAIN
- D — NEW DRAIN
- T — EXISTING TELEPHONE
- T — NEW TELEPHONE
- W — EXISTING WATER MAIN
- W — NEW WATER MAIN
- WS — NEW WATER SERVICE
- WS — NEW WATER SERVICE
- ℄ — PROPERTY LINE
- CONTRACT LIMITS
- BURIED VALVE W/ VALVE BOX
- NEW CHAIN LINK FENCE
- EXISTING CHAIN LINK FENCE
- 18" — TREE TRUNK DIAMETER
- BM — BENCH MARK
- (E) — ELECTRIC MANHOLE
- (S) — SANITARY MANHOLE
- (T) — TELEPHONE MANHOLE
- (D) — DRAINAGE MANHOLE
- FIRE HYDRANT/WALL HYDRANT
- UTILITY POLE
- 00 / 00 00 — SECTION NO./ DETAIL LETTER; DRAWING NO. ON WHICH SECTION / DETAIL IS SHOWN; DRAWING NO. ON WHICH SECTION / DETAIL IS TAKEN
- 80 — EXISTING ELEVATION CONTOUR
- X 78.5 — EXISTING SPOT ELEVATION
- 80 — FINAL ELEVATION CONTOUR
- + 78.5 — FINAL SPOT ELEVATION
- EXTRACTION WELL
- PTMW-1 — EXISTING GROUNDWATER MONITORING WELL
- ASMW-2 — NEWLY INSTALLED GROUNDWATER MONITORING WELL

SYMBOLS

- EXISTING
- FUTURE
- NEW
- NEW (HIDDEN)
- 6" LAYER OF RCA
- NEW BLOCK
- GRATING
- EARTH
- NEW CONCRETE (SITE PLANS ONLY)
- AIR RELEASE VALVE
- GATE VALVE
- BACK PRESSURE CONTROL VALVE
- BALL VALVE
- BUTTERFLY VALVE
- BUTTERFLY VALVE W/MOTORIZED ACTUATOR
- PLUG VALVE
- CHECK VALVE
- SOLENOID VALVE ASSEMBLY
- VENTURI METER
- FLANGED FITTING
- MECHANICAL JOINT FITTING
- UNION
- FS — FLOW SWITCH
- PS — PRESSURE (OR VACUUM) SWITCH
- PI — PRESSURE INDICATOR
- FT — FLOW TRANSMITTER
- CORPORATION STOP/ SERVICE CONNECTION
- FS — FLOW SENSOR
- WM — WATER METER
- WS — WOBBLE SWITCH
- PG, PE — PRESSURE GAUGE
- HOSE BIBB
- BALL CHECK VALVE
- QUICK DISCONNECT

PROJECT RECORD

NO.	DATE	REVISION	INT.
1	11/4/02	ORIGINAL DRAWINGS BY DVIRKA AND BARTILUCCI-REVISED BY URS	
2	10/9/03	AS-BUILT	
3	MAY 2004	FINAL AS-BUILT	

"THESE AS-BUILT DRAWINGS ARE BEING CERTIFIED SOLELY FOR COMPLIANCE WITH THE CONSTRUCTION DRAWINGS AND APPROVED CHANGES. URS IS CERTIFYING THAT THE AS-BUILT DIMENSIONS ARE NOMINAL AND WITHIN THE CONTRACT TOLERANCES."

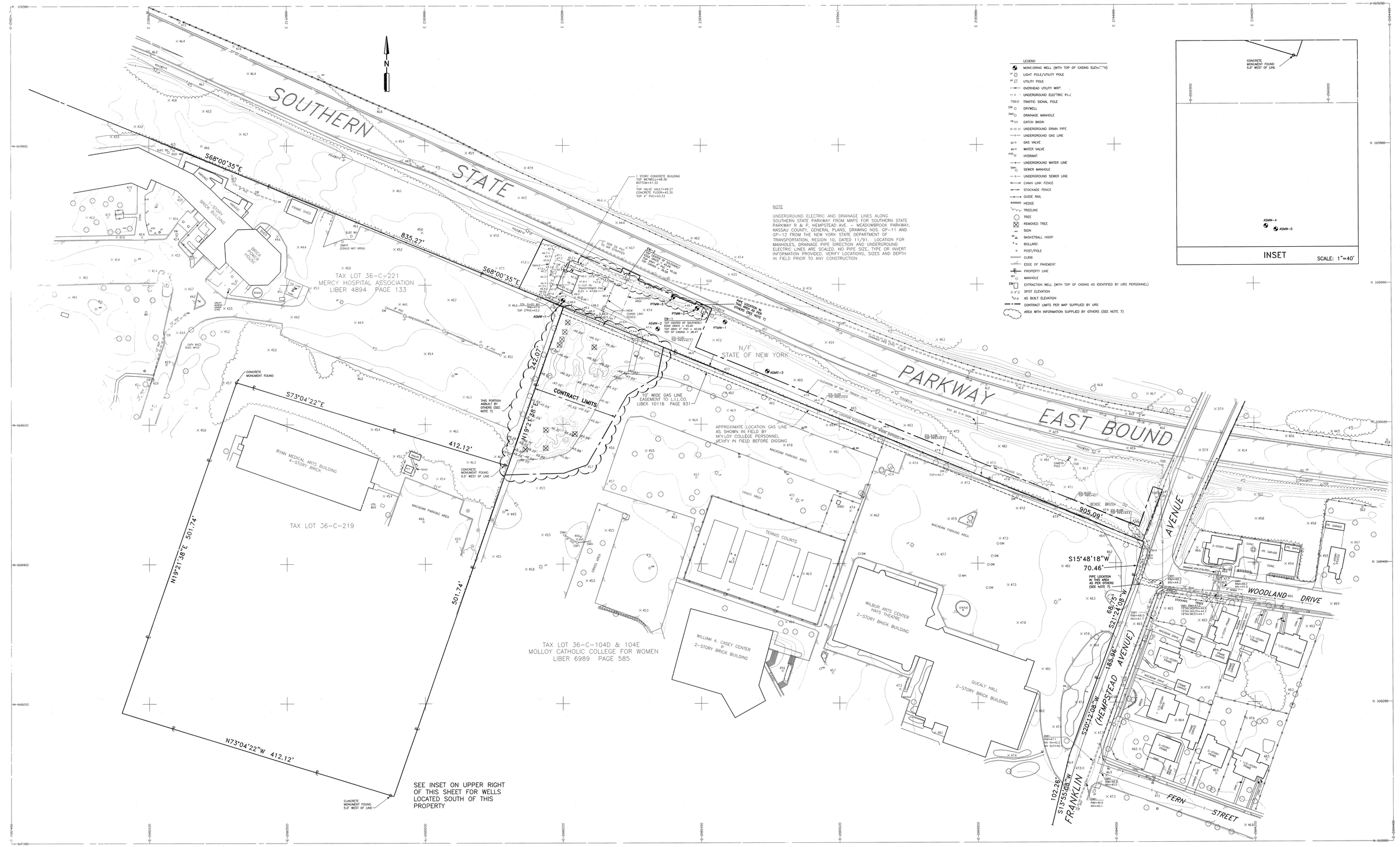
URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACTS D004264

SYMBOLS AND ABBREVIATIONS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: N.T.S.
DRAWING NO. L1

WED, FEB 14, 2001 04:21 P K:\C G:\1640\DW_DESIGN\1640-SLDWG



NOTE

UNDERGROUND ELECTRIC AND DRAINAGE LINES ALONG SOUTHERN STATE PARKWAY FROM MAPS FOR SOUTHERN STATE PARKWAY R & P, HEMPSTEAD AVE. – MEADOWBROOK PARKWAY, NASSAU COUNTY, GENERAL PLANS, DRAWING NOS. GP–11 AND GP–12 FROM THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION, REGION 10, DATED 11/91. LOCATION FOR MANHOLES, DRAINAGE PIPE DIRECTION AND UNDERGROUND ELECTRIC LINES ARE SCALED. NO PIPE SIZE, TYPE OR INVERT INFORMATION PROVIDED. VERIFY LOCATIONS, SIZES AND DEPTH IN FIELD PRIOR TO ANY CONSTRUCTION

LEGEND

- MONITORING WELL (WITH TOP OF CASING ELEV.="")
- LIGHT POLE/UTILITY POLE
- UTILITY POLE
- OVERHEAD UTILITY WIRE
- UNDERGROUND ELECTRIC
- TRAFFIC SIGNAL POLE
- DRYWELL
- DRAINAGE MANHOLE
- CATCH BASIN
- UNDERGROUND DRAIN PIPE
- UNDERGROUND GAS LINE
- GAS VALVE
- WATER VALVE
- HYDRANT
- UNDERGROUND WATER LINE
- SEWER MANHOLE
- UNDERGROUND SEWER LINE
- CHAIN LINK FENCE
- STOCKADE FENCE
- GUIDE RAIL
- HEDGE
- TREELINE
- TREE
- REMOVED TREE
- SIGN
- BASKETBALL HOOP
- BOLLARD
- POST/POLE
- CURB
- EDGE OF PAVEMENT
- PROPERTY LINE
- MANHOLE
- EXTRACTION WELL (WITH TOP OF CASING AS IDENTIFIED BY URS PERSONNEL)
- SPOT ELEVATION
- AS BUILT ELEVATION
- CONTRACT LIMITS PER MAP SUPPLIED BY URS
- AREA WITH INFORMATION SUPPLIED BY OTHERS (SEE NOTE 7)

SEE INSET ON UPPER RIGHT OF THIS SHEET FOR WELLS LOCATED SOUTH OF THIS PROPERTY

WELL ELEVATION TABLE (in feet)			
WELL ID	TOP MANHOLE	NOTCH TOP CASING	
PTMW–1	45.20	44.76	44.91
PTMW–2	45.29	44.46	44.52
PTMW–3	44.88	–	44.49
ASMW–1	48.09	–	47.29
ASMW–2	46.91	–	46.25
ASMW–3	47.37	–	46.99
ASMW–4	44.50	–	44.06
ASMW–5	44.64	–	44.25

NOTE: TOP MANHOLE AND TOP CASING ARE AS DEFINED BY URS PERSONNEL

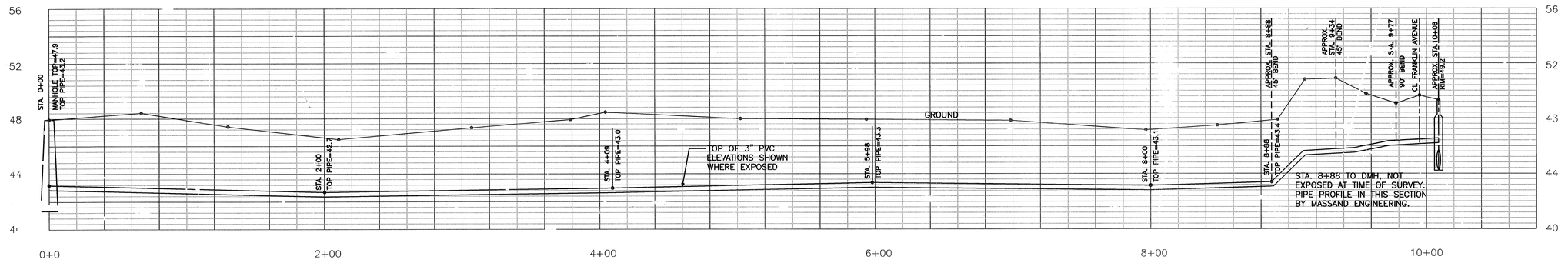
I HEREBY CERTIFY THAT THIS MAP IS BASED ON AN ACTUAL FIELD SURVEY COMPLETED ON MARCH 29, 2000 WITH ASBUILT INFORMATION FROM FIELD SURVEY COMPLETED ON APRIL 5, 2004 AND CONFORMS TO THE MINIMUM STANDARDS FOR LAND SURVEYS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.

DONALD G. [illegible], L.S., N.Y.S. LIC. NO. 49759
DONALD G. [illegible] L.S.
58 E. [illegible] DRIVE
[illegible] VALLEY, N.Y. 1091/

NOTES:

1. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM, N.A.D. 1927 FROM NASSAU COUNTY GIS MONUMENTS BE10N AND BE10NAZ
2. VERTICAL DATUM: NGVD 1929
3. UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S EMBOSSED SEAL IS A VIOLATION OF SECTION 7209, SUB–DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.
4. ONLY COPIES FROM THE ORIGINAL TRACING MARKED WITH THE LAND SURVEYOR'S EMBOSSED SEAL SHALL BE CONSIDERED VALID, TRUE COPIES.
5. TOPOGRAPHY FROM AERIAL PHOTOGRAMMETRY BY LOCKWOOD MAPPING COMPANY, 36 KARLAN DRIVE, ROCHESTER, NY 14617, 800–765–5510. DATE OF FLIGHT JANUARY 6, 2000.
6. UNDERGROUND UTILITIES SHOWN ARE AS MARKED IN FIELD BY UTILITIES COMPANIES OR VISIBLE ON SURFACE. VERIFY LOCATIONS PRIOR TO ANY CONSTRUCTION, DIGGING OR OTHER SUBSURFACE DISTURBANCES. WATERLINE LOCATION ON FRANKLIN AVE. WAS NOT MARKED AND ITS LOCATION IS ASSUMED IN FRONT OF THE THREE PROPERTIES NORTH OF FERN STREET.
7. CLOUDED AREAS ARE NOT PART OF YEC'S RESPONSIBILITY. DETAILS IN THESE AREAS WERE OBTAINED FROM MASSAND ENGINEERING.

REVISIONS	YEC, INC.		DRAWING NO.
4/20/04 – ADDED ASBUILT INFO	VALLEY COTTAGE	NEW YORK	G2
	FINAL CONDITIONS SURVEY AS OF APRIL 5, 2004		
	TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK		
	DATE: SEPT. 2000	SCALE: 1" = 40'	DRAWN BY: MBW
	CHECKED BY: DRS	JOB NO. #0121	



PIPE PROFILE

HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

I HEREBY CERTIFY THAT THIS MAP IS BASED ON AN ACTUAL FIELD SURVEY COMPLETED ON MARCH 29, 2000 WITH ASBUILT INFORMATION FROM FIELD SURVEY COMPLETED ON APRIL 5, 2004 AND CONFORMS TO THE MINIMUM STANDARDS FOR LAND SURVEYS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.

DONALD R. STEDGE, L.S., N.Y.S. LIC. NO. 49759
DONALD R. STEDGE, P.L.S.
58 EDGEWOOD DRIVE
CENTRAL VALLEY, N.Y. 10917

NOTES:

1. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM, N.A.D. 1927 FROM NASSAU COUNTY GIS MONUMENTS
2. VERTICAL DATUM: NGVD 1929
3. UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S EMBOSSED SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.
4. ONLY COPIES FROM THE ORIGINAL TRACING MARKED WITH THE LAND SURVEYOR'S EMBOSSED SEAL SHALL BE CONSIDERED VALID, TRUE COPIES.

REVISIONS	YEC, INC.	DRAWING NO.
4/20/04 - ADDED ASBUILT INFO	VALLEY COTTAGE NEW YORK	G2A
	DISCHARGE PIPE PROFILE FRANKLIN CLEANERS SITE TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK	
	DATE: MAY 2004 · SCALE: 1"=40'H, 4'V · DRAWN BY: MBW · CHECKED BY: DRS · JOB NO. A0121	

NOTES:

1. SURVEY WITHIN CONTRACT LIMIT PERFORMED BY MASSAND ENGINEERING L.S., PC., IN AUGUST 2002.
3. SURVEY INFORMATION OUTSIDE CONTRACT LIMIT OBTAINED FROM SURVEY PREPARED BY YEC, INC. DATED APRIL 2000 AND IS SHOWN FOR REFERENCE ONLY.
3. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM N.A.D. 1927 FROM NASSAU COUNTY GIS MONUMENTS.
4. VERTICAL DATUM: NGVD 1929.

MONUMENTS:

PID	N	E	DESIGNATION
KU 4765	172927.870 FT	2102919.927 FT	08E 10N
KU 4785	171884.187 FT	2102501.985 FT	08E 10N AZ
KU 4805	167175.178 FT	2106787.101 FT	09E 09N
KU 4825	166510.806 FT	2106858.125 FT	09E 09N AZ

BENCHMARKS:

PID	EL	DESIGNATION
KU 1466	30.43 FT	G 37
KU 1467	30.56 FT	ROCKVILLE CENTRE

CERTIFICATE:
CERTIFIED THAT SURVEY ELEVATIONS AND LOCATIONS WITH CONTRACT LIMITS AS MARKED ARE IN CONFORMANCE WITH CONTRACT DOCUMENTS.

LEGEND:

	MONITORING WELL (WITH TOP OF CASING ELEVATION)
	EXISTING EXTRACTION WELL
LP	LIGHT POLE/UTILITY POLE
UP	UTILITY POLE
— OW —	OVERHEAD UTILITY WIRE
— E —	UNDERGROUND ELECTRIC WIRE
TSB	TRAFFIC SIGNAL BOX
DW	DRYWELL
DMH	DRAINAGE MANHOLE
CB	CATCH BASIN
= = =	UNDERGROUND DRAIN PIPE
— G —	UNDERGROUND GAS LINE
GV	GAS VALVE
WV	WATER VALVE
HYD	HYDRANT
— W —	UNDERGROUND WATER LINE
SMH	SEWER MANHOLE
— S —	UNDERGROUND SEWER LINE
	CHAIN LINK FENCE
	STOCKADE FENCE
	GUIDE RAIL
	HEDGE
	TREELINE
	TREE
	REMOVED TREE
	SIGN
BB	BASKETBALL HOOP
B	BOLLARD
	POST/POLE
	CURB
	EDGE OF PAVEMENT
	PROPERTY LINE
	CONTRACT LIMIT
	TRAVERSE CONT. PT. STA. #51
×46.34 BPILE	BOTTOM OF PILE ELEVATION
×60.32 TPILE	TOP OF PILE ELEVATION
×43.83 EOASPH	EDGE OF ASPHALT ELEVATION
×47.55 GRD	GROUND ELEVATION

EXISTING ELEVATION
AUGUST 2002
OBTAINED BY MASSAND ENGINEERING

SOUTHERN STATE PARKWAY

SOUTHERN STATE PARKWAY EAST BOUND

OUTLINE OF PROPOSED FENCE LINE

OUTLINE OF PROPOSED ONE-STORY CONCRETE BLOCK BUILDING

PROPERTY CORNER MONUMENT NOT FOUND

CONTRACT LIMIT

N/F STATE OF NEW YORK

STA. #50

STA. #51

STA. #53

STA. #54

PTMW-3 TOC=44.56

PTMW-2 TOC=44.84

EW-1 WELL TOC=44.83

PTMW-1 TOC=45.09

MACADAM PARKING AREA

GRASS AREA

TENNIS COURTS

SHED

CAMERA POLE

TSB

EXIT 20 S-N SIGN

MOLLOY COLLEGE SIGN

DENSE BRUSH

WILBUR ARTS CENTER
HAYS THEATRE
2-STORY BRICK

2-STORY FRAME

FRANKLIN (HEMPSTEAD AVENUE) AVENUE

WOODLAND DRIVE

DRAINAGE STR.(3"SLTED)

DMH RIM=49.2 INV=44.2

16" RCP

6" SEWER S

STOCKADE FENCE

DMH RIM=47.8
15"INV.NORTH=44.8
15"INV.SOUTH=44.2
18"INV.WEST=44.1

SMH RIM=48.0 INV=41.7

STACK

NO.	DATE	REVISION	INT.

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.

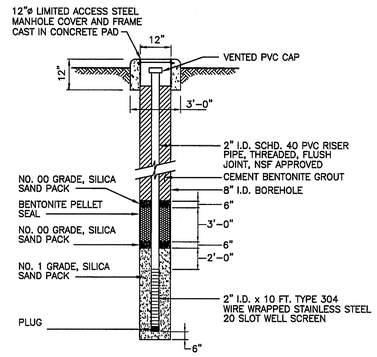
PROJECT ENGINEER:	DRAWN BY:
DESIGNED BY:	CHECKED BY:

MASSAND ENGINEERING, L.S., P.C.
211-13 UNION TURNPIKE BAYSIDE, N.Y. 11364
(718)464-3200 FAX (718)464-3570

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

EXISTING CONDITIONS
INITIAL SURVEY SEPT. 12, 2002

PROJECT NO.	DRAWING NO.
DATE:	G2c
SCALE: 1"=30'	

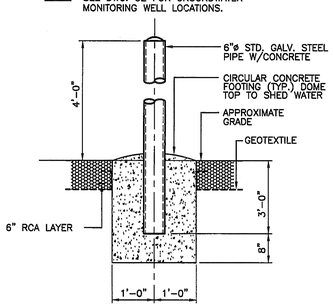


GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

NTS

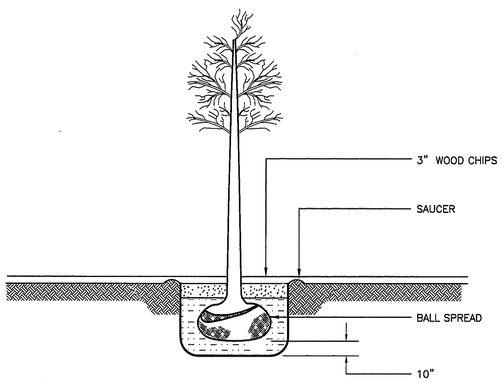
WELL NO.	TOP OF SCREEN (ft-bgs)	EL. OF TOP OF CASING (ft-msl)	EL. OF TOP OF RIM (ft-msl)
ASMW-1	80.2	47.29	48.09
ASMW-2	80.0	46.25	46.91
ASMW-3	80.0	46.99	47.37
ASMW-4	100.0	44.06	44.50
ASMW-5	123.0	44.25	44.64

NOTE: SEE DWG. G2 FOR GROUNDWATER MONITORING WELL LOCATIONS.



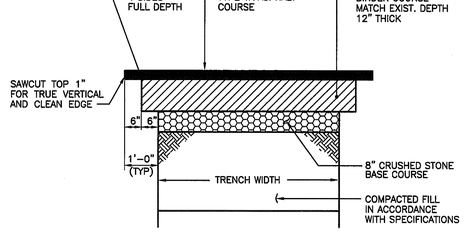
BOLLARD DETAIL

N.T.S.



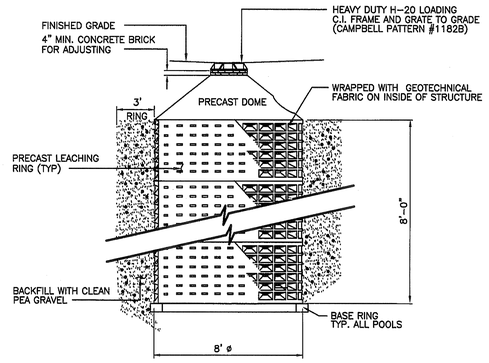
TREE PLANTING DETAIL

N.T.S.



PAVEMENT RESTORATION DETAIL

NTS

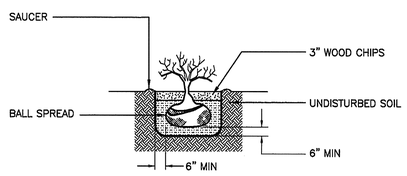


DRYWELL DETAIL

N.T.S.

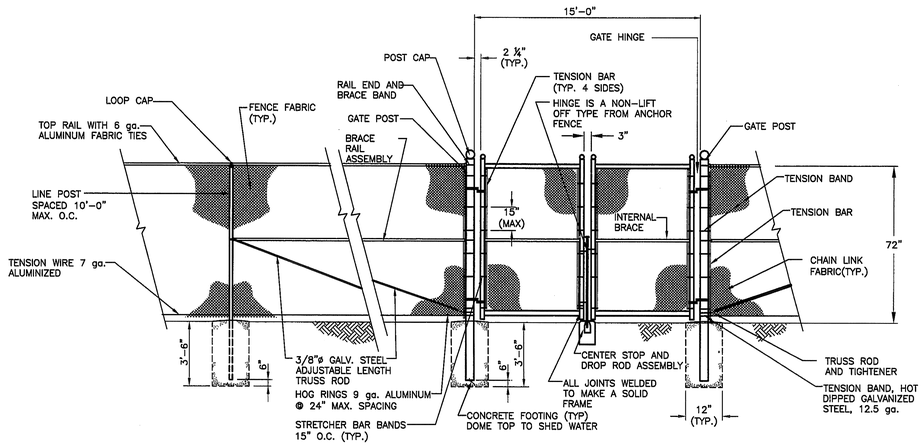
NOTES:

1. EASTERN CEDAR (JUNIPERAS VERGINIA) MIN. 4'-0" HIGH INSTALLED IN ACCORDANCE WITH THE APPROVED LANDSCAPE PLAN.
2. VERBUNIUM DENTATUM INSTALLED IN ACCORDANCE WITH THE APPROVED LANDSCAPE PLAN.



SHRUB PLANTING DETAIL

N.T.S.



6'-0" HIGH FENCE & GATE DETAILS

N.T.S.

Fabric: Same and adjoining fence fabric (For Temporary Gate Only)

	Diameter	Wall	Wt per ft	Length	Material
Gate Frame	2" O.D.		2.72 lb	---	Galvanized pipe, sch 40
Gate Post	4" O.D.		9.11 lb	9 ft	Galvanized pipe, sch 40

Fabric: Same and adjoining fence fabric

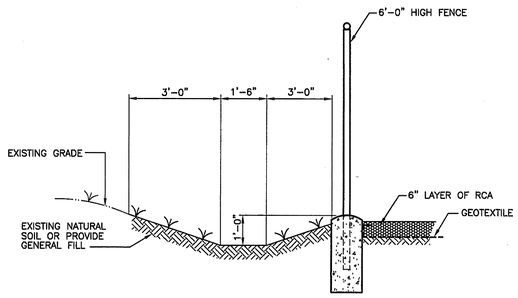
	Diameter	Wall	Wt per ft	Length	Material
Gate Frame	2" square		3.07 lb	---	Aluminum, alloy 6063-T6
Gate Post	4" O.D.		9.11 lb	9 ft	Galvanized pipe, sch 40

Fabric	Height	Mesh	Gauge	Selvage	Finish
	6 ft	2"	9	Twisted top & knuckled bottom	Aluminized

Framework	O.D.	Wall	Wt per ft	Length
End/corner post	2.875	0.203	5.79 lb	9 ft
Line post	2.875	0.203	5.79 lb	9 ft
Top rail	1.660	0.140	2.27 lb	21 ft
Brace Rail	1.660	0.140	2.27 lb	10 ft max.

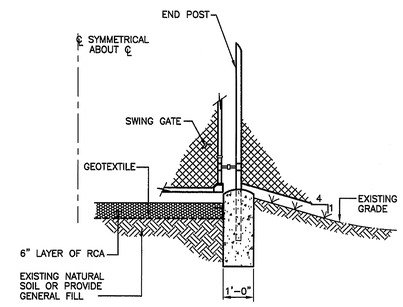
NOTES:

1. VERTICAL PRIVACY SLATS INSTALLED IN FENCE AND GATE FABRIC.
2. PRIVACY SLATS 6 FT IN HEIGHT AND 1-1/8" WIDE PLASTIC VERTICAL TUBING.
3. PRIVACY SLATS LOCKED INTO PLACE WITH LOCKING STRIPS. NO FASTENERS ARE REQUIRED.
4. CONCRETE 4000 PSI.
5. TREATMENT PLANT PERIMETER GATE DOES NOT HAVE INTERNAL BRACE.



TYPICAL DETAIL OF SWALE

N.T.S



TYPICAL ROADWAY SECTION

N.T.S

PROJECT RECORD

NO.	DATE	REVISION	INT.
1	11/4/02	ORIGINAL DRAWINGS BY DVIRKA AND BARTILUCCI-REVISED BY URS	
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3	MAY 2004	FINAL AS-BUILT	

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URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

MISCELLANEOUS SITE DETAILS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G3

WED, FEB 14, 2001 04:14 P XC: G:\1640\DWG\JACSON\1640-G4.DWG

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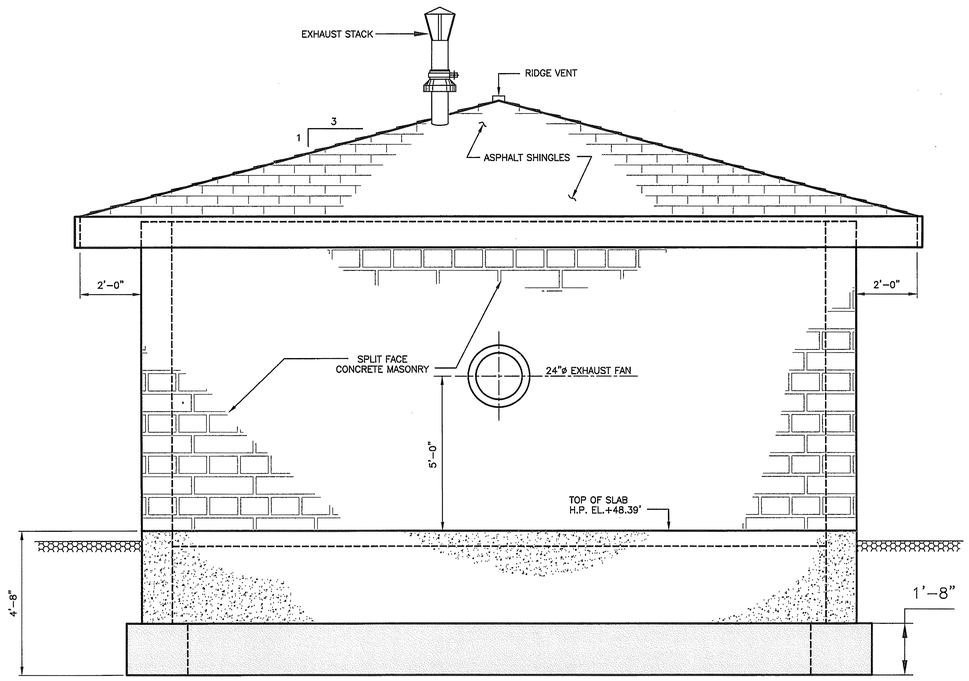
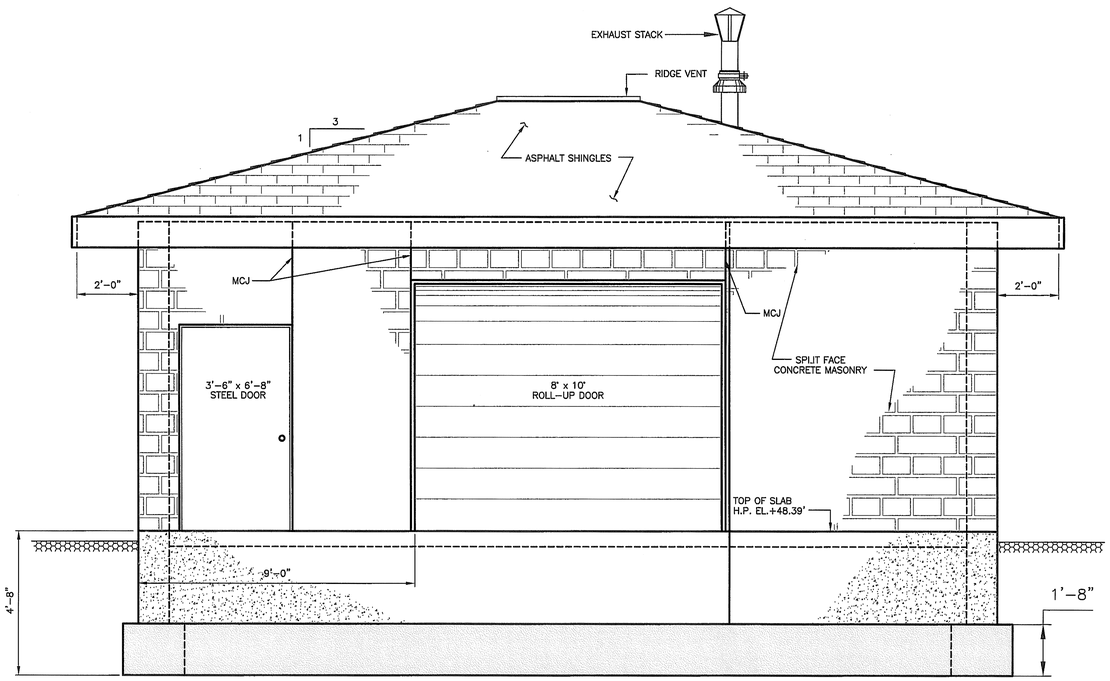


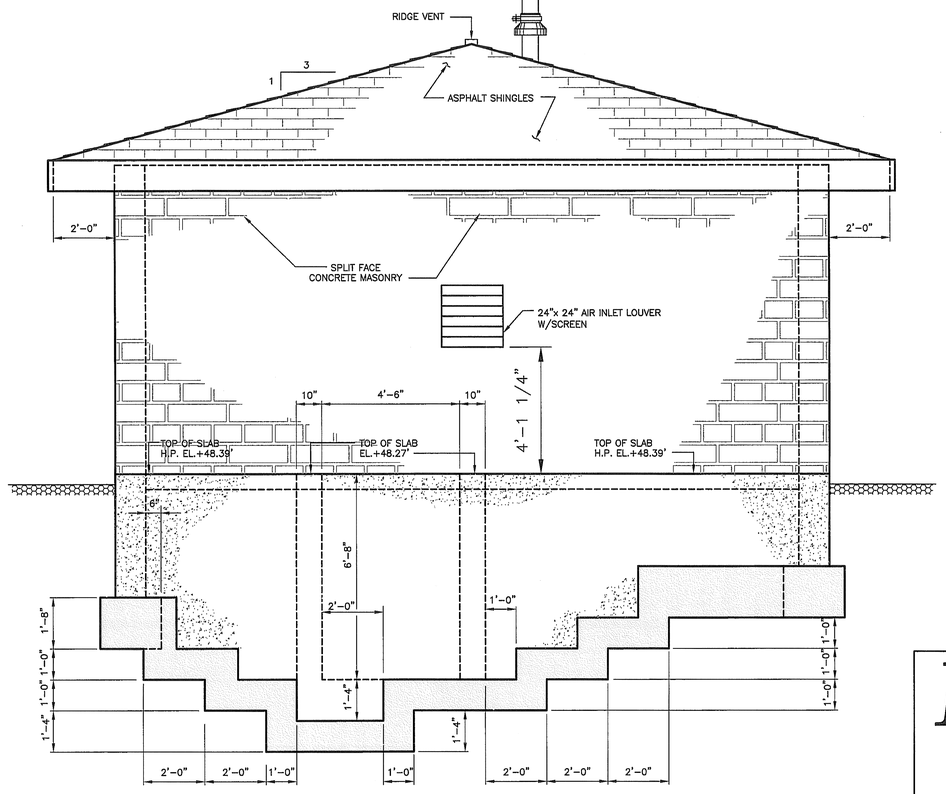
NORTH ELEVATION

SCALE: 1/2"=1'-0"



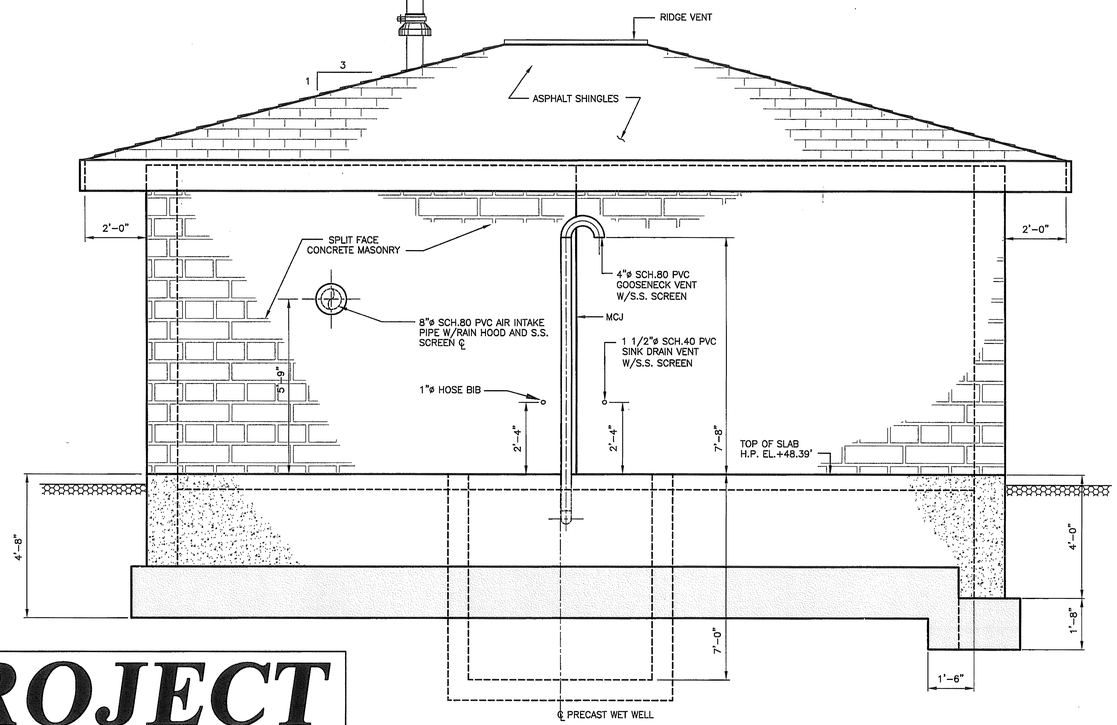
EAST ELEVATION

SCALE: 1/2"=1'-0"



SOUTH ELEVATION

SCALE: 1/2"=1'-0"



WEST ELEVATION

SCALE: 1/2"=1'-0"

PROJECT RECORD

NO.	DATE	REVISION	INT.
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3	MAY 2004	FINAL AS–BUILT	

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WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION
AND TREATMENT SYSTEM
CONTRACT D004264

ARCHITECTURAL ELEVATIONS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G4

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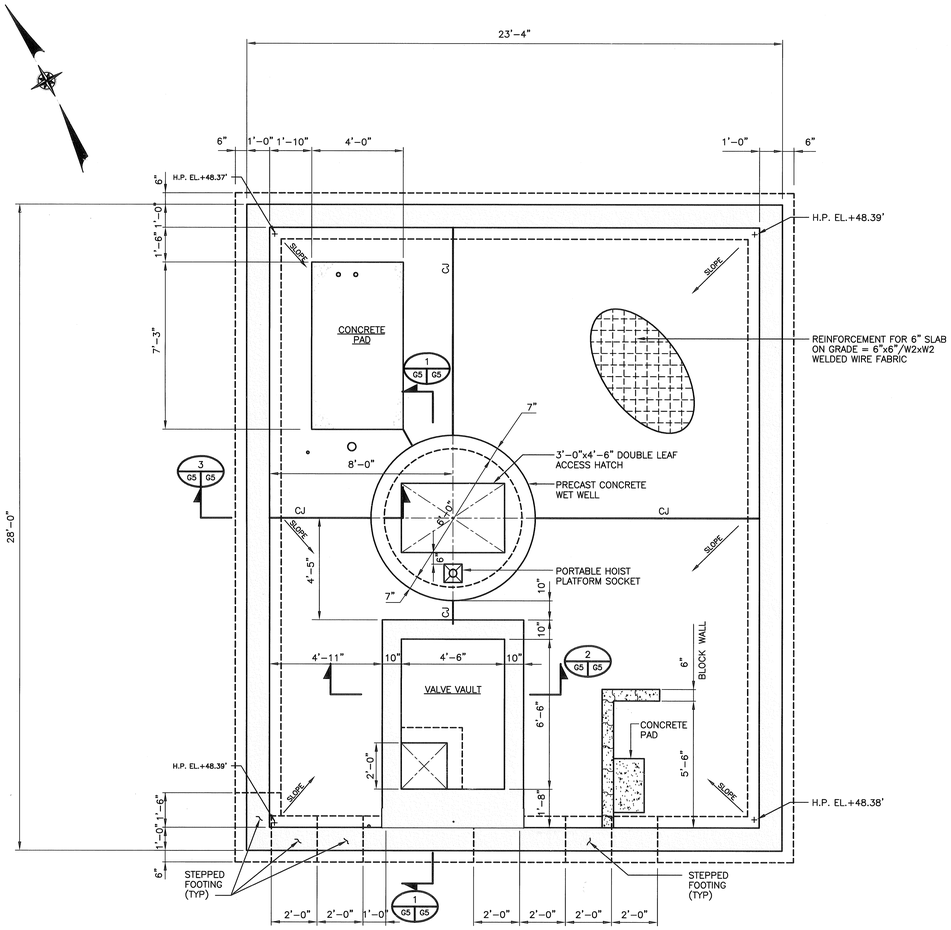
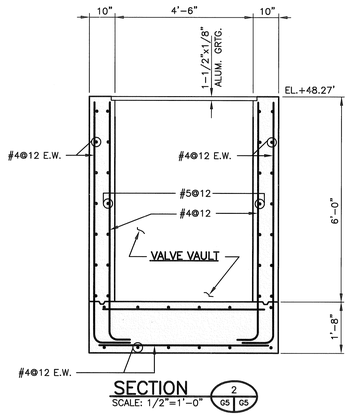


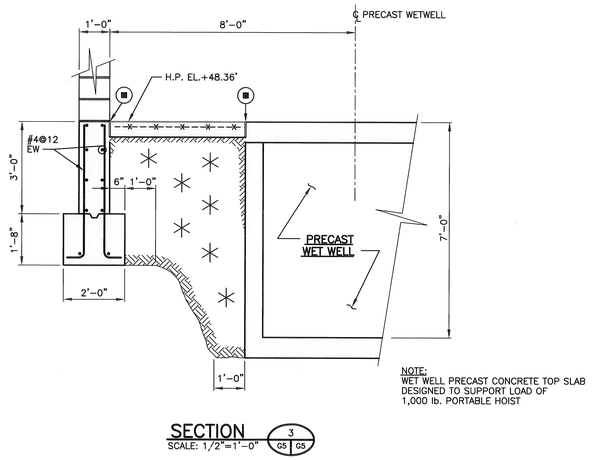
FIRST FLOOR AND FOUNDATION PLAN

SCALE: 3/8"=1'-0"

NOTE: SLOPE FLOOR SLAB TO VALVE VAULT

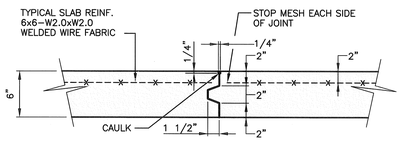


SECTION
SCALE: 1/2"=1'-0"
2 G5 G5



NOTE:
WET WELL PRECAST CONCRETE TOP SLAB DESIGNED TO SUPPORT LOAD OF 1,000 lb. PORTABLE HOIST

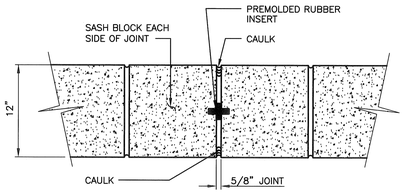
SECTION
SCALE: 1/2"=1'-0"
3 G5 G5



TYPICAL CONTROL JOINT DETAIL FOR SLAB ON GRADE

SCALE: 1-1/2"=1'-0"

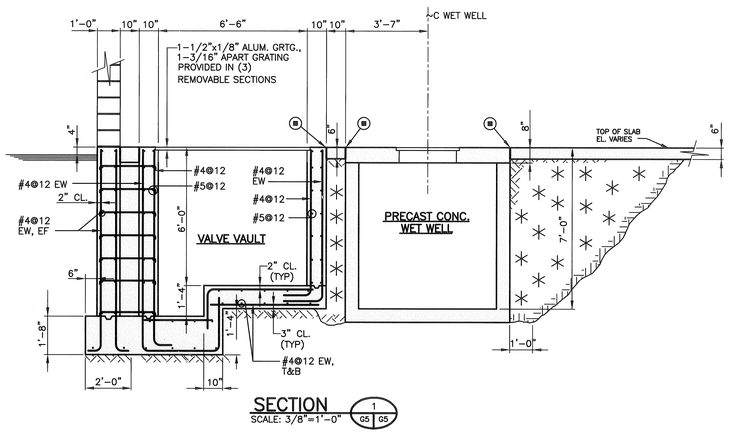
(MARKED CJ ON G5)



TYPICAL CONTROL JOINT DETAIL MASONRY CONTROL JOINT

SCALE: 1-1/2"=1'-0"

(MARKED MCJ ON ARCH. ELEVATIONS DWG. G4)



SECTION

SCALE: 3/8"=1'-0"

1 G5 G5

LEGEND:

✳ = WELL COMPACTED SELECT FILL WHERE EARTH UNDER SLAB IS DISTURBED BY EXCAVATION OF WET WELL AND VALVE VAULT.

⊛ = 1/2" PREMOLDED FILLER (SEE ISOLATION JOINT DETAIL ON DWG. G6)

PROJECT RECORD

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3	MAY 2004	FINAL AS-BUILT	

STATE OF NEW YORK · ANNE H. FUNG · NO. 078927 · LICENSED PROFESSIONAL ENGINEER

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URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

STRUCTURAL PLAN, SECTIONS AND DETAILS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G5

TUE., FEB 20, 2001 08:38 K:\C G:\1640\Dw_DESIGN\1640-2.DWG

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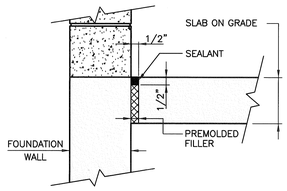
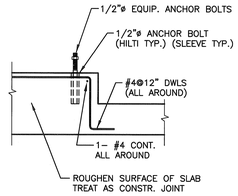
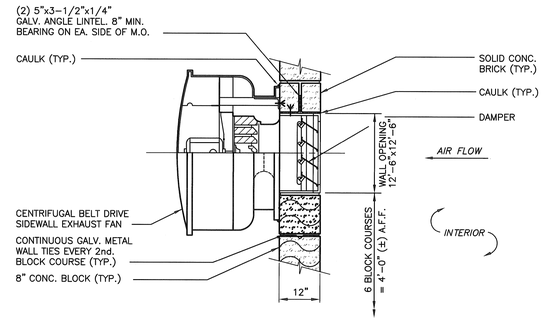


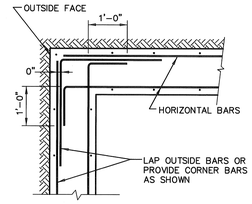
TYPICAL SLAB ON GRADE ISOLATION JOINT DETAIL AT FOUNDATION WALL
N.T.S.



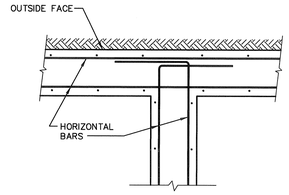
EQUIPMENT PAD DETAIL
N.T.S.



TYPICAL SIDEWALL EXHAUST FAN DETAIL THROUGH BLOCK WALL
N.T.S.

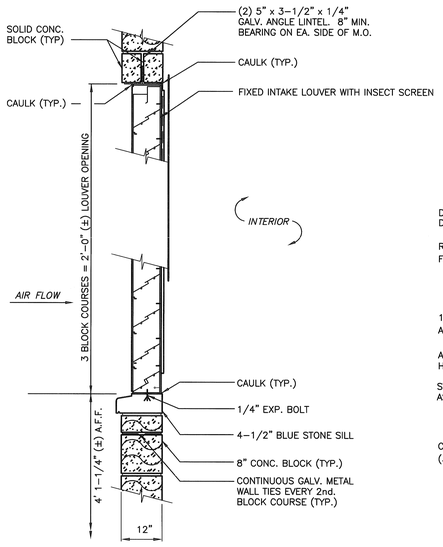


AT CORNERS

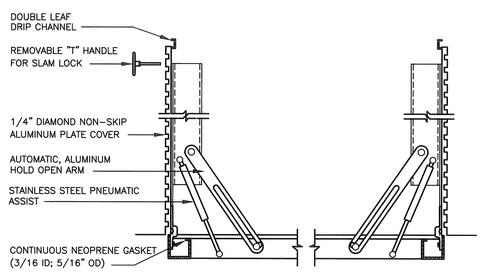


AT INTERSECTIONS

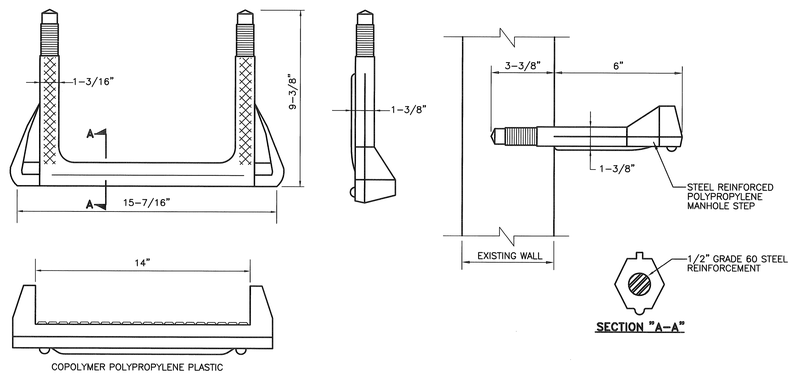
PLAN OF HORIZONTAL REINFORCING OF CONCRETE WALLS AND DEEP BEAMS
N.T.S.



LOUVER DETAIL THROUGH BLOCK WALL
N.T.S.

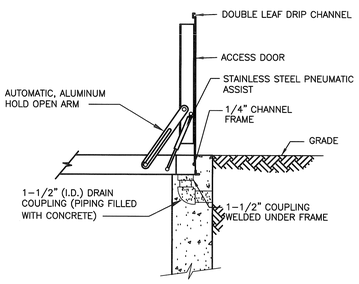


WET WELL INTERIOR ALUMINUM DOUBLE LEAF ACCESS DOOR
N.T.S.



SECTION "A-A"

DETAIL OF VALVE VAULT STEP INSTALLATION
N.T.S.



WET WELL ACCESS HATCH DRAIN DETAIL
N.T.S.

PROJECT RECORD

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STATE OF NEW YORK · WAYNE H. FORD · No. 076257 · LICENSED PROFESSIONAL ENGINEER

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URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

ARCHITECTURAL/STRUCTURAL DETAILS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G6

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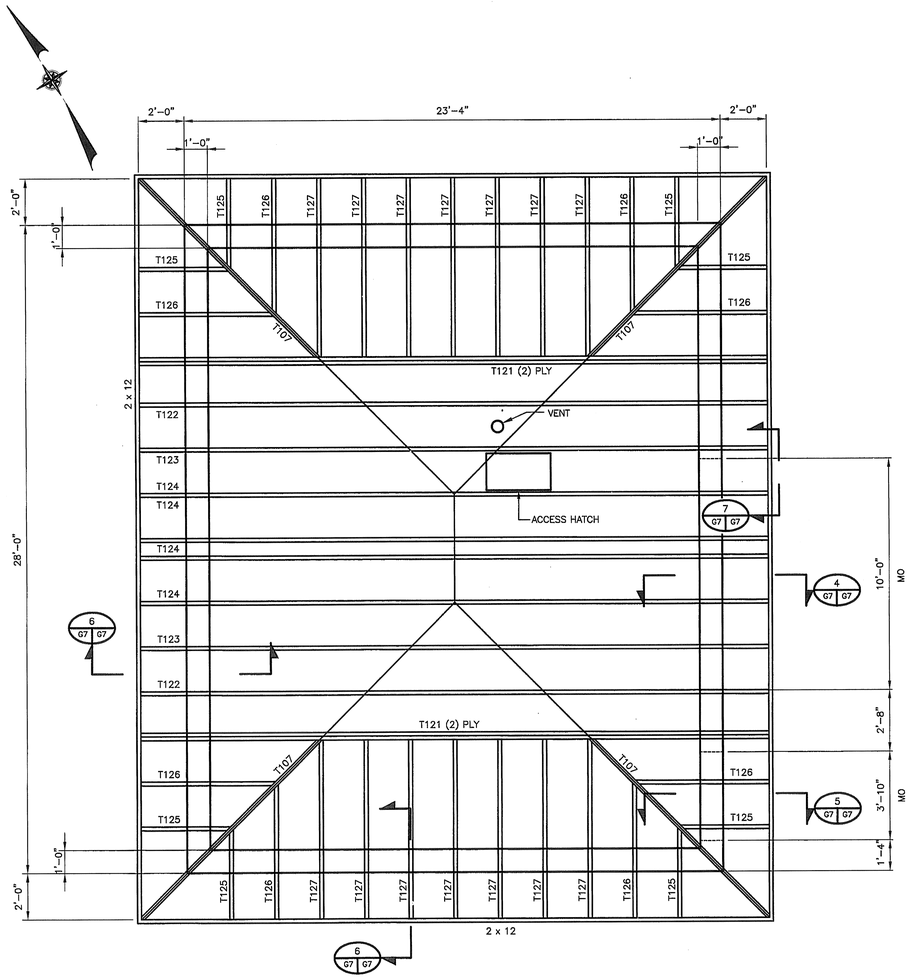
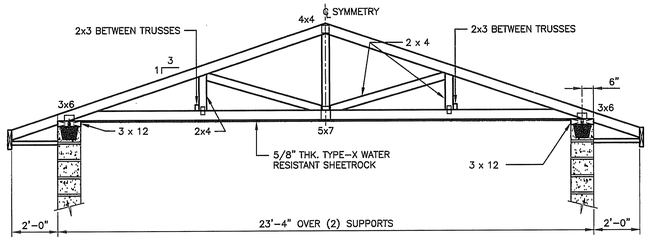


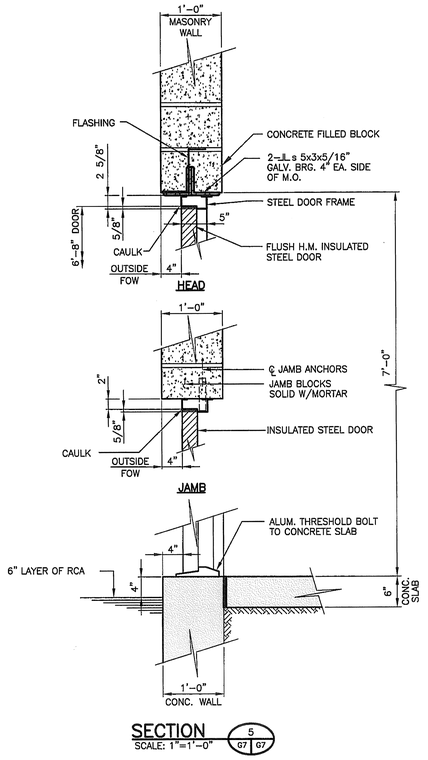
ROOF FRAMING PLAN

SCALE: 3/8"=1'-0"



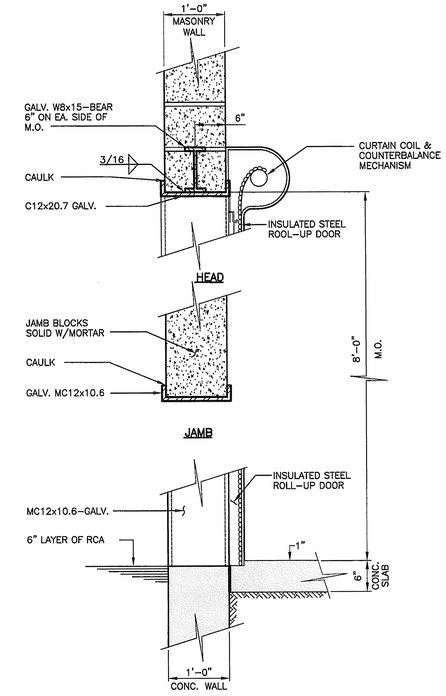
TYPICAL TRUSS T124

SCALE: 3/8"=1'-0"



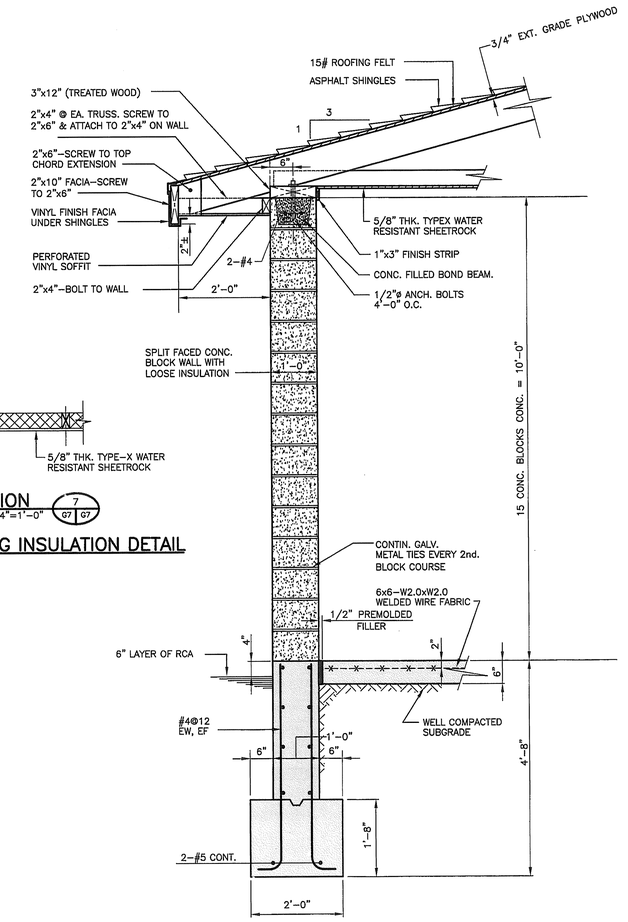
SECTION

SCALE: 1"=1'-0" (5 G7 G7)



SECTION

SCALE: 1"=1'-0" (4 G7 G7)

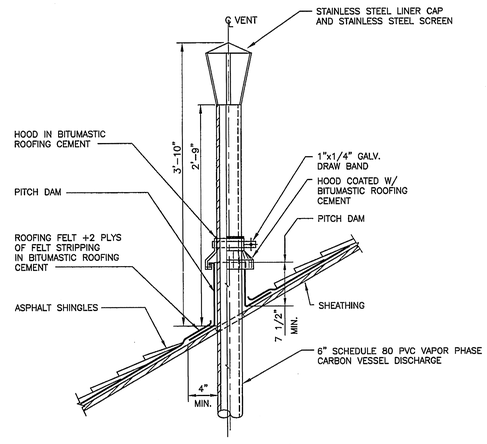


SECTION

SCALE: 3/4"=1'-0" (6 G7 G7)

TYPICAL CEILING INSULATION DETAIL

TYPICAL EXTERIOR WALL DETAILS



ROOF VENT PENETRATION DETAIL

N.T.S.

PROJECT RECORD

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URS
WAYNE, NEW JERSEY

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FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

ROOF FRAMING PLAN, SECTIONS AND DETAILS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G7

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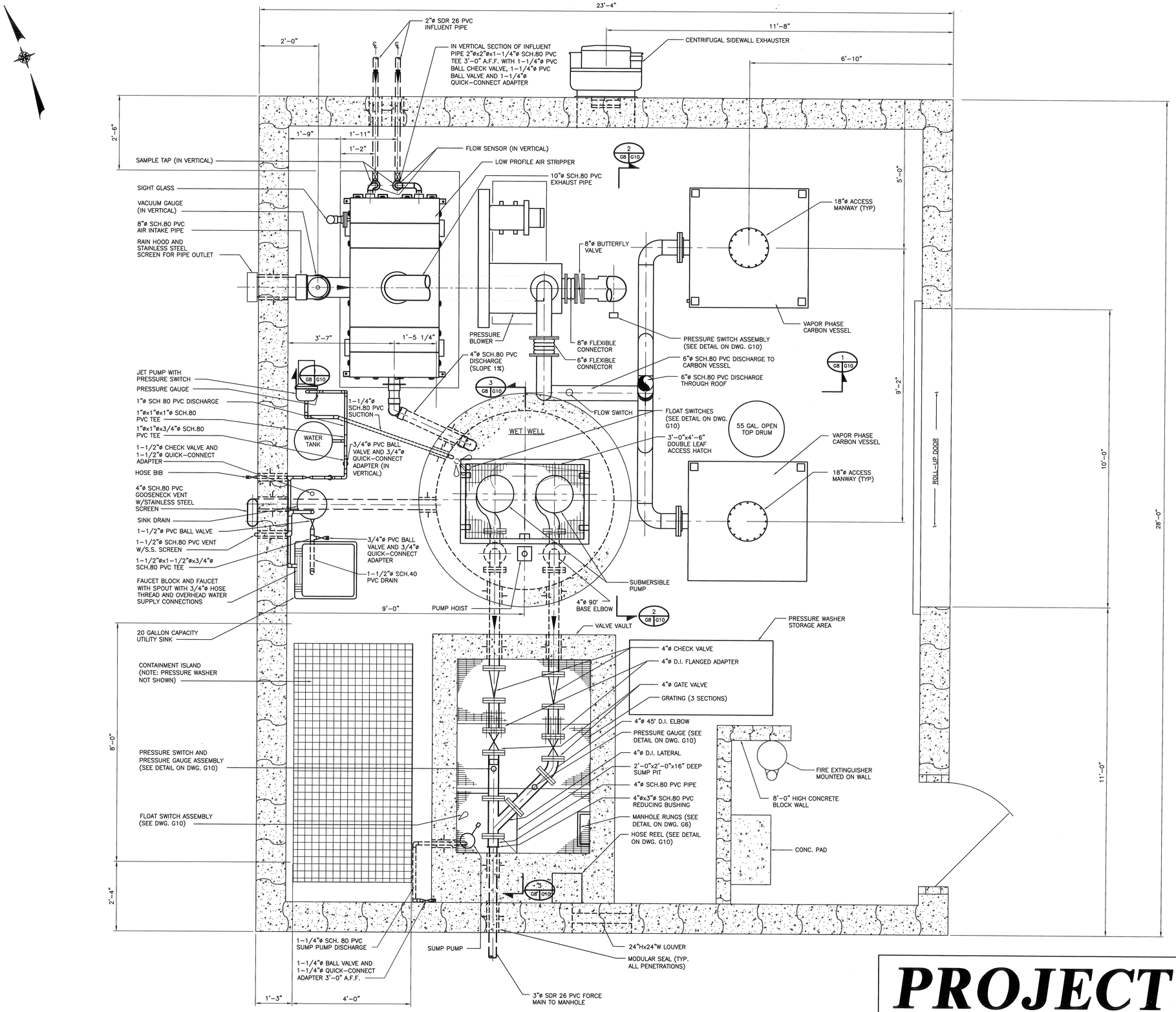

NOTES:

1. REFER TO DRAWING E2 FOR THE LOCATIONS OF FLOW INDICATOR/TRANSMITTERS, VARIABLE FREQUENCY DRIVES AND TRANSFORMERS, CONTROL PANELS, REMOTE REGISTER, ETC.
2. FOR INSTRUMENTATION LOCATION AND DETAILS SEE SECTION 1 DWG. G10.
3. 55 GALLON DRUM IS MOVEABLE.

PROJECT RECORD

NO.	DATE	REVISION	INT.
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STATE OF NEW YORK ANNE H. FUNG LICENSED PROFESSIONAL ENGINEER No. 078937

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

MECHANICAL PLAN

PROJECT NO. 807260
DATE: MAY 2004
SCALE: 3/4" = 1'-0"
DRAWING NO. G8

THU, FEB 13, 2003 11:54 A KC G:\1640\DWL_DESIGN\1640-6.DWG

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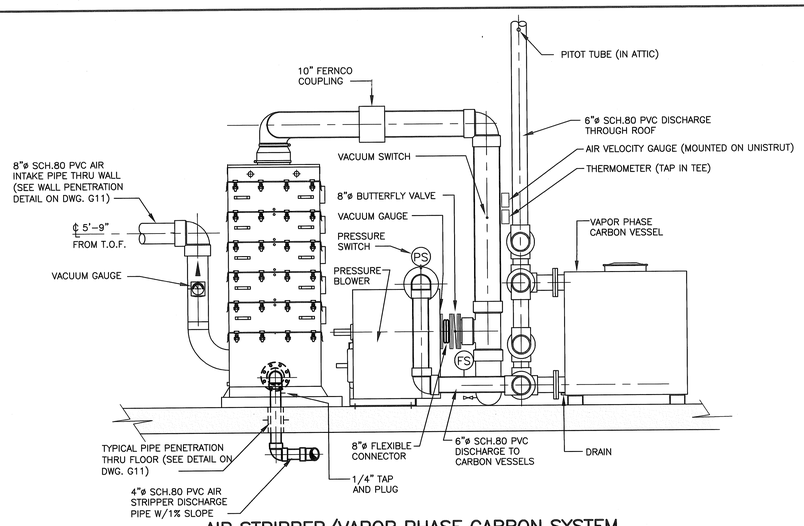
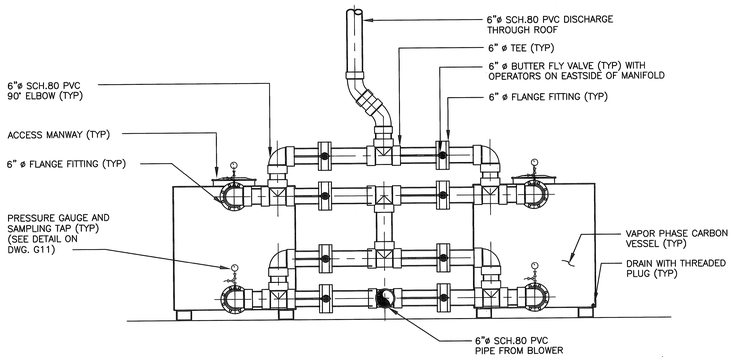


AIR STRIPPER/VAPOR PHASE CARBON SYSTEM SECTION

(ELEVATION VIEW) 1 / G8 | G10

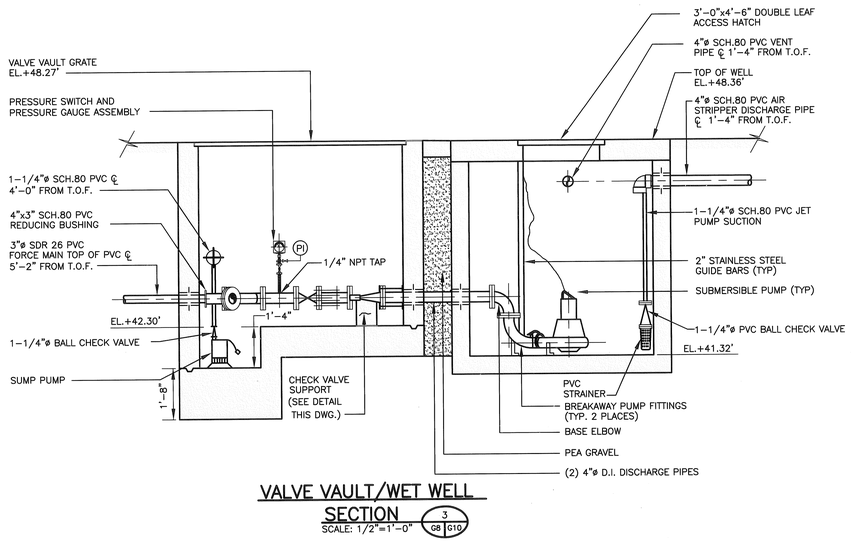
NOTE: PRESSURE BLOWER DRIVE GUARD NOT SHOWN



VAPOR PHASE CARBON MANIFOLD SECTION

(ELEVATION VIEW) 2 / G8 | G10

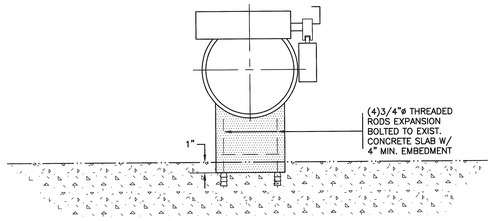
SCALE: 1/2"=1'-0"



VALVE VAULT/WET WELL SECTION

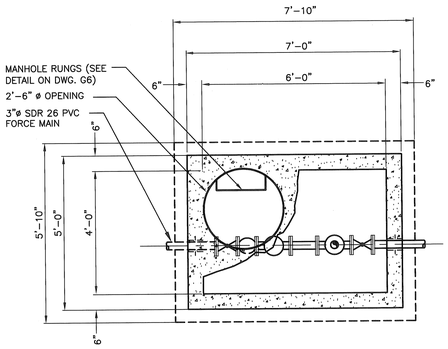
SCALE: 1/2"=1'-0" 3 / G8 | G10

NOTE: FLOAT SWITCH ASSEMBLIES NOT SHOWN



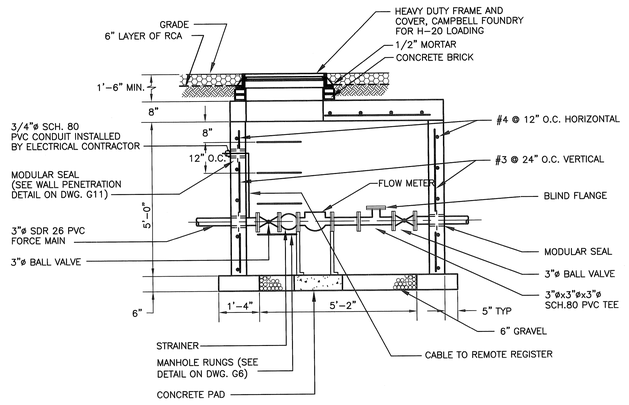
CHECK VALVE SUPPORT DETAIL

N.T.S



FLOW METER VAULT PLAN (WITHOUT MANHOLE COVER)

SCALE: 1/2"=1'-0"



FLOW METER VAULT SECTION

SCALE: 1/2"=1'-0"

PROJECT RECORD

NO.	DATE	REVISION	INT.
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STATE OF NEW YORK · ANNE M. FUNDA · No. 075927 · LICENSED PROFESSIONAL ENGINEER

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WAYNE, NEW JERSEY

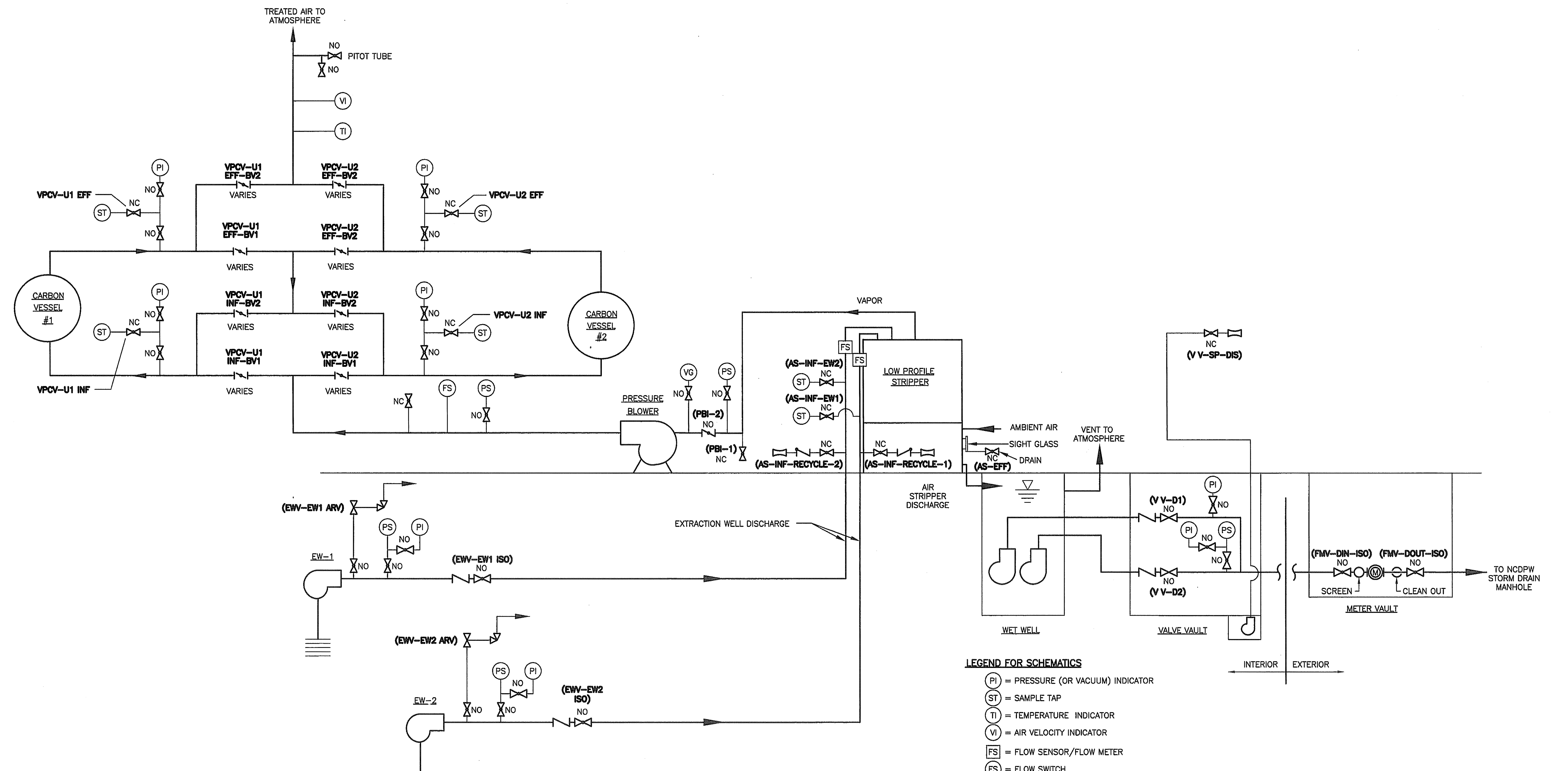
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

MECHANICAL SECTIONS, SCHEMATICS AND FLOW METER VAULT

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G10

WED, FEB 14, 2001 03:40 P AC - (\1640\DR_DESIGN\1640-11.DWG)

K:\Cad\E2w04592 (FRANKLIN CLEANERS)\FRANKLIN CLEANERS\AS BUILT SEPT 30, 2003\1640-G10.dwg, 06/08/2004 12:50:16 PM



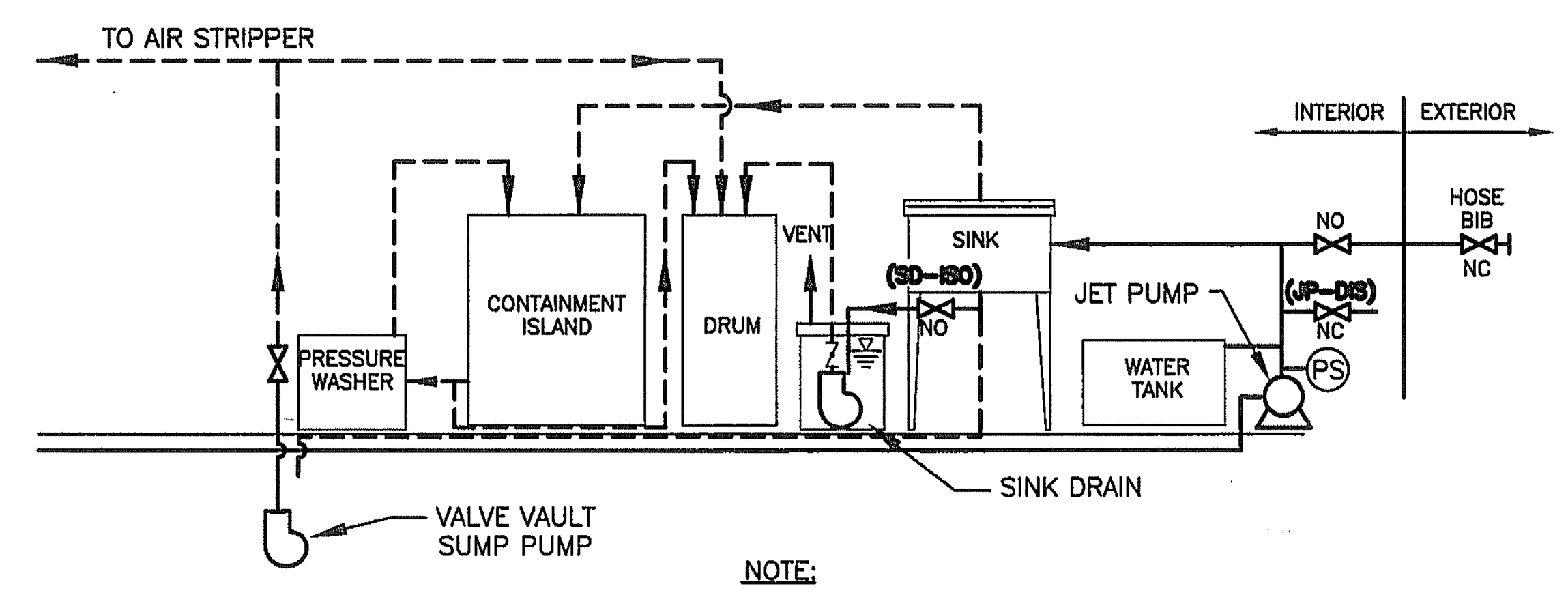
TREATMENT SYSTEM SCHEMATIC

LEGEND FOR SCHEMATICS

- (PI) = PRESSURE (OR VACUUM) INDICATOR
- (ST) = SAMPLE TAP
- (TI) = TEMPERATURE INDICATOR
- (VI) = AIR VELOCITY INDICATOR
- [FS] = FLOW SENSOR/FLOW METER
- (FS) = FLOW SWITCH
- (PS) = PRESSURE (OR VACUUM) SWITCH
- ——— RIGID PIPING
- — — — HOSE

CARBON VESSEL VALVE POSITION SCHEDULE

	CARBON VESSEL NO.1				CARBON VESSEL NO.2			
UNIT OPERATIONS	VPCV-U1-INF-BV1	VPCV-U1-INF-BV2	VPCV-U1-EFF-BV1	VPCV-U1-EFF-BV2	VPCV-U2-INF-BV1	VPCV-U2-INF-BV2	VPCV-U2-EFF-BV1	VPCV-U2-EFF-BV2
SERIES FLOW FROM CARBON VESSEL NO. 1 TO CARBON VESSEL NO. 2	OPEN	CLOSE	OPEN	CLOSE	CLOSE	OPEN	CLOSE	OPEN
SERIES FLOW FROM CARBON VESSEL NO. 2 TO CARBON VESSEL NO. 1	CLOSE	OPEN	CLOSE	OPEN	OPEN	CLOSE	OPEN	CLOSE
ISOLATION OF CARBON VESSEL NO. 1	OPEN	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
ISOLATION OF CARBON VESSEL NO. 2	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	OPEN
PARRALELL FLOW FROM CARBON VESSEL NO. 1 TO CARBON VESSEL NO. 2	OPEN	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE	OPEN



NOTE:
ALL FITTINGS, ADAPTERS AND COUPLINGS ARE FURNISHED AND INSTALLED AS REQUIRED TO PROVIDE WATERTIGHT HOSE CONNECTIONS TO THE EQUIPMENT AS SHOWN IN THE SCHEMATIC

SCHEMATIC FOR UTILITY SINK, CONTAINMENT ISLAND AND RELATED EQUIPMENT

VALVE SCHEDULE

VAPOR						
ID	size	type	MOC	Position	SERVICE	Location
N/A	1"	ball	BM	NO	Vapor/Liquid - EW1	EW1 air relief isolation
N/A	1"	ball	BM	NO	Vapor/Liquid - EW2	EW2 air relief isolation
EWV-EW1-ARV	1"	air relief	BM	NO	Vapor/Liquid - EW1	EW1 air relief
EWV-EW2-ARV	1"	air relief	BM	NO	VaporLiquid - EW2	EW2 air relief
PBI-1	1/4"	ball	SS	NC	Vapor/Liquid - drain	Blower suction - header pipe drain
N/A	1/4"	ball	SS	NO	Vapor - instrumentation	Blower suction vacuum gauge
N/A	1/4"	ball	SS	NO	Vapor - instrumentation	Blower suction - vacuum switch
N/A	1/4"	ball	SS	NO	Vapor - instrumentation	Blower discharge - pressure switch
N/A	1"	ball	PVC	NO	Vapor - instrumentation	Blower discharge - extra
PBI-2	8"	Butterfly	PVC	N0	Vapor- Discharge	Blower suction
VPCV-U1-INF-BV1	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 1 Inlet 1
VPCV-U1-INF-BV2	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 1 Inlet 2
VPCV-U2-INF-BV1	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 2 Inlet 1
VPCV-U2-INF-BV2	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 2 Inlet 2
VPCV-U1-EFF-BV1	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 1 Discharge 1
VPCV-U1-EFF-BV2	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 1 Discharge 2
VPCV-U2-EFF-BV1	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 2 Discharge 1
VPCV-U2-EFF-BV2	6"	Butterfly	PVC	See Valve Position Schedule	Vapor- Discharge	VPC manifold Unit 2 Discharge 2
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 1 Inlet sample/gauge iso.
VPCV-U1-INF	1/4"	ball	SS	NC	Vapor	VPC Unit 1 Inlet sample tap.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 1 Inlet gauge iso.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 1 Outlet sample/gauge iso.
VPCV-U1-EFF	1/4"	ball	SS	NC	Vapor	VPC Unit 1 Outlet sample tap.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 1 Outlet gauge iso.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 2 Inlet sample/gauge iso.
VPCV-U2-INF	1/4"	ball	SS	NC	Vapor	VPC Unit 2 Inlet sample tap.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 2 Inlet gauge iso.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 2 Outlet sample/gauge iso.
VPCV-U2-EFF	1/4"	ball	SS	NC	Vapor	VPC Unit 2 Outlet sample tap.
N/A	1/4"	ball	SS	NO	Vapor	VPC Unit 2 Outlet gauge iso.
N/A	1/8"	ball	BRASS	NO	Vapor	Pitot tube high
N/A	1/8"	ball	BRASS	NO	Vapor	Pitot tube low

LIQUID						
ID	size	type	MOC	Position	SERVICE	Location
N/A	2"	Ball Check	PVC	--	Liquid - un-Treated	EW1 vault
N/A	2"	Ball Check	PVC	--	Liquid - un-Treated	EW2 vault
EWV-EW1-ISO	2"	Ball Valve	PVC	NO	Liquid - un-Treated	EW1 vault
EWV-EW2-ISO	2"	Ball Valve	PVC	NO	Liquid - un-Treated	EW2 vault
N/A	1/4"	ball	SS	NO	Liquid - un-Treated	EW1- PI isolation
N/A	1/4"	ball	SS	NO	Liquid - un-Treated	EW2- PI isolation
N/A	1/4"	ball	SS	NO	Liquid - un-Treated	EW1- PS isolation
N/A	1/4"	ball	SS	NO	Liquid - un-Treated	EW2- PS isolation
AS-INF-RECYCLE-1	1 1/4"	Ball	PVC	NC	Liquid - un-Treated	AS recycle #1
AS-INF-RECYCLE-2	1 1/4"	Ball	PVC	NC	Liquid - un-Treated	AS recycle #2
AS-INF-EW1	1/4"	ball	SS	NC	Liquid - un-Treated	AS/EW #1 sample tap
AS-INF-EW2	1/4"	ball	SS	NC	Liquid - un-Treated	AS/EW #2 sample tap
AS-EFF	3/4"	ball	SS	NC	Liquid - Treated	AS sight glass drain
VV-D1	4"	Gate	DI	NO	Liquid - Treated Water	Valve Vault - Pump 1 discharge
VV-D2	4"	Gate	DI	NO	Liquid - Treated Water	Valve Vault - Pump 2 discharge
N/A	4"	swing check	DI	--	Liquid - Treated Water	Valve Vault - Pump 1 discharge
N/A	4"	swing check	DI	--	Liquid - Treated Water	Valve Vault - Pump 2 discharge
N/A	1/4"	ball	SS	NO	Liquid - Treated Water	Valve vault - PI/PS iso
SD-ISO	1 1/2"	ball	PVC	NO	Liquid - Treated Water	West Wall
JP-DIS	3/4"	ball	PVC	NC	Liquid - Treated Water	West Wall
VV-SP-DIS	1 1/4"	ball	PVC	NC	Liquid - Treated Water	South Wall
FMV-DIN-ISO	3"	ball	PVC	NO	Liquid - Treated Water	Meter Vault
FMW-DOUT-ISO	3"	ball	PVC	NO	Liquid - Treated Water	Meter Vault

PROJECT RECORD

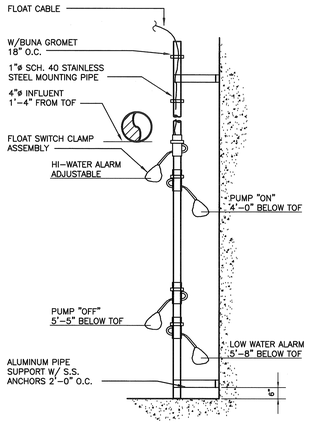
NO.	DATE	REVISION	INT.
1	11/4/02	ORIGINAL DRAWINGS BY DVIRKA AND BARTILUCCI—REVISED BY URS	
2	10/9/03	AS-BUILT	
3	MAY 2004	FINAL AS-BUILT	

URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

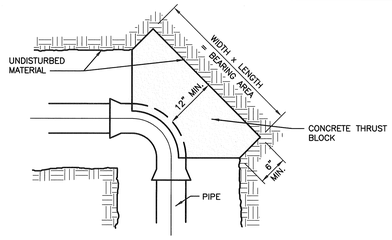
SCHEMATICS AND VALVE SCHEDULE

PROJECT NO. 807260
DATE: MAY 2004
SCALE: NONE
DRAWING NO. G10A



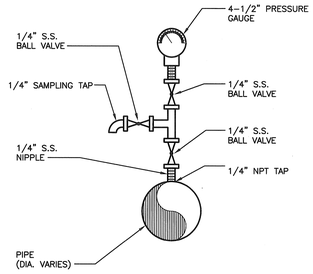
WET WELL PUMP FLOAT CONTROL DETAIL
N.T.S.

THRUST BLOCK BEARING AREA REQUIRED IN SQUARE FEET						
PIPE SIZE	FITTING TYPE					
	11-1/4°	22-1/2°	45°	90°	TEE	WYE
2"	0.30	0.30	0.30	0.60	0.30	–
3"	0.60	0.60	0.60	1.2	0.60	–

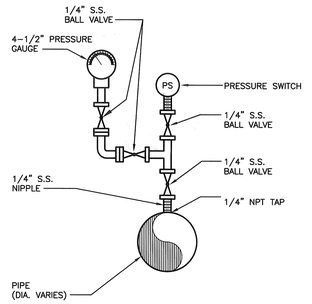


NOTE: THRUST BLOCKS HAVE BEEN PROVIDED PER SPECIFICATIONS AT ALL CHANGES IN DIRECTION HORIZONTAL OR VERTICAL AND ALL OTHER POINTS REQUIRING RESISTANCE TO PRESSURE.

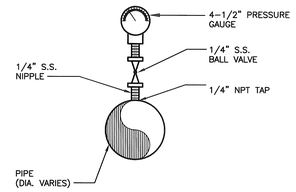
CONCRETE THRUST BLOCK
N.T.S.



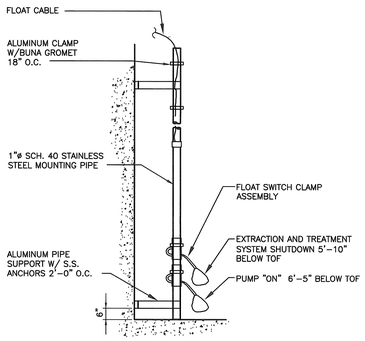
TYPICAL PRESSURE GAUGE SAMPLE TAP ASSEMBLY DETAIL
N.T.S.



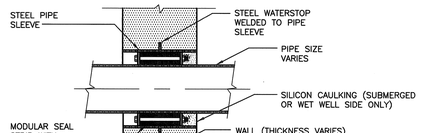
TYPICAL PRESSURE GAUGE PRESSURE SWITCH DETAIL
N.T.S.



TYPICAL PRESSURE GAUGE MOUNTING DETAIL
N.T.S.



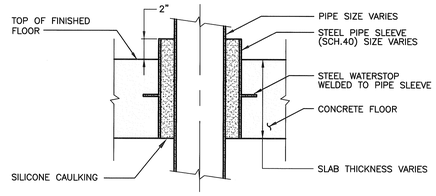
VALVE VAULT SUMP FLOAT DETAIL
N.T.S.



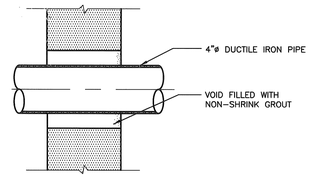
NOTE: MODULAR SEAL STRIP PLACED SO THAT BOLTS CAN BE ADJUSTED DURING NORMAL OPERATION.

TYPICAL PIPE PENETRATION THRU WALL
N.T.S.

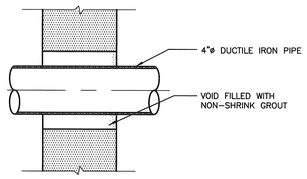
(USE FOR ALL NEW WALL PENETRATIONS)



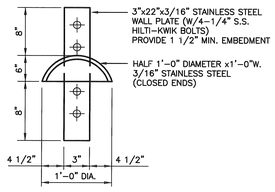
TYPICAL PIPE PENETRATION THRU FLOOR
N.T.S.

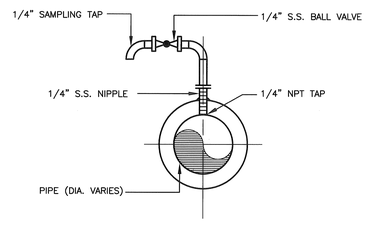


VALVE VAULT DUCTILE IRON PIPE PENETRATION
N.T.S.

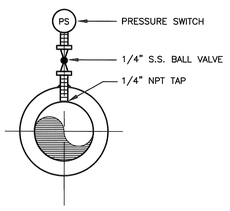


WET WELL DISCHARGE PIPE PENETRATION
N.T.S.

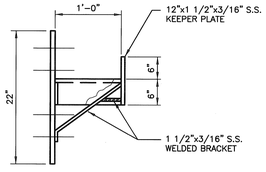




TYPICAL SAMPLE TAP ASSEMBLY
N.T.S.

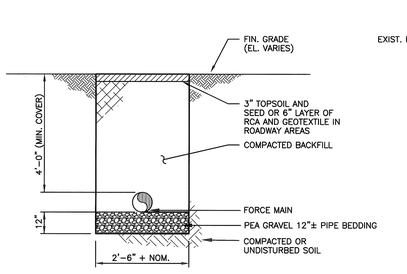


TYPICAL PRESSURE SWITCH ASSEMBLY DETAIL
N.T.S.

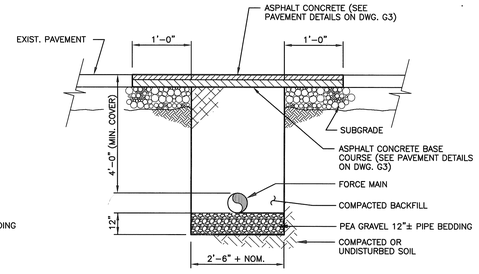


HOSE REEL DETAIL
N.T.S.

(LOCATE 3'-0" A.F.F. AS SHOWN ON DRAWING G8)



IN UNPAVED AND ROADWAY AREAS



IN EXISTING PAVED AREAS

PROJECT RECORD

NO.	DATE	REVISION	INT.
1	11/4/02	ORIGINAL DRAWINGS BY DVIRKA AND BARTILUCCI-REVISED BY URS	
2	10/9/03	AS-BUILT	
3	MAY 2004	FINAL AS-BUILT	

STATE OF NEW YORK ANNE H. FUNG 076251 LICENSED PROFESSIONAL ENGINEER

"THESE AS-BUILT DRAWINGS ARE BEING CERTIFIED SOLELY FOR COMPLIANCE WITH THE CONSTRUCTION DRAWINGS AND APPROVED CHANGES. URS IS CERTIFYING THAT THE AS-BUILT DIMENSIONS ARE NOMINAL AND WITHIN THE CONTRACT TOLERANCES."

URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

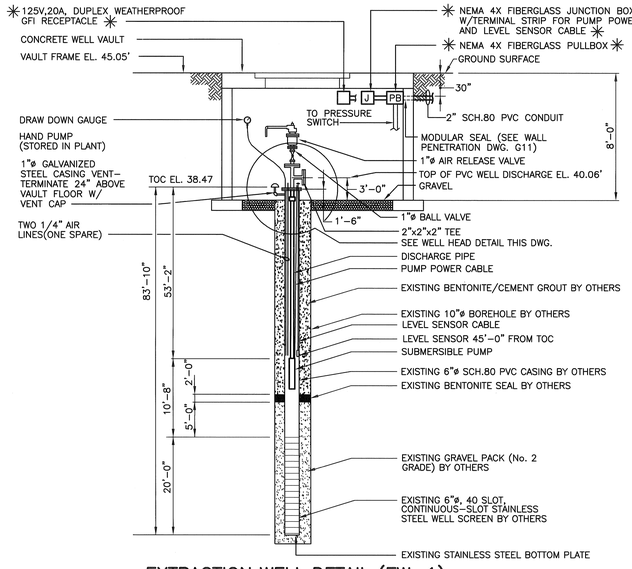
MECHANICAL DETAILS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: N.T.S.
DRAWING NO. G11

TUE, FEB 20, 2001 08:33 A KC G:\1640\DW_DESIGN\1640-12.DWG

K:\Cadd\2e04592 (FRANKLIN CLEANERS)\FRANKLIN CLEANERS\AS BUILT SEPT 30, 2003\1640-G11.dwg, 06/08/2004 12:32:16 PM

PROJECT RECORD



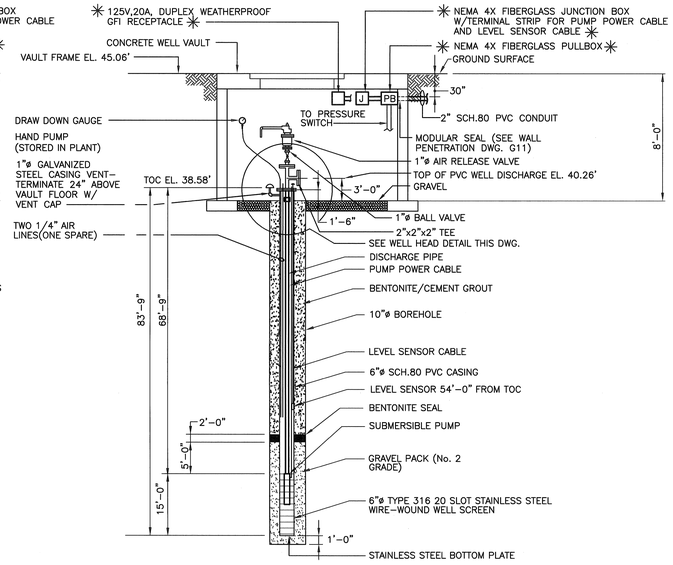
EXTRACTION WELL DETAIL (EW-1)

N.T.S.

NOTE: PIPING INSIDE WELL VAULT NOT SHOWN.

NOTE: EXTRACTION WELL NO.1 INSTALLED BY OTHERS, TOP OF SCREEN AND DEPTH TO BOTTOM ELEVATIONS AND DIMENSIONS OBTAINED FROM ENGINEERS DRAWINGS.

✳ FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR

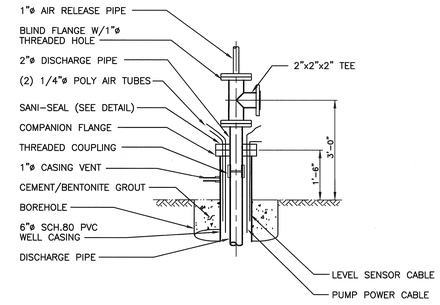


EXTRACTION WELL DETAIL (EW-2)

N.T.S.

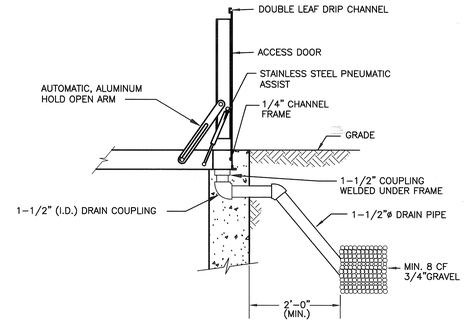
NOTE: PIPING INSIDE WELL VAULT NOT SHOWN.

✳ FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR



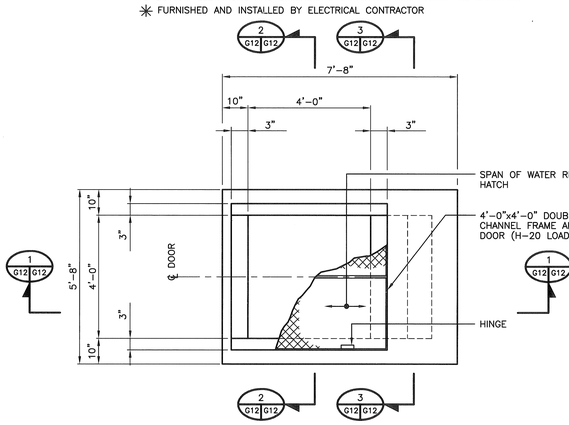
WELL HEAD DETAIL

N.T.S.



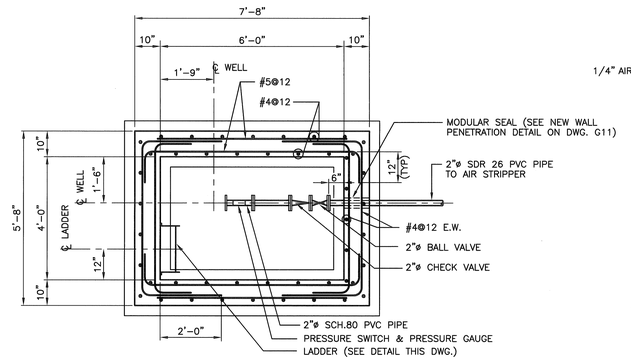
ACCESS HATCH DRAIN DETAIL

N.T.S.



TOP PLAN - WELL VAULT

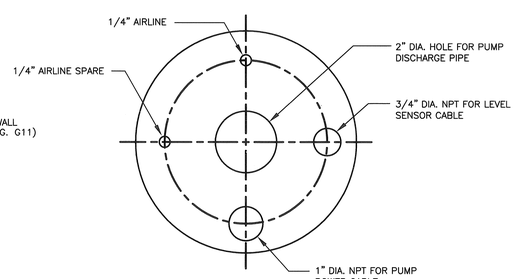
SCALE: 1/2"=1'-0"



SECTIONAL PLAN - WELL VAULT

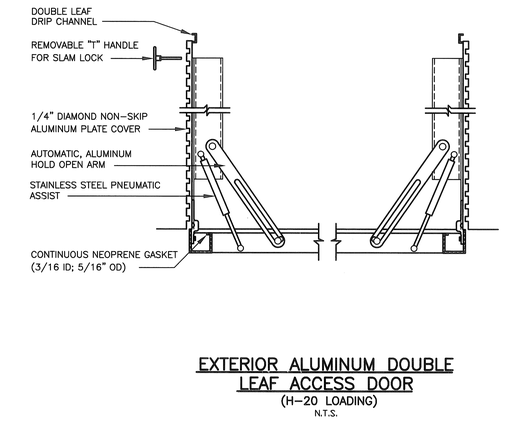
SCALE: 1/2"=1'-0"

NOTE: WELL HEAD ASSEMBLY NOT SHOWN.



WELL HEAD 6" SANITARY SEAL DETAIL

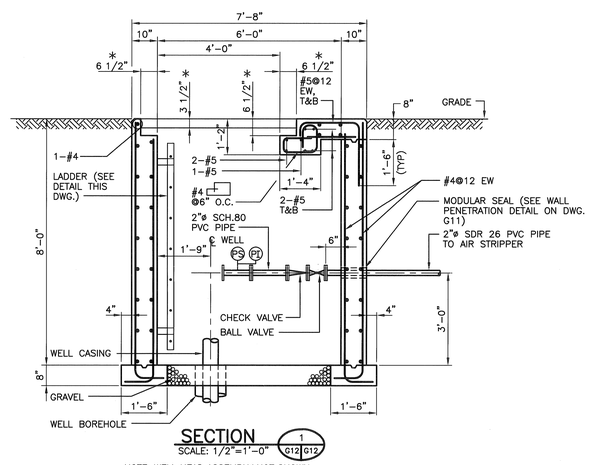
N.T.S.



EXTERIOR ALUMINUM DOUBLE LEAF ACCESS DOOR

(H-20 LOADING)

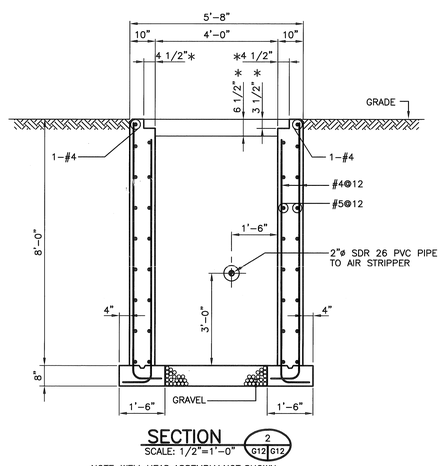
N.T.S.



SECTION

SCALE: 1/2"=1'-0" (1 G12 G12)

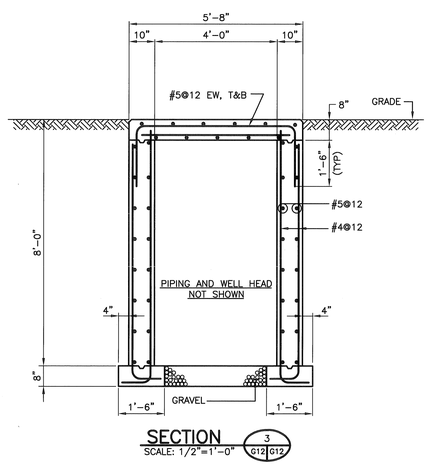
NOTE: WELL HEAD ASSEMBLY NOT SHOWN.



SECTION

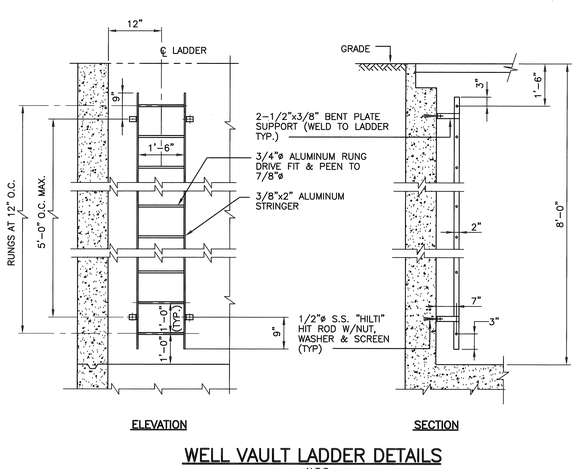
SCALE: 1/2"=1'-0" (2 G12 G12)

NOTE: WELL HEAD ASSEMBLY NOT SHOWN.



SECTION

SCALE: 1/2"=1'-0" (3 G12 G12)



ELEVATION SECTION

WELL VAULT LADDER DETAILS

N.T.S.

NO.	DATE	REVISION	INT.
1	11/4/02	ORIGINAL DRAWINGS BY DVIRKA AND BARTILUCCI-REVISED BY URS	
2	10/9/03	AS-BUILT	
3	MAY 2004	FINAL AS-BUILT	

STATE OF NEW YORK · ANNE H. FUNG · LICENSED PROFESSIONAL ENGINEER · NO. 075937

"THESE AS-BUILT DRAWINGS ARE BEING CERTIFIED SOLELY FOR COMPLIANCE WITH THE CONSTRUCTION DRAWINGS AND APPROVED CHANGES. URS IS CERTIFYING THAT THE AS-BUILT DIMENSIONS ARE NOMINAL AND WITHIN THE CONTRACT TOLERANCES."

URS
WAYNE, NEW JERSEY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004264

EXTRACTION WELLS, WELL VAULT PLAN, SECTIONS AND DETAILS

PROJECT NO. 807260
DATE: MAY 2004
SCALE: AS NOTED
DRAWING NO. G12

WED, FEB 14, 2001 04:05 P. K:\C... G:\1640\DWG\JACKSON\1640-WELLS.DWG

K:\Cadd\2e04592 (FRANKLIN CLEANERS)\FRANKLIN CLEANERS\AS BUILT SEPT 30, 2003\1640-G12.dwg, 06/08/2004 12:19:27 PM

RECORD DRAWING OF WORK AS BUILT

This document has been reviewed, coordinated and checked in detail for accuracy of content and for compliance with the Contract Drawing.

Date_____

Contractor J.K. ELECTRIC CO. INC.

Signed_____

CONDUIT AND CABLE SCHEDULE

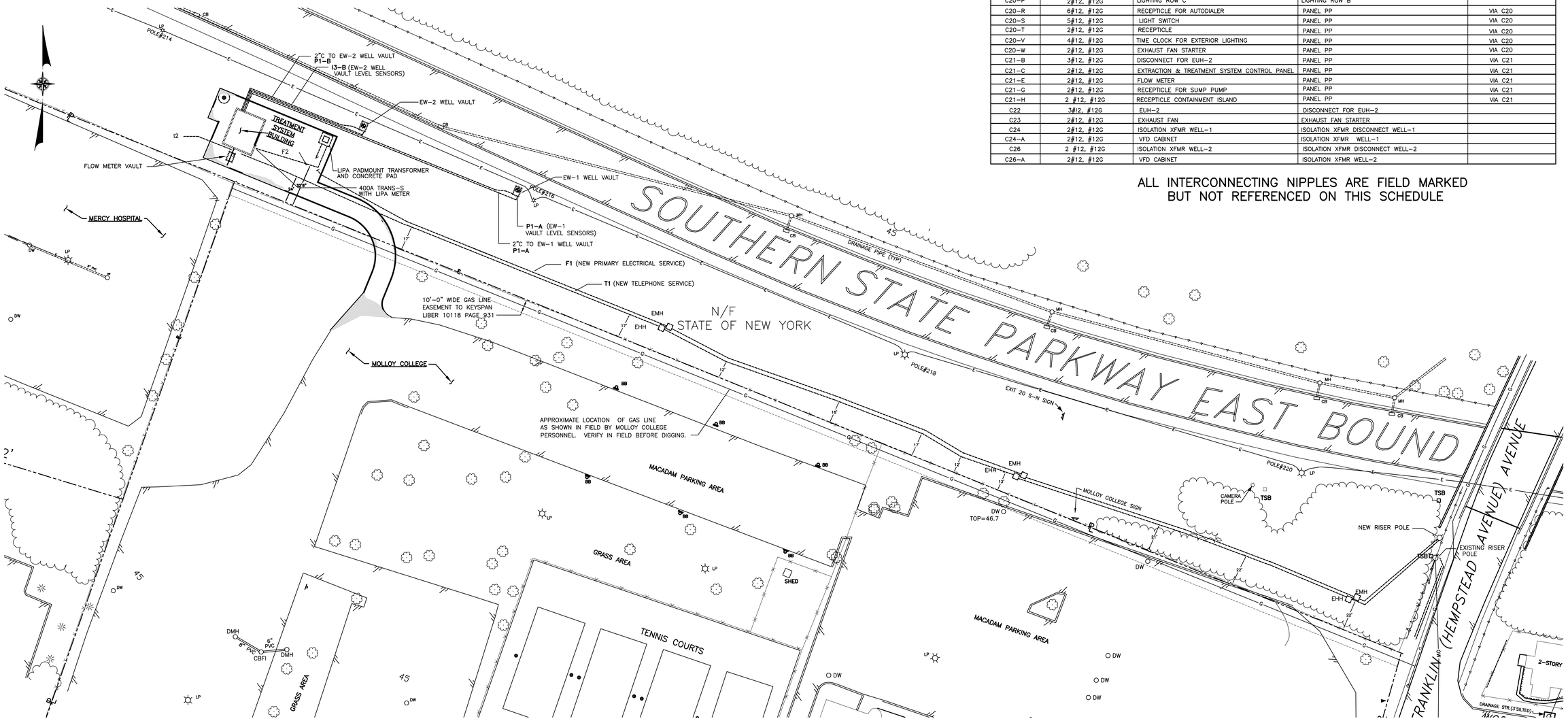
CONDUIT NUMBER	CABLE	FROM	TO	REMARKS
F1	3#2 AL	RISER POLE	LIPA PADMOUNT TRANSFORMER	PRIMARY ELECTRICAL SERVICE
F2	4–500KCMIL	LIPA PADMOUNT TRANSFORMER	POWER PANEL PP	208Y/120 SECONDARY SERVICE
T1	DRAG LINE	RISER POLE	TELEPHONE SERVICE TERMINAL	
T2	CAT–5	TELEPHONE SERVICE TERMINAL	TELEPHONE PULL BOX	
T3	CAT–5	TELEPHONE PULL BOX	TELEPHONE	
T4	4#14	EXTRACTION AND TREATMENT SYSTEM CONTROL PANEL	TELEPHONE PULL BOX	
P1	6#12, #12G	VFD CABINET	OUTDOOR PULL BOX	
P1–A	5#12 ,#12G	OUTDOOR PULL BOX	JUNCTION BOX IN EW–1 WELL VAULT	
P1–B	5#12 ,#12G	OUTDOOR PULL BOX	JUNCTION BOX IN EW–2 WELL VAULT	
P3	3#2, #8G	BLOWER	RVSS MOTOR STARTER FOR BLOWER	
P4	FLOAT SWITCH CABLES	FLOAT SWITCHES IN WET WELL	SUBMERSIBLE PUMP CONTROL PANEL;	
P5	PUMP CABLES	SUBMERSIBLE PUMPS #1 & 2	SUBMERSIBLE PUMP CONTROL PANEL	
I1	2–3/c #18 SHIELDED	FLOW SENSORS	FLOW INDICATOR/TRANSMITTER	
I2	FLOW METER CABLE	FLOW METER IN VAULT	FLOW REGISTER IN TREATMENT BLDG.	
I3	2–3c #18 SHIELDED	EXTERIOR PULL BOX	EXTRACTION AND TREATMENT SYSTEM CONTROL PANEL	
I3A	1–3c #18 SHIELDED	EXTERIOR PULL BOX	JUNCTION BOX FOR LEVEL PROBE IN EW–1	
I3B	2–3c #18 SHIELDED	EXTERIOR PULL BOX	JUNCTION BOX FOR LEVEL PROBE IN EW–2	
A2–A	2#14	DOOR SWITCHES	TELEPHONE PULL BOX	VIA A2
A2–C	2#14	DOOR SWITCHES	TELEPHONE PULL BOX	VIA A2
A2–D	2#14	SUBMERSIBLE PUMP CONTROL PANEL	TELEPHONE PULL BOX	VIA A2
A4	2#14	EXHAUST FAN THERMOSTAT	EXHAUST FAN STARTER	

ALL INTERCONNECTING NIPPLES ARE FIELD MARKED BUT NOT REFERENCED ON THIS SCHEDULE

CONDUIT AND CABLE SCHEDULE

CONDUIT NUMBER	CABLE	FROM	TO	REMARKS
C1–A	10#14	VFD CABINET	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C1
C1–B	4#14	OUTDOOR PULL BOX	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C1
C4–A	2#14	FLOW INDICATOR/TRANSMITTER	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C4
C4–B	2#14	FLOW SWITCH IN STRIPPER PUMP	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C4
C5–A	2#14	PRESSURE SWITCH–BLOWER DISCHARGE	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C5
C5–B	2#14	PRESSURE SWITCH–BLOWER DISCHARGE	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C5
C5–C	2#14	FLOW SWITCH ON BLOWER DISCHARGE	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	VIA C5
C6	4#14	SUBMERSIBLE PUMP CONTROL PANEL	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	
C13–B	2#12, #12G	JET PUMP STARTER	PANEL PP	VIA C13
C13–C	2#12, #12G	RECEPTICLE	PANEL PP	VIA C13
C13–D	2#14	SUBMERSIBLE PUMP CONTROL PANEL	JET PUMP STARTER	VIA C13–A & B
C14	2#12, 2#14, #12G	JET PUMP	JET PUMP STARTER	11704
C15	4#14	TERMINAL CABINET FOR FLOW/PRESSURE SWITCHES	EXTRACTION AND TREATMENT SYSTEM CONTROL PANEL	11704
C15–A	4#14	FLOW AND PRESSURE SWITCHES	TERMINAL CABINET FOR FLOAT/PRESSURE SWITCHES	11704
C16–B	2#12, #12G	RECEPTICLE	PANEL PP	VIA C16
C16–D	3#12,#12G	VFD CABINET	PANEL PP	VIA C16
C16–E	2#12, #12G	RECEPTICLE	PANEL PP	VIA C16
C16–G	2#12, #12G	ISOLATION XFMR DISCONNECT WELL–1	PANEL PP	VIA C16
C16–H	2#12, #12G	ISOLATION XFMR DISCONNECT WELL–2	PANEL PP	VIA C16
C17–A	3#10, #10G	SUBMERSIBLE PUMP CONTROL PANEL	PANEL PP	VIA C17
C17–B	3#12, #12G	DISCONNECT FOR EUH–2	PANEL PP	VIA C17
C17–C	3#12, #12G	EUH–2	DISCONNECT FOR EUH–2	VIA C17–B
C18	3–1/0,#6G	POWER WASHER RECEPTICLE	PANEL PP	
C19	3#2, #8G	RVSS MOTOR STARTER FOR BLOWER	PANEL PP	
C20–C		PULL BOX	PANEL PP	VIA C20
C20–D	2#12, #12G	EXIT LIGHT	PULL BOX	
C20–E	2#12, #12G	EMERGENCY LIGHT	PULL BOX	
C20–F	2#12, #12G	EXTERIOR LIGHT OVER ENTRANCE DOOR	TIMER	VIA C20–V
C20–G	2#12, #12G	EXTERIOR WALL PACKS	TIMER	VIA C20–V
C20–I	2#12, #12G	FLOURESENT FIX. AT FRONT DOOR	LIGHT SWITCH	VIA C20–S
C20–K	2#12, #12G	EMERGENCY LIGHT	LIGHT SWITCH	VIA C20–S
C20–L	2#12, #12G	LIGHTING ROW A	FLOURESENT FIX AT FRONT DOOR	VIA C20–J&L
C20–M	2#12, #12G	EMERGENCY LIGHT	LIGHTING ROW A	VIA C20–J
C20–O	2#12, #12G	LIGHTING ROW B	LIGHTING ROW A	VIA C20–N&I
C20–P	2#12, #12G	LIGHTING ROW C	LIGHTING ROW B	
C20–R	6#12, #12G	RECEPTICLE FOR AUTODIALER	PANEL PP	VIA C20
C20–S	5#12, #12G	LIGHT SWITCH	PANEL PP	VIA C20
C20–T	2#12, #12G	RECEPTICLE	PANEL PP	VIA C20
C20–V	4#12, #12G	TIME CLOCK FOR EXTERIOR LIGHTING	PANEL PP	VIA C20
C20–W	2#12, #12G	EXHAUST FAN STARTER	PANEL PP	VIA C20
C21–B	3#12, #12G	DISCONNECT FOR EUH–2	PANEL PP	VIA C21
C21–C	2#12, #12G	EXTRACTION & TREATMENT SYSTEM CONTROL PANEL	PANEL PP	VIA C21
C21–E	2#12, #12G	FLOW METER	PANEL PP	VIA C21
C21–G	2#12, #12G	RECEPTICLE FOR SUMP PUMP	PANEL PP	VIA C21
C21–H	2 #12, #12G	RECEPTICLE CONTAINMENT ISLAND	PANEL PP	VIA C21
C22	3#12, #12G	EUH–2	DISCONNECT FOR EUH–2	
C23	2#12, #12G	EXHAUST FAN	EXHAUST FAN STARTER	
C24	2#12, #12G	ISOLATION XFMR WELL–1	ISOLATION XFMR DISCONNECT WELL–1	
C24–A	2#12, #12G	VFD CABINET	ISOLATION XFMR WELL–1	
C26	2 #12, #12G	ISOLATION XFMR WELL–2	ISOLATION XFMR DISCONNECT WELL–2	
C26–A	2#12, #12G	VFD CABINET	ISOLATION XFMR WELL–2	

ALL INTERCONNECTING NIPPLES ARE FIELD MARKED BUT NOT REFERENCED ON THIS SCHEDULE



NO.	DATE	REVISION	INT.

PROJECT ENGINEER: | DRAWN BY:

DESIGNED BY: | CHECKED BY:

J.K. ELECTRIC CO. INC.
374 NEPTUNE AVE.
NORTH BABYLON NEW YORK
11704

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004275

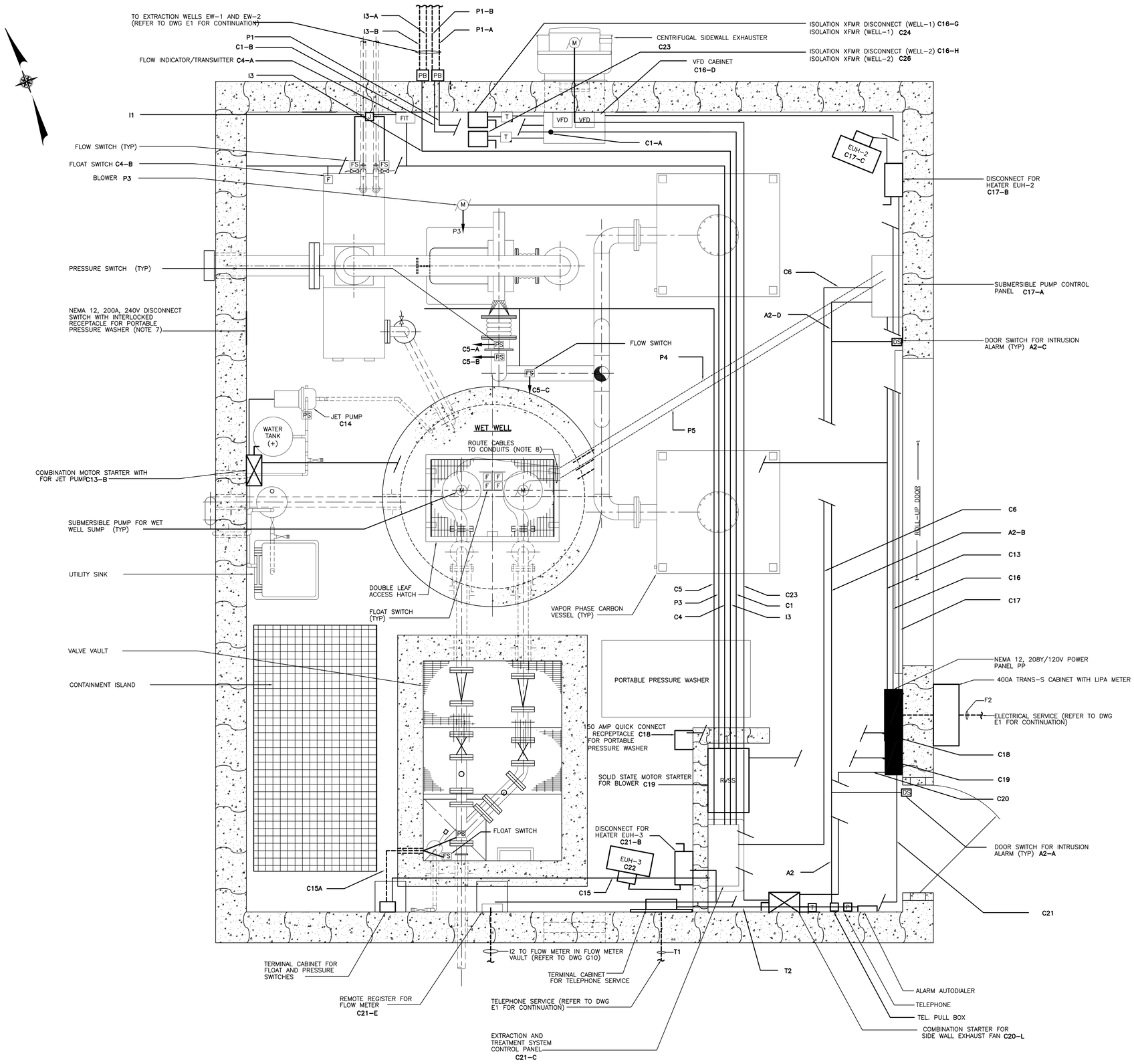
ELECTRICAL SITE PLAN
AS–BUILTS

PROJECT NO.

DATE: SEPTEMBER 2003

SCALE: 1"=30'

DRAWING NO. **E1**



RECORD DRAWING OF WORK AS BUILT

This document has been reviewd, coordinated and checked in detail for accuracy of content and for compliance with the Contract Drawing.

Date _____

Contractor J.K. ELECTRIC CO. INC.

Signed _____

NO.	DATE	REVISION	INT.

PROJECT ENGINEER: | DRAWN BY:

DESIGNED BY: | CHECKED BY:

J.K. ELECTRIC CO. INC.
374 NEPTUNE AVE.
NORTH BABYLON NEW YORK
11704

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004275

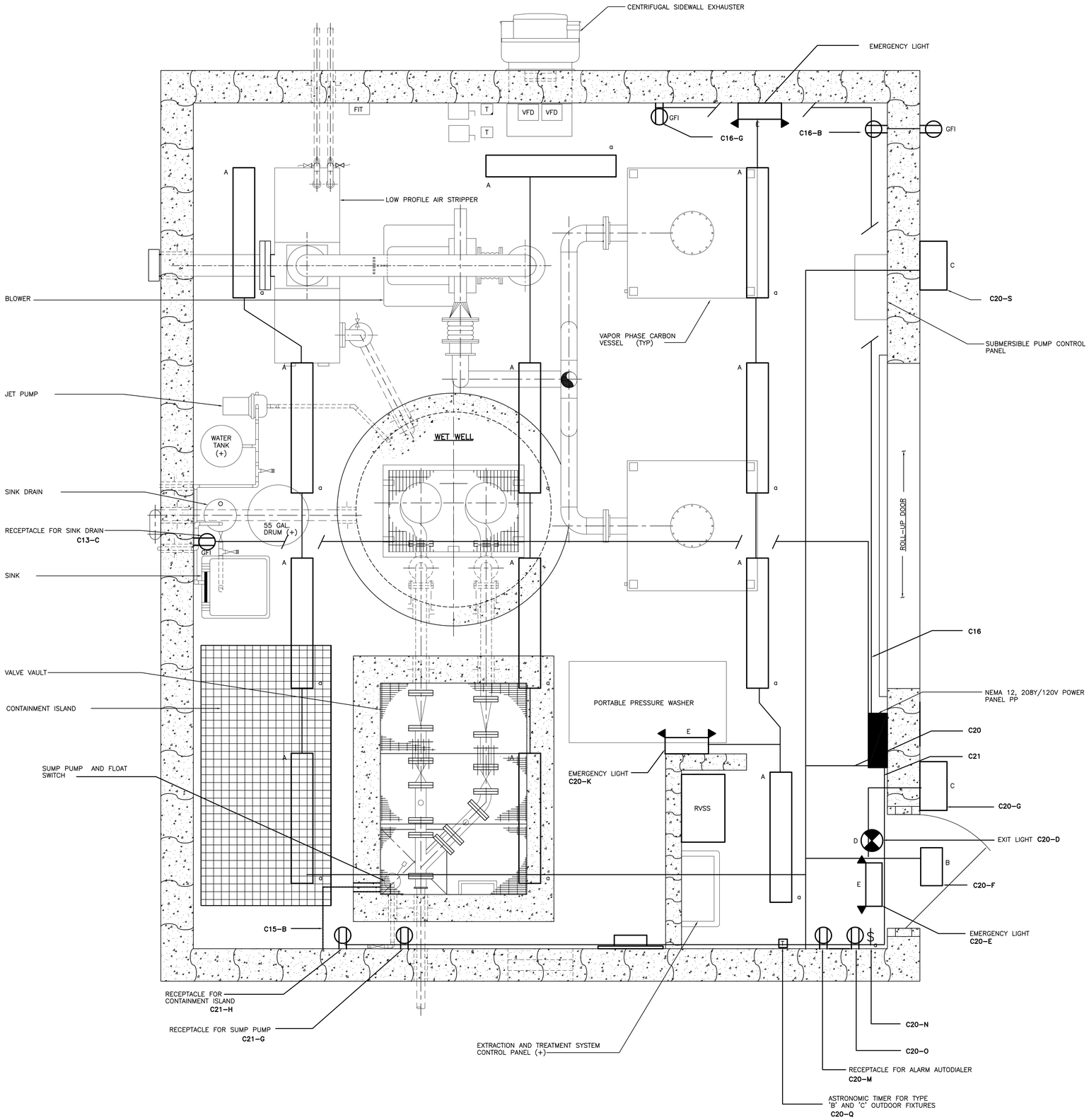
ELECTRICAL POWER AND CONTROL PLAN AS-BUILT

PROJECT NO.

DATE: SEPTEMBER 2003

SCALE: 3/4" = 1'-0"

DRAWING NO. **E2**



RECORD DRAWING OF WORK AS BUILT

This document has been reviewd, coordinated and checked in detail for accuracy of content and for compliance with the Contract Drawing.

Date_____

Contractor J.K. ELECTRIC CO. INC.

Signed_____

NO.	DATE	REVISION	INT.

PROJECT ENGINEER: | DRAWN BY:

DESIGNED BY: | CHECKED BY:

J.K. ELECTRIC CO. INC.
374 NEPTUNE AVE.
NORTH BABYLON NEW YORK
11704

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

FRANKLIN CLEANERS SITE

GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004275

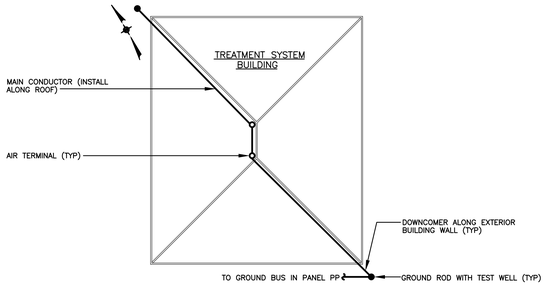
ELECTRICAL LIGHTING PLAN AS-BUILT

PROJECT NO.

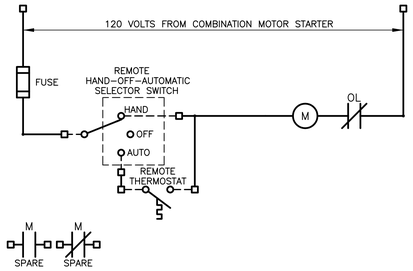
DATE: SEPTEMBER 2003

SCALE: 3/4" = 1'-0"

DRAWING NO. **E3**

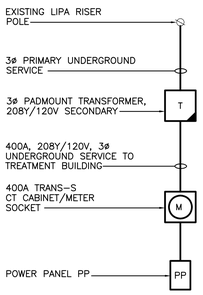


LIGHTNING PROTECTION SYSTEM PLAN



WIRING DIAGRAM NO. 1

CENTRIFUGAL SIDEWALL EXHAUSTER

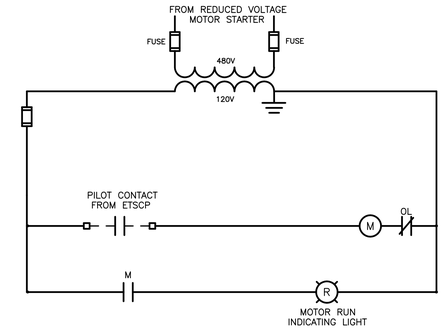


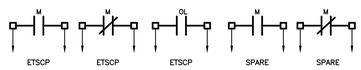
SINGLE LINE DIAGRAM

N.T.S.

POWER PANEL – PP						
CKT NO.	DEVICE POLE	DEVICE TRIP	LOAD DESIGNATION	LOAD H.P.	LOAD KVA	FEEDER
1	2	30	VFD – WELL PUMP EW-1	2		2#10, #10G – 3/4"C
3	–	–				
5	1	25	JET PUMP	3/4		2#10, #10G – 3/4"C
7	3	30	SUBMERSIBLE PUMP CONTROL PANEL	2@3		3#10, #10G– 3/4"C
9	–	–				
11	–	–				
13	3	20	UNIT HEATER UH-1		5	3#12, #12G – 3/4"C
15	–	–				
17	–	–				
19	3	20	UNIT HEATER UH-3		5	3#12, #12G – 3/4"C
21	–	–				
23	–	–				
25	3	150	PORTABLE PRESSURE WASHER		39	3-1/0, #6G –2"C
27	–	–				
29	–	–				
31	1	20	INTERIOR LIGHTING		1.2	2#10, #12G – 3/4"C
33	1	20	EXTERIOR AREA LIGHTING		.5	2#12, #12G – 3/4"C
35	1	20	INTERIOR RECEPTACLES		.5	2#12, #12G – 3/4"C
37	1	20	RECEPTACLE – WELL EW-1		.3	2#12, #12G – (NOTE 2)
39	1	–	SPACE			
41	1	–	SPACE			
2	2	30	VFD – WELL PUMP EW-2	2		3#12, #12G-3/4"C
4	–	–				
6	1	20	RECEPTACLE – SINK DRAIN	1/3		2#12, #12G – 3/4"C
8	3	100	BLOWER	20		3#2, #8G-1 1/4"C
10	–	–				
12	–	–				
14	3	20	UNIT HEATER UH-2		5	3#12, #12G – 3/4"C
16	–	–				
18	–	–				
20	1	20	EXTRACTION & TREATMENT SYST CP		.5	2#12, #12G – 3/4"C
22	1	20	ALARM AUTODIALER		.1	2#12, #12G – 3/4"C
24	1	20	SIDEWALL EXHAUST FAN	1/3		2#12, #12G – 3/4"C
26	1	20	RECEPTACLE – WELL EW-2		.3	2#12, #12G – NOTE 2
28	1	20	RECEPTACLE – CONTAINMENT ISLAND		.3	2#12, #12G – 3/4"C
30	1	20	EXTERIOR DOORWAY LIGHTING		.1	2#12, #12G – 3/4"C
32	1	20	RECEPTACLE – SUMP PUMP	1/2		
34	1	20	SPACE			
36	1	–	SPACE			
38	1	–	SPACE			
40	1	–	SPACE			
42	1	–	SPACE			

MAIN BUSS: 400A **TYPE:** BOLT-ON **MOUNTING:** SURFACE
MAIN: 400A CB **VOLTS:** 208Y/120 **AIC(SYM):** 22,000
FEEDER: F2 **PHASE:** 3PH, 4W+GND **EST. CONN KVA:** 90

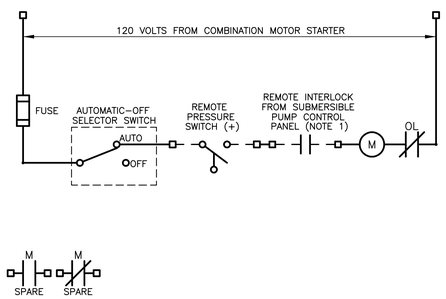




WIRING DIAGRAM NO.2

BLOWER

NOTES:
1. MOTOR STARTER FOR BLOWER IS REDUCED VOLTAGE, SOLID STATE TYPE.
2. ETSCP = EXTRACTION AND TREATMENT SYSTEM CONTROL PANEL.



WIRING DIAGRAM NO. 3

JET PUMP

NOTE:
1. INTERLOCK TO SHUT DOWN JET PUMP UPON SUBMERSIBLE PUMP OFF LEVEL.

RECORD DRAWING OF WORK AS BUILT

This document has been reviewd, coordinated and checked in detail for accuracy of content and for compliance with the Contract Drawing.

Date_____

Contractor J.K. ELECTRIC CO. INC.

Signed_____

NO.	DATE	REVISION	INT.

J.K. ELECTRIC CO. INC.
374 NEPTUNE AVE
NORTH BABYLON
NEW YORK 11704

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FRANKLIN CLEANERS SITE
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
CONTRACT D004275

MISCELLANEOUS ELECTRICAL DETAILS AS BUILT

DATE: MAY 2004
SCALE: N.T.S.

DRAWING NO. **E4**

APPENDIX B

INSTITUTIONAL CONTROL/ENGINEERING CONTROL EVALUATION FORM

Enclosure 1
Engineering Controls - Standby Consultant/Contractor Certification Form

Site Details **Box 1**

Site No. 130050

Site Name Franklin Cleaners

Site Address: 206-208 B, South Franklin Street Zip Code: 11550
City/Town: Hempstead
County: Nassau
Site Acreage: 0.1

Reporting Period: May 01, 2016 to May 01, 2017

	YES	NO
1. Is the information above correct?	☐	☐
If NO, include handwritten above or on a separate sheet.		
2. To your knowledge has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period?	☐	☐
3. To your knowledge has there been any change of use at the site during this Reporting Period (see 6NYCRR 375-1.11(d))?	☐	☐
4. To your knowledge have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period?	☐	☐
If you answered YES to questions 2 thru 4, include documentation or evidence that documentation has been previously submitted with this certification form.		
5. To your knowledge is the site currently undergoing development?	☐	☐

Box 2

	YES	NO
6. Is the current site use consistent with the use(s) listed below? Unrestricted, Residential, Restricted-Residential, Commercial, and Industrial	☐	☐
7. Are all ICs/ECs in place and functioning as designed?	☐	☐

IF THE ANSWER TO EITHER QUESTION 6 OR 7 IS NO, sign and date below and contact the DEC PM regarding the development of a Corrective Measures Work Plan to address these issues.

_____ _____
Signature of Standby Consultant/Contractor Date

SITE NO. 130050 **Box 3**

Description of Institutional Controls

Parcel	Owner	Institutional Control
34.-366-292	Stephen Gregoretti	Monitoring Plan Site Management Plan O&M Plan

Site Management Plan - July 2012
SPDES Equivalency - December 2016

Box 4

Description of Engineering Controls

Parcel	Engineering Control
34.-366-292	Groundwater Treatment System Groundwater Containment Alternate Water Supply Vapor Mitigation

Onsite:
Two (2) sets of paired sub-slab soil vapor extraction points in the basement of the former cleaner location (currently operating as a delicatessen).

Offsite:
A groundwater extraction and treatment system (GWE&TS) extracts groundwater from two (2) extraction points (EW-1 and EW-2) at approximatley 40 gpm combined. Contaminated groundwater is conveyed to and treated in a shallow-tray air stripper (3 trays operating). Volatle organic compounds are volatilized and directly vented to the ambient air. Treated groundwater is pumped to a storm sewer network. The GWE&TS is anticipated to operate for up to 20 years.

A groundwater monitoring well network includes seven (7) observation wells (ASMW-1 through ASMW-7).

MCOL-1 was constructed as an irrigation well for use by Molloy College, replacing a shallow irrigation well that had the potential to draw from contaminated groundwater.

Box 5

Periodic Review Report (PRR) Certification Statements

1. I certify by checking "YES" below that:

   a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the certification, including data and material prepared by previous contractors for the current certifying period, if any;

   b) 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 generally accepted engineering practices; and the information presented is accurate and compete.

YES	NO
☐	☐

2. If this site has an IC/EC Plan (or equivalent as required in the Decision Document), for each Institutional or Engineering control listed in Boxes 3 and/or 4, I certify by checking "YES" below that all of the following statements are true:

   (a) the Institutional Control and/or Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

   (b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

   (c) nothing has occurred that would constitute a failure to comply with the Site Management Plan, or equivalent if no Site Management Plan exists.

YES	NO
☐	☐

IF THE ANSWER TO QUESTION 2 IS NO, sign and date below and contact the DEC PM regarding the development of a Corrective Measures Work Plan to address these issues.

_____ _____

Signature of Standby Consultant/Contractor Date

Enclosure 2

Certification Instructions

I. Verification of Site Details (Box 1 and Box 2):

Answer the "YES/NO" questions in the Verification of Site Details Section. The Engineering Standby Contractor may include handwritten changes and/or other supporting documentation, as necessary.

II. Certification of Institutional Controls/ Engineering Controls (Boxes 3, 4, and 5)

1. Review the listed IC/ECs, confirming that all existing controls are listed, and that all existing controls are still applicable. If there is a control that is no longer applicable the Engineering Standby Contractor should petition the Department separately to request approval to remove the control.

2. In Box 5, complete certifications for all Plan components, as applicable, by checking the corresponding checkbox.

3. If you cannot certify "YES" for each Control listed in Box 3 & Box 4, sign and date the form in Box 5. Attach supporting documentation that explains why the **Certification** cannot be rendered. The DEC PM should be contacted to begin development of a plan of proposed corrective measures and an associated schedule for completing the corrective measures, including detailed cost information in a proposed budget. Note that this **Certification** form must be submitted even if an IC or EC cannot be certified

If the Department concurs with the explanation, the proposed corrective measures, and the proposed schedule and budget, a letter authorizing the implementation of those corrective measures will be issued by the Department's Project Manager. Once the corrective measures are complete, a revised Periodic Review Report (with a signed IC/EC Certification) must be submitted which covers both the period for which a certification initially could not be provided and the ensuing time period until the correction measure was completed. This revised PRR should be submitted within 45 days after completion of the corrective measures to the Department. If the Department has any questions or concerns regarding the PRR and/or completion of the IC/EC Certification, the Project Manager will contact you.

III. IC/EC Certification by Signature (Box 6**):**

Where the site has Institutional and Engineering Controls, the certification statement in Box 6 must be completed by a Professional Engineer or Qualified Environmental Professional, as noted on the form.

If you certified "YES" for each Institutional and Engineering Control, please complete and sign the IC/EC Certification page.

IV. Certification Form Modifications

Changes to the Certification Form shall be discussed with the Project Manager prior to submission. Any approved changes must be made on the Certification Form provided by Site Control and supporting documentation or reasoning shall be attached.

Enclosure 3
Periodic Review Report (PRR) General Guidance

I. Executive Summary: (1/2-page or less)
   A. Provide a brief summary of site, nature and extent of contamination, and remedial history.
   B. Effectiveness of the Remedial Program - Provide overall conclusions regarding;
      1. progress made during the reporting period toward meeting the remedial objectives for the site
      2. the ultimate ability of the remedial program to achieve the remedial objectives for the site.
   C. Compliance
      1. Identify any areas of non-compliance regarding the major elements of the Site Management Plan (SMP, i.e., the Institutional/Engineering Control (IC/EC) Plan, the Monitoring Plan, and the Operation & Maintenance (O&M) Plan).
      2. Propose steps to be taken and a schedule to correct any areas of non-compliance.
   D. Recommendations
      1. recommend whether any changes to the SMP are needed
      2. recommend any changes to the frequency for submittal of PRRs (increase, decrease)
      3. recommend whether the requirements for discontinuing site management have been met.

II. Site Overview (one page or less)
   A. Describe the site location, boundaries (figure), significant features, surrounding area, and the nature and extent of contamination prior to site remediation.
   B. Describe the chronology of the main features of the remedial program for the site, the components of the selected remedy, cleanup goals, site closure criteria, and any significant changes to the selected remedy that have been made since remedy selection.

III. Evaluate Remedy Performance, Effectiveness, and Protectiveness

   Using tables, graphs, charts and bulleted text to the extent practicable, describe the effectiveness of the remedy in achieving the remedial goals for the site. Base findings, recommendations, and conclusions on objective data. Evaluations and should be presented simply and concisely.

IV. IC/EC Plan Compliance Report (if applicable)
   A. IC/EC Requirements and Compliance
      1. Describe each control, its objective, and how performance of the control is evaluated.
      2. Summarize the status of each goal (whether it is fully in place and its effectiveness).
      3. Corrective Measures: describe steps proposed to address any deficiencies in ICECs.
      4. Conclusions and recommendations for changes.
   B. IC/EC Certification

      The certification must be complete (even if there are IC/EC deficiencies), and certified by the appropriate party as set forth in a Department-approved certification form(s).

V. Monitoring Plan Compliance Report (if applicable)
   A. Components of the Monitoring Plan (tabular presentations preferred) - Describe the requirements of the monitoring plan by media (i.e., soil, groundwater, sediment, etc.) and by any remedial technologies being used at the site.
   B. Summary of Monitoring Completed During Reporting Period - Describe the monitoring tasks actually completed during this PRR reporting period. Tables and/or figures should be used to show all data.
   C. Comparisons with Remedial Objectives - Compare the results of all monitoring with the remedial objectives for the site. Include trend analyses where possible.
   D. Monitoring Deficiencies - Describe any ways in which monitoring did not fully comply with the monitoring plan.
   E. Conclusions and Recommendations for Changes - Provide overall conclusions regarding the monitoring completed and the resulting evaluations regarding remedial effectiveness.

VI. Operation & Maintenance (O&M) Plan Compliance Report (if applicable)

A. Components of O&M Plan - Describe the requirements of the O&M plan including required activities, frequencies, recordkeeping, etc.
B. Summary of O&M Completed During Reporting Period - Describe the O&M tasks actually completed during this PRR reporting period.
C. Evaluation of Remedial Systems - Based upon the results of the O&M activities completed, evaluated the ability of each component of the remedy subject to O&M requirements to perform as designed/expected.
D. O&M Deficiencies - Identify any deficiencies in complying with the O&M plan during this PRR reporting period.
E. Conclusions and Recommendations for Improvements - Provide an overall conclusion regarding O&M for the site and identify any suggested improvements requiring changes in the O&M Plan.

VII. Overall PRR Conclusions and Recommendations

A. Compliance with SMP - For each component of the SMP (i.e., IC/EC, monitoring, O&M), summarize;
   1. whether all requirements of each plan were met during the reporting period
   2. any requirements not met
   3. proposed plans and a schedule for coming into full compliance.
B. Performance and Effectiveness of the Remedy - Based upon your evaluation of the components of the SMP, form conclusions about the performance of each component and the ability of the remedy to achieve the remedial objectives for the site.
C. Future PRR Submittals
   1. Recommend, with supporting justification, whether the frequency of the submittal of PRRs should be changed (either increased or decreased).
   2. If the requirements for site closure have been achieved, contact the Departments Project Manager for the site to determine what, if any, additional documentation is needed to support a decision to discontinue site management.

VIII. Additional Guidance

Additional guidance regarding the preparation and submittal of an acceptable PRR can be obtained from the Departments Project Manager for the site.

APPENDIX C

SYSTEM MONITORING LOG

FRANKLIN CLEANERS SITE, NYSDEC SITE No. 130050
SYSTEM MONITORING LOG

DATE					
TIME					
EW-1					
Flow Rate (gpm)					
Total Flow (gal)					
VFD Operating Frequency (Hz)					
Pump Runtime (hrs @ time)					
Bicycle Pump Pressure Reading (psi)					
Water Column Above Pump (ft H_2O)(psi x 2.31)					
Routine Sampling Performed (YES/NO)					
EW-2					
Flow Rate (gpm)					
Total Flow (gal)					
VFD Operating Frequency (Hz)					
Pump Runtime (hrs @ time)					
Bicycle Pump Pressure Reading (psi)					
Water Column Above Pump (ft H_2O)(psi x 2.31)					
Routine Sampling Performed (YES/NO)					
Air Stripper					
Sump Level (inches)					
Effluent pH (grab sample field reading)					
Fresh Air Inlet Vacuum (in H_2O)					
Blower Suction (in H_2O)					
Blower Discharge (in H_2O)					
Blower Runtime (hrs @ time)					
Exhaust VOC Concentration (ppm)					
Exhaust Flow Rate (scfm)					
Exhaust Temperature (^oF)					
Routine Sampling Performed (YES/NO)					

FRANKLIN CLEANERS SITE, NYSDEC SITE No. 130050
SYSTEM MONITORING LOG

DATE					
TIME					
Wet Well					
Pump No. 1 Runtime (hrs)					
Pump No. 2 Runtime (hrs)					
Valve Vault					
Pump No. 1 Operating Pressure (psi)					
Pump No. 1 Flow Rate (gpm)					
Pump No. 2 Operating Pressure (psi)					
Pump No. 2 Flow Rate (gpm)					
Flow Meter Vault					
Total Flow (gallons @ time)					
Jet Pump					
Line Pressure (psi)					

COMMENTS

APPENDIX D

SPDES PERMIT EQUIVALENCY

TABLE 01651-1 Site No.: 1-30-050

Part 1, Page 1 of 1

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning February 1, 2001

and lasting until January 31, 2006

the discharges from the treatment facility to water index number HB-233, Class SC, RECEIVING WATER shall be limited and monitored by the operator as specified below:

Outfall Number and Parameter	Discharge Limitations: Daily Avg.	Daily Max.	Units	Minimum Monitoring Requirements: Measurement Frequency	Sample Type
Outfall 001 - Treated Groundwater Remediation Discharge:					
Flow	Monitor	Monitor	GPD	Continuous	Meter
pH (range)		6.5 to 8.5	SU	2/Month	Grab
Tetrachloroethene		5	ug/L	2/Month	Grab
1,1 Dichloroethene		10	ug/L	2/Month	Grab
1,1,1 Trichloroethane		10	ug/L	2/Month	Grab
Trichloroethene		10	ug/L	2/Month	Grab
cis 1,2 Dichloroethene		10	ug/L	2/Month	Grab
Iron		1.0	mg/L	2/Month	Grab
Manganese		1.0	mg/L	2/Month	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:

Chief - Operation Maintenance and Support Section
Bureau of Hazardous Site Control
Division of Environmental Remediation
NYSDEC
50 Wolf Road
Albany, NY 12233-7010

With a copy sent to:

R Schneck, Reg. 1

(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 ug/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 or biocidal-type compounds 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 attached General Conditions.

APPENDIX E

MONITORING WELL CONSTRUCTION LOGS

Dvirka and Bartlucci
CONSULTING ENGINEERS

WELL CONSTRUCTION LOG

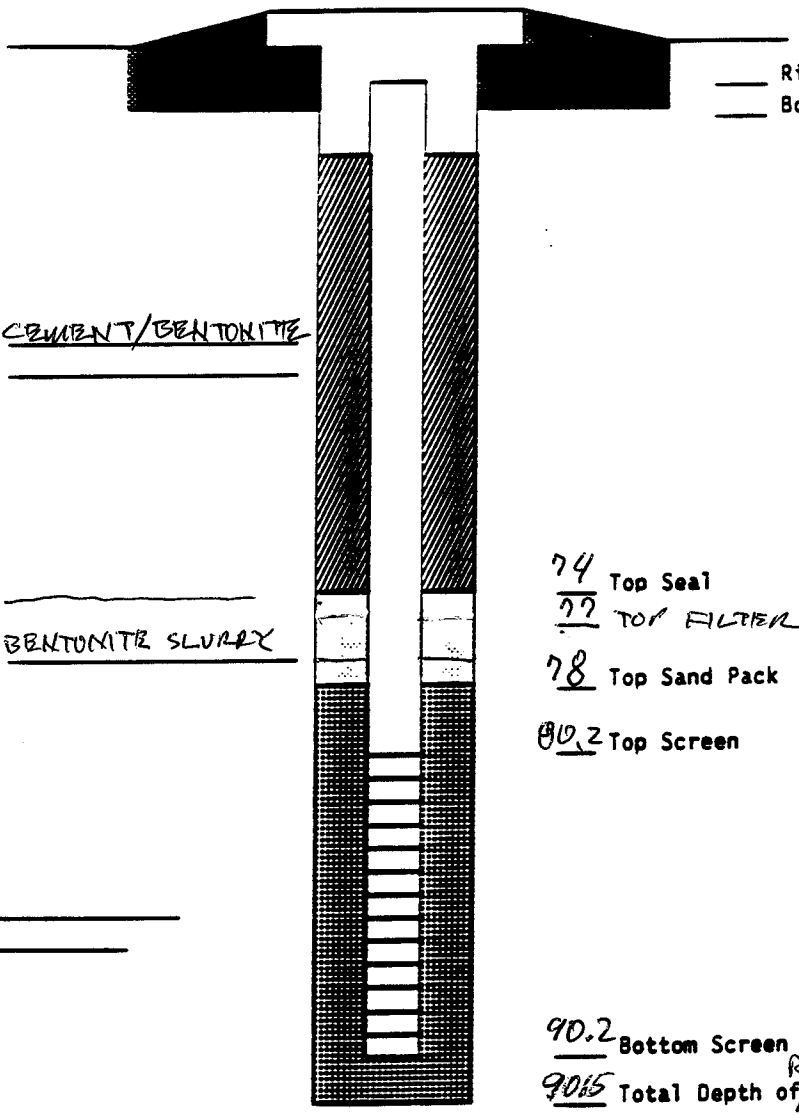
SITE FRANKLIN CLEANERS JOB NO. 1851 WELL NO. ΔSMW-1

TOTAL DEPTH 90.3 SURFACE ELEV. _____ TOP RISER ELEV. _____

WATER LEVELS (DEPTH, DATE, TIME) _____ DATE INSTALLED 5/15/03

RISER DIA 2" MATERIAL PVC LENGTH 80
SCREEN DIA 2" MATERIAL SS LENGTH 10 SLOT SIZE 020

SCHEMATIC



Surface Seal Type _____

Grout Type CEMENT/BENTONITE

FILTER SAND

Seal Type BENTONITE SLURRY

Sand Pack Type _____
Size NO. 1

Ground Surface
___ Riser Elevation
___ Bottom Surface Seal

74 Top Seal
72 TOP FILTER SAND
78 Top Sand Pack
80.2 Top Screen

90.2 Bottom Screen
9015 Total Depth of Boring

RE-DRILLED WELL

96-106 - BENTONITE GROUT

Dvirka and Bartilucci
CONSULTING ENGINEERS

WELL CONSTRUCTION LOG

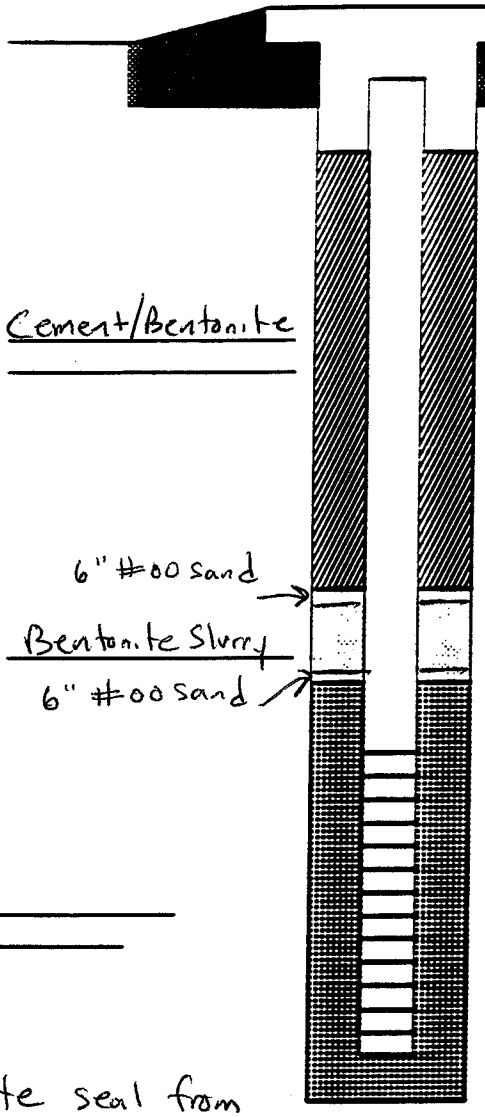
SITE Franklin Cleaners JOB NO. 1851 WELL NO. ASMW-2

TOTAL DEPTH 90' SURFACE ELEV. _____ TOP RISER ELEV. _____

WATER LEVELS (DEPTH, DATE, TIME) _____ DATE INSTALLED 2/27/03

RISER DIA 2" MATERIAL PVC LENGTH 80'
SCREEN DIA 2" MATERIAL stainless steel LENGTH 10' SLOT SIZE 020

SCHEMATIC



Surface Seal Type _____

Ground Surface
___ Riser Elevation
___ Bottom Surface Seal

Grout Type Cement/Bentonite

6" #00 Sand

Seal Type Bentonite Slurry

6" #00 Sand

72.5 Top Seal

76.5 Top Sand Pack

80' Top Screen

Sand Pack Type _____
Size #1

90 Bottom Screen

96' Total Depth of Boring

Bentonite seal from 95.5' to 93'

* split spoons taken to 98'

Dvirka and Bartlucci
CONSULTING ENGINEERS

WELL CONSTRUCTION LOG

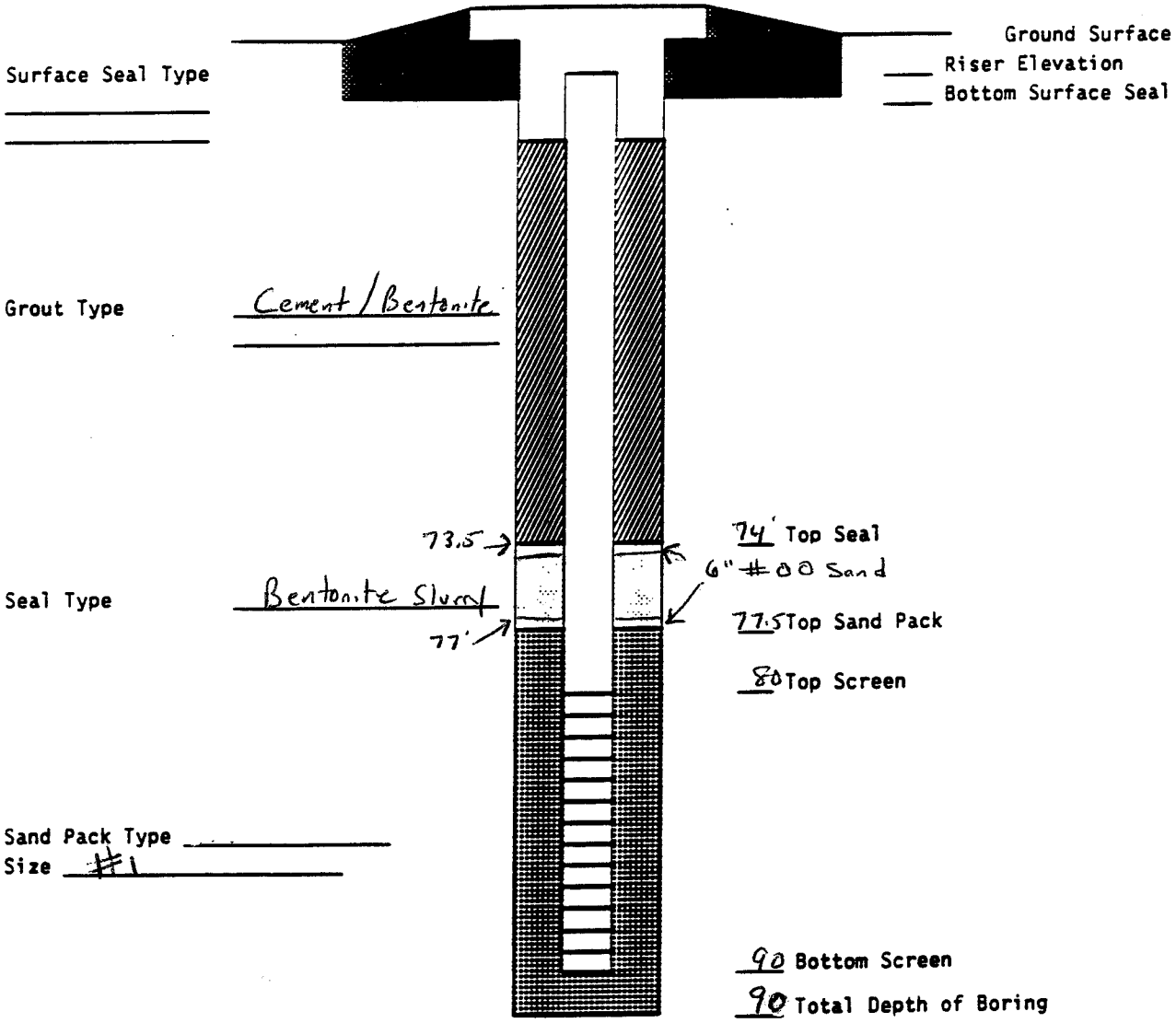
SITE Franklin Cleaners JOB NO. 1851 WELL NO. ~~1851~~ ASMW-3

TOTAL DEPTH 90 SURFACE ELEV. _____ TOP RISER ELEV. _____

WATER LEVELS (DEPTH, DATE, TIME) _____ DATE INSTALLED 3/4/03

RISER DIA 2 MATERIAL PVC LENGTH 80'
SCREEN DIA 2 MATERIAL Stainless Steel LENGTH 10' SLOT SIZE .020

SCHEMATIC



* split spoons taken to 92'

Dvirka and Bartilucci
CONSULTING ENGINEERS

WELL CONSTRUCTION LOG

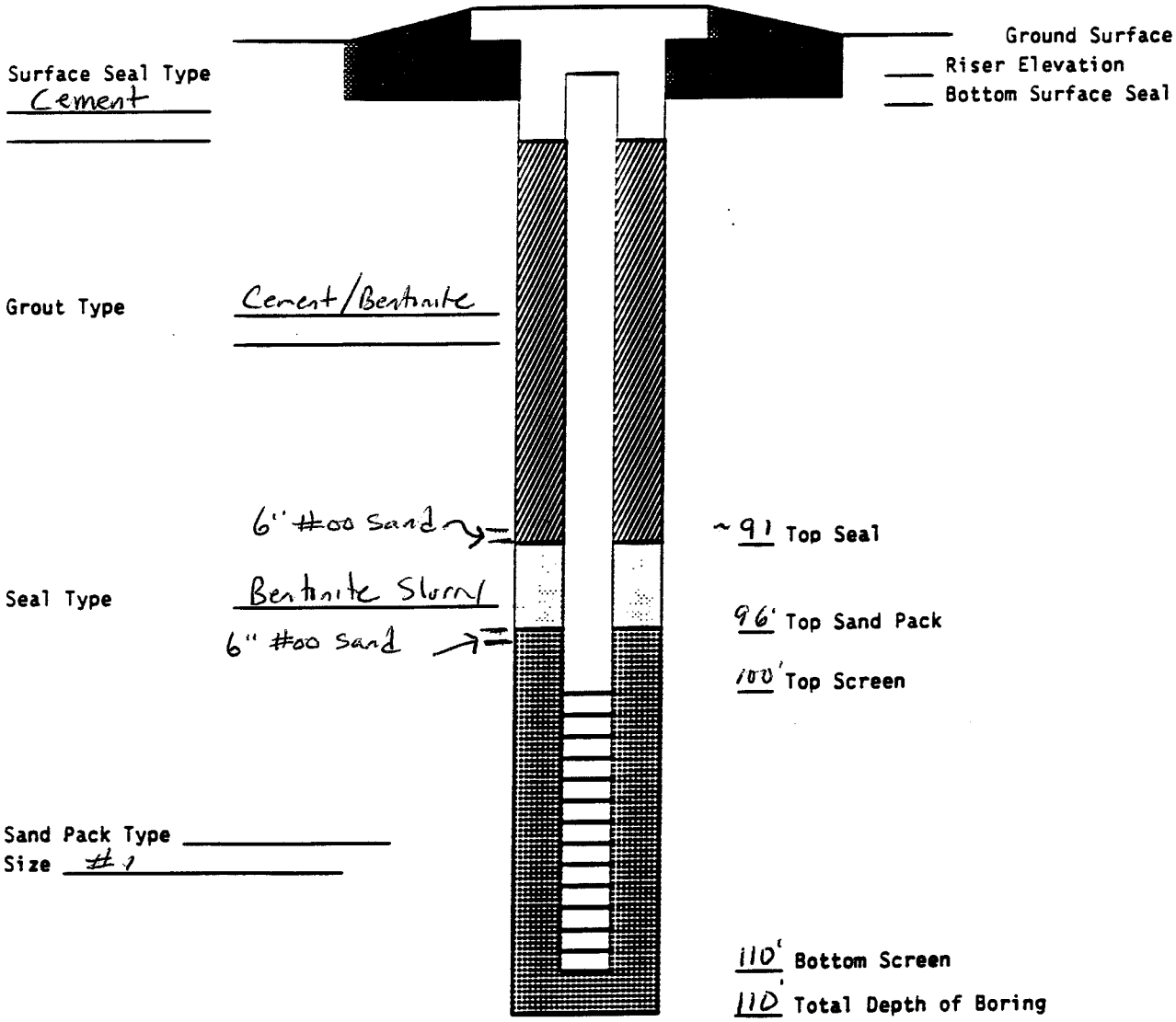
SITE Franklin Cleaners JOB NO. 1851 WELL NO. ASMW-4

TOTAL DEPTH 110' SURFACE ELEV. _____ TOP RISER ELEV. _____

WATER LEVELS (DEPTH, DATE, TIME) _____ DATE INSTALLED 2-12-03

RISER DIA 2 MATERIAL PVC LENGTH 100
SCREEN DIA 2 MATERIAL Stainless Steel LENGTH 10' SLOT SIZE 20

SCHEMATIC



Dvirka and Bartilucci CONSULTING ENGINEERS

WELL CONSTRUCTION LOG

SITE Franklin Cleaners JOB NO. 1851 WELL NO. ASMW-5

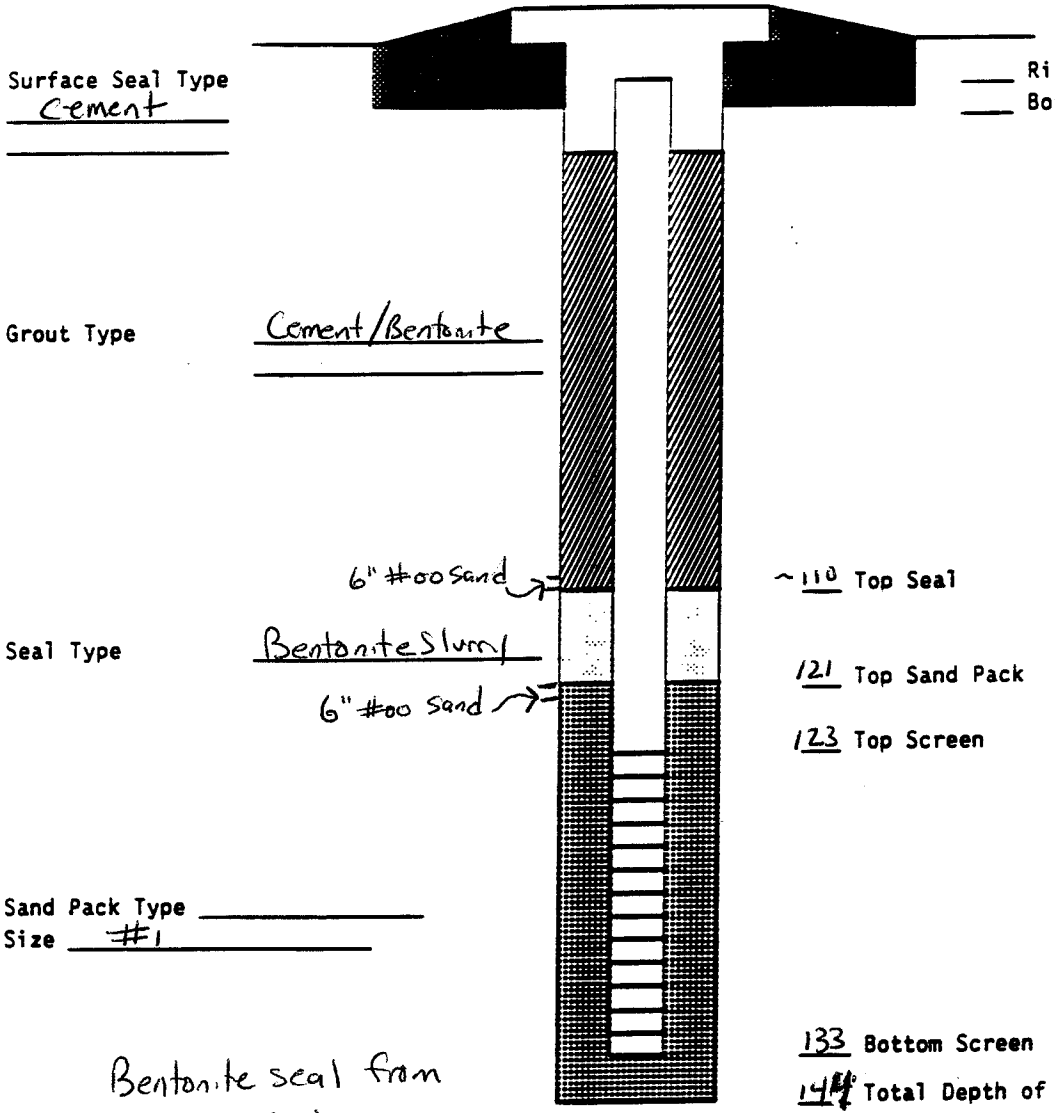
TOTAL DEPTH 133 SURFACE ELEV. _____ TOP RISER ELEV. _____

WATER LEVELS (DEPTH, DATE, TIME) _____ DATE INSTALLED 2-13-03

RISER DIA 2 MATERIAL PVC LENGTH 123'

SCREEN DIA 2 MATERIAL Stainless Steel LENGTH 10' SLOT SIZE 20

SCHEMATIC



Bentonite seal from 140' to 134'

*split spoons taken to 146'

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Well Construction Log

Site Franklin Cleaners Site Job No. 2307 Well No. ASMW-6

Total Depth 138' Surface Elevation 43.64 Top Riser Elevation 43.33

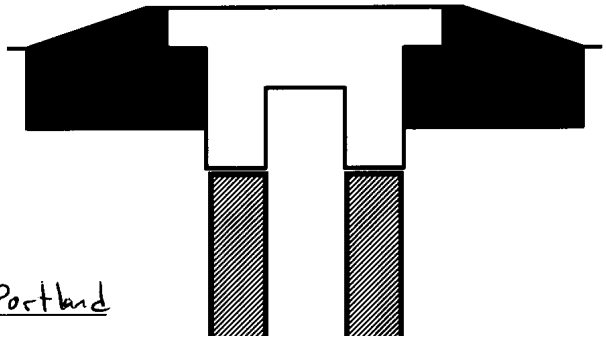
Water Levels (Depth, Date, Time) 20.30, 12/16/04, 1329 Date Installed 12/8/04

Riser Dia. 2" Material PVC Length 122'

Screen Dia. 2" Material PVC Length 10' Slot Size .020

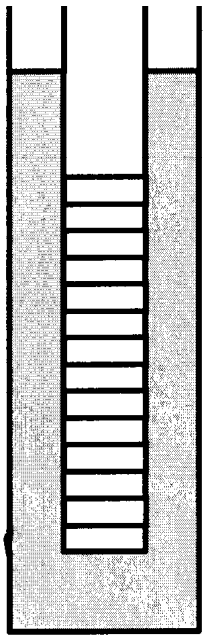
SCHEMATIC

Surface Seal Type
Cement/Flush mount well cap



Ground Surface
_____ Riser Elevation
_____ Bottom Surface Seal

Grout Type Bentonite/Portland



119' Top Sand Pack

122 Top Screen

Sand Pack Type _____
Size #1
6" #00 placed above & below bentonite seal

#1 sand 135'
Bentonite Slurry
138'

132' Bottom Screen

138' Total Depth of Boring

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Well Construction Log

Site Franklin Cleaners Site Job No. 2307 Well No. ASMW-7

Total Depth 250 Surface Elevation 43.56 Top Riser Elevation 43.21

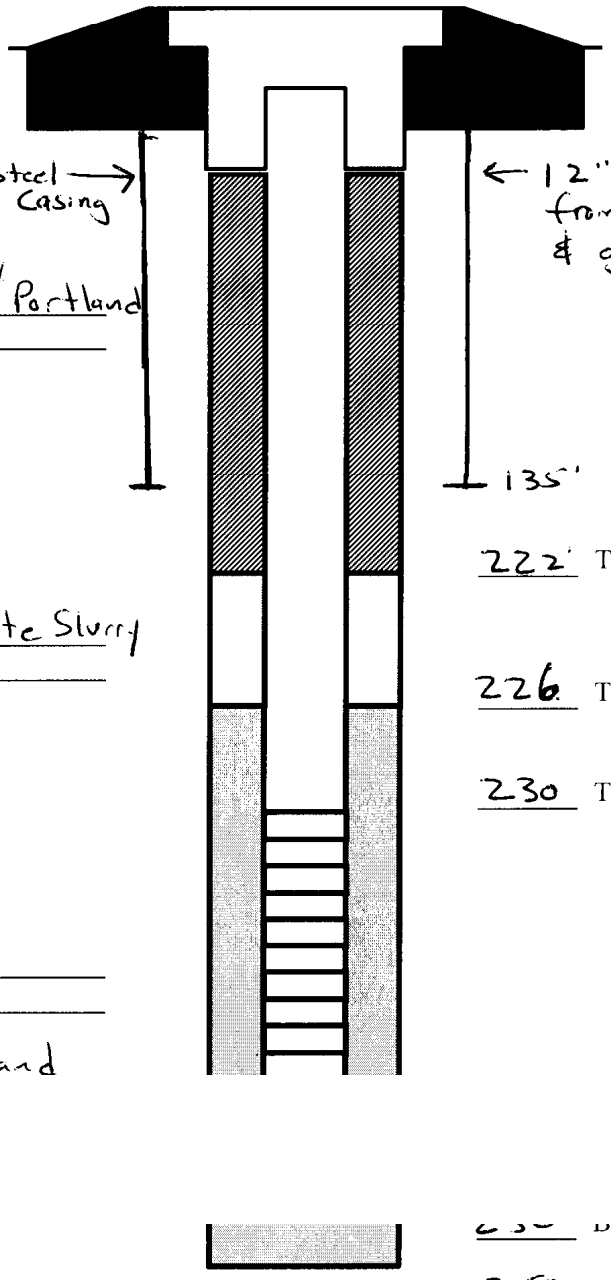
Water Levels (Depth, Date, Time) 25.08, 12/16/04, 1201 Date Installed 12/15/04

Riser Dia. 6" Material PVC Length 230

Screen Dia. 6" Material St. Steel Length 20 Slot Size .020

SCHEMATIC

Surface Seal Type
Cement / Flush mount well cup



Ground Surface
_____ Riser Elevation
_____ Bottom Surface Seal

Grout Type Bentonite / Portland

Seal Type Bentonite Slurry

222 Top Seal

226 Top Sand Pack

230 Top Screen

Sand Pack Type _____
Size #1

1' of #00 sand

Bottom Screen

250 Total Depth of Boring

APPENDIX F

MONITORING WELL FIELD INSPECTION LOG

SITE NAME: SITE ID.:

INSPECTOR:

MONITORING WELL FIELD INSPECTION LOG

DATE/TIME:

WEll ID.:

	YES	NO
WELL VISIBLE? (If not, provide directions below)		

WELL COORDINATES? NYTM X_____ NYTM Y_____

PDOP Reading from Trimble Pathfinder:_____ Satelites:_____

GPS Method (circle) Trimble And/Or Magellan

	YES	NO
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back).....		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL: .....

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED.....

TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable)

PROTECTIVE CASING MATERIAL TYPE: .....

MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches): .....

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): .....

MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): .....

MEASURE WELL DIAMETER (Inches): .....

WELL CASING MATERIAL: .....

PHYSICAL CONDITION OF VISIBLE WELL CASING: .....

ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE .....

PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES.....

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

REMARKS:

Sketch

APPENDIX G

OCTOBER 2003 O&M PLAN

OPERATIONS AND MAINTENANCE MANUAL GROUNDWATER TREATMENT SYSTEM

FRANKLIN CLEANERS SITE
Site No.: 1-30-050
Hempstead, New York

Prepared for:

New York State Department of Environmental Conservation

Prepared by:

URS
Remediation Operating Services

Wayne, New Jersey

Revision 2
October 2003

-Flygt Submersible Pump Controls Manual

Franklin Cleaners
Control Panel

Pumping Services, Inc.
368 Lincoln Blvd.
Middlesex, NJ 08846
Tel: (732) 469-4540
Fax: (732) 469-5912

A. Control Panel Specifications
B. Operation Instructions
C. Drawings
D. Component Specifications

6/16/2003

Control Panel Specifications

FLYGT

An ITT Industries company

ENGINEERING SUBMITTALS

FILE	
JOB NAME-	FRANKLIN CLEANERS
QUOTE NO.-	55875AC Rev: A
DATE-	3/14/2003
CUSTOMER	PUMPING SERVICES – DALE PARKHURST

ELECTRICAL SERVICE	
VOLTAGE -	208
PHASE -	3
WIRES -	4

CONTROL SYSTEM	
TYPE OF CONTROL PANEL -	DUPLEX STATION
SENSING DEVICE -	FLOATS
NUMBER OF MOTORS -	2
MOTOR H.P.-	3HP (10 FLA)
ENCLOSURE:	
MATERIAL -	STEEL
NEMA RATING -	12
SIZE -	36" X 30" X 10"
MODIFICATIONS -	LEGENDS W/ SCREWS – UL 508 913 SEL - ETL
MOUNTING STYLE -	WALL MOUNT

PRODUCTION REQUIREMENT
[ ] APPROVAL WAIVED
[ ] APPROVED AS SUBMITTED
[ ] DRAWINGS APPROVED AS NOTED, "PROVIDE CLEAR AND PRECISE COMMENTS"

APPROVAL SIGNATURE:_____

UL approval check list

✓ make sure fuses are proper size

✓ label all fuses

✓ isolate neutral

____ check the following components for ul approval:

flasher

alarm light

heater (hoffman or strip heater)

✓ all wire must be 90 deg at least

✓ make sure the phase monitor is fused

____ must have an overload chart

✓ fill out the pump data sheet includes voltage, horse power, fls, and total fla

____ ground fault protection on the secondary of the transformer when non ul components are in control circuit of panel

____ attach a non ul component list sheet when needed

✓ mark all ground lugs with ground label

✓ mark terminal block with torque requirement label

____ mark out 4, 4x if a hole is made in the enclosure

✓ intrinsically safe markings

install grounded barrier

mark terminal strip

✓ SEL on panels with Main or Main and Emergency

____ Article 702 on panels with Main and Emergency

✓ SEL drawing 60, 100, 150, 200 (other) 40

UL NUMBER BD-050158

PANEL SERIAL NUMBER 03-0439

ETL approval check list

✓ make sure fuses are proper size

✓ label all fuses

✓ isolate neutral

____ check the following components for ETL approval:

flasher

alarm light

heater (hoffman or strip heater)

✓ all wire must be 90 deg at least

✓ make sure the phase monitor is fused

____ must have an overload chart

✓ fill out the pump data sheet includes voltage, horse power, fls, and total fla

✓ mark all ground lugs with ground label

✓ mark terminal block with torque requirement label

____ mark out 4, 4x if a hole is made in the enclosure

✓ intrinsically safe markings

install grounded barrier

mark terminal strip

✓ SEL on panels with Main or Main and Emergency

____ Article 702 on panels with Main and Emergency

✓ SEL drawing 60, 100, 150, 200 (other) 40

PANEL SERIAL NUMBER 03-0439

PANEL QUOTE NUMBER 55875AC

Operation Instructions

OPERATIONS MANUAL

GENERAL:

This control system will operate two (2) submersible sewage pumps and provides for automatic alternation of pumps to equalize run time. The controls operate with three (3) float regulators adjusted to predetermined levels within the wet well. Aluminum dead front with breaker knockouts is provided for safety and allows for check operation of system.

BREAKERS:

The circuit breakers are located in the upper right hand portion of the enclosure and include: (1) main circuit breaker (MCB); (2) pump motor breakers (MB); (3) transformer circuit breaker (TCB); and (4) control circuit breaker (CCB).

Incoming power 208 VAC, 3 phase, 4 wire from the local utility is applied to the main circuit breaker. The power from the MCB is distributed to the other circuit breakers. MB1 and MB2 control power to pumps 1 and 2 respectively. The TCB controls the power to the control power transformer (CPT), which control the control voltage. The CCB controls power to the control circuits.

STARTERS:

The starters are located in the lower right hand portion of the enclosure and contain the necessary control wiring to actuate the starter coils on demand from the controls. The starters contain a melting allow overload heater on each power leg rated at the full load amp draw of the pumps. Excessive amp draw by the pumps will open the overload relay contacts and shut down the pump. The manual reset handle located on the overload relay must be reset before the pumps will restart.

NOTE: If reset is required, the amp draw of the pump should be checked.

CONTROLS:

The controls consist of a 120 VAC intrinsically safe control system for safety reasons. The relays control sequencing and voltage application to the pump alternator (PAA), lights and alarm functions.

The output voltage of the intrinsically safe relays is applied to the float switches directly and consists of a DC voltage level. When the float switch tilts, the contact closure signals the ISR to turn on and feed a 120 VAC signal to the operating relay coil.

OPERATING SEQUENCE

(a) Low level operation:

When the low level float switch [FR1] tilts, it removes the voltage from the pump call for in hand and automatic. R1 will energize for dry contact remote alarm and activate R2 for a common alarm.

(b) Lead Pump Operation:

When the level in the wet well rises, tilts float regulator (FR2), ISR2 relay is activated for a holding circuit for the lead pump call. ISR2 controls the off level and sets the shut off level for the lead pump.

As the level rises in the wet well, float regulator (FR3) tilts. ISR3 is activated which supplies a voltage to TD1 and through contacts 3-1, to the manual and automatic alternator through the HOA switches for starting of the lead pump. When the motor starter is activated, a run light is illuminated and the elapsed time starts recording signifying the motor is on. The lock in circuit to the off float switch is through relay TD1 contacts 6-8. The lead pump will operate until the off float switch opens.

(c) Alarm Operation:

The following alarm conditions will be identified by alarm indications.

1. Low level alarm. [Pilot Light]
2. Pump 1 fail. [Pilot Light]
3. Pump 2 fail. [Pilot Light]
4. High Pressure. [Pilot Light]

(d) Alternator Operation:

The automatic alternator operates on de-energization to prevent contact arcing and momentary starting of pumps. The alternator sequences with the OFF float regulator (FR2). The manual alternator switch lead-auto-lag switch mounted on the dead front determines the sequencing of the pumps. The lead-lag selector switch must be in the left (auto) position for normal operation, whenever a pump becomes inoperative, (say pump # 1) the selector switch may be placed in the # 2 position so that pump 2 is always the lead pump.

To replace a pump, place the alternator switch in the lead pump position of the pump to stay active. Turn the defective pump motor breaker and the HOA switch off position. The pump may now be removed.

(e) Pump Fail:

If a pump is called and does not start, TD2 or TD3 will time out. TD2 will activate R3 and pump 1 fail pilot light. Once activated R3 will latch through R3 contact [3-1] to a manual reset push button. TD3 will activate R4 and pump 2 fail pilot light. Once activated R4 will latch through R4 contact [3-1] to a manual reset push button.

Remote System:

The remote signals will be activated in the case of a failure as indicated above. The signals are provided at terminal strip "A".

The following conditions will be sent out as dry contacts.

1. Phase fail
2. Pump 1 Fail
3. Pump 2 Fail
4. High Pressure
5. Low Level
6. Overtemp/Moisture 1
7. Overtemp/Moisture 2
8. Common Alarm
9. Pump Run

MINI-CAS II Operation:

Each pump is supplied with a moisture-thermal controller that will provide an indication of the motor status. In the event of a pump failure, a remote indication is supplied through relays R5 and R6.

MAINTENANCE:

To assure watertight integrity, the hold-down "dogs" on the cabinet should be secure at all times. A mild protective spray, such as CRC 226, should be used bi-monthly on the outer door gasket.

All conduit openings should be sealed to preclude intrusion of gases from the wet well.

NORMAL CONDITIONS OF COMPONENTS:

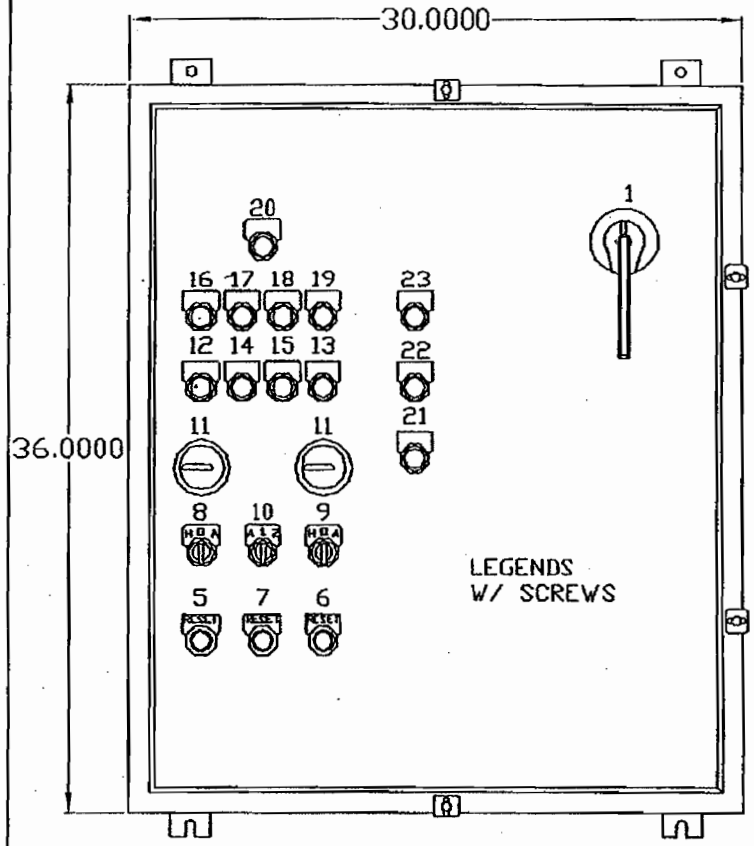
1. Intrinsically safe relays - When the LED is on, power is applied to the unit.

2. Relays - The indicator lights illuminate when the relay is activated.

MALFUNCTION INDICATION POSSIBLE CAUSES

1. Pump(s) will not run. (hand position)	1A. Loss of incoming power. B. Motor breakers in off position. C. HOA in off position. D. CCB in off position. E. MS OL's tripped. F. Defective ISR1. G. Defective F1, F2. H. Defective motor starter. I. Motor over temp. TTS open J. MINI-CAS FUS II dropped out.
2. Pump(s) will not run. (auto position)	2A. All of above. B. Defective ISR3. C. Defective FR3. D. Defective manual alternator. E. Defective CCT.
3. Alternator will not alternate.	3A. Defective FR2. B. Defective alternator C. Defective ISR2. D. Manual alternator switch in wrong position.

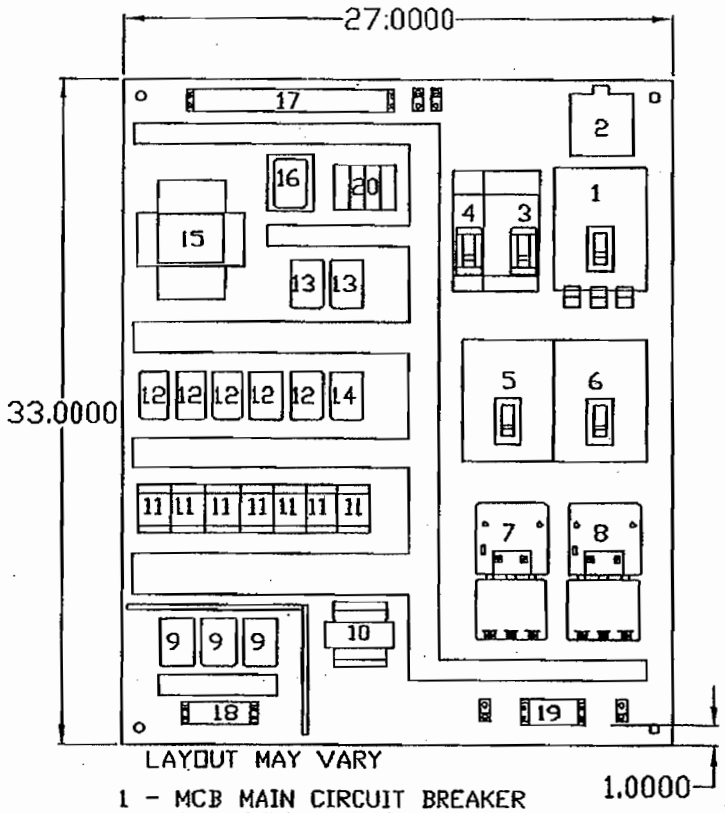
Drawings



1 - MAIN BREAKER
5 - MINICAS 1 RESET
6 - MINICAS 2 RESET
7 - PUMP FAIL RESET
8 - PUMP 1 HAND-OFF-AUTO
9 - PUMP 2 HAND-OFF-AUTO
10 - ALTERNATION SELECTOR SWITCH
11 - ELAPSE TIME METER
12 - RL1 PUMP 1 RUN
13 - RL2 PUMP 2 RUN
14 - PL5 PUMP 1 FAIL
15 - PL6 PUMP 2 FAIL
16 - PL7 OVERTEMP 1
17 - PL8 MOISTURE 1
18 - PL10 MOISTURE 2
19 - PL9 OVERTEMP 2
20 - PL11 HIGH PRESSURE
21 - PL1 LOW LEVEL
22 - PL2 OFF LEVEL
23 - PL3 ON LEVEL

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

ITT-FLYGT
ITT-FLYGT CORP.
TRUMBULL, CT 06611



1 - MCB MAIN CIRCUIT BREAKER
2 - LA LIGHTNING ARRESTOR
3 - TCB TRANSFORMER CIRCUIT BREAKER
4 - CCB CONTROL CIRCUIT BREAKER
5 - MB1 MOTOR BREAKER 1
6 - MB2 MOTOR BREAKER 2
7 - MS1 MOTOR STARTER 1
8 - MS2 MOTOR STARTER 2
9 - ISR1 THROUGH ISR3 INTRINSICALLY SAFE RELAY
10 - CCT CONTROL CIRCUIT TRANSFORMER
11 - R1 THROUGH R8 CONTROL RELAY
12 - TD1 THROUGH TD6 TIME DELAY
13 - MC1&2 MINICAS
14 - ALT ALTERNATOR
15 - CPT CONTROL POWER TRANSFORMER
16 - PM PHASE MONITOR
17 - TSA TERMINAL STRIP A
18 - TSB TERMINAL STRIP B
19 - TSC TERMINAL STRIP C
20 - F FUSE BLOCK

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

ITT-FLYGT
ITT-FLYGT CORP.
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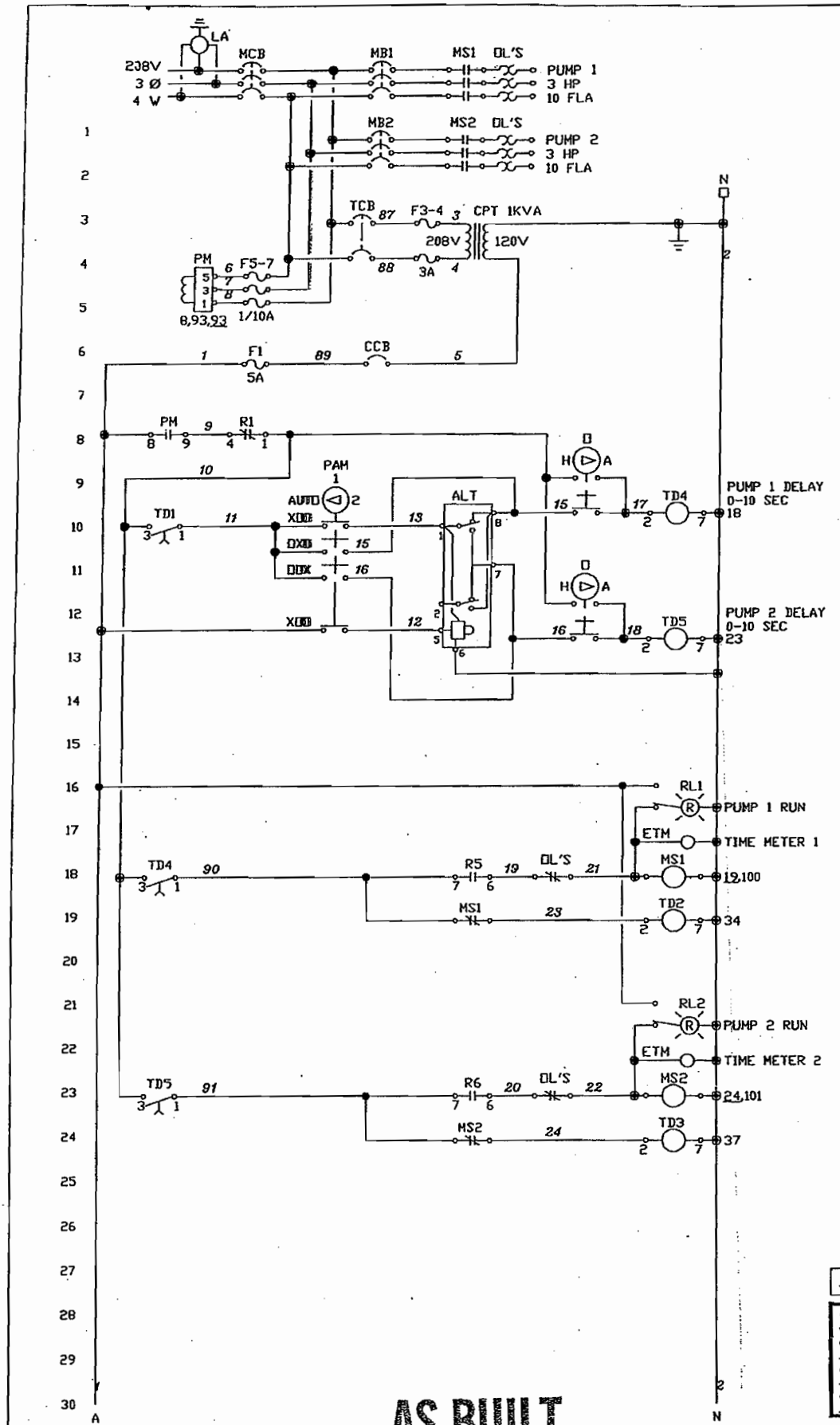


AS BUILT

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

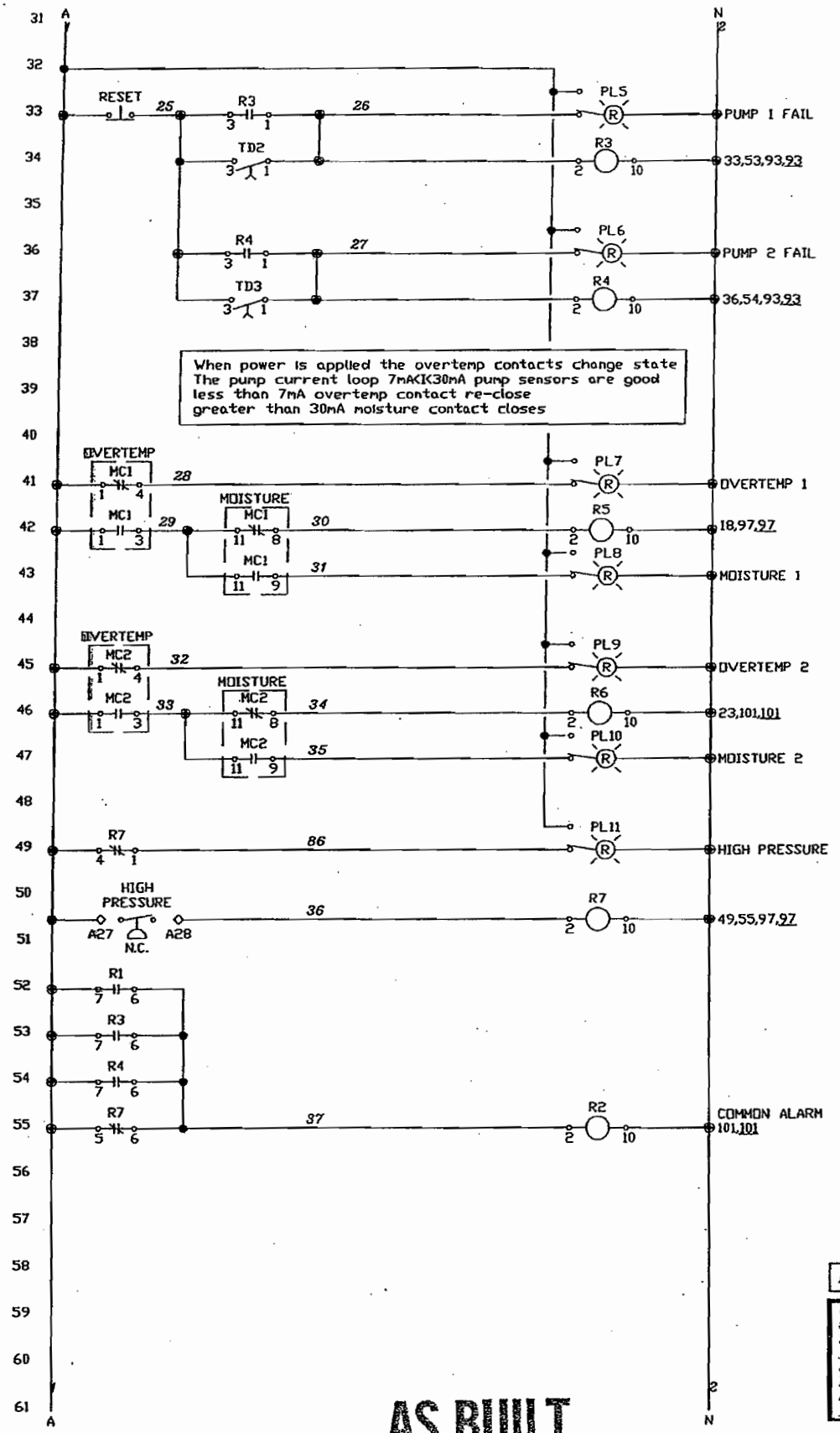
ITT-FLYGT CORP.
TRUMBULL, CT 06611

ITT-FLYGT

ETL LISTED

UL LISTED
508 STANDARD
SERIAL NO.

SERVICE ENT
HAZ LOCATION
SERIAL NO.



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TRUMBULL, CT 06611

ITT-FLYGT

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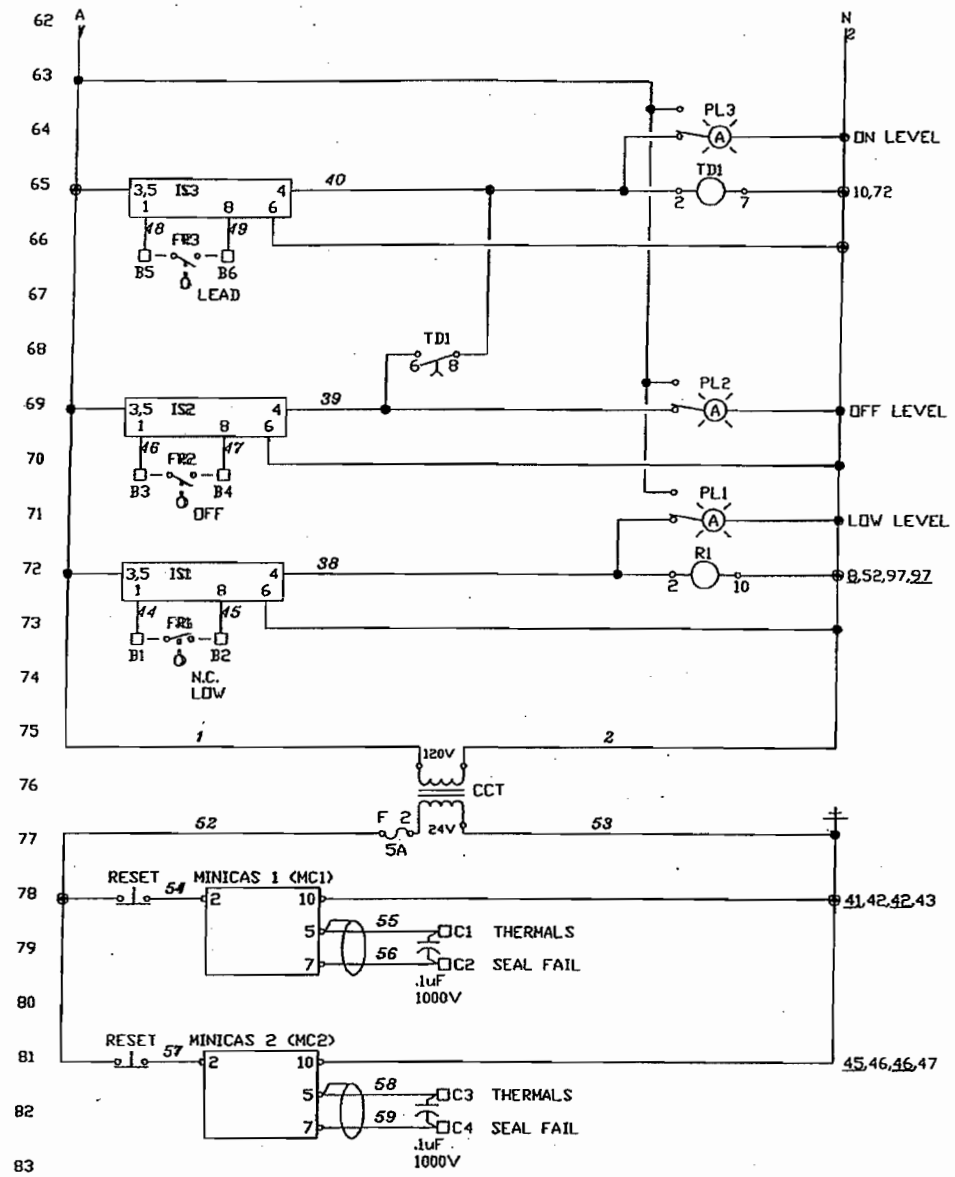

AS BUILT

FRANKLIN CLEANERS			
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55875AC	3.11.03	MED	A

ITT-FLYGT CORP.
TRUMBULL, CT 06611

ITT-FLYGT

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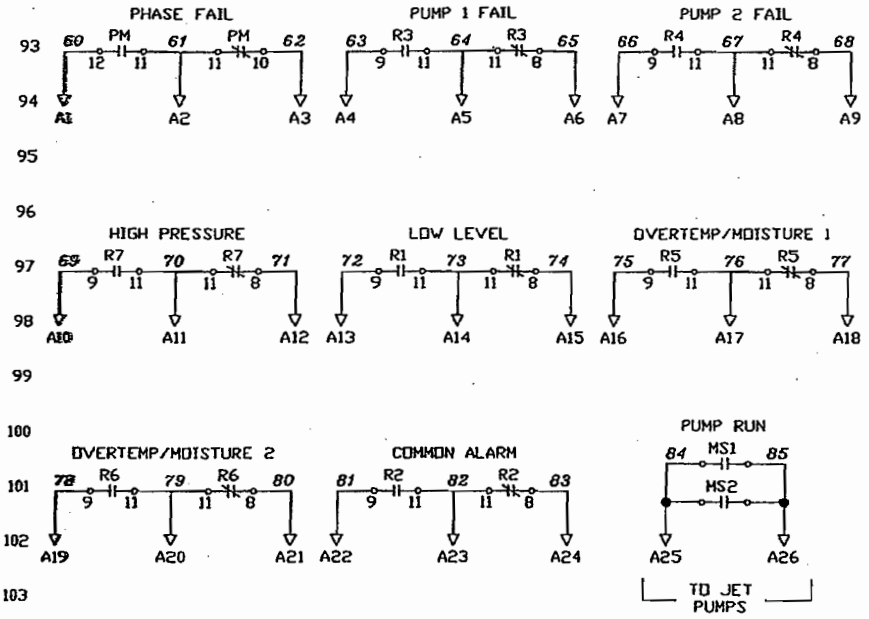
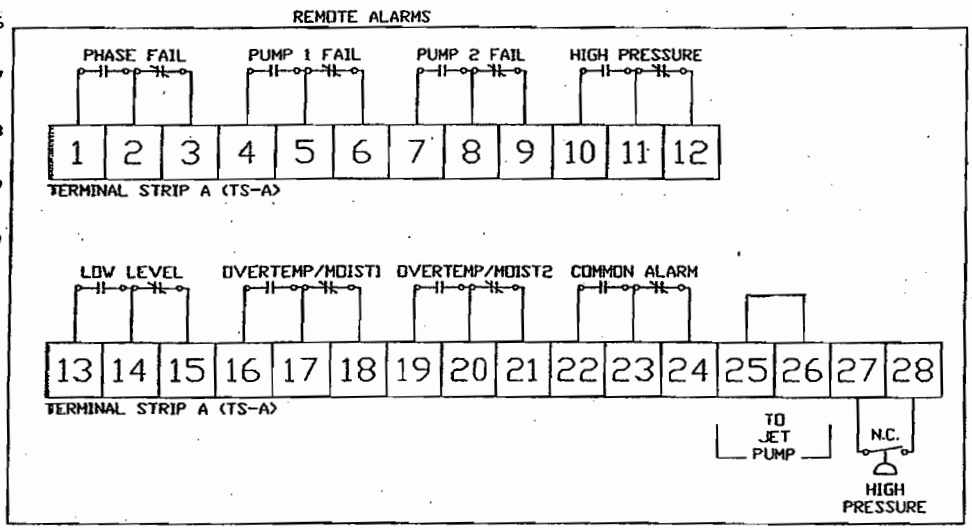
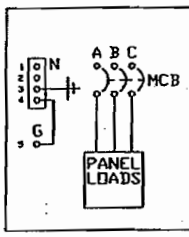


LAST WIRE #91

Dry contacts leaving panel powered by other source





SERVICE	40 AMP	
WIRE	8 AWG	TABLE D
GROUND WIRE	8 AWG	TABLE C
TERMINAL 1	8 AWG	TABLE D
TERMINAL 2	8 AWG	TABLE D
TERMINAL 3	8 AWG	TABLE C
TERMINAL 4	8 AWG	TABLE C
TERMINAL 5	8 AWG	TABLE C

CUSTOMER	PUMPING SERVICES			
JOB NAME	FRANKLIN CLEANERS			
VOLTAGE	208	PHASE 3		HZ 60
H.P.	#1 3	#2 3	#3 X	#4 X
F.L.A.	10A	10A	X	X
TOTAL F.L.A.	25A			
SERIAL #	03-0439	DATE: 4/24/2003		

ETL LISTED

UL LISTED
508 STANDARD
SERIAL NO.

SERVICE ENT
HAZ LOCATION
SERIAL NO.

AS BUILT

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

ITT-FLYGT

ITT-FLYGT CORP.
TRUMBULL, CT 06611

FLYGT

An **ITT Industries** company

AS BUILT

BILL OF MATERIAL | BY: MED

QUOTE NO.	55875AC	Date:4/25/2003	Rev: A
JOB NAME	FRANKLIN CLEANERS	03-0439	
CUSTOMER	PUMPING SERVICES	Po#	

QTY	LEGEND	DESCRIPTION	MFG.	PART #	Check Off
1		ENCLOSURE	HOFFMAN	A-363010LPX	[✓]
1		SUB PANEL	HOFFMAN	A-36P30	[✓]
1	N	ISOLATED NEUTRAL BLOCK	SQD	SN12125	[✓]
2	G	GROUND BUSS	SQD	PK7GTA	[✓]
1	MCB	MAIN CIRCUIT BREAKER	SQD	FAL32040	[✓]
1	OP M	OPERATOR MECHANISM (FAL)	SQD	9421-LN3	[✓]
1		MULTI-LUG KITS (6-#14-#6)	SQD	PDC6FA6	[✓]
2	**MB**	**MOTOR BREAKER**	**SQD**	**FAL36015-13M**	[✓]
1	CCB	CONTROL BREAKER	SQD	FAL14015	[✓]
1	TCB	TRANSFORMER CIRCUIT BREAKER	SQD	FAL24030	[✓]
2	MS	MOTOR STARTER (SIZE 1)	SQD	8536-SCO3V02S B	[✓]
6	OL	OVERLOAD HEATERS	SQD	AR15.4	[✓]
1	CPT	CONTROL POWER TRANSFORMER	SQD	9070-T1000D3	[✓]
1	CCT	CONTROL TRANSFORMER	SQD	9070-T75D23S12	[✓]
2	TS	TERMINAL STRIP	MARATHON	SERIES 200	[✓]
1	TS	TERMINAL STRIP	MARATHON	SERIES 300	[✓]
2	* F	FUSE	LITTELFUSE	BLF –5 /250V	[✓]
2	* F	FUSE (TIME DELAY AC-DC)	LITTELFUSE	KLDR –3 /600V	[✓]
3	* F	FUSE (FAST ACT AC - DC)	LITTELFUSE	KLK-1/10 /600V	[✓]
6		FUSE HOLDER	LITTELFUSE	L60030M1PQ	[✓]
2	HOA	HAND-OFF-AUTO SELECTOR	SQD	9001SKS43B	[✓]
2		(NO, NC) CONTACT	SQD	9001-KA1	[✓]
1	PAM	PUMP ALTERNATOR MANUAL	SQD	9001SKS46B	[✓]
1		(NO, NC) CONTACT	SQD	9001-KA1	[✓]
2		(NC) CONTACT	SQD	9001-KA3	[✓]
2	RL	RUN LIGHT	SQD	9001SKT1	[✓]
10	PL	PILOT LIGHT	SQD	9001SKT1	[✓]
2	ETM	ELAPSED TIME METER	REDINGTON	710-0016	[✓]
3	P/B	PUSH BUTTON	SQD	9001-SKR1U	[✓]
3		(NC) CONTACT	SQD	9001-KA3	[✓]
7	R	CONTROL RELAY (120VAC)	POTTER B.	KRPA14AN-120	[✓]
3		8 PIN SOCKET (ISR)	OMRON	PF083A	[✓]
6		8 PIN SOCKET	IDEC	SR2P-06	[✓]
9		11 PIN SOCKET	IDEC	SR3P-05	[✓]
1		12 PIN SOCKET	CUSTOM CONN	SD12	[✓]
1	ALT	AUTO ALTERNATOR (13SP)	FLYGT	14-40 31 86	[✓]

Component Specifications

3	ISR	INTRINSICALLY SAFE RELAY (120V)	FLYGT	14-40 32 22	[✓]
1	PM	PHASE MONITOR (230V 12 PIN)	FLYGT	14-40 32 12	[✓]
2	MC	MINI-CAS (ADD .1Uf 1000V CAPACITOR TO MINI-CAS PINS 5-7)	FLYGT	14-40 71 13	[✓]
1	LA	LIGHTNING ARRESTOR	SQD	6671 SDSA3650	[✓]
5	**TD**	**TIME DELAY**	**SQD**	**9050-JCK60V20**	[✓]
1	VC	VAPOR CAPSULE	ZERUST	VCC-1	[✓]

NOTES: *** OR EQUAL**

PACKING LIST

Quote#:55875AC	**Date: 4/25/2003**	**Rev: A**

SPARE PARTS

QTY	LEGEND	DESCRIPTION	MFG	PART #	
1	**CPT**	**CONTROL POWER TRANSFORMER**	**SQD**	**9070-T1000D3**	[✓]
1	**CCT**	**CONTROL TRANSFORMER**	**SQD**	**9070-T75D23S12**	[✓]
3	**R**	**CONTROL RELAY (120VAC)**	**POTTER B.**	**KRPA14AN-120**	[✓]
3	**TD**	**TIME DELAY**	**SQD**	**9050-JCK60V20**	[✓]
12	*F	FUSE	LITTELFUSE	BLF –5 /250V	[✓]
12	*F	FUSE (FAST ACT AC - DC)	LITTELFUSE	KLK-1/10 /600V	[✓]
12	*F	FUSE (TIME DELAY AC-DC)	LITTELFUSE	KLDR –3 /600V	[✓]
16	**PL**	**PUSH-TO-TEST PILOT LIGHTS**	**SQD**	**9001SKT1**	[✓]

AS BUILT

SHOP CHECK SHEET

Quote#:55875AC	Date: 4/25/2003	Rev: A

P.O.#				Ship Date	4/25/2003
H.P.'s	3	# PUMPS	2	VOLTAGE	208V PHASE 3
		DRIPSHIELD	NO	SERIAL #	03-0439
DEADFRONT	N/A	ENCLOSURE TYPE	12/3R	MATL.	STEEL

SPECIAL INSTRUCTIONS	Check OFF
STAINLESS SCREWS IN DOOR LEGENDS	[✓]
INTRINSICALLY SAFE DEVICES HAVE ALUMINUM BARRIER	[✓]
REMOTE PRESSURE SWITCH NOT INCLUDED	[✓]
CORROSION INHIBITOR	[✓]

Wire Numbers – Type	[✓]
Legends and Legend Sheet	[✓]
Ground Lugs	[✓]
Overload Heater Chart	[✓]
Pump Data Sheet	[✓]
Drawings on Door	[✓]
Picture of Panel	[✓]

ETL LABEL	[✓]
UL Serial No. **BD050158**	[✓]
Service Entrance	[✓]
UL Hazardous Locations **BD395290**	[✓]

Spare Parts

AS BUILT

[ ] In Panel See Packing List [ ]

[ ] In Separate Box See Packing List [ ]

Wired by: subpanel B.S._____ door/deadfront J.N._____

Tester T.W._____

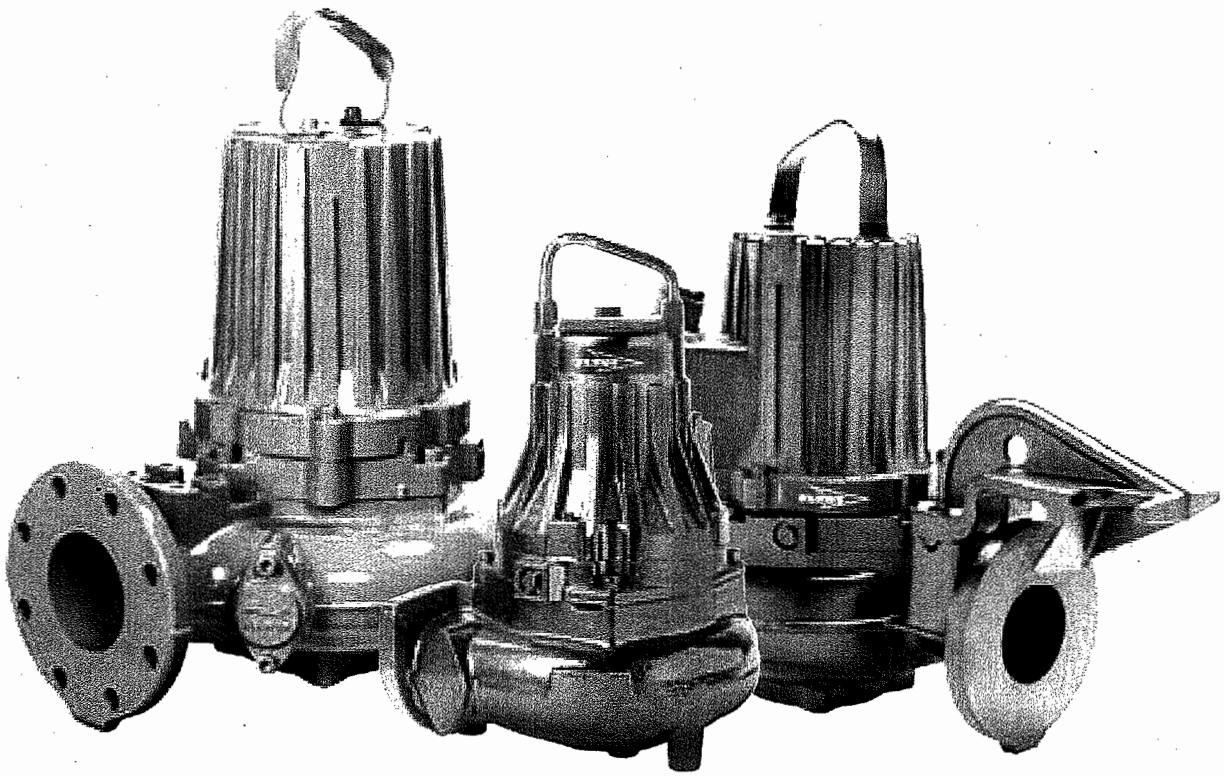
Inspector J.N. _____

Comments Entire packing list shipped seperate in boxes as marked.

ITT

Water & Wastewater

For reliable and efficient wastewater handling



Engineered for life

Flygt N-Pump series

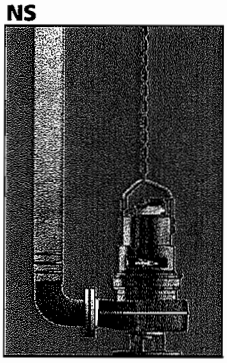
Reduced pumping efficiency, high energy and maintenance costs shouldn't be a fact of life in wastewater handling. The submersible Flygt N-Pump series from ITT Water & Wastewater features a radical hydraulic end design which ensures efficient, reliable and trouble-free pumping over long duty periods.

The result: improved operational economy which dramatically reduces the total life cost of your installation.

The highest efficiency values for a typical single-vane pump in a best-specific speed range are around 70%. By comparison, Flygt N-Pumps deliver 80% or better – equating to 15% less power consumption. And Flygt N-Pumps maintain this efficiency even in fluids with a high solids and fibrous content thanks to a unique semi-open self cleaning impeller. This is complemented by a special relief groove in the volute. The self-cleaning flow path through the pump greatly reduces the risk of clogging, even under the worst conditions.

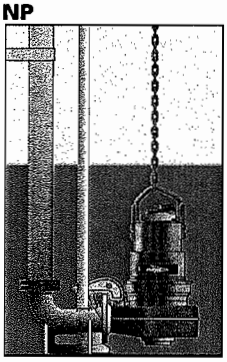
Methods of installation

NS



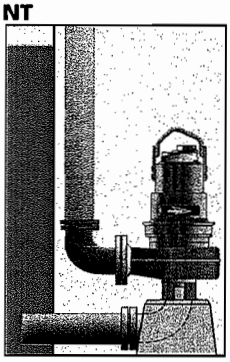
A semi-permanent, free-standing installation. Transportable version with pipe or hose connection.

NP



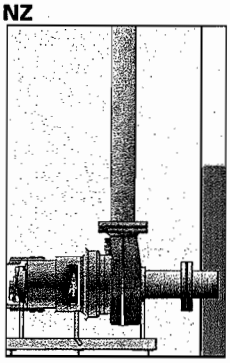
For semi-permanent wet well installations. The pump is installed with twin guide bars on a discharge connection.

NT



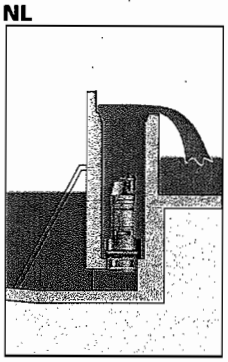
A vertically-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipe work.

NZ



A horizontally-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipe work.

NL

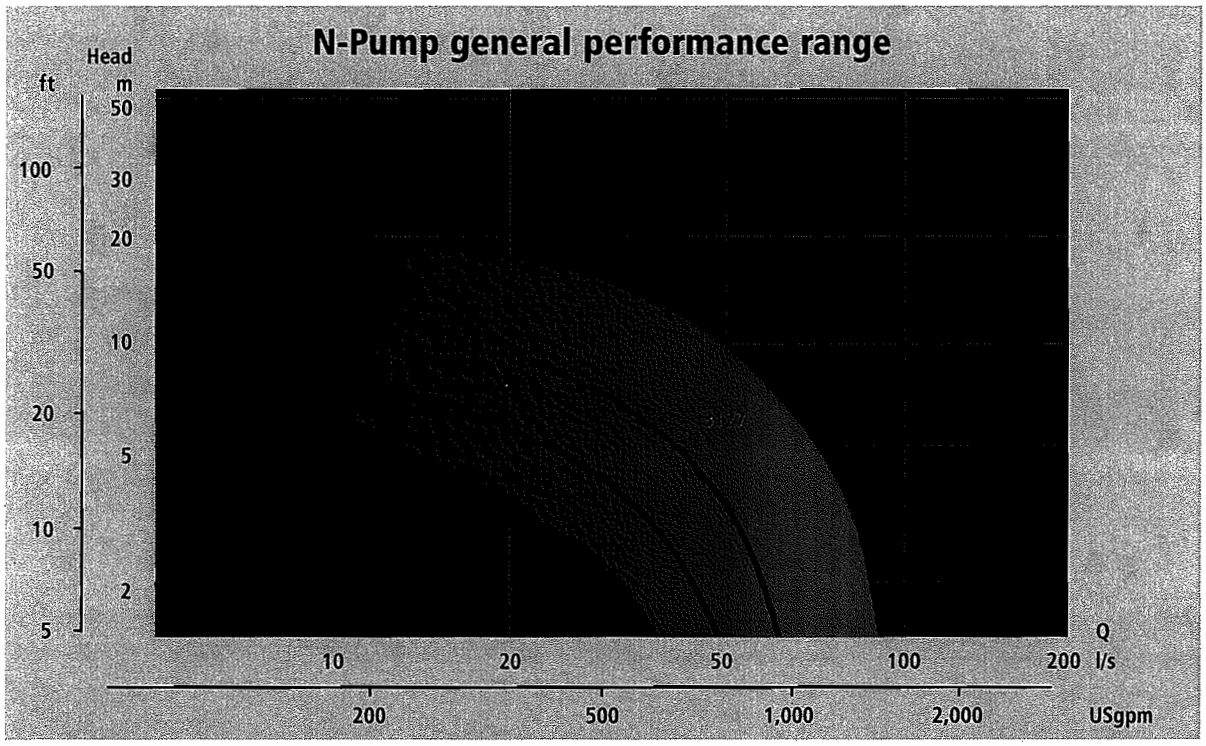


The semi-permanent installation of a pump within a vertical steel or concrete column (not available for the 3085).

Pumping capacities up to 100 l/s, 1600 gpm

Thanks to the self-cleaning advantages of the impeller and volute design, Flygt N-Pumps offer new possibilities for cost-effective operation in a wide variety of applications. These include pumping:

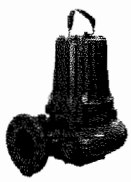
- Wastewater
- Cooling water
- Storm water
- Raw water
- Sludge
- Industrial effluent



Demonstrating the pumping performance of the Flygt N-Pump series

Flygt N-pumps

Model	3085	3102	3127
Rating	50 Hz, 1.3 kW, 2 kW 60 Hz, 2.2 hp, 3 hp	50 Hz, 3.1 kW, 4,2 kW 60 Hz, 5 hp, 6 hp	50 Hz, 4.7 kW, 5.9 kW 60 Hz, 7.5 hp, 10 hp
Discharge	80 mm/3"	80 mm/3" 100 mm/4" 150 mm/6"	100 mm/4" 150 mm/6"



Choosing the optimum pump is further simplified through the use of WebFLYPS, ITT Water & Wastewater's dedicated pump selection software.

Product quality means attention to details

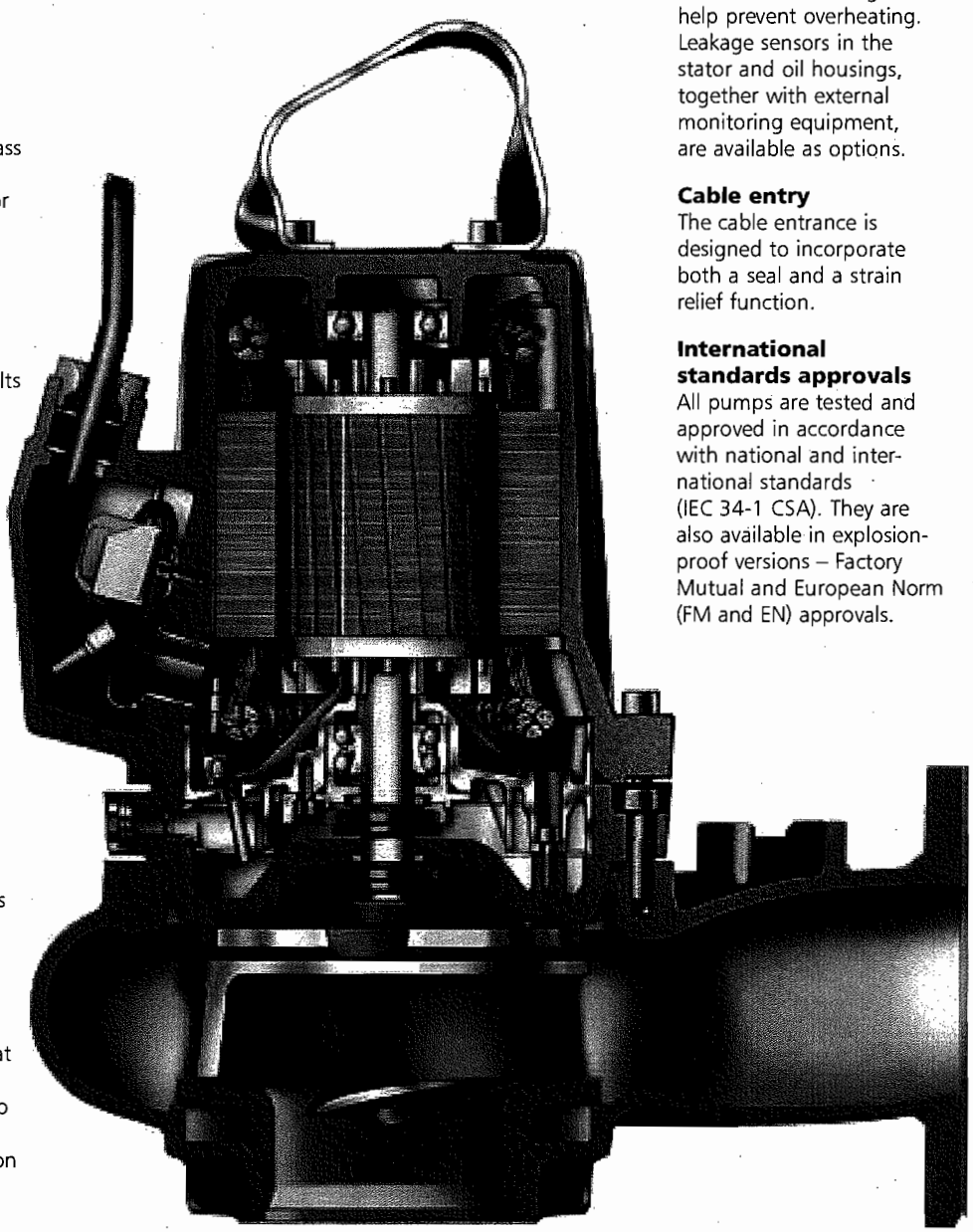
Motor
Squirrel cage, high performance induction motor, specially designed and manufactured by ITT Water & Wastewater for submersible use. Stator windings are trickle impregnated in resin to class H insulation and rated at 180°C (355° F) allowing for up to 30 starts per hour.

Shaft
A short overhang of the shaft virtually eliminates shaft deflection. This results in significantly increased seal and bearing life, low vibration and quiet operation.

Seals
Two sets of mechanical shaft seals that work independently for double security. Designed, patented and manufactured by ITT Water & Wastewater.

Seal wear protection
Spin-out™ is a patented design that protects the outer seal by expelling abrasive particles from the seal chamber.

Oil housing
In addition to lubricating the seals, the oil filled compartment diffuses heat from the motor and the bearings. The housing also provides additional security against penetration by liquids.



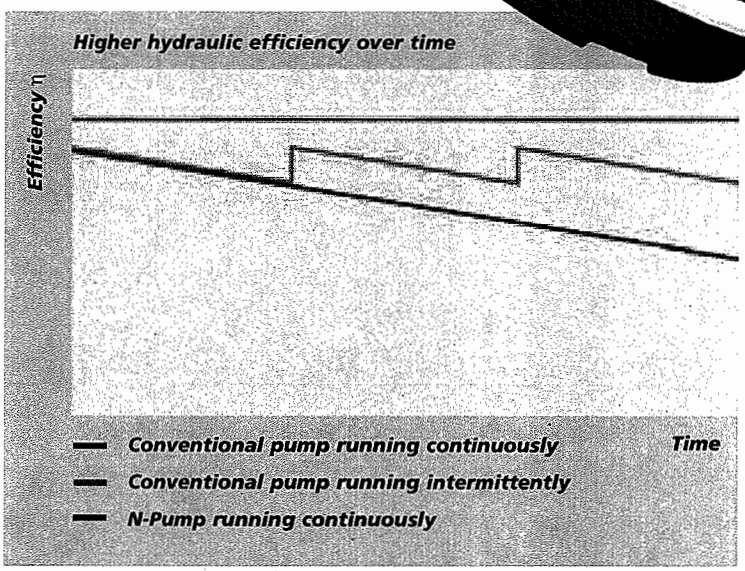
Monitoring
Thermal sensors embedded in the stator windings help prevent overheating. Leakage sensors in the stator and oil housings, together with external monitoring equipment, are available as options.

Cable entry
The cable entrance is designed to incorporate both a seal and a strain relief function.

International standards approvals
All pumps are tested and approved in accordance with national and international standards (IEC 34-1 CSA). They are also available in explosion-proof versions – Factory Mutual and European Norm (FM and EN) approvals.

Sustained higher hydraulic efficiency

The revolutionary design of the self-cleaning impeller is complemented by a special relief groove in the volute. This patented combination, which provides a self-cleaning flow path through the pump, greatly reduces the risk of clogging and makes the Flygt N-Pump series an ideal solution for high-efficiency pumping over long duty periods. That means lower overall energy consumption: a significant factor in reducing the whole life cost of your pumping operation.



The red line in the graph shows how the efficiency decreases when a conventional wastewater pump in continuous operation gets clogged.

The green line shows how a conventional wastewater pump that runs intermittently also has a generally low efficiency due to clogging. Temporary efficiency gains may be achieved through back flushing of the pump.

The blue line shows the Flygt N-Pump performing with sustained efficiency

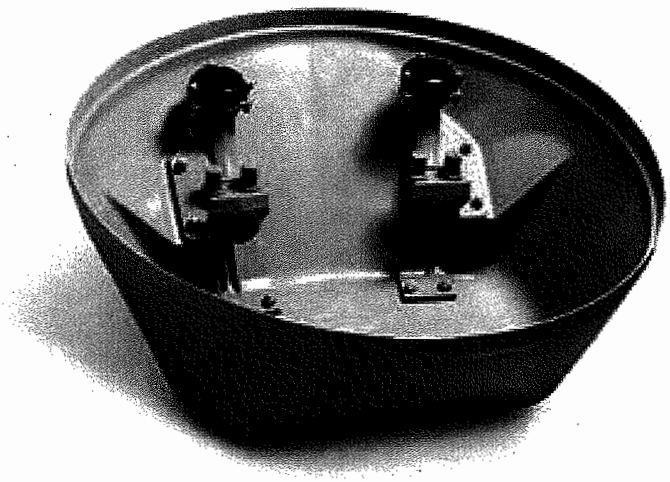
Keeping your station in top form

Supplying our customers with problem-free solutions is our goal at ITT Water & Wastewater – and that means more than simply supplying the correct pump for your particular application. The following are examples of some of the ancillary equipment which we can supply to improve the all-round efficiency of your operation.

The sump designed to clean itself

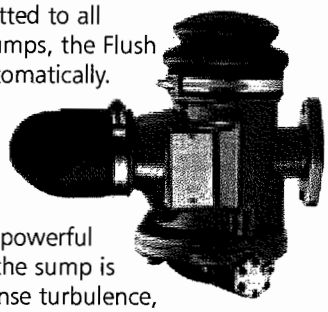
The unique design of The Optimal Pump station sump, with its integrated discharge connections, is an ideal cost-efficient solution for new stations and retro-fitting older stations. The sump has been hydraulically optimized to improve the flow over the sump floor during pumping.

The result: increased turbulence, causing resuspension of settled solids and the entrainment of floating debris, which can then be pumped away during the operating cycle.



Flush valve: the automatic desludger

Developed specifically to be fitted to all standard Flygt submersible pumps, the Flush Valve operates completely automatically.

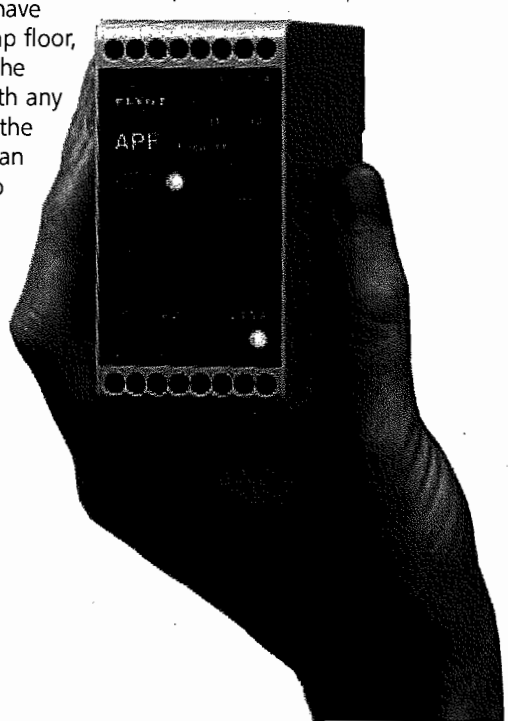


Attached easily to the volute of the pump, the valve is open at the start of each pumping cycle and water is forced through the valve in a powerful jet flushing stream. Water in the sump is immediately subjected to intense turbulence, and all the sludge deposits, as well as floating solids, are re-suspended before being pumped out. The valve closes automatically after approximately 20 seconds, and reopens again after pump stop, ready for the next pumping cycle.

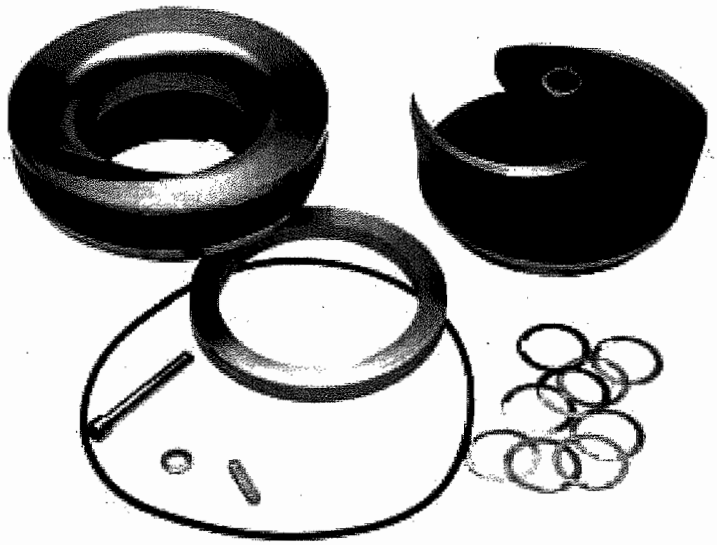
Flygt APF: automatic cleaning up to 40 times a day

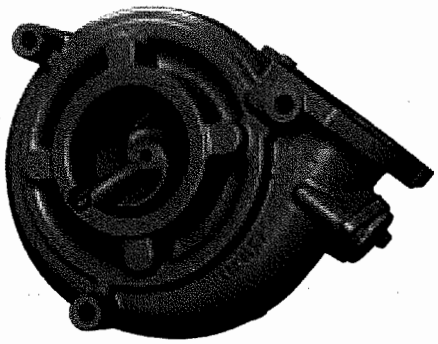
Flygt APF is the maintenance-free control system that ensures clean stations even when you're dealing with the most heavily-contaminated wastewater.

The Flygt APF is simply connected to the main control system, which it overrides during cleaning cycles by operating the pumps down to the level at which air starts to be drawn into the pump. At this level, controlled turbulence and maximum velocities cause any solids, which have settled on the sump floor, to be drawn into the pump together with any debris floating on the surface. The unit can be programmed to operate up to 40 times a day.



Upgrading and servicing





ITT Water & Wastewater's design philosophy has always been to build equipment that gives you a maximum return for your investment: and that means designing pumps for a long service life with minimum downtime.

If you already operate an installation with Flygt C-Pumps, the Flygt N-Pump upgrade kit gives you an opportunity to further extend the operational life of your equipment and gain the superior pumping efficiencies of the Flygt N-Pump range.

Each kit contains everything you need to upgrade your existing pumps to Flygt N-Pump standard, and there's a kit available for most Flygt C-Pump models (please check with your representative which models apply). Kits are easy to install and fully supported by the ITT Water & Wastewater Service Network.

The upgrade kit allows you to:

- Cut the cost of regular and emergency maintenance by reducing the risk of clogging
- Boost the operational efficiency of your existing equipment
- Improve the return on your original investment

The N-technology is beneficial in all installations. In the most demanding applications a Guide Pin will further enhance the pump's performance. The Guide Pin effectively directs the solids towards the relief groove. The result - a self-cleaning flow path also in these applications.

World-wide service network

No two pumping stations and systems will be alike, so the level of maintenance and support that you require from your service partner will differ according to your situation. With ITT Water & Wastewater, you can choose the type of support package that precisely meets your needs.

From simply supplying pumps to your specifications, to full service assistance on system planning, design, construction, implementation, operation or maintenance: ITT Water & Wastewater's total service concept means that you get the service you need, on your terms.

15-year spare parts guarantee

We guarantee availability of spare parts for 15 years after we stop production of a pump model. This is just one of the ways in which ITT Water & Wastwater meets its long-term commitment to customers.

ITT

What can ITT Water & Wastewater do for you?

Integrated solutions for fluid handling are offered by ITT Water & Wastewater as a world leader in transport and treatment of wastewater. We provide a complete range of water, wastewater and drainage pumps, equipment for monitoring and control, units for primary and secondary biological treatment, products for filtration and disinfection, and related services. ITT Water & Wastewater, headquartered in Sweden, operates in some 140 countries across the world, with own plants in Europe, China and North and South America. The company is wholly owned by the ITT Corporation of White Plains, New York, supplier of advanced technology products and services.

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FLYGT SANITAIRE® WEDECO LEOPOLD

N-Pumps 3085-3127.08.Eng.04.08 893626 Trosa Tryckeri AB 63602

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

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Project: ____ *Job No.* ____

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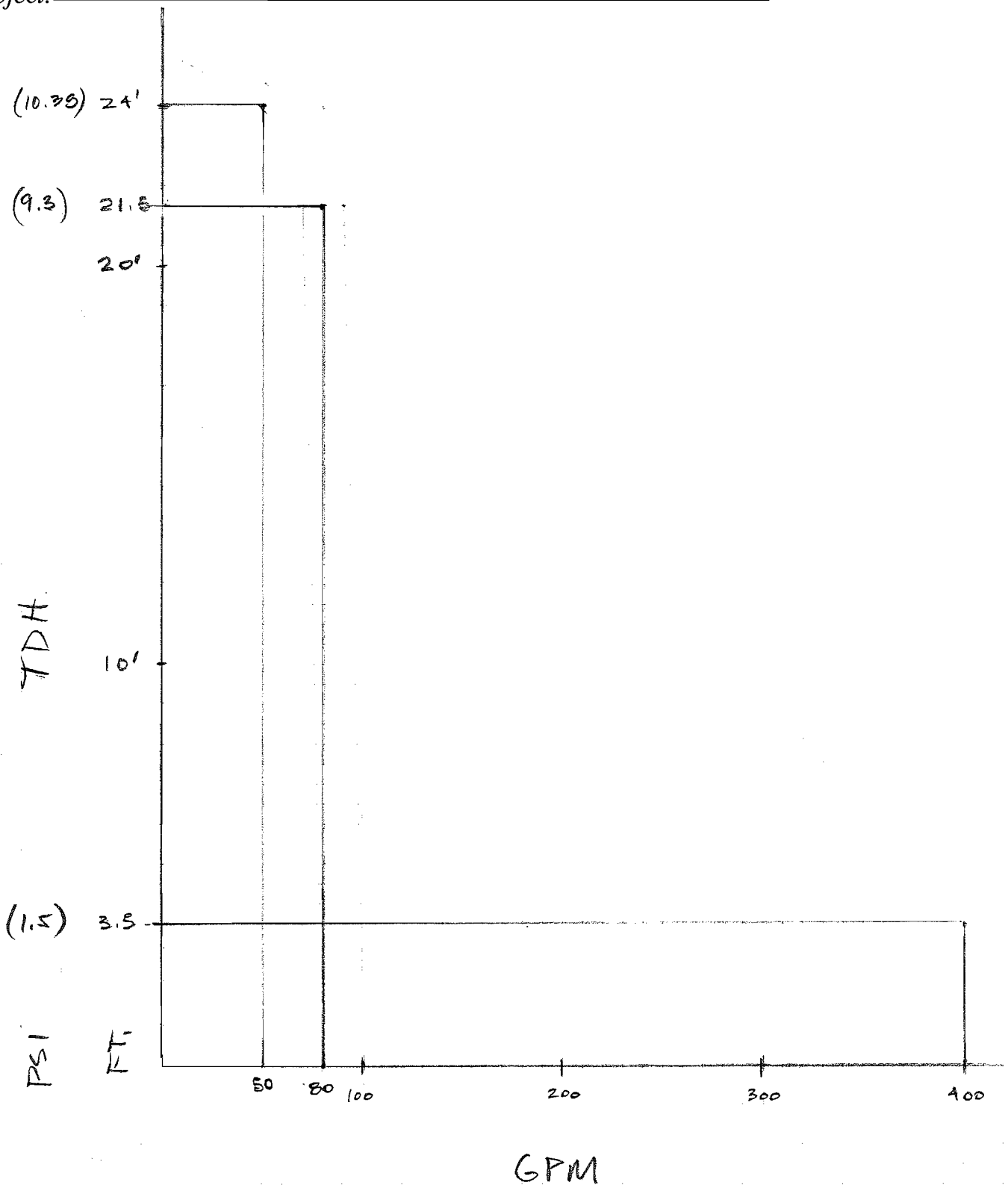

SECTION 15160

SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Refer to Division 1 for supplementary requirements for guarantees, shop drawings, technical manuals, start-up, etc.

2. Division 9 for Painting.

3. Division 16 Electrical.

4. Section 15161, Submersible Pump Controls.

5. Section 15099 for Pressure Gauges.

6. Section 15099 for Valves.

B. Scope of Work

1. The Contractor shall furnish, install, test and place in satisfactory operation, as shown on the Drawings and specified, two (2) submersible pumps complete with all appurtenances, accessories, spare parts as required to produce a complete and workable installation. The submersible pumps and pump controls for the treatment system as specified in Section 15161, shall be provided by one approved pump manufacturer.

1.2 SUBMITTALS

A. Data to be submitted:

1. The Contractor shall submit pump curves for the units which he/she proposes to supply, showing total dynamic head, pump efficiency, brake horsepower, power input to electric drive motor and overall efficiency of pumping unit for the various conditions under which the units are to operate, together with descriptive data and specifications describing in detail the construction of the complete units.

2. The manufacturer shall furnish evidence that he/she has equipment of a similar type in satisfactory operating condition for not less than

5 years. A list giving locations and dates of installation shall be furnished to the Engineer.

3. The Contractor shall submit a certification executed by the pump manufacturer stating that the pumps, and drives are totally compatible.

4. Operation and maintenance manuals in accordance with Division 1.

5. Certified P.E. stamped bearing life calculations.

B. Dimensional Data:

1. The Contractor shall submit to the Engineer for approval, within 45 days after the award of the Contract, shop drawings certified as correct, showing all weights and dimensions necessary for the installation of foundations, anchor bolts, piping and valve connections.

2. Submit anchor bolt sizes, depth of embedment, shear and pullout strength for approval.

1.3 QUALITY ASSURANCE

A. Factory Testing - Pumps:

1. Each pump shall be shop tested in the manufacturer's shop, in accordance with the test code of the Hydraulic Institute and as specified herein.

2. Tolerances allowed for acceptance of pump will be per the Hydraulics Institute.

3. Shop tests on pumps shall be performed in the wet pit mode.

4. A description of the manufacturer's test equipment and test procedures shall be submitted if requested by the Engineer.

5. Each pump shall be given a performance test during which the pump shall be run at normal rated speed over the specified range of the rate of flow and then held at shut-off head for at least two minutes. The performance test shall be run with pumps and motors in a submerged condition. Tests shall show that the pump has the general characteristics of head, efficiency, horsepower, and such other properties as appear on the approved pump curves and shop drawings without overheating, cavitation, and excessive vibration over the entire pump curve.

6. Mechanical and electrical integrity shall be established both before and after testing by physical inspection and by use of a megger.

7. A failure of any pumping unit meeting the operating requirements specified, for any reason, shall be considered an incomplete test. Upon correction of the problem causing failure, the pumping unit shall be retested.

8. Seven certified copies of all factory pump test data shall be submitted for approval. As a minimum, shop test results shall include the following information:

   a. All raw data sheets.

   b. Manufacturer certified test curves showing:

      1) Hydraulic efficiency.

      2) Input power KW.

      3) Wire to water efficiency.

      4) Brake horsepower.

      5) Flow vs. head (minimum 8 points).

      6) Flow vs. head (minimum 2 speeds).

      7) Amperage readings (at 8 points).

PART 2 - MATERIALS

2.1 FABRICATION AND MANUFACTURE

A. Performance:

1. The submersible pump installation shall consist of identical pumps. Pumps shall be constant speed units driven by squirrel cage induction motors and shall be of the submersible, nonclogging impeller type.

   The following tabulated data lists conditions of service.

B. Manufacturer:

Submersible pumps shall be manufactured by Flygt Corporation, ITT.

The submersible pumps shall be (or approved equal):

Pumping Station	Flygt Model No.	Flygt Impeller No.	Flygt Impeller Type
Franklin Cleaners Treatment System	CP3085	438	1-Vane

Submersible Pumps
Tabulated Data

Capacity of Treatment System	80 gpm (each pump)
Number of Pumps	2
Pump Size (in.) suction and discharge	4 x 4
Rate of Flow at rating point (gallons per minute)	80
Total dynamic head at rating point (TDH)	21.5 (feet)
Maximum speed at rating point (revolutions per minute RPM)	1,700
Pump efficiency at rated point min.	40%
Rate of Flow at secondary point (gallons per minute)	50
Total dynamic head at secondary point (TDH)	24
Maximum speed at secondary point (revolutions per minute RPM)	1,700
Range of rate of flow for satisfactory pump operation @ specified speed	50 gpm @ 24 feet TDH through 400 gpm @ 3.5 feet TDH
Minimum diameter of sphere, in inches that will pass through pump	2.5
Installation Wet Pit/Dry Pit	Wet Pit
Electric Motor Nominal Motor Horsepower	3.0
Electrical voltage and characteristics of electric motor	200V, 3 phase, 60 Hz
Maximum motor speed	1,700

Maximum number of starts per hour	15 at constant speed
Nominal Cable Length (ft.)	45 minimum (length to be verified by the Contractor)

C. General Pumping Unit Requirements:

1. The submersible pumping units shall be vertical, nonclogging, centrifugal pumps with bottom inlet and centerline discharge. The pumps shall be direct driven by integral squirrel cage, electric induction motors. Each pump shall include a motor, bearings, discharge elbow, guide rail system, anchor bolts, foundations, spare parts, and all accessories specified herein.

2. The pumps shall be the submersible type and shall be installed in wet pit mode. The pump motors shall be guaranteed to run in a totally, partially, or nonsubmerged condition for continuous 24-hour operation without damage.

3. All major components of the pumping unit (i.e., discharge elbow, volute casing, stator housing, etc.) shall be manufactured from close grained cast iron.

4. All nuts, bolts, washers, and other fastening devices supplied with the pumps shall be stainless steel.

5. All mating surfaces requiring a watertight seal shall be machined and fitted with Buna-n O-rings.

6. Pumps shall be furnished with standard Class 125 cast iron discharge flanges.

7. Solids passing capability: Minimum 2.5 inches.

8. Guide Rail System shall be stainless steel.

D. Anchoring of Pump:

1. Pumps shall be furnished with heavy duty cast iron discharge elbows. The discharge elbow shall support the entire weight of the pumping unit and shall withstand all stresses thereon caused by vibration, shock, direct, eccentric and superimposed loads from discharge piping.

2. All anchor bolts, nuts, washers, and miscellaneous hardware shall be Type 316 stainless steel.

E. Pump Volute Casings:

1. Casings shall be manufactured from close grained cast iron.

F. Impellers:

1. The impeller(s) shall be of gray cast iron, Class 30, dynamically balanced, double shrouded nonclogging design having a long throughlet without acute turns.

2. Impeller(s) shall be retained with an Allen head bolt and shall be capable of passing a minimum 2.5-inch diameter solid.

3. All impellers shall be coated with alkyd resin primer.

4. The impeller vanes shall be smooth, finished throughout, and shall be free from sharp edges.

   a. Metal Removal: Surface of the impeller shall be free from fused on sand, scale, and shall be smooth. Runners, risers fins, and other cast-on pieces shall be removed. The outer periphery of the impeller shall be reduced, trimmed, as required to meet performance specifications without adversely affecting surface finish, microstructure, hardness, dimensional tolerance and other special requirements. All sharp edges and corners resulting from machining shall be deburred and radiused. Radius size and tolerance shall equal the as cast dimensions.

   b. Metal Addition: Minor surface defects of the impeller may be corrected by welding, sealed by impregnation with a sealing medium, or coated according to special requirements. All corrective work is subject to the same quality standards as are used to inspect the impeller. Metal addition shall be made without adversely affecting surface finish, microstructure, hardness, dimensional tolerance and other special requirements. Metal addition other than specified in this subsection shall not be allowed.

5. Impellers shall be statically and dynamically balanced after assembly to the rotor.

6. Impellers shall be key seated and securely held to the shaft by a key and a streamlined silicon bronze nut or by a specifically approved

equal method. The arrangement shall be such that the impeller cannot unscrew or be loosened by torque from either forward or reverse rotation. Designs based on threaded connection between pump shaft and impeller will not be considered.

G. Shafts:

1. Pump shafts shall be AISI Type 420 stainless steel. Carbon steel shafts with sleeves are not acceptable.

2. Shafts shall be supported by double row lower bearings for axial thrust and a single row upper bearing for radial thrust.

3. All shafts shall be dynamically balanced and shall be amply sized to minimize shaft deflection. Shaft overhang shall not exceed 2.5 times the shaft diameter.

4. Bearings shall be cooled via circulating oil having lubricating characteristics. Removable plugs shall be furnished to periodically check oil levels.

H. Sealing Devices:

1. Each pump shall be provided with a balanced tandem mechanical seal cartridge running in an oil bath. The seal case shall be constructed of 316 stainless steel. Both sets of faces (both upper and lower sets) shall be tungsten carbide. Conventional double mechanical seals with a spring assembly between the rotating faces, requiring constant differential pressure to effect sealing and subject to penetration and opening by pumping forces shall not be considered equal to the tandem seal specified.

2. A float leakage sensor shall be furnished in the motor housing of each pump. This sensor shall be wired to the pump control panel and shall activate an alarm light upon seal failure.

I. Power and Control Cables:

1. Power and control cables shall be furnished in lengths to run continuously from the pump to the pump control panel as shown on the Contract Drawings and as specified herein. Cables shall be coordinated with connection to the Pump Control Panel.

2. Cables shall be of the "SO" type and shall conform to industry standards for loads, resistance under submersion against groundwater, and be of stranded construction. The cables shall enter the pump through a heavy duty entry assembly which shall be

provided with an internal grommet assembly to protect against tension once secured and must have a strain relief assembly as part of standard construction.

3. The cables for each pump shall be bundled in 10-foot segments for overall neatness and ease of pump removal.

J. Motors:

1. Each pump shall be furnished with a squirrel cage, induction motor enclosed in a watertight housing suitable for use and compatible with the drive system.

2. The motors shall be furnished with moisture resistant Class F insulation treated to be moisture and fungus resistant, NEMA B design, 1.15 service factor, designed for continuous duty and shall be non-overloading throughout the entire pump curve range of operation without utilizing the motor service factor. See Submersible Pumps Tabulated Data for range requirements of pump operation.

3. Motors shall be capable of sustaining 15 starts per hour at a minimum ambient temperature of 40°C.

4. Motors shall be capable of uninterrupted operation with a voltage drop of 10%.

5. The power cables entering the motor housing shall connect to a terminal board which separates the incoming service from the pump motor, where, if leakage occurs, the terminal board shall short out and not cause damage to the motor. Each pump shall be equipped with a separate terminal board that totally isolates the incoming service from the pump motors.

6. The motor rotor and stator shall run in air and be cooled by conductive heat transfer utilizing cooling fins on the exterior of the motor housing. Bearings, shall be pre-packed with special high temperature grease. The motor cooling system shall be designed for all conditions of service at maximum and minimum speeds and shall allow the unit to pump continuously without damage to the unit when the liquid level is above the low level alarm switch liquid level.

7. Thermal switches shall be furnished to monitor stator temperatures. The stator shall be equipped with three thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). Thermal switches shall automatically de-energize the motor when its temperature exceeds a preset limit as recommended by the manufacturer.

8. The pump manufacturer's nameplates shall be engraved or stamped on stainless steel and fastened to the motor casing with stainless steel screws or drive pins.

9. Minimum efficiency of motor shall be 77.5% at full load.

K. Options included for Pump:

1. Stainless steel guide bar and accessories for each pumping unit.

2. Stainless steel lifting chain with forged steel lifting hooks 5 feet on center for each pumping unit.

3. Stainless steel strain relief assemblies for pump motor cables with attachments suitable for installation at the top of the wet pit.

2.2 SAFETY SWITCH

A. Pressure Switch:

1. Pressure switch for submersible pump discharge service shall be specifically designed for use in water service application.

2. The switch shall be operated by a Buna N diaphragm and have visible set points and be externally adjustable.

3. Switch shall activate a single pole, double throw snap switch.

4. Switch shall have one normally open and normally closed contact.

5. Manufacturer:

a. Dwyer Instruments, Inc. Catalog No. AP-153-37

b. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Concrete Foundations

1. All pumps shall be mounted on concrete foundations as shown on the Drawings.

B. Electrical

1. The installation and support of power and control cables between the pumps and the pump control panel will be performed under the Electrical Contract D004275.

3.2 FIELD QUALITY CONTROL

A. Field Testing:

1. After the installation of the pumps, controls and all appurtenances, and when construction of other units of the treatment system will permit, each complete pumping unit will be subject to field tests as specified in Section 01650 and as specified herein under actual operating conditions.

2. The field tests shall be made by the Contractor under the direct supervision of a qualified factory trained engineer, and in the presence of, and as directed by the Engineer. The protocol for the test shall be prepared by the Contractor for the Engineer's review and approval. The protocol shall be developed to determine flow rate and total dynamic head are consistent with the manufacturer's certified pump curve at a minimum of four operating points.

3. The field tests shall determine the head, discharge and overall efficiency characteristics of each pumping unit and in addition, shall demonstrate that under all conditions of operation each unit:

   - has not been damaged by transportation or installation.
   - has been properly installed.
   - has no mechanical defects.
   - is in proper alignment.
   - has been properly connected.
   - is free of overheating of any parts.
   - is free of all objectionable vibration and noise.
   - is free of overloading of any parts.

4. Vibration and natural frequency tests shall be performed by the pump manufacturer during the field testing. Values in excess of those listed in the Hydraulic Institute Standards shall be corrected prior to acceptance of the installation. Values shall also be compared to shop/factory testing results and shall not deviate by more than 10%.

5. Testing shall be accomplished using groundwater, unless otherwise approved by the Engineer.

6. The Contractor shall be responsible for compliance with all confined space entry laws and regulations.

B. Supervision:

1. The equipment manufacturer shall furnish the services of a factory trained engineer for the above testing.

3.3 SCHEDULES

A. Spare Parts:

1. The manufacturer shall furnish the following spare parts.

Spare Parts Schedule

Description of Spare Parts

Two spare impellers with hex nut and washer.

Two complete sets of O rings.

Two sets of upper and lower bearings.

Two mechanical seal assemblies.

2. This shall be delivered as directed by the Engineer.

++ END OF SECTION ++

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SECTION 15161

SUBMERSIBLE PUMP CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Refer to Division 1 for general requirements including, but not limited to guarantees, operation and maintenance manuals, fabricated equipment, manufacturer's services, etc.

2. Refer to Division 16 for additional electrical requirements such as panel wiring, nameplates, etc.

3. Refer to Section 15160 for coordination with submersible pumps and motors.

B. Supply of Pump Controls and Pumps:

1. The manufacturer of the pumps is responsible to ensure that the pump controls are completely compatible with the pumps supplied and shall furnish documentation so stated.

2. In order to ensure a single source of responsibility, pumps and pump controls shall be supplied by the same manufacturer.

3. The pump control system shall be supplied by the Flygt Corporation, ITT.

C. Scope of Pump Control System:

1. The pump control system shall provide automatic control of the starting and stopping of (2) two constant speed submersible pumps. The peak flow will be handled by one (1) pump with the second pump serving as an operational standby unit. All pump control system components shall be housed in a NEMA 12, wall mounted enclosure. Motor starters for the pumps shall be furnished within the pump control panel.

2. The pump control system shall consist of a level sensing system utilizing float switches.

3. A pump shall shut down upon high motor winding temperature condition.

4. Both pumps shall shut down upon high discharge pressure condition.

5. Electrical interlock for jet pump control circuit in order that jet pump shuts down upon lead pump off in wet well.

D. Factory Testing:

1. The pump control equipment shall be electrically and operationally tested at the factory in accordance with an approved test plan and certified test reports submitted to the Engineer prior to shipment to job site. The Department reserves the right to attend the factory test.

E. UL 508 Requirements:

1. After panels are completely fabricated and tested, panels shall bear a UL 508 serialized label. The manufacturer shall be a UL-listed fabrication facility or the manufacturer shall have the panels fabricated and tested in a UL-listed shop facility.

1.2 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted for approval prior to fabrication in accordance with the requirements of Division 1 of these specifications.

2. Shop drawings shall include physical arrangement of the control panel, internal details, wiring diagrams, control schematics, description of components and nameplate schedule.

3. Complete point-to-point wiring diagrams shall be provided, including all external devices and terminations in panels furnished by others.

4. Control schematics shall be referenced to a detailed written description of the functions of all switches, relays and time delays. Shop drawings will not be reviewed without this detailed functional description. Descriptions shall include, as applicable, but shall not be limited to the following:

a. Operation of pump controls including station elevations for alarms and start-stop for all pumps.

b. Interlocking with motor starters, pump control mode selection (i.e., lead-lag-standby selection).

c. Operation of pump alternation by means of automatic or manual control.

d. Operational description of all alarms.

e. Descriptions shall be complete and shall be the basis of instruction for operating and maintenance personnel.

5. The Contractor shall submit a certification executed by the pump control manufacturer stating that the pumps and pump controls are totally compatible.

6. Submit operations and maintenance manuals in accordance with Division 1.

B. Record Drawings:

1. The Contractor shall provide updated "As-Built" record drawings of the pump control system, updated to record all wiring, component, and logic changes made through the startup period, including final wire numbers and device terminal numbers of equipment and wiring furnished and installed by others.

PART 2 - MATERIALS

2.1 FABRICATION AND MANUFACTURE

A. Power Supply:

1. A 30 amp, 208 volt, three-phase power supply shall be provided to the control panel.

The pump control panel shall contain a disconnect switch for the incoming three-phase power supply.

B. Panel Construction:

1. The pump control panel shall consist of a NEMA 12 steel wall mounted enclosure. Devices specific for one pump, such as elapsed time meters, shall be grouped together in a logical fashion. The pump control panel shall be fabricated of 14 gauge minimum steel, suitably braced internally for structural rigidity and strength. Enclosure

surface shall be phosphatized for corrosion resistance. The maximum dimensions of the pump control panel shall be 36"H x 24"W x 12"D.

2. All external wiring shall be wired by the vendor to a master terminal board with all wires and terminals being properly identified. Wiring diagrams shall be equivalent to NEMA Class II, Type C.

3. Provisions shall be made to supervise incoming power and provide alarm signal in the event there is a failure of power to the pump control panel.

C. Motor Starters, Circuit Breakers, Controls:

1. Main power disconnect switch, pad lockable in the open position.

2. NEMA size 1 combination motor starter with ambient compensated bimetallic overload relay and HMCP motor circuit protector for each pump. Each combination starter shall contain a control power transformer specific to that starter (or pump) for the Hand-Off-Auto control circuit. A separate control power transformer shall be provided for common control circuits (alternation, float switches, etc.).

3. The circuit breakers shall be of the automatic, mechanically trip free type having arc extinguishers and magnetic motor protection type trip devices providing instantaneous short circuit protection. Circuit breakers shall have interrupting capacity minimum 10,000 amperes, r.m.s., symmetrical, short circuit current. Circuit breakers shall have quick-make and quick break toggle mechanisms for manual as well as automatic operations.

4. The panel shall include for each pump, a red (running) indicating light, elapsed time meter, and hand-off-auto selector switch. Indicating lights shall be oil-tight, Type OT push-to-test type. Elapsed time meters shall be of the synchronous motor type with digital readout counter for panel mounting. The register shall read 0-99,999.9 hours and shall be nonreset, 3-1/2" wide.

5. A time delay relay shall be provided for staggered starting of each pump. The relay shall be adjustable from 0 to 30 seconds.

6. Provide a 3 position selector switch to provide Automatic, 1-2 or 2-1 sequencing. Furnish circuitry for both manual and automatic alternation. Operation in the automatic mode shall provide for automatic alternation (sequencing) of the lead pump. Alternator to be solid state hybrid type. Operation in the remaining positions shall assign the stipulated pumps to appropriate lead-lag positions. Provide off delay time to allow switching of pump sequence selector

switch from one position to another while pumps are operating. Time delay shall be adjustable (0-10 sec.) factory set at 3 seconds. Switching shall not disrupt pumping operation.

7. Alarm lights (push-to-test) and reset button, as well as dry contacts (one normally open, one normally closed) for remote alarm indication shall be provided for the following:

   a. Power or phase failure alarm.

   b. Pump failure alarm(s), one per pump.

   c. High pressure alarm on pump discharge.

   d. Redundant low level wet well alarm and power cutoff.

   e. Pump high motor winding temperature alarm, one per pump.

   f. Summary alarm encompassing each of the above alarm conditions.

8. Control transformers to supply control voltages as required.

9. Grounded barrier between power and intrinsically safe float circuits.

10. Liquid level indicator lights, arranged vertically, for each control point in the wet well program.

11. Terminals for connection of float switches, connection of stator thermal sensors (high motor winding temperature) and connection of pressure switch on pump discharge.

12. Interface relays in control panel for proper operation of the moisture sensor and thermal switches supplied by the manufacturer of pumps (Flygt Mini-CAS).

13. One inch by two inch (minimum) engraved phenolic nameplates, stainless steel screw attached, for all operable and indicating components.

14. Relays: Relays shall be of the plug-in design and have a transparent, polycarbonate dust cover to protect the contact surfaces from airborne dust and other contaminants. All relays shall have 3PDT contacts and a molded nylon coil rated for continuous duty operation on 24 and 120 VAC. Relay contacts shall be rated for 10A at 300 VAC with .187 quick connect terminals.

Relay sockets shall be of the (.187) eleven (11) blade design and have screw terminals with self-lifting clamps. Terminal identification numbers shall be visible on the sockets.

15. Time-Delay Relays: Time-delay relays shall be of the plug-in design and have a dust cover to protect the contact surfaces from airborne dust and other contaminants. Time-delay relays shall operate on 24 or 120 VAC and shall have DPDT contacts rated at 10A. The timing function shall incorporate CMOS technology with two selectable timing ranges. The timing ranges shall be (0.06-160 seconds) and (15 seconds-640 minutes). The time-delay relay shall be provided with a red LED for output contact status. Time-delay relays shall be on-delay or off-delay as required.

    Time-delay relay sockets shall be of the octal design and have screw terminals with self-lifting clamps. Terminal identification numbers shall be provided in the sockets.

16. Control Circuit Transformers: Nominal control voltage not to exceed 120V.

    Control power transformers (CPT) to be mounted inside the enclosure.

    Overcurrent protection to be supplied on both the line and load sides. Line protection for all step-down transformers shall use properly sized thermal magnetic circuit breakers only, no fuses will be acceptable.

    Transformers to be sized for a minimum of 25% extra capacity under full load conditions. Minimum size shall be 1 KVA.

    One secondary line shall be grounded for operator safety.

    Transformers shall be manufactured by MICRON, or equal.

17. A normally closed dry contact shall be provided to shut down the jet pump upon lead pump off. The contact, which shall open on lead pump off, shall be wired to the jet pump motor starter control circuit by the Electrical Contractor. The jet pump motor starter shall be furnished and installed by the Electrical Contractor and shall be located remote to the Submersible Pump Control Panel.

D. Pump Control Program Schedule (Actual elevations to be determined in field):

Description	Elevation
*High Water Level Alarm	46.30'
Lead Pump On	45.30'
Lead Pump Off	43.22'
Low Water Level Alarm	42.72'

*Float switch shall be connected directly to extraction and treatment system control panel.

E. Float Switches

1. Furnish and install a total of four (4) float switches with tube support system for the pump control system.

   a. Floats shall be Mini Float switches, complete with clamp assemblies, as manufactured by Anchor Scientific, Inc. or equal.

   b. The Contractor shall furnish and install, as shown on the drawings, a 1" diameter schedule 40 stainless steel pipe to support the float switches.

   c. Float switch housing shall be polypropylene. Float switch cable shall consist of an appropriate unspliced length (from float switch to pump control panel) of heavy duty type SJ0 neoprene jacketing with standard #18 conductors. The float switch for high level alarm shall be normally closed (open upon rising level). All others shall be normally open (close upon rising level). No splices will be permitted in the float switch cable between the float switch and the plug connector. Cable shall be fumished with strain relief for connection to bottom of control panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Electrical Connections:

1. The installation and support of power and control cables from the pump control panel to the main power source and other appurtenant equipment such as pumps, panelboard, and instruments shall be performed in accordance with Division 16, by the Electrical Contractor.

B. Protection During Construction:

1. The control panel shall be protected from moisture, dust and dirt both during storage and after installation for the entire construction period.

3.2 FIELD QUALITY CONTROL

A. Supervision:

1. The pump control manufacturer shall provide a service representative to insure that all external wiring connections made by others are correct and shall so certify in writing to the Department. He/she shall make all final adjustments to place the equipment in proper operating order. He/she shall be available during the station startup and testing period. He/she shall provide separate instructional services as elsewhere specified.

B. Pump Control System Testing:

1. All pump programs shall be simulated and certified to be correct prior to placing pumps on line.

C. Service:

1. The vendor shall furnish the services of a qualified operating and maintenance technician for start-up at the site to check and certify proper installation, and to demonstrate proper operation.

3.3 SCHEDULES

A. Spare Parts:

1. The following spare parts shall be furnished with each control system, unless noted:

   a. Two sets of pilot lights.

   b. Twelve sets of fuses for each size and type.

   c. One control transformer for each size and type.

   d. Three relays for each size and type.

   e. One spare float switch

2. All spare parts shall be boxed and labeled for long-term storage.

B. Parts Lists:

1. Complete parts lists for each item included in the pump control system including a reference to a drawing number locating the specific part; the part description; and the item tag designation, shall be provided.

2. If the part is not of the Vendor's manufacture, he/she shall completely identify the name of the distributor (must be the local distributor not the distributor in the vendor's geographic area) address and phone number of this source of the equipment.

3. A price list for all parts shall be supplied.

3.4 MANUFACTURER TRAINING

A. The Contractor shall furnish the services of qualified factory trained specialists from the manufacturer to instruct the Department's operations and maintenance personnel in the recommended operation and maintenance of this equipment. The training requirements, duration of instruction, and other qualifications shall be in accordance with Section 01730.

++ END OF SECTION ++

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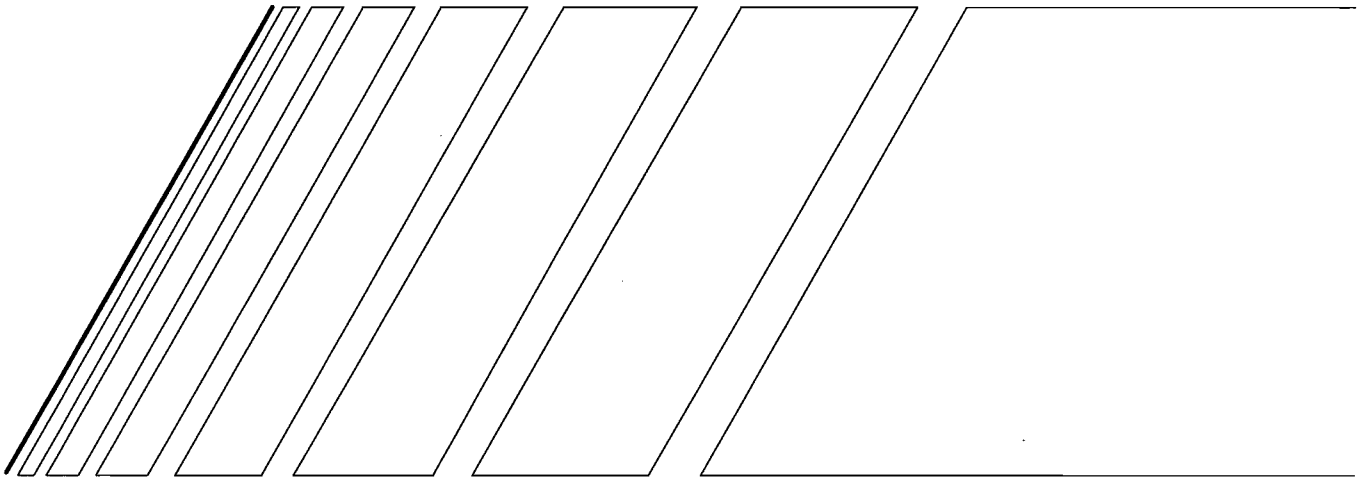
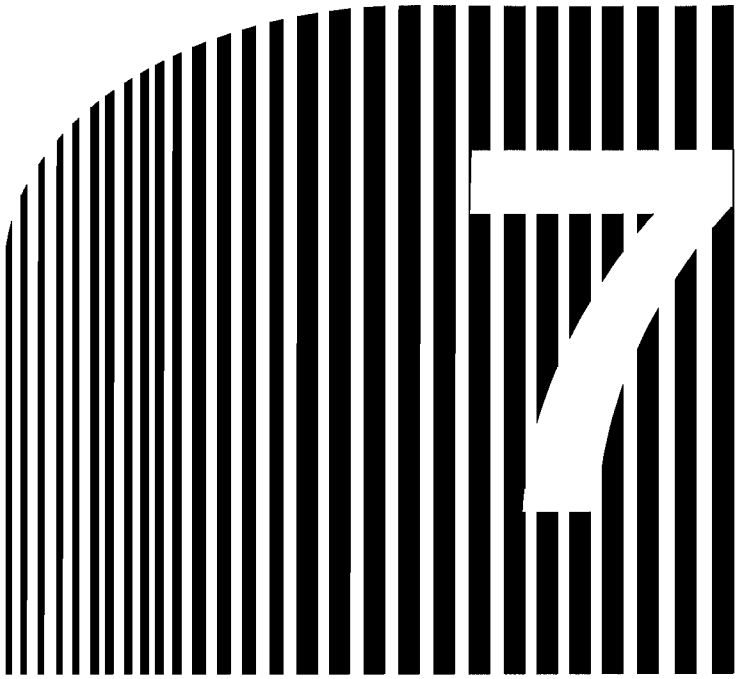


USER'S MANUAL

SYSDRIVE 3G3JV SERIES

Compact Simplified Inverter



Chapter 7

• Maintenance Operations .

7-1 Protective and Diagnostic Functions

7-1-1 Fault Detection (Fatal Error)

The Inverter will detect the following faults if the Inverter or motor burns or the internal circuitry of the Inverter malfunctions. When the Inverter detects a fault, the fault code will be displayed on the Digital Operator, the fault contact output will operate, and the Inverter output will be shut off causing the motor to coast to a stop. The stopping method can be selected for some faults, and the selected stopping method will be used with these faults. If a fault has occurred, refer to the following table to identify and correct the cause of the fault. Use one of the following methods to reset the fault after restarting the Inverter. If the operation command is being input, however, the reset signal will be ignored. Therefore, be sure to reset the fault with the operation command turned off.

- Turn on the fault reset signal. A multi-function input (n36 to n39) must be set to 5 (Fault Reset).
- Press the STOP/RESET Key on the Digital Operator.
- Turn the main circuit power supply off and then on again.

■ Fault Displays and Processing

Fault display	Fault name and meaning	Probable cause and remedy
oC	**Overcurrent (OC)** The Inverter output current is as high as or higher than 200% of the rated output current.	• A short-circuit or ground fault has occurred and at the Inverter output. → Check and correct the motor power cable. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The motor capacity is too large for the Inverter. → Reduce the motor capacity to the maximum permissible motor capacity. • The magnetic contactor on the output side of the Inverter has been opened and closed. → Rearrange the sequence so that the magnetic contactor will not open or close while the Inverter has current output. • The output circuit of the Inverter is damaged. → Replace the Inverter.
ou	**Overvoltage (OV)** The main circuit DC voltage has reached the overvoltage detection level (200-V models: 410 V DC min.; 400-V models: 820 V DC min.).	• The deceleration time is too short. → Increase the deceleration time. • The power supply voltage is too high. → Decrease the voltage so it will be within specifications. • There is excessive regenerative energy due to overshooting at the time of acceleration. → Suppress the overshooting as much as possible.

Fault display	Fault name and meaning	Probable cause and remedy
Uv 1	**Main circuit undervoltage (UV1)** The main circuit DC voltage has reached the undervoltage detection level (230 V DC for the 3G3JV-A2□-A, 160 V DC for the 3G3JV-AB□-A, and 460 V DC for the 3G3JV-A4□-A).	• Power supply to the Inverter has phase loss, power input terminal screws are loose, or the power cable is disconnected. → Check the above and take necessary countermeasures. • Incorrect power supply voltage → Make sure that the power supply voltage is within specifications. • Momentary power interruption has occurred. → Use the momentary power interruption compensation (Set n47 so that the Inverter restarts after power is restored) → Improve the power supply. • The internal circuitry of the Inverter is damaged. → Change the Inverter.
oH	**Radiation fin overheated (OH)** The temperature of the radiation fins of the Inverter has reached 110°C ± 10°C.	• The ambient temperature is too high. → Ventilate the Inverter or install a cooling unit. • The load is excessive. → Reduce the load. → Decrease the Inverter capacity. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The acceleration/deceleration time is too short. → Increase the acceleration/deceleration time. • The ventilation is obstructed. → Change the location of the Inverter to meet the installation conditions. • The cooling fan of the Inverter does not work. → Replace the cooling fan.

Fault display	Fault name and meaning	Probable cause and remedy
oL 1	**Motor overload (OL1)** The electric thermal relay actuated the motor overload protective function.	• The load is excessive. → Reduce the load. → Decrease the Inverter capacity. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The value in n11 for maximum voltage frequency is low. → Check the motor nameplate and set n11 to the rated frequency. • The acceleration/deceleration time is too short. → Increase the acceleration/deceleration time. • The value in n32 for rated motor current is incorrect. → Check the motor nameplate and set n32 to the rated current. • The Inverter is driving more than one motor. → Disable the motor overload detection function and install an electronic thermal relay for each of the motors. The motor overload detection function is disabled by setting n32 to 0.0 or n33 to 2. • The motor protective time setting in n34 is short. → Set n34 to 8 (the default value).
oL2	**Inverter overload (OL2)** The electronic thermal relay has actuated the Inverter overload protective function.	• The load is excessive. → Reduce the load. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The acceleration/deceleration time is too short. → Increase the acceleration/deceleration time. • The Inverter capacity is insufficient. → Use an Inverter model with a higher capacity.
oL3	**Overtorque detection (OL3)** There has been a current or torque the same as or greater than the setting in n60 for overtorque detection level and that in n61 for overtorque detection time. A fault has been detected with n59 for overtorque detection function selection set to 2 or 4.	• The mechanical system is locked or has a failure. → Check the mechanical system and correct the cause of overtorque. • The parameter settings were incorrect. → Adjust the n60 and n61 parameters according to the mechanical system. Increase the set values in n60 and n61.
GF	**Ground fault (GF)** The ground fault current at the output of the Inverter has exceeded the rated output current of the Inverter.	• A ground fault has occurred at the Inverter output. → Check the connections between the Inverter and motor and reset the fault after correcting its cause.

Fault display	Fault name and meaning	Probable cause and remedy
EF□	**External fault □ (EF□)** An external fault has been input from a multi-function input. A multi-function input 1, 2, 3, or 4 set to 3 or 4 has operated. The EF number indicates the number of the corresponding input (S2 to S5).	• An external fault was input from a multi-function input. → Remove the cause of the external fault. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.
F00	**Digital Operator transmission fault 1 (F00)** An initial memory fault has been detected	• The internal circuitry of the Inverter has a fault. → Turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F01	**Digital Operator transmission fault 2 (F01)** A ROM fault has been detected.	• The internal circuitry of the Inverter has a fault. → Turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F04	**Initial memory fault (F04)** An error in the built-in EEPROM of the Inverter has been detected.	• The internal circuitry of the Inverter has a fault. → Initialize the Inverter with n01 set to 8 or 9 and turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F05	**Analog-to-digital converter fault (F05)** An analog-to-digital converter fault has been detected.	• The internal circuitry of the Inverter has a fault. → Turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F07	**Digital Operator fault (F07)** An error in the built-in control circuit of the Digital Operator has been detected.	• The internal circuitry of the Digital Operator has a fault. → Turn the Digital Operator off and on. → Replace the Digital Operator if the same fault occurs again.
STP	**Emergency stop (STP)** An emergency stop alarm is input to a multi-function input. (A multi-function input 1, 2, 3, or 4 set to 19 or 21 has operated.)	• An emergency stop alarm is input to a multi-function input. → Remove the cause of the fault. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.
OFF	**Power supply error** • Insufficient power supply voltage • Control power supply fault • Hardware fault	• No power supply is provided. → Check and correct the power supply wire and voltage. • Terminal screws are loosened. → Check and tighten the terminal screws. • The Inverter is damaged. → Replace the Inverter.

7-1-2 Warning Detection (Nonfatal Error)

The warning detection is a type of Inverter protective function that does not operate the fault contact output and returns the Inverter to its original status once the cause of the error has been removed. The Digital Operator flashes and display the detail of the error. If a warning occurs, take appropriate countermeasures according to the table below.

Note Some warnings or some cases stop the operation of the Inverter as described in the table.

■ Warning Displays and Processing

Fault display	Warning name and Meaning	Probable cause and remedy
Uu (flashing)	**Main Circuit Undervoltage (UV)** The main circuit DC voltage has reached the undervoltage detection level (200 V DC for the 3G3JV-A2□-A, 160 V DC for the 3G3JV-AB□-A, and 400 V DC for the 3G3JV-A4□-A).	• Power supply to the Inverter has phase loss, power input terminal screws are loose, or the power line is disconnected. → Check the above and take necessary countermeasures. • Incorrect power supply voltage → Make sure that the power supply voltage is within specifications.
ou (flashing)	**Main Circuit Overvoltage** The main circuit DC voltage has reached the overvoltage detection level (200-V models: 410 V DC min.; 400-V models: 820 V DC min.).	• The power supply voltage is too high. → Decrease the voltage so it will be within specifications.
oH (flashing)	**Radiation fin overheated (OH)** The temperature of the radiation fins of the Inverter has reached 110°C ± 10°C.	• The ambient temperature is too high. → Ventilate the Inverter or install a cooling unit.
oL3 (flashing)	**Overtorque detection (OL3)** There has been a current or torque the same as or greater than the setting in n60 for overtorque detection level and that in n61 for overtorque detection time. A fault has been detected with n59 for overtorque detection function selection set to 1 or 3.	• The mechanical system is locked or has a failure. → Check the mechanical system and correct the cause of overtorque. • The parameter settings were incorrect. → Adjust the n60 and n61 parameters according to the mechanical system. Increase the set values in n60 and n61.
SEr (flashing)	**Sequence error (SER)** A sequence change has been input while the Inverter is in operation. Local or remote selection is input while the Inverter is in operation. **Note** The Inverter coasts to a stop.	• A sequence error has occurred. → Check and adjust the local or remote selection sequence as multi-function input.
bb (flashing)	**External base block (bb)** The external base block command has been input. **Note** The Inverter coasts to a stop.	• The external base block command has been input as multi-function input. → Remove the cause of external base block input. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.

Fault display	Warning name and Meaning	Probable cause and remedy
EF (flashing)	**Forward- and reverse-rotation input (EF)** The forward and reverse commands are input to the control circuit terminals simultaneously for 0.5 s or more. **Note** The Inverter stops according to the method set in n04.	• A sequence error has occurred. → Check and adjust the local or remote selection sequence.
STP (flashing)	**Emergency stop (STP)** The Digital Operator stops operating. The STOP/RESET Key on the Digital Operator is pressed while the Inverter is operating according to the forward or reverse command through the control circuit terminals. **Note** The Inverter stops according to the method set in n04.	• The parameter setting was incorrect. → Turn off the forward or reverse command once, check that the n06 parameter setting for STOP/RESET Key function selection, and restart the Inverter.
	The emergency stop alarm signal is input as multi-function input. A multi-function input 1, 2, 3, or 4 set to 20 or 22 has been used. **Note** The Inverter stops according to the method set in n04.	• An emergency stop alarm is input to a multi-function input. → Remove the cause of the fault. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.
FAn (flashing)	**Cooling fan fault (FAN)** The cooling fan has been locked.	• The cooling fan wiring has a fault. → Turn off the Inverter, dismount the fan, and check and repair the wiring. • The cooling fan in not in good condition. → Check and remove the foreign material or dust on the fan. • The cooling fan is beyond repair. → Replace the fan.

7-2 Troubleshooting

Due to parameter setting errors, faulty wiring, and so on, the Inverter and motor may not operate as expected when the system is started up. If that should occur, use this section as a reference and apply the appropriate measures.
Refer to *7-1 Protective and Diagnostic Functions*, if the contents of the fault are displayed,

7-2-1 Parameters Fail Set

■ The display does not change when the Increment or Decrement Key is pressed.

- Parameter write-prohibit is input.

  This occurs when n01 for parameter write-prohibit selection/parameter initialization is set to 0. Set n01 to an appropriate value according to the parameter to be set.

- The Inverter is operating.

  There are some parameters that cannot be set during operation. Refer to the list of parameters. Turn the Inverter off and then make the settings.

■ The Digital Operator does not display anything.

Turn the Inverter off and on. If the Digital Operator still does not display anything, the internal circuitry of the Inverter must have failed. Replace the Inverter.

7-2-2 Motor Fails to Operate

■ The motor does not operate with input through the control circuit terminals even though the frequency reference is correct.

- The operation method setting is incorrect.

  If parameter n02 for operation mode selection is not set to 1 to enable the control circuit terminals, the RUN command cannot be executed through the control circuit terminals.

  Check and correct the setting in n02.

- Input in 2-wire sequence while 3-wire sequence is in effect and vice-versa.

  The Inverter will operate in 3-wire sequence according to the RUN, stop, and forward/stop commands if n37 for multi-function input 2 is set to 0. At that time, the Inverter will not operate if input in 2-wire sequence is ON. On the other hand, the Inverter in 2-wire sequence will only rotate in the reverse direction if input in 3-wire sequence is ON.

  Check and correct the setting in n37 or change the input method of the RUN command.

- The Inverter is not in RUN mode.

  When the PRGM or LO/RE indicator (red indicator) of the Digital Operator is lit, the Inverter does not start.

  Cancel the RUN command, press the Mode Key to change the mode of the Inverter, and restart the Inverter with the green indicator lit.

- The frequency reference is too low.

  If the frequency reference is set below the minimum output frequency set in n14, the Inverter will not operate.

  Raise the frequency reference to at least the minimum output frequency.

- The Inverter is in local mode.

  The Inverter in local mode starts with the RUN command given with the RUN Key pressed.

  Check the LO/RE indicator. If the display is "Lo," the Inverter is in local mode. Press the Increment Key and set the Inverter to remote mode with "rE" displayed.

  If the above operation is not possible, a multi-function input is set to local/remote selection. In that case, the mode can be changed with the multi-function input only. Turn the corresponding input terminal OFF so that the Inverter will be set to remote mode.

- The wiring on the Inverter control circuit terminals is incorrect.

  The Inverter cannot check input signals if the input wiring on the control circuit terminals is incorrect.

  Operate the Digital Operator and check the input terminal status of multi-function monitor U06.

  The NPN or PNP input sequence is selectable. The NPN input sequence is the default setting.

  Refer to *2-2-2 Terminal Block* and check that the setting of switch SW7 and wiring are correct.

■ The motor does not operate with input through the control circuit terminals. (The frequency reference is zero or different from the set value.)

- The frequency reference setting is incorrect.

  The analog input of frequency references is ignored with the Digital Operator selected. The digital input of frequency references is ignored unless the Digital Operator is selected.

  Check that the setting in n03 for frequency reference selection coincides with the actual method of giving frequency instructions.

  Before using analog input, refer to *2-2-2 Terminal Block* and check that the setting of SW8 and the actual method (with voltage and current) of providing frequency references are correct.

- The Inverter is in local mode.

  Frequency references can be provided only through key sequences on the Digital Operator or with the FREQ adjuster to the Inverter in local mode.

  Check the LO/RE indicator. If the display is "Lo," the Inverter is in local mode. Press the Increment Key and set the Inverter to remote mode with "rE" displayed.

  If the above operation is not possible, the multi-function input will be set to local/remote selection. In that case, the mode can be changed with the multi-function input only. Turn the corresponding input terminal OFF so that the Inverter will be set to remote mode.

- The analog input gain or bias setting is incorrect.

  Check that the frequency reference gain in n41 and frequency reference bias in n42 are set according to the actual analog input characteristics.

■ The motor stops during acceleration or when a load is connected.

- The load may be too big.

  The 3G3JV has a stall prevention function and automatic torque boost function, but the motor responsiveness limit may be exceeded if acceleration is too rapid or if the load is too big.

  Lengthen the acceleration time or reduce the load. Also consider increasing the motor capacity.

■ The motor only rotates in one direction.

• Reverse rotation-prohibit is selected.

If n05 for reverse rotation-prohibit selection is set to 1 (reverse run prohibited), the Inverter will not accept reverse-rotation commands.

To use both forward and reverse rotation, set n05 to 0.

7-2-3 Motor Rotates in the Wrong Direction

• The output wiring of the motor is faulty.

When the U/T1, V/T2, and W/T3 terminals of the Inverter are properly connected to the T1(U), T2(V), and T3(W) terminals of the motor, the motor operates in a forward direction when a forward rotation command is executed. The forward direction depends on the maker and the motor type. Therefore, be sure to check the specifications.

Switching two wires among the U/T1, V/T2, and W/T3 will reverse the direction of rotation.

7-2-4 Motor Outputs No Torque or Acceleration is Slow

• The stall prevention level during running is too low.

If the value in n57 for stall prevention level during operation is too low, the speed will drop before torque output is turned ON.

Check to be sure that the set value is suitable.

• The stall prevention level during acceleration is too low.

If the value in n56 for stall prevention level during acceleration is too slow, the acceleration time will be too long.

Check to be sure that the set value is suitable.

7-2-5 Motor Deceleration is Slow

• The deceleration time setting is too long.

Check the deceleration time settings in n17 and n19.

• Stall Prevention during Deceleration

The Inverter incorporates a stall prevention function that will automatically prolong the period of deceleration if the motor has an excessive amount of regenerative energy. This function will operate if the period of deceleration is longer than the set value. If the period of deceleration needs to coincide with the set value, use an Inverter model with a larger capacity or a model incorporating a function to process regenerative energy (such as the SYSDRIVE 3G3MV or 3G3EV-series Inverter).

7-2-6 Motor Burns

• The load is too big.

If the load of the motor is too big and the motor is used with the effective torque exceeding the rated torque of the motor, the motor will burn out. For example, the rated torque of the motor and capacity may be limited to eight hours of use if the inscription on the motor states that the motor is rated for eight hours. If the 8-hour rated torque is used for normal operation, it may cause the motor to bun out.

Reduce the load amount by either reducing the load or lengthening the acceleration/deceleration time. Also consider increasing the motor capacity.

- The ambient temperature is too high.

  The rating of the motor is determined within a particular ambient operating temperature range. The motor will burn out if it runs continuously at the rated torque in an environment in which the maximum ambient operating temperature is exceeded.

  Lower the ambient temperature of the motor to within the acceptable ambient operating temperature range.

- The withstand voltage between the phases of the motor is insufficient.

  When the motor is connected to the output of the Inverter, a surge will be generated between the switching of the Inverter and the coil of the motor.

  Normally, the maximum surge voltage is approximately three times the input power supply voltage of the Inverter (i.e., approximately 600 V for 200-V models, and approximately 1,200 V for 400-V models).

  Therefore, the dielectric strength of the motor to be used must be higher than the maximum surge voltage.

7-2-7 Controller or AM Radio Receives Noise when Inverter is Started

- Noise derives from Inverter switching.

  Take the following actions to prevent noise.

  - Lower the carrier frequency of the Inverter in n46.

    The number of internal switching times is reduced, so noise can be reduced to some extent.

  - Install an Input Noise Filter.

    Install an Input Noise Filter on the power input area of the Inverter.

  - Install an Output Noise Filter.

    Install an Output Noise Filter on the output area of the Inverter.

  - Use metal tubing.

    Electric waves can be shielded by metal. Therefore, enclose the Inverter with a metal tube.

7-2-8 Ground Fault Interrupter is Actuated when Inverter is Started

- Leakage current flows through the Inverter.

  The Inverter performs internal switching. Therefore, a leakage current flows through the Inverter. This leakage current may actuate the ground fault interrupter, shutting the power off.

  Use a ground fault interrupter with a high leakage-current detection value (sensitivity amperage of 200 mA or more, operating time of 0.1 s or more) or one with high-frequency countermeasures for Inverter use.

  Reducing the carrier frequency value in n46 is also effective.
  In addition, remember that a leakage current increases in proportion to the cable length. Normally, approximately 5 mA of leakage current is generated for each meter of cable.

7-2-9 Mechanical Vibration

■ Mechanical system makes unusual noise.

- Resonance between the characteristic frequency of the mechanical system and the carrier frequency.

  There may be resonance between the characteristic frequency of the mechanical system and the carrier frequency. If the motor is running with no problems and the machinery system is vibrating with a high-pitched whine, it may indicate that this is occurring. To prevent this type of resonance, adjust the carrier frequency value in n46.

- Resonance between the characteristic frequency of a machine and the output frequency of the Inverter.

  There may be resonance between the characteristic frequency of a machine and the output frequency of the Inverter. To prevent this from occurring, use the frequency jump function with the constants set in n49 through n51 to change the output frequency or install vibration-proof rubber on the motor base to prevent the resonance of the mechanical system.

■ Vibration and hunting are occurring.

- Influence by the slip compensation function.

  The slip compensation function of the Inverter may influence the characteristic frequency of the mechanical system to cause vibration or hunting. In that case, increase the time constant in n67 for slip compensation. The larger this time constant is, however, the slower the response speed of the slip compensation function will be.

■ Motor vibrates excessively and does not rotate normally.

- Motor Phase Interruption

  If one or two of the three phases of the motor are open, the motor will vibrate excessively and will not rotate. Check that the motor is wired correctly without any disconnection. The same phenomenon will occur if the output transistor of the Inverter is open and damaged. Check the balance of the Inverter's output voltage as well.

7-2-10 Motor Rotates after Output of Inverter is Turned Off

- Insufficient DC Control

  If the motor continues operating at low speed, without completely stopping, and after a deceleration stop has been executed, it means that the DC braking is not decelerating enough.

  In such cases, adjust the DC control as described below.

  - Increase the parameter in n52 for DC control current.
  - Increase the parameter in n53 for interruption DC control time.

7-2-11 Detects OV when Motor Starts and Motor Stalls

- Insufficient DC control at startup

  Generation of OV and stalling can occur if the motor is turning when it is started.

  This can be prevented by slowing the rotation of the motor by DC braking before starting the motor.

  Increase the parameter in n54 for startup DC control time.

7-2-12 Output Frequency Does Not Reach Frequency Reference

- The frequency reference is within the jump frequency range.

  If the jump function is used, the output frequency stays within the jump frequency range.

  Make sure that the jump width settings in n49 through n50 for jump frequencies 1 and 2 and jump width in n51 are appropriate.

- The preset output frequency exceeds the upper-limit frequency.

  The upper-limit frequency can be obtained from the following formula.
  Maximum frequency in n09 × frequency reference upper limit in n30/100

  Make sure that the parameters in n09 and n30 are correct.

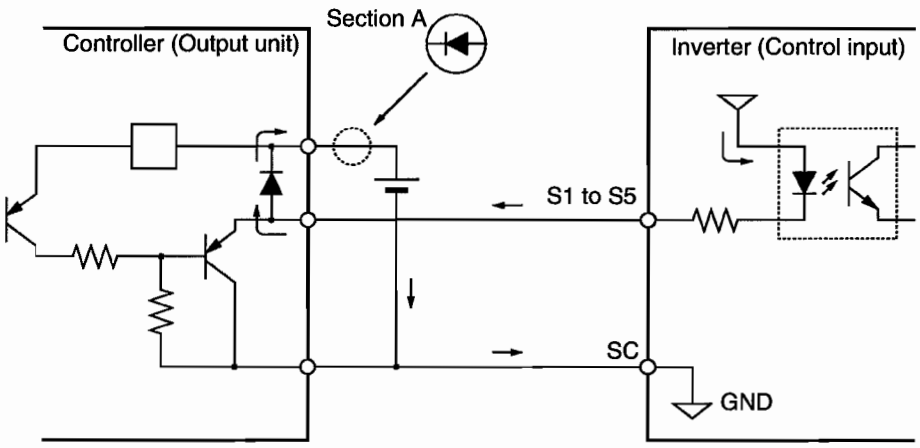
7-2-13 Inverter Does Not Run Because EF (Simultaneous Input of Forward and Reverse Commands) is Detected, or Motor Rotates Momentarily While Control Device Power is OFF

- Sequence Error

  An EF will be detected if a forward command and a reverse command are input simultaneously for 0.5 seconds or longer. Correct the sequence.

- Malfunction Due to Unwanted Current Path

  Inverter inputs may remain ON due to an unwanted current path for the controller outputs. With the wiring shown in the following table, if the controller output power supply is less than 24 V DC or if the power is OFF, the current indicated by the arrow will flow and the Inverter inputs will operate. If that occurs, insert a diode as shown in the diagram at point A.



7-3 Maintenance and Inspection

⚠ **WARNING** Do not touch the Inverter terminals while the power is being supplied.

⚠ **WARNING** Maintenance or inspection must be performed only after turning OFF the power supply, confirming that the CHARGE indicator (or status indicators) is turned OFF, and after waiting for the time specified on the front cover. Not doing so may result in electrical shock.

⚠ **WARNING** Maintenance, inspection, or parts replacement must be performed by authorized personnel. Not doing so may result in electrical shock or injury.

⚠ **WARNING** Do not attempt to take the Unit apart or repair. Doing either of these may result in electrical shock or injury.

⚠ **Caution** Carefully handle the Inverter because it uses semiconductor elements. Careless handling may result in malfunction.

⚠ **Caution** Do not change wiring, disconnect connectors, the Operator, or optional items, or replace fans while power is being supplied. Doing so may result in injury, damage to the product, or malfunction.

■ Daily Inspection

Check the following items with the system in operation.

- The motor should not be vibrating or making unusual noises.
- There should be no abnormal heat generation.
- The output current value shown on the monitor display should not be higher than normal.
- The cooling fan on the bottom of the Inverter should be operating normally, if the Inverter model has the cooling fan.

■ Periodic Inspection

Check the following items during periodic maintenance.

Before beginning inspection, be sure to turn off the power supply. Confirm that all the indicators on the front panel have turned off, and then wait until at least 1 minute has elapsed before beginning the inspection.

Be sure not to touch the terminals right after the power has been turned off. Otherwise, an electric shock may occur.

- The terminal screws of the Inverter should not loose.
- There should be no conductive dust or oil mist on the terminal block or inside the Inverter.
- The mounting screws of the Inverter should not be loose.

- No dirt or dust should be accumulating on the radiation fin.
- No dust should be accumulating on the vents of the Inverter.
- There should be no abnormalities in the outward appearance of the Inverter.
- There should be no unusual noises or vibration and the accumulated operating time should not exceeded the specifications.

■ Periodic Maintenance Parts

The Inverter is configured of many parts, and these parts must operate properly in order to make full use of the Inverter's functions. Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the Inverter operating normally over a long period of time, it is necessary to perform periodic inspections and replace parts according to their service life.

Periodic inspection standards vary with the installation environment and usage conditions of the Inverter.

The maintenance periods of the Inverter are described below. Keep them as reference.

Maintenance Periods (Reference)

- Cooling fan: 2 to 3 years
- Electrolytic capacitor: 5 years
- Fuse: 10 years

The usage conditions are as follows:

- Ambient temperature: 40°C
- Load factor: 80%
- Operation: 8 hours per day
- Installation: According to instructions in manual

It is recommended that the ambient temperature and power-on time be reduced as much as possible to extend of the life of the Inverter.

Note For details regarding maintenance, consult your OMRON representative.

■ Replacement of Cooling Fan

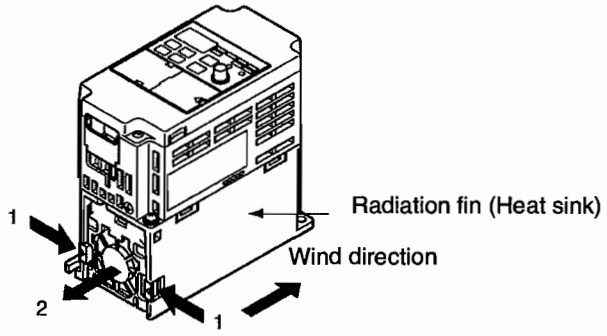
If the FAN fault is displayed or the cooling fan needs replacement, take the following steps to replace it.

• Cooling Fan Models

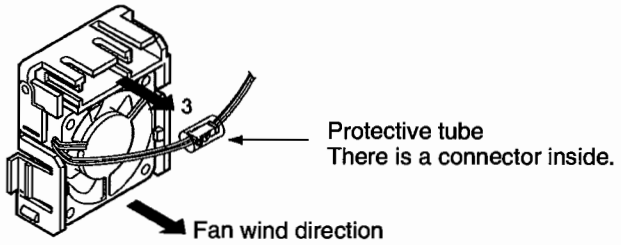
Inverter		Cooling Fan
3-phase 230-V AC	3G3JV-A2007-A	3G3IV-PFAN2007
	3G3JV-A2015-A or 3G3JV-A2022-A	3G3IV-PFAN2015J
	3G3JV-A2037-A	3G3IV-PFAN2037
Single-phase 230-V AC	3G3JV-AB015-A	3G3IV-PFAN2015J
3-phase 460-V AC	3G3JV-A4015-A or 3G3JV-A4022-A	3G3IV-PFAN2015J
	3G3JV-A4037-A	3G3IV-PFAN2037

• Replacing Cooling Fan (68- or 140-mm-wide Inverters)

1. Press the left and right sides of the fan cover located on the lower part of the radiation fin in the arrow 1 directions. Then lift the bottom of the Fan in the arrow 2 direction to remove the Fan as shown in the following illustration.



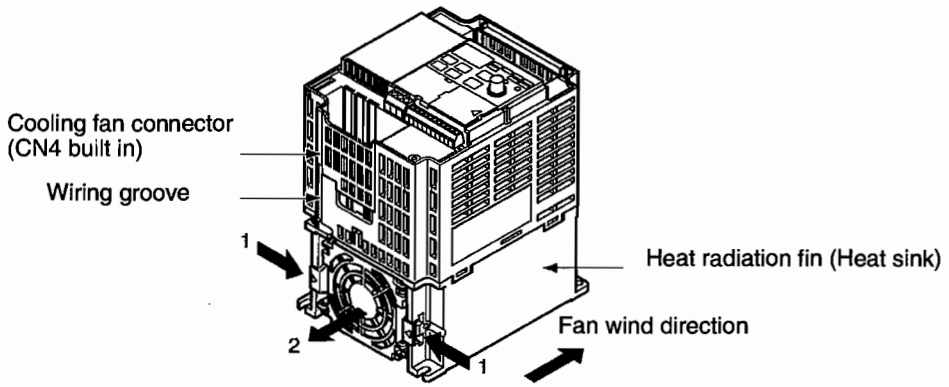
2. Hold the fan wire and pull the protective tube of the cover in the arrow 3 direction.



3. Slide the protective tube and remove the internal connector.
4. Remove the Fan from the fan cover.
5. Mount the new Fan on the fan cover. At this time, make sure that the wind direction of the Fan will be in the direction of the heat radiation fin.
6. Attach the connector, cover the connector with the protective tube, and insert the connector into the cover.
7. Mount the fan cover with the new Fan to the lower part of the heat radiation fin. Make sure that the fan cover snaps on securely with the heat radiation fin.

• Replacing Cooling Fan of 108-mm-wide Inverter Model

1. Dismount the front cover, bottom cover, and fan connector CN4.



2. Press the left and right sides of the fan cover located on the lower part of the radiation fin in the arrow 1 directions. Then lift the bottom of the Fan in the arrow 2 direction to remove the fan as shown in the following illustration.
   Disconnect the wire from the electrical inlet on the bottom of the plastic casing.
3. Remove the Fan from the fan cover.
4. Mount the new Fan on the fan cover. At this time, make sure that the wind direction of the fan will be in the direction of the heat radiation fin.
5. Mount the fan cover with the new Fan to the lower part of the heat radiation fin. Make sure that the fan cover snaps on securely with the heat radiation fin.
6. Wire the power line through the electrical inlet on the bottom of the plastic casing and the wiring groove into the internal circuitry of the Inverter.
7. Attach the wire to connector CN4 and attach the bottom cover and front cover.

OPERATIONS AND MAINTENANCE MANUAL GROUNDWATER TREATMENT SYSTEM

FRANKLIN CLEANERS SITE
Site No.: 1-30-050
Hempstead, New York

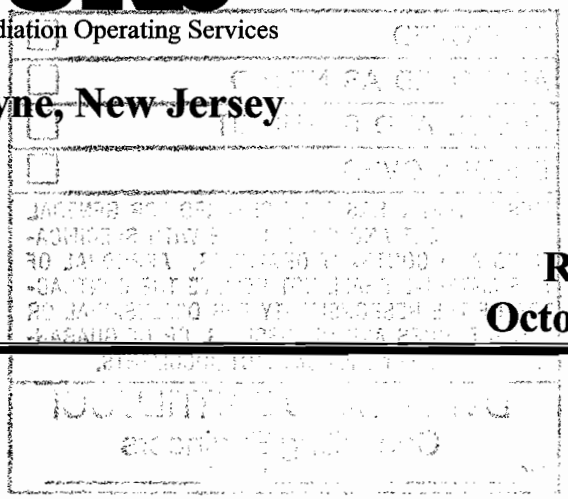
Prepared for:

New York State Department of Environmental Conservation

Prepared by:

URS
Remediation Operating Services

Wayne, New Jersey



Revision 2
October 2003

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LIST OF ACRONYMS

AC	Alternating Current
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DO	Dissolved oxygen
FRP	Fiberglass reinforced plastic
gpm	gallons per minute
GWTP	Groundwater Treatment Plant
GWTS	Groundwater Treatment System
HDPE	High density polyethylene
HOA	Hand/Off/Auto
HP	Horsepower
HSO	Health and Safety Officer
LCP	Local Control Panel
MCC	Motor Control Center
MOC	Material of Construction
MSDS	Material Safety Data Sheet
NC	Normally closed
NCDPW	Nassau County Department of Public Works
NEC	National Electrical Code
NO	Normally open
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PC	Process Controller
P&ID	Piping and Instrumentation Diagram
PLC	Programmable logic controller
PPE	Personal protective equipment
PVC	Polyvinyl chloride
RH	Relative humidity
SDR	Standard Dimension Ratios
SPDES	State Pollutant Discharge Elimination System
SS	Stainless steel
TDH	Total Dynamic Head
TDS	Total dissolved solids
UPS	Uninterruptable power supply
VOC	Volatile organic compound

1.0 INTRODUCTION

1.1 General Background

The Franklin Cleaners Site Project was constructed for the New York State Department of Environmental Conservation under contract number D004264. This project involves construction of a groundwater extraction system, a treatment plant building, startup, and operation and maintenance (O&M) of a groundwater extraction treatment system/plant (GWTS/GWTP) for a period of 12 months.

1.2 Purpose and Objectives

This O&M Manual provides guidelines for supervisory and operating personnel to achieve and sustain successful operation of the GWTS.

This Manual includes a discussion of the design of the facility and supplements the service manuals provided by the manufacturers of the equipment. It will be available to operating personnel at all times and will serve as the primary reference for day-to-day operation.

1.3 Operation and Managerial Responsibilities

To ensure efficient and economical GWTS operations, the responsibilities of the operating personnel and management need to be clearly defined. These responsibilities are presented in the following two sections.

1.3.1 Operational Personnel's Responsibilities

It is the responsibility of the operational personnel to know the proper operational procedures in order to operate the treatment system effectively. They need to be continuously informed of the best operating and maintenance practices.

The operating staff must maintain accurate and neat operational and maintenance records. The operational personnel need to be aware of the safety hazards connected with the various treatment activities and are required to keep management advised of potential problems in operation and maintenance of the system. Knowledge of the efficiencies of the unit operations and processes involved in the treatment system and how to monitor these units is necessary.

One part-time Plant Operator is required to run the GWTS. Other support personnel are used to perform troubleshooting and maintenance as needed.

1.3.2 Management's Responsibilities

It is the responsibility of the GWTS management team to maintain efficient plant operation and maintenance and maintain operations and management records. The requirements of the staff need to be established, as well as job descriptions and development of organizational charts. Management will develop and implement operator-training programs, provide good working conditions, and maintain an adequate supply of safety equipment and proper tools for the operations personnel. Management is responsible for making periodic inspections of the treatment system, discussing problems with the operations personnel and observing operations practices. Furthermore, management is required to prepare budgets and reports, and plan for future facility needs.

1.4 Treatment Requirements/Effluent Limitations

The GWTS is designed to achieve the cleanup goals set forth by the Record of Decision for the Franklin Cleaners Site. The effluent shall meet the discharge criteria specified in the SPDES groundwater discharge permit equivalence, issued by NYSDEC on February 1, 2001 (see Appendix B).

If any of the effluent parameters exceed the SPDES permit discharge limits, corrective actions must be taken and the NYSDEC must be notified of the situation. Process data must be reviewed and additional process samples will be collected to determine the cause of the exceedance. Once the cause is determined, appropriate corrective actions must be taken to correct the problem.

Contaminated air emitted from the air stripper will be processed in the vapor phase carbon adsorbers. Processed air that is free from the contaminants will be released to the atmosphere. Emission test will be carried out by sampling and laboratory contaminants analysis in the influent groundwater, and real time monitoring of the stack air with a Tedlar bag and a photo-ionization detector.

1.5 Process Description

Process flow diagrams for the GWTS are included in this Manual (see the Figures & Drawings section of this Manual). The major flow components include:

- Groundwater extraction
- Air stripping
- Vapor phase adsorption
- Effluent Discharge

There are two (2) extraction wells (EW-1 & EW-2), located on the southern shoulder of the New York Southern State Parkway that pump groundwater to the treatment plant through two (2) individual 2" PVC pipes. The un-treated groundwater enters the tray air stripper at the top through two (2) inlet nozzles. The water travels by gravity through five (5) air stripper trays, fresh air is drawn up through the accumulated water in each tray. The air stripper exhaust air is transported through a pipe manifold network through two (2) vapor phase carbon units (VP-1 and VP-2) and discharged through the exhaust stack to the atmosphere.

Water discharges from the air stripper sump through a 4" pipe into a wet well. From the wet well the treated water is pumped to a sewer manhole. Two (2) submersible pumps are located in the wet well, which is automatically energized when the water reaches a preset level. The treated water is then pumped through the valve vault piping, through the meter vault located just outside the south wall of the treatment building. The treated water passes through the meter vault and travels east through some 1000 feet of 3" effluent piping to a local sewer manhole.

Sample taps are provided in the system to take samples at different points of the treatment process. Sample taps are used to analyze the influent and effluent water, as well as, air exhaust from the vapor phase carbon adsorbers and to ascertain the quality of effluent discharge (air and water) per the NYSDEC permit and requirements.

The GWTS is designed to operate at a capacity of 70 gallons per minute (gpm).

2.0 DESCRIPTION, OPERATION AND CONTROL OF GROUNDWATER TREATMENT SYSTEMS

2.1 Groundwater Extraction System

2.1.1 Design and Description

The groundwater extraction system consists of two (2) extraction wells (EW-1 and EW-2), each equipped with a submersible well pump and 2" discharge pipes, which transport the groundwater to the air stripper. The locations of the extraction wells are shown on the Franklin Cleaners Site Plan, Drawing No. G-2.

The extraction well pumps are submersible pumps with variable speed motors. The pumps are Grundfos Model No. 25E3 with rated capacity of up to 35 gpm at 80 feet TDH at 80 Hz. The motor rating of the Redi-Flo pumps is 2 HP. The transport pipe from the extraction wells to the GWTP building is 2" polyvinyl chloride (PVC) pipe. The pipes inside the building (from building wall to the air stripper) are made of PVC.

well could not yield

2007
EW-2 Redi flow 4 - 5E-8 2-HP motor
6.56 GPM @ 78'

2.1.2 Operation

Groundwater extracted from two (EW-1 and EW-2) extraction wells is pumped to the GWTS located on-site.

The piping layout includes individual 2" PVC feed lines from each extraction well to the low profile air stripper located in the on-site treatment facility. The groundwater extraction pumps start and stop based on the water level in the well and the water level in the low profile air stripper sump.

The expected flow rate of the extraction wells is approximately 43 gpm. This flow rate depends on actual recovery rates of the groundwater extraction wells. The pumps can be operated in "Hand" or "Auto" mode and are linked to the air stripper sump high-level alarm. The system should never be left unattended while any switch is in the "Hand" position. For normal Operation the Extraction and Treatment System selector switch must always remain in the "Auto" mode.

In the "auto" mode, each extraction pump and the blower shuts off at low water level in the either well. The pumps are interlocked with the levels in the air stripper sump. At low water levels, an alarm light will illuminate on the groundwater control panel and the auto dialer will call the designated numbers as programmed. The alarm condition must be corrected and then the alarm is

reset. Then the extraction well pumps and the blower are manually restarted. A Hand/Off/Auto (HOA) switch is provided at the Extraction Treatment System Control Panel to shut the pumps down manually, if needed.

If, over time, fouling of the wells becomes apparent, the NYSDEC must be notified immediately and appropriate actions must be taken to correct the problem.

2.1.3 Groundwater Monitoring System

The groundwater monitoring system at the Franklin Cleaners site consists of 5 monitoring wells.

2.1.3.1 Extraction Wells

The extraction well submersible pump rating for EW-1 and EW-2 is 35 gpm. Extraction well EW-2 shall not be operated at a flow rate higher than 8.5 gpm and a frequency not higher than 62.2 Hertz (with opened valves) in order to avoid a low alarm level in extraction well EW-2, and total system shut down.

2.1.3.2 Monitoring Wells

There are five (5) groundwater-monitoring wells located throughout the Franklin Cleaners site. The locations of wells are shown in the site plan (see Dwg G-2). Groundwater levels in the monitoring wells must be measured at the following frequency:

- Start-up
- Monthly - O&M

Refer to the Sampling and Analysis Plan for further detail. A brief overview follows:
One sample from each of the five (5) groundwater monitoring wells (total of five samples) shall be collected and analyzed prior to start up and then 15 days after start up of the extraction wells. O&M Sampling will be every thirty (30) days during the first 3 months of the Operating Period and once every ninety (90) days thereafter, resulting in a total of eight (8) sampling rounds and forty (40) groundwater samples. The first groundwater-sampling round shall be performed thirty (30) days prior to the scheduled date for startup of the extraction wells.

Groundwater samples shall be analyzed for VOCs by NYSDEC OLM04.2.

2.1.4 Evaluation and Maintenance of Extraction Pumps and Lines

The extraction pumps should be removed if well treatment or mechanical redevelopment is required. Discharge lines should remain in place during treatments for encrustation or fouling. If a well exhibits a decrease in yield without a decrease in specific capacity, then the condition of the pump and associated discharge line must be evaluated. The condition of the pumping system is to be evaluated based on the below listed items:

- Does the pump operate on its original curve?
- Is there excessive operational vibration?
- Has the amperage or voltage load changed?

Once a problem has been identified with the pump and/or discharge line, the pump must be pulled out from the well, disassembled to inspect condition of impellers, cleaned, tested to ensure the pump is operating to design specifications, and then re-installed in the well. Refer to the Section 7.3.7 of this Manual for the lock-out/tag-out procedures before shutting the pumping system and power off. If the problem is determined to be electrical in nature, then an evaluation of the well(s) electrical system must be performed.

2.2 Air Stripping System

2.2.1 Purpose

The air stripper strips and removes the VOCs from the groundwater.

2.2.2 Design and Description

One (1) skid mounted, low profile, tray type, STAT 180 stainless steel construction, air stripper is provided. The five tray air stripper is used to treat the wastewater using the counter current flow of air and water to remove the contaminants. Water is injected into the top of the air stripper and air is injected in the bottom of the air stripper. The air stripper contains a high-level switch assembly housed next to the sight glass. The air stripper has a stainless steel gravity drain sump. Effluent from the stripper sump discharges by gravity to the wet well.

The air stripper skid is equipped with an induced draft air blower. The specifications for the air blower is as follows:

Air Blower: Model: New York Blower, Model: 2506A
Quantity: One
Type: Induced Draft, Pressure Blower
Capacity: 750 CFM @ 50"WC
Motor: 20 HP, 3 Phase, XP Motor TEFC
Accessories: High Pressure Alarm Switch & High Vacuum Alarm Switch

2.2.3 Normal Operation and Control

The groundwater from the extraction wells is pumped to the air stripper system. The groundwater is fed to the top of the air stripper and flows through the inlet distribution piping and through the stripper by gravity. Air enters the bottom of the stripper and travels upward in the stripper using the induced draft blower. The air/water contact leads to the transfer of volatile organic chemicals from water to air phase. The bottom of the air stripper acts as a sump (500 gallons capacity). The groundwater from the air stripper sump flows through a 4" pipe into the wet well.

Each tray has a weir that holds approx. 4" of water and has a "down comer" with a flapper assembly that prevents air from going up the "down comer". A gravity drain sump has a ball float/ flapper assembly that prevents air from going out the drain and forces it up through the trays. As the water level rises in the sump, the ball floats and lifts the flapper to allow water to discharge. When the unit is in operation at the specified airflow and water flow (refer to Attachment 7) there will be approximately 6" of pressure drop per tray.

Fresh air enters the building through an 8" PVC pipe plumbed to the sump of the tray stripper. The blower draws the fresh air through the tray stripper discharging through the top of the stripper.

2.2.4 Air Stripper Cleanout Procedure

The air stripper cleanout will be carried out per the manufacturer's recommendations. The manufacturer's O&M manual presented in Attachment 7 to this Manual is to be referred to for the cleanout procedure. A connection with the valve on the inlet line to the air stripper for chemical reinjection and cleanout posts on the air stripper are provided for this purpose.

2.3 Wet Well and Valve Vault

2.3.1 Purpose

The wet well receives processed water from the tray air stripper and then discharge the processed water to the NCDPW storm drain manhole.

The valve vault allows access to the Flygt isolation valves and instrumentation.

2.3.2 Design and Description

The design and dimensions of the Wet Well and the Valve Vault are identified on the contract drawings.

The functions of the **Wet Well** is to collect treatment water, serve as a surge tank and supply of water for utility purposes (i.e., utility sink supply, exterior grounds maintenance, and a source of water for the pressure washer/containment island operation).

The function of the **Valve Vault** is to house the Flygt isolation valves and instrumentation. The Valve Vault also functions as a sump for any wash down water or water discharge on the treatment plant floor. If water should collect in the Valve Vault above the float set point, an alarm is triggered and the entire treatment system is shutdown.

2.3.3 Normal Operation and Control

The wet well has two (2) submersible pumps that are activated by floats when the processed water reaches the desired level in the wet well. After activation of the pump, the processed water is sent through the valve vault piping to the meter vault where the processed water is totalized and then discharged to the NCDPW storm drain manhole. The wet well is equipped with a high level switch, when activated will shut down the plant. Detailed description of the submersible pumps is provided below:

Submersible Pumps: Flygt Submersible Pumps, Model CP 3085.182-438
Capacity (Rated): 80 gpm @ 21.5 feet TDH
Motor: 3 HP
Discharge Piping – 4" Ductile Iron

An alternate sequence function of the submersible control panel is to operate and monitor the operation and status of the water level in the Wet Well.

The Wet Well will be tested once a month for the first quarter then once a quarter for leaks. A copy of the test results shall be provided in the monthly progress monitoring reports.

2.4 Meter Vault

2.4.1 Purpose

To totalize the amount of processed water that is discharged to the NCDPW storm drain manhole for reporting purposes.

2.4.2 Design and Description

The meter vault consists of a 3" Kent/ABB flow meter. It consists of a magnetic driven low torque registration, which insures accuracy. It can be serviced in-line and is tamperproof.

2.4.3 Normal Operation and Control

Processed water from the wet well is measured through the 3" Kent/ABB and discharged to the NCDPW storm drain manhole at an accuracy rate of > 98.5%.

2.5 Vapor Phase Carbon Adsorber System

2.5.1 Purpose

The purpose of the vapor phase carbon adsorber system is to adsorb and remove the VOCs entrained with the air from the air stripper.

2.5.2 Design and Description

The skid mounted vapor phase carbon adsorber system consists of a pair of carbon mild steel (Zinc Plated) vessels and interconnecting piping. Each carbon vessel is normally 4 feet by 4 feet with a height of 4 feet and is epoxy painted both inside and outside. Each vessel contains 1,000 lbs – 4 x 10 mesh size of virgin carbon. PVC piping (ducting) rack is designed such that the vessels can be operated in series or in parallel.

2.5.3 Normal Operation and Control

The air laden with the VOCs from the air stripper system flows by induced draft through the vapor phase carbon adsorbers (vapor adsorbers) via the interconnecting PVC piping rack. The air enters from the side and out from the top. The vapor adsorbers can be operated in parallel or series mode.

The pressure differential across the vapor absorbers is monitored through local pressure gauges, Dwyer Models 61060 & 61030. Based on the pressure readings, it can be determined whether the vapor adsorbers are fouled. The pressure drops may indicate clogging of the vapor adsorbers. The pressure drops varies with the relative humidity (RH) of the air going into the vapor adsorbers. At higher RH, the pressure differential may be high because the carbon will adsorb more moisture. The decision for changeout of the carbon will be based on the pressure drop across the skid and analysis of the air samples taken on the inlet and outlet side of the skid.

One (1) air stripper blower is provided and is piped (6-in. duct) and valved to connect the vapor phase adsorber skid. The discharge is vented to the atmosphere above the roof. The air blower can be controlled manually or automatically. In addition, an HOA switch is provided on the Extraction and Treatment System Control Panel to shutdown the blower.

The influent and effluent from the vapor phase carbon shall be monitored weekly (see sampling and analysis plan). Samples are to be collected by filling one Tedlar bag at each of the four sample ports. The Tedlar bags are to be tested using a handheld photionization detector. The Tedlar bags are to be used only once and disposed of properly. The purpose of the vapor-phase carbon adsorber system is to adsorb and remove the VOCs entrained within the air from the air stripper. Emission sampling will be performed to determine if GAC in the carbon vessel need to be replaced. Total concentration of VOCs in the inlet and outlet of each carbon vessel will be determined once every 7 days. If VOCs at the outlet of any carbon vessel exceeds 1 ppm, the system will be shut down and replace the GAC in the primary vessel. Prior to restarting the system the flow shall be diverted such that the vessel becomes the secondary vessel. The replacement, redirecting of flow and restarting of the system shall be completed within 72 hours of detecting a total VOC concentration of greater than 1 ppm. Change out procedures shall be performed according to the approved Plan of Operation. The vapor phase carbon operation is in series.

2.6 Auto-Dialer

2.6.1 Purpose

The purpose of the auto dialer is to monitor the GWTS operation while the plant is not manned.

2.6.2 Design and Description

The auto-dialer is a self- contained microprocessor controlled system capable of monitoring up to 8 alarm channels and AC power.

Upon detection of any alarm or status change, the system shall commence dialing programmed telephone numbers and deliver a voice message identifying and describing the alarm conditions. The system will continue to call telephone numbers in succession until it is acknowledged. As soon as the alarm is acknowledged the Department will be notified within 24 hours. If the system automatically shuts down, URS will determine the cause of the shut down with in 24 hours of the shut down. If there is a reason why the system can not be restarted within 24 hours of the shut down, the Department shall be notified immediately. Otherwise, the system shall be restarted within 24 hours of shutdown.

2.6.3 Normal Operation and Control

When the GWTS is unattended, the auto-dialer will be activated to ensure that any alarm condition that occurs will be forwarded to the on-call operator to via the auto-dialer. The following is the list of call contact numbers:

Company	Name	Phone	Fax	Cell
URS	Greg Gangemi	631-845-5617	631-845-5618	631-235-9422
URS	Sam Morales	631-845-5617	631-845-5618	516-662-1026
URS	Ken Sullivan	973-812-6869	973-785-1957	908-513-6434

3.0 INSTRUMENTATION, PROCESS CONTROLS AND MONITORING

3.1 Control Panel Description

There are 2 control panels provided for the GWTS:

1. Extraction and Treatment System Control Panel controls the extraction wells and blower. For details, See Attachment 10.

2. Submersible Pump Control Panel controls the submersible pumps. For details, See Attachment 6.

4.0 START-UP AND SHUT-DOWN OF GROUNDWATER TREATMENT SYSTEM

4.1 Operator Orientation

The following is an outline of the major subjects, which are to be covered in the orientation program required for all operators:

- equipment familiarization
- equipment operation
- testing procedures
- operation and maintenance
- safety

4.1.1 Equipment Familiarization and Operation

A thorough understanding and familiarization of the names of equipment and their operation will expedite corrective action being taken when an operator is required to perform certain duties.

4.1.2 Testing Procedures

Compliance and process testing is necessary for the operations of the GWTS. Therefore, operators should understand the test procedures. Explanation in this area should be made on how the waste stream is sampled, what parameters are being measured, the frequency required and the expected accuracy of the test procedures. Operators should have sufficient knowledge after reviewing the training manual, so they can perform these tests effectively.

4.1.3 Operation and Maintenance

Operators should be familiar with maintenance procedures. They can prevent downtime by making routine preventative inspections of the equipment prior to a planned shutdown such as to detect overheating bearings, improper lubrication and other obvious trouble areas. See Section 5.4 of this Manual for a more detailed discussion on maintenance. Operators should refer to vendor's data/catalogs included as attachments in this manual for specific equipment details and maintenance instructions.

4.1.4 Safety

Operators should be made aware of areas where slips, trips and falls due to spillage or obstacles could create hazardous conditions. Refer to the O&M HASP.

4.2 Pre-Start-Up Procedures

This section covers the pre-start-up procedures that need to be taken.

4.2.1 Preliminary Steps

1. Check the circuit breaker panel in the MCC to be sure all breakers are "On". If any breakers are tripped, note it accordingly in the operating log, and investigate the equipment on the circuit.

2. Check the trip switches to be sure all switches are in the "On" position.

3. Inspect each of the major process vessels to ensure they are free of leaks.

4. Identify on-line and standby equipment. Verify that valves associated with the on-line equipment are on-line (open) and valves associated with standby equipment are off-line (closed).

5. As you turn on pumps and equipment, listen for any unusual noises and vibrations.

4.3 Start-Up Procedures

Before starting any system, thoroughly inspect the system for signs of damage. Use the provided P&ID to verify that the system has been connected correctly. Then, read the start up procedure.

4.3.1 Control Panel 3 phase, 240V

WARNING! – Do not power the panel until this procedure is complete. Damage to the panel may result.

1. Switch the disconnect to the "OFF" position and open the inner door. Verify that the inner door disconnect is in the off position.
2. Switch on the main incoming power to the panel. CAUTION! - The disconnect now has power!
3. Confirm that incoming power is 240 V on all three phases. If the incoming power has a

"high leg" (a four wire delta system), measure the voltage from each leg to ground. It is critical that L1and L3 to ground be 120 volts. Power for the control panel is taken from either L1 or L3. If the high leg (usually L2, 208V) is wired in the L1 or L3 position, the panel may be damaged upon powering the system.

4. Record the following operating conditions:

L1 to ground _____ V
L2 to ground _____ V
L3 to ground _____ V
L1 to L2 _____ V
L1 to L3 _____ V
L2 to L3 _____ V

5. Be sure that all circuit protectors are reset.
6. Close the inner door. Make sure that all of the green HOA's (Hand-Off-Auto) are in the "OFF" position. Turn the inner disconnect to the "ON" position. The panel should have power. All of the alarm lights may be lit depending on the panel. If so, press the "RESET" button. If the alarms will not reset, an alarm may be tripped. (See Attachment 10 for details)
7. If the system was wired at CARBONAIR, then the motors will have been synchronized. Rotation needs to be verified on only one motor. To do so, bump any motor holding the HOA in the "HAND" position for no more than a second (rotation arrows are located most pieces of equipment). If rotation is backwards, have an electrician exchange the incoming power leads L1 and L3. Be sure to lock out and tag the main incoming power. Verify that there is no power with a multimeter.

4.3.2 Well Pump

1. Verify that all pump effluent connection have been made, and open all valves downstream of the pump. Close all sample taps
2. Bump the pump to verify rotation by holding the PUMP HOA in the "HAND" position. The pump will work with any rotation. Correct rotation can be verified by monitoring the flow rate and back pressure of the pump. If the flow rate is about 50% or less of the performance curve, then the rotation is backwards. If rotation is backwards, have an electrician exchange two of the power leads. **Be sure to lock out and tag the main incoming power. Verify that there is no power with a multimeter.**
3. If no there is no flow, then the pump is above the water level. Do not run the pump for an extended length of time without water. The pump height should be reevaluated.
4. Put the Pump HOA in the "AUTO" position[1]. Throttle the pump to the desired flow. Record the following operating conditions:

PUMP motor amp draw _____
PUMP pressure _____
PUMP flow rate _____
Deadhead pressure (pressure w/pump effluent valve closed) _____

4.3.3 STAT, 3ϕ

1. Verify that all influent and effluent connection have been made, and open all inlet, outlet, and bleed valves to ensure that there are no restrictions on the blower. Close all sample taps.
2. Verify that the panel is operational and installed correctly (see panel start up procedures)
3. Bump the blower to verify rotation by holding the STAT blower HOA in the "HAND" position. Rotation arrows are located on the blower to signify proper rotation. If rotation is backwards, have an electrician exchange two of the power leads. **Be sure to lock out and tag the main incoming power. Verify that there is no power with a multimeter.**
4. Once rotation has been confirmed to be correct, put the STAT blower HOA in the "AUTO" position to start the blower. Let the blower run with no load for a few minutes[1]. If the system has a bleed valve, close the bleed valve.
5. Introduce water into the system.
6. Once the system has reached operating conditions, record the following applicable operating conditions:

STAT sump pressure	_____
STAT motor amp draw	_____
STAT back pressure, if there is off gas treatment	_____
Air flow rate, if a meter is available	_____
Water flow rate, if a meter is available	_____

4.4 Shut Down Procedures

CAUTION! – When disabling any motor or piece of equipment be certain that all source of power and fluid have been locked out and tagged.

4.4.1 Well Pump

1. Disable well pump.

Remove all water from pump effluent line.

4.4.2 STAT, 3ϕ

1. Be sure all sources of water are disables.
2. Let system blower continue to run for 10 minutes.
3. Disable blower.

Remove all remaining water in the sump.

4.5 Start-Up after Shutdown

Before re-starting the system after a shutdown, all alarms will be reset and all switches on the LCP/MCC will be put into the "Auto" mode. Now, the system can be started up as described in Section 3.3 above.

4.6 Emergency Shutdown

The plant is designed to shut down if an emergency exists. Shutdown conditions are discussed in Attachment 10.

5.0 INSTALLATION, MAINTENANCE AND TROUBLESHOOTING

5.1 Introduction

To ensure the continuous trouble-free operation of the Franklin Cleaners GWTS, an effective maintenance program is required. This program will provide regularly scheduled preventive maintenance for all plant equipment. By regularly inspecting and maintaining each piece of equipment and keeping accurate records of required maintenance, problems can usually be avoided discovered and corrected before an equipment failure results in an unscheduled plant shutdown.

5.2 Equipment List and Vendor Equipment Data

A copy of the service manuals as provided by the manufacturers of the equipment (included as attachments to this manual) is stored on-site and is available to operating personnel. Also, plant layout and other details and dimensions are available from the drawings presented in the Figures and Drawings section.

5.3 Storage and Installation of Equipment

Manufacturer's recommendation will be strictly followed for equipment storage and installation. The manufacturer's recommendation can be found from the vendor data and catalogues presented in the Attachment section.

5.4 Preventive Maintenance

A periodic planned maintenance schedule will be followed as per the manufacturers' recommendations. Maintenance materials such as supplies, tools and equipment will be available before any maintenance can be performed.

A maintenance schedule has been developed from the manufacturer's O&M manuals and is included in this Manual (see Appendix A-1).

5.5 Lubrication Schedule

The lubrication schedule including lubrication type, quantity and frequency is included as Appendix A-2.

5.6 Corrective Maintenance

If a piece of equipment or instruments malfunctions, the operator will troubleshoot and try to determine what the problem is. The NYSDEC will be notified of the situation. Once the problem is determined, the Project Manager will obtain a verbal approval from the NYSDEC to proceed with the repair or replacement.

5.7 Troubleshooting

Troubleshooting guides for the different equipment and instrumentation can be found in the manufacturers' O&M manuals.

5.8 Manufacturer's O&M Manuals

Equipment and instrumentation manufacturer's O&M manuals are provided as Attachments to this manual. These manuals may be used as references for specific O&M procedures per equipment or instrument. Written permission for the use of manufacturer's copyrighted documents are included in Appendix C.

5.9 Health and Safety Monitoring Equipment

An Organic Vapor Meter, MiniRae 2000 with Manual and Isobutylene Calibration Span Gas will be available when the operator visits the plant. For the Calibration of the Health and Safety Monitoring Equipment, care, and operation and maintenance, the manufacturer's O&M manual will be referenced.

5.10 Expendable O&M Supplies

An adequate supply of expendable O&M supplies will be made available as needed:

- Personal Protective Equipment
- Hand tools
- Sampling equipment
- Housekeeping supplies
- Sanitary supplies

5.11 Housekeeping

Proper housekeeping is an important part of any O&M project. A clean work place is a safe work place. Spills of water, chemicals or any other substance must be cleaned up immediately or as soon as feasible.

6.0 UTILITY AND OTHER SUPPORT SERVICES

6.1 Utility Sink and Containment Island Unit

Processed water from the wet well is withdrawn from the wet well via the 3/4 hp jet pump located on the treatment plant floor along the west wall. The jet pump operation is regulated by a pressure switch and water level in the wet well. A water tank maintains water pressure for the jet pump system. The pressurized treated water supplies water to:

1. Utility sink, located inside the plant along the west wall
2. Exterior hose bib, located on the exterior of the west wall
3. Pressure Washer, fitting used for water supply to the containment island wash down station.

Water from the utility sink discharges into a pump station, which will discharge via flexible hose to a 55-gallon storage drum. Water from the pump station drum and/or valve vault sump pump, may also be pumped directly to the air stripper influent piping for treatment.

Processed water is used for operation of the containment island and pressure washer. The operator connects the flexible hoses from the jet pump discharge piping to the containment island. In addition, flexible hoses are connected from the containment island to the pressure washer. The containment island system continuously filters the water for particulates and pumps the filtered water to the pressure washer.

To drain the containment island, the operator connects flexible hoses from the containment island to the sink discharge piping. This water is then pumped through the sink drain pump to either the 55-gallon storage drum or the air stripper influent piping for treatment.

6.2 Electrical Distribution System

The main electrical and instrumentation panels included in the GWTP are:

- Main MCC panel inside the plant,
- A local control panel for the Flyght pump operation,

- LCP which house the VFD's for the 2 Extraction Wells, which is LCP for the jet pump system,
- Main disconnects inside the building for the Extraction Wells,
- The containment island and pressure washer have their own local controls.

Maintenance and Troubleshooting: The electrical distribution systems provided on the site are to be maintained by the contractor. If any maintenance is required on this system, a New York State licensed electrical contractor must be contacted to perform this work.

6.3 Non-Potable Water System

Non-potable water is provided to be used for the utility sink and for the containment island unit.

Maintenance and Troubleshooting: The non-potable water system, or "utility water" system, for the site is the processed effluent water. This water source is not to be used for personal cleaning or as a drinking source. This system obtains its water from the wet well via a jet pump that is regulated by a pressure switch. Maintenance required on this system is minimal.

6.4 Sanitary System

This facility is operated part-time, hence a toilet is not provided inside the plant.

6.5 Heating, and Ventilation System

The building is ventilated by an exhaust fan on the north wall and a fresh air inlet louver on the south wall.

The Heating and Ventilation system installed in the GWTP building consists of:

1. Two (2) electrical unit heaters supplied by the electrical contractor.

2. One (1) Centrifugal Wall Exhauster, Greenheck Model CWB-100-3, belt drive, capacity 1,400 cfm @ 0.125 in. H_2O static pressure, 1/3 HP, belt driven propeller, wall mounted with fan guard, wall housing, motor (115 volts, 1 phase, 60 Hz) operated shutter – Model S30 and weather intake cowl.

6.6 Lighting System

Emergency and area lighting within the site are to be checked on a regular basis. Inspections on the emergency lighting battery status are to be made on a scheduled timeframe. Area lighting is to be maintained and bulbs should be replaced as needed.

7.0 SAFETY, HAZARDS AND PRECAUTIONS

7.1 Refer to the HASP. Separate Document.

8.0 TESTING, RECORDS AND DOCUMENTATION

8.1 Laboratory Testing

8.1.1 Sampling Program

This section provides a brief overview of the sampling program associated with the operation of the Franklin Cleaners GWTS. The sampling program is designed to document compliance with the discharge permit requirements and monitor the performance of the groundwater treatment facility and allow the operators to evaluate and control the performance of the unit processes at the facility. For specific details on the sampling program, the Draft Sampling and Analysis Plan dated June 2003, should be consulted, and used for guidance. A summary matrix for the sampling program and analytical methods employed at the Franklin Cleaners site are found in the Sampling and Analysis Plan.

8.1.2 Laboratory References

Chemtech for the Franklin Cleaners Site is MBE Certified, in Mountainside, New Jersey.

CHEMTECH CONSULTING GROUP, INC.
Environmental Laboratories
Since 1967 MBE Certified
284 Sheffield Street
Mountainside, NJ 07092
Attention: Omayra Penas
Tel: - (908) 789-8900
Fax: - (908) 789-8900

Chemtech will provide all necessary sample containers and delivery of containers to the site and vice versa.

8.1.3 Interpretation of Laboratory Tests

During operation of the treatment plant, extensive analytical data will be generated by both the off-site laboratory and by the operating staff. This section describes the parameters that are being monitored and their significance to successful operation of the facility.

8.1.3.1 General Water Quality Indicator Parameters

pH: pH is a measure of the hydrogen ion concentration in water. It is expressed as the negative logarithm of the hydrogen ion concentration. The scale extends from 0 to 14. Levels below 2 indicate extremely acid conditions, and levels between 2 and 5 are considered to be strong to mild acidic. pH level, around 7, is considered neutral. Most natural surface water and groundwater falls within this range. Mildly to strong caustic solutions have a pH between 9 and 12 and extremely caustic solutions have pH values above 12. pH will be measured on site using a portable water quality meter.

Temperature: Temperature can be measured with a liquid filled thermometer. Most pH meters have electronic temperature sensors that can also be used to measure temperature in the field. For accurate measurement of temperature, the thermometer used must be calibrated using a thermometer of known accuracy. The treatment process does not regulate temperature. Temperature readings during well sampling, for example, are taken to help determine if the well has been adequately purged. Temperature will be measured on site using a portable water quality meter.

Dissolved Oxygen: Dissolved oxygen (DO) is a measure of the concentration, in mg/l, of molecular oxygen (O_2) in solution. Oxygen is poorly soluble in water. At 0°C (32°F) the maximum concentration of dissolved oxygen is 14.6 mg/l. As temperature increases the solubility of oxygen decreases, dropping to 7 mg/l at 35°C (95°F). DO will be measured on site using a portable water quality meter.

Total Solids and Conductivity: Total dissolved solids (TDS) a measure of the amount of dissolved substances in the water. The determination is made by filtering a sample of the water to remove suspended material. A filter with a pore size of 0.45 microns is used as an arbitrary dividing line between dissolved and suspended material. The filtered water is evaporated in a drying oven and the weight of the residue is reported as dissolved solids. TDS is not a very useful parameter for making operational decisions in the field because of the time required to complete the analysis. Conductivity, a measure of the water's ability to conduct electricity, can be correlated with TDS. The relationship between conductivity and TDS is as follows:

$$\text{TDS (ppm)} = 0.68 * \text{conductivity}$$

Conductivity will be measured on site using a portable water quality meter (Horiba), while TDS will be measured at Chemtech.

8.1.3.2 Specific Organic and Inorganic Contaminants

Volatile Organics: Volatile organic compounds (VOCs) are common industrial solvents with low boiling points. They are used for cleaning, as paint thinners and in many other applications. VOCs are common environmental contaminants. The Franklin Cleaners treatment facility is designed to remove VOCs from the groundwater.

8.2 Records

8.2.1 Operating Records

Records of the Franklin Cleaner's groundwater treatment system operation, maintenance, and monitoring efforts serve a number of purposes. They are useful to water treatment plant operating personnel, management, state and federal agencies, and others with similar systems or related problems. Because plant operation will continue for years, proper "archiving" of information is necessary to monitor the status, and document the history of the plant.

Records may be used to serve the following purposes:

1. Evaluation of plant performance - review of operating and monitoring records can indicate system efficiency, and help pinpoint present and potential problems in the plant.
2. Assessing maintenance frequency of plant components - maintenance records are also necessary qualifications for warranties issued by manufacturers.
3. Supporting budget requests for personnel or equipment to assist in preparation of annual budgets.
4. Providing a foundation for defense against legal action, especially during emergencies.
5. Providing information for use in reports to regulatory agencies.
6. Submitting information for use by public and administrative officials.
7. Compliance with relevant permits, laws, and regulations.

8. Providing information for potential revenue generating ventures.

Records are not to be maintained for their own sake, but for their expected usefulness and value. The following types of records are required in operating the water treatment plant:

- daily reports and records
- monthly reports
- monitoring records
- laboratory records
- maintenance records
- inventory of spare parts

8.2.2 Daily Reports and Records

Daily records will be maintained to record data pertaining to the control of the plant such as flow, inventory of chemicals, etc. This daily report will be developed further during startup and O&M.

8.2.3 Monthly Reports

Monthly progress reports will be generated, summarizing the activities and maintenance performed for the month. The monthly progress report will include, at a minimum, the following information:

- Results of effluent and influent monitoring
- Water level measurements at all monitoring wells
- Parts replacement/maintenance; spare parts inventory
- Accidents/incidents that may have occurred;
- Any emergency events;
- Volume of groundwater treated from each extraction well during the reporting period;
- Overall performance of the water treatment plant; and
- Quantity of water discharged to date.

Monthly progress reports including summaries of the sampling data results will be submitted to the NYSDEC.

8.2.4 Monitoring Records

8.2.4.1 Process

Process data is monitored manually by the operator. Process data sheets will be developed during startup and O&M. Refer to the monthly report.

8.2.4.2 Discharge

Discharge monitoring is performed as stipulated in the SPDES discharge permit equivalence.

8.2.4.3 Monitoring Wells

Monitoring well data (water levels and annual sampling results, etc.) must be summarized and included in the progress reports.

8.3 Laboratory Records

Copies of all laboratory reports must be kept in the URS office. Copies must be submitted to the NYSDEC.

8.4 Maintenance Records

A maintenance management program is to be used to record all maintenance performed on the equipment. Vendor and manufacturer's information must also be recorded.

Plant maintenance records will be kept in the plant computer for references. Records of each equipment (pumps, tanks, mixer, instruments, etc.) with its specification and service repair record are to be produced and kept up to-date.

8.5 Equipment Warranty

Item #	Description	Warranty Period
1.0	Epoxy Resin Coating	1 Year
2.0	Paint	10 Years
3.0	Hand Operated Hoist	12 Months
4.0	Large Diameter Valves, Specials and Appurtenances	12 months
5.0	Submersible Pumps	18 Months
6.0	Submersible Pump Controls	18 Months
7.0	Air Stripper	18 months
8.0	Pressure Blower	18 months
9.0	Extraction Well Pumps	18 months
10.0	Extraction and Treatment System Controls	18 months
11.0	Carbon Vessels	18 months
12.0	Containment Island Pressure Washer Utility Sink Sink Drain Jet Pump Water Tank (Warranty Period from manufacturing time)	18 months 18 Months 12 Months 18 months 18 months 5 Years
13.0	Influent Flow Sensing System	12 Months
14.0	Flow Meter	12 Months
15.0	Sump Pump	12 Months
16.0	Ventilation Equipment	12 Months
17.0	Alarm System	Provided under separate document
18.0	Unit Heater - Electrical	Provided under separate document
19.0	Control Station	Provided under separate document

8.6 Inventory Control

A spare parts inventory is to be updated monthly and submitted with the monthly progress report.

LIST OF TABLES

Franklin Cleaners Site
Hempstead, New York

EQUIPMENT PARTS LIST

Description	Manufacturer	Parts List	Nearest Mfr Rep. Contact Nearest Service and spare parts warehouse	Recommendations Spare Parts	Spare Inventory	Cost ($) Spare Parts	Lead Time	Shelf Life	Preservation	Packaging & Labeling Methods
Hand Operated Hoist	Fulton Fulton Performance Products 50 Indianhead Dr., POBox 8, Mosinee WI 54455-0008 Phone: (715) 693-1700	Fulton K1550 Work Winch Post/tripod	Fulton Performance Products 50 Indianhead Dr., POBox 8, Mosinee WI 54455-0008 Phone: (715) 693-1700	None None	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
Large Diameter Valves and Appurtenances	Spears Manufacturing Company 15853 Olden Street, Sylmar CA 91342 Phone: (818) 364-1611	Spears Ball Valves Repair Kits	Holbrook Supply 790 Grundy Ave Holbrook, NY 11741 Phone: (631) 588-6880	3/4" TU-VRK-005 1 1/4" TU-VRK-012 1 1/2" TU-VRK-015 2" TU-VRK-020 3" TU-VRK-030	0 0 0 0 0	13.39 13.85 37.02 51.82 84.07	2 Days 2 Days 2 Days 2 Days 2 Days	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
	Dwyer 102 Highway 212 Michigan City, Indiana 45381-0373 Phone: (219) 879-8000	Capsuhelic Gauge Series 4000	Dresser Measurement & Control Division Shelton Operation 2 Research Drive, Shelton, CT 06484 Phone: (203) 925-4000	None	N/A	N/A	N/A	N/A	N/A	N/A
	M&H Valve Company POBox 2088 Annison Alabama 36202 Phone: (205) 237-3521	M&H Gate Valves AWWA C500	Holbrook Supply 790 Grundy Ave Holbrook, NY 11741 Phone: (631) 588-6880	None	N/A	N/A	N/A	N/A	N/A	N/A
Gate Valve	M&H Valve Company POBox 2088 Annison Alabama 36202 Phone: (205) 237-3521	M&H Check Valves	Holbrook Supply 790 Grundy Ave Holbrook, NY 11741 Phone: (631) 588-6880	None	N/A	N/A	N/A	N/A	N/A	N/A
Submersible Pumps	Flygt	Flygt Pumps Model # 3085	Pumping Services 368 Lincoln Boulevard, Middlesex NJ 08846 Phone: (732) 469 - 4540	Basic Repair Kit - part # 8018925	0	258.00	3 Days			
Submersible Pump Controls	Flygt	UL 508 913 SEL - ETL Duplex Station	Pumping Services 368 Lincoln Boulevard Middlesex NJ 08846 Phone: (732) 469 - 4540	Auto Alternator (13SP) Relay, Flygt Part # 14-40 31 86 MiniCAS Supervision Relay, Flygt Part # 14-4071 13 Intrinsically Safe Relay, Flygt Part # 14-40 32 22 Phase Monitor, Flygt Part # 14-40 32 12 Float Switch Flygt Part # ENM-10	1 1 3 1 1	171.80 222.20 143.00 128.50 150.00	1 week 1 week 1 week 1 week 1 week	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
Air Stripper	CarbonAir 2731 Nevada Avenue North, New Hope MN 55427-2806 Phone: (800) 526 - 4999	Slat Series	CarbonAir 2731 Nevada Avenue North, New Hope MN 55427-2806 Phone: (800) 526 - 4999	None	N/A	N/A	N/A	N/A	N/A	N/A
	W.E Anserson	Float Switch Model L8	2731 Nevada Avenue North, New Hope MN 55427-2806 Phone: (800) 526 - 4999	None	N/A	N/A	N/A	N/A	N/A	N/A
Pressure Blower	New York Blowe PO Box 386 Marlon CT 06444-0386 Phone:(203) 395-3227 Contact: Phil Ritola	Model 2506A File No. X04835 X04835-100;SIZE2506S20 Arreingement 1 pressure blower CW-TH-Z	New York Blower - ACFM Dynamics,LLC PO Box 386 Marlon CT 06444-0386 Phone:(203) 395-3227 Contact: Phil Ritola	Bearings, 1-11/16" grease-lubricated pair V-belt, Matched set	1 set 1set	525.00 60.00	1 week J110 1 week	N/A N/A	N/A N/A	N/A N/A
	Mercold/Dwyer Inc. 102 Highway 212 Michigan City, Indiana 45381-0373 Phone: (219) 870-8000	Diephragm Pressure Switch Flow switch Pressure gauge Vacuum gauge	All Island Industrial Supply 47 Heisser Court Farmingdale, NY 11735 Phone: (516) 755 3020	None None None None	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A

Franklin Cleaners Site
Hempstead, New York

EQUIPMENT PARTS LIST

Description	Manufactu.er	Parts List	Nearest Mfr Rep. Contact Nearest Service and spare parts warehouse	Recommendations Spare Parts	Spare Inventory	Cost ($) Spare Parts	Lead Time	Shelf Life	Preservation	Packaging & Labeling Methods
Extraction Well Pumps	Grundfos 3131 N. Business Park Avenue Fresno CA 93727 Phone: (800, 333 - 1366	Grundfos 25E3	Morris Industries P.O Box 278 Pompton Plains, NJ 07444-0278 Phone: (800) 835-0777 (George Berry)	Pump # 5030003 Motor # 98022532	0 0	528.00 599.00	3 Days 3 Days	N/A N/A	N/A N/A	N/A N/A
	Omron One East Commerce Drive Schaumburg, IL 60173 Phone: (800; 556-6766	Sysdrive 3G3JV	CarbonAir 2731 Navada Avenue North, New Hope MN 55427-2806 Phone: (800) 526 - 4999	None	N/A	N/A	N/A	N/A	N/A	N/A
	Dwyer 102 Highway 212 Michigen City, Indiana 45361-0373 Phone: (219) 879-8000	Dwyer Pressure Switch Model No. AP-153-37	All Island Industrial Supply 47 Heisser Court Farmingdale, NY 11735 Phone: (516) 755 3020	None	N/A	N/A	N/A	N/A	N/A	N/A
	Crispin Valve 800 Fowler Avenue Berwick, PA 18603 Phone: (570) 752-4524	air relief valve	Blackman Plumbing Supply Company 2700 rte. 112 Medford, NY 11763 Phone: 631) 475-3170	None	N/A	N/A	N/A	N/A	N/A	N/A
	Ashcroft 250 East Main Street Stratford, CT 06614-5145 Phone: (800) 328-8258	Duragauge 1279 Pressure Gauge	All Island Industrial Supply 47 Heisser Court Farmingdale, NY 11735 Phone: (516) 755 3020	None	N/A	N/A	N/A	N/A	N/A	N/A
	Gems Sensors Cowles Road Plainville,CT 06062 Phone: (860) 747-3000	WarrickWire Suspended Electrode	CarbonAir 2731 Navade Avenue North, New Hope MN 55427-2806 Phone: (800) 526 - 4999	None	N/A	N/A	N/A	N/A	N/A	N/A
Extraction and Treatment System Controls	IDEC 1175 Elko Drive Sunnyvale, CA 94089-2209 Phone: (800) 262-4332	Control Panel	Powertech Controls Co. inc. 1019 Fort Salonga Road Northport, NY 11768 Phone: (800) 938-8678	Pilot Lights: White - HW1L-M2F11QD-W-120V Green - HW1L-M2F11QD-G-120V Amber - HW1L-M2F11QD-A-120V Red - HW1L-M2F11QD-R-120V 3 Pole Relay - RH3B-UL-AC120V 3 Pole Base Relay - SH3B-05 3 Pole Relay - RH2B-UL-AC120V 3 Pole Base Relay - SH2B-05	 2 0 0 0 2 2 2 2	 19.93 19.93 19.93 19.93 8.65 3.98 7.12 3.65	 3 Weeks 3 Weeks 3 Weeks 3 Weeks 10 Days 3 Days 3 Days 3 Days	 N/A N/A N/A N/A N/A N/A N/A N/A	 N/A N/A N/A N/A N/A N/A N/A N/A	 N/A N/A N/A N/A N/A N/A N/A N/A
Carbon Vessels	TetraSolv 484 E. Carmel Dr., Suite 339, Carmel IN 46032 Phone: (317) 818 - 0600	Vepor Phese Carbon Vessel	TetraSolv Industries 484 E. Carmel Dr., Suite 339, Carmel IN 46032 Phone: (317) 818 - 0600	None	N/A	N/A	N/A	N/A	N/A	N/A
Jet Pump	Grundfos 3131 N. Business Park Avenue Fresno CA 93727 Phone: (800) 333 - 1366	JPS4 Jet Pump	Morris Industries P.O. Box 278 Pompton Plains, NJ 07444-0278 Phone: (800) 835-0777 (George Berry)	None	N/A	N/A	N/A	N/A	N/A	N/A
Influent Flow Sensing System	Signet Scientific Company 3401 Aerojet Avenue El Monte, CA 91731-2882 Phone: (626) 571-2770	2536 Rotor-X Flow Sensor	Ryan Herco So. Plainfield, NJ Phone: (800) 848-1141 Kevin Buchanan (781) 438-5646	None	N/A	N/A	N/A	N/A	N/A	N/A
Flow Meter	Amco Water Metering Systems 1100 SW 38th Avenue Ocala, FL 34473 Phone: (352) 732-4670	Amco Flowmeter	Remsco 14 Arch Street Watervliet, NY 12189 Phone: (518)-273-6300	None	N/A	N/A	N/A	N/A	N/A	N/A
Sump Pump	Grundfos 3131 N. Business Park Avenue Fresno CA 93727 Phone: (800) 33^ - 1366	KP 350	Walters West End Supply, Inc. 491 Newark St. Lindenhurst, NY 11757 Phone: 631884-0900 (Ron)	Wear Plate Kit #15180 Gasket Kit # 15293 Impeller Kit # 15786	1 1 1	30.70 56.70 32.50	1 week 1 week 2 weeks	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A

Franklin Cleaners Site
Hempstead, New York

EQUIPMENT PARTS LIST

Description	Manufacturer	Parts List	Nearest Mfr Rep. Contact Nearest Service and spare parts warehouse	Recommendations Spare Parts	Spare Inventory	Cost ($) Spare Parts	Lead Time	Shelf Life	Preservation	Packaging & Labeling Methods
Ventilation Equipment	Greenheck P.O. Box 410 Schofield, Wisconsin 54476-0410 Phone: (715) 359-6171	CWB Centrifugal Side Well Exhaust Fan	PO Box 410 Schofield Wisconsin 54476-0410 Phone: (715) 359 - 6171	None	N/A	N/A	N/A	N/A	N/A	N/A
Sink Pressure Tank	Amtrol Inc. 1400 Division Road W. Warwick, RI 02893 Phone: (401) 884-6300	Pressure Tank	Palermo Supply Company 400 Allwood Road Clifton, NJ 07012 Phone: (973) 614- 9464	None	N/A	N/A	N/A	N/A	N/A	N/A
Containment Island	Pressure Island 3345 Edison Way Menlo Park, CA Phone: (650) 780-7900	CIE 4800	OMNI Finishing Systems Inc. Northampton Industriel Park 163 Railroad Drive Ivyland, PA 18974 Phone: (215) 953-1166	**Filtration**						
				Inlet screen, large 3-3/16" - 014-10150	0	21.50	2 week	N/A	N/A	N/A
				Filter Housing - 010-12523	0	77.25	2 week	N/A	N/A	N/A
				10 micron filter cartridge (set of four) - 010-12597	0	51.00	2 week	N/A	N/A	N/A
				50 micron filter cartridge (set of four) - 010-12525	0	51.00	2 week	N/A	N/A	N/A
				Pumps						
				Ozone / Boost pump. Laing 115v - 010-10720	0	138.00	2 week	N/A	N/A	N/A
				Flojet pump head assembly - 010-10720	0	92.50	2 week	N/A	N/A	N/A
				Repair Kits						
				Quad kit, valve chamber, viton - 010-12422	0	27.50	2 week	N/A	N/A	N/A
				Plumbing						
				Ozone Venturi injector - 014-10740	0	40.00	2 week	N/A	N/A	N/A
				Motors						
				.17 HP, 1 phase - 010-11075	0	141.00	2 week	N/A	N/A	N/A
				Electrical						
				Solenoid valve, 1/2" brass, 150 psi (auto fill) - 014-12989	0	59.50	2 week	N/A	N/A	N/A
				Relay, 2 pole -013-11110	0	12.50	2 week	N/A	N/A	N/A
				Relay, 3 pole - 013-11090	0	16.25	2 week	N/A	N/A	N/A
				Relay base, 2 pole - 013-12016	0	8.25	2 week	N/A	N/A	N/A
				Relay base 3 pole - 013-10400	0	11.50	2 week	N/A	N/A	N/A
				Rocker switch, lighted - 013-12409	0	7.75	2 week	N/A	N/A	N/A
				Float, double reed (filter pump/fill) - 013-12537	0	87.50	2 week	N/A	N/A	N/A
				Ozone Bulb, 120/240 volt - 010-12808	0	55.00	2 week	N/A	N/A	N/A
				Ozone Generator Balast, 120 volt - 01012809	0	32.00	2 week	N/A	N/A	N/A
				Accessories						
				Oil skimmer belt - 012-16006	0	82.00	2 week	N/A	N/A	N/A
				Oil Skimmer Scraper - 012-16179	0	79.50	2 week	N/A	N/A	N/A
Sink Drain	Grundfos 3131 N. Business Park Avenue Fresno CA 93727 Phone: (800) 333 - 1386	Sink-paQ	Morris Industries P.O. Box 278 Pompton Plains, NJ 07444-0278 Phone: (800) 835-0777 (George Berry)	None	N/A	N/A	N/A	N/A	N/A	N/A
Pressure Washer	Janny Products Inc. 850 North Pleasent Avenue Somerset, PA 15501 Phone: (614) 445-3400	E1000-C Steam Generator	Gamco 3441 W. Columbus Avenue Chicago, Illinois 60652 Phone: (773) 436-0022	Flow Switch - JD7279	0	63.75	10 days	N/A	N/A	N/A
				Relief valve - JD7048-C	0	20.25	10 days	N/A	N/A	N/A
				Trigger Gun - JD7400	0	41.50	10 days	N/A	N/A	N/A
				3/8" x 50' Hose - JD7624	0	126.00	10 days	N/A	N/A	N/A
				Unloader5 valve - JV1300	0	138.00	10 days	N/A	N/A	N/A
				Wash Tip - JD7755	0	7.50	10 days	N/A	N/A	N/A
				Wash Tip - JD7758	0	7.50	10 days	N/A	N/A	N/A
				Wash Tip - JD7757	0	7.50	10 days	N/A	N/A	N/A
				Wash Tip - JD7756	0	7.50	10 days	N/A	N/A	N/A
				Synthetic Oil Pump - JD7999-B	0	11.50	10 days	N/A	N/A	N/A
				Steam nozzle - JP3308-B	0	17.75	10 days	N/A	N/A	N/A
				Steam orifice - JP3175-09	0	5.00	10 days	N/A	N/A	N/A
				Reducer Coupling - JD920-01	0	2.50	10 days	N/A	N/A	N/A
				Plug - JD3103-04	0	3.50	10 days	N/A	N/A	N/A

Franklin Cleaners
Hempstead New York

OPERATIONS AND MAINTENANCE MANUAL
ITEMIZED LISTING

Specification Section	Itemized Listing	O&M Section	Approved Shop Drawings
Manufacturer's O&M Maual			
09821	Epoxy Resin Coating	1.0	TN 73 (ASN) (Approved As Noted)
09900	Paint	2.0	TN 63A (ASN) (Approved As Noted)
14310	Hand Operated Hoist	3.0	TN 45B (Approved)
15099	Large Diameter Valves, Specials and Appurtenances	4.0	TN 53 B (Approved)
15160	Submersible Pumps	5.0	TN 50 C (Approved)
15161	Submersible Pump Controls	6.0	TN 51C (ASN) (Approved As Noted)
15200	Air Stripper	7.0	TN 23C (Approved)
15300	Pressure Blower	8.0	TN 19D (Approved)
15400	Extraction Well Pumps	9.0	TN 22C (ASN) (Approved As Noted)
15401	Extraction and Treatment System Controls	10.0	TN 48B (Approved) TN 17B (Approved)
15500	Carbon Vessels	11.0	TN 68 (Approved)
15600	Containment Island Pressure Washer Utility Sink Sink Drain Jet Pump Water Tank	12.0	TN 46B (Approved)
15700	Influent Flow Sensing System	13.0	TN 18A (Approved)
15800	Flow Meter (ABB)	14.0	TN 30B (ASN) (Approved As Noted)
15990	Sump Pump	15.0	TN 47A (Approved)
17100	Ventilation Equipment	16.0	TN 57A (Approved)
16761	Alarm System	17.0	Refer to Separate Document
16770	Unit Heater - Electrical	18.0	Refer to Separate Document
16925	Control Station	19.0	Refer to Separate Document
08360	Roll-up Door	20.0	TN 64A (ASN) (Approved As Noted)

LIST OF APPENDICES

Appendix

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B PERMITS / DOCUMENTATION
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C WRITTEN PERMISSION FOR USE OF COPYRIGHTED DOCUMENTS
   1. Spears Manufacturing Company
   2. Dresser Instruments
   3. Dwyer
   4. Carbonair
   5. The New York Blower Company
   6. Omron
   7. Tetrasolv Filtration
   8. +GF+ Signet
   9. Greenheck

APPENDIX A

EQUIPMENT AND INSTRUMENTS

1. Maintenance Schedule
2. Lubrication Schedule

Franklin Cleaners Site
Hempstead, New York

MAINTENANCE SCHEDULES

Over and above maintenance schedule suggested below, daily visual inspection of all equipment, piping, flanges, valves, instruments, etc. shall be performed for leakage, unusual noise and proper working.

Typical Maintenance Schedule			
Item	Action	Frequency	Remarks
Epoxy Resin Coating	----	----	Not Required
Paint (Carboline)	Inspection	Annually	O&M Manual Attachment 2 Cleaning - Wipe with damp cloth use cleaning detergents/ solution if staining persists
Hand Operated Hoist (Flygt)	Inspection	Annually	O&M Manual Attachment 3
Large Diameter Valves, Specials and Appurtenances (Spears)	Inspection	Annually	O&M Manual Attachment 4 No Manufacturer's Maintenance Manual required
Flygt Submersible Pump	Inspection	4,000 hours Continuous Operation 1,000 hours	O&M Manual Attachment 5 The pump shall be inspected once a year, but more frequently under severe operating conditions. The pump shall be overhauled in an authorized service shop every 3 years. If seals are replaced, oil shall be inspected after one week of operation.
Flygt Submersible Pump Controls	Inspection	Annually	O&M Manual Attachment 6 To assure water tight integrity, the hold-down "dog" on the cabinet should be secure at all times. A mild protective spray such as CRC 226, should be used bi-monthly on the outer door gasket.
Air Stripper (Carbonair)	Inspection Cleaning Cleaning	Annually As needed As needed	O&M Manual Attachment 7 There are several maintenance tasks which must be performed periodically to insure continued trouble free operation, Disassembly/Cleaning, Reassembly, and Replacement Procedure. Clean trays when differential pressure per tray exceeds 9" of water. Sight glass should be cleaned when it is rust-colored.
Pressure Blower New York Blower (Carbonair)	Inspection	4,000 hours	O&M Manual Attachment 8 Inspect the complete compressor at every 4000 hours of operation. Check the fan wheel for any wear or corrosion and check V-belt for proper alignment and tension. Lengthen or shorten the frequency of inspection (i.e. 4,000 hours) based on the first inspection.
Extraction Well Pumps Grundfos redi-Flo4 Pump (Carbonair)	---	Not Required	O&M Manual Attachment 9 The well pumps do not require any regular maintenance. If any pump stops working or delivering water, before pulling out the pump from the well, perform troubleshooting per the O & M manual.
Extraction and Treatment System Controls	Inspection	Annually	O&M Manual Attachment 10
Carbon Vessel (TetraSolv)	Inspection	Annually	O&M Manual Attachment 11
Containment Island (Pressure Island)	Inspection	Annually	O&M Manual Attachment 12 Process water reservoir - polypropylene tub shall be inspected regularly Inlet screen- must be cleaned as needed Oil skimmer catch pan - should be checked regularly
Pressure Washer	Inspection	Per use	O&M Manual Attachment 12 Steam Jenny O&M, page 37
Sink Drain (Sink paQ)	Inspection	Annually	O&M Manual Attachment 12
Jet Pump (Grunfos JPS4)	Inspection	Annually	O&M Manual Attachment 12
Water Tank (X-Trol)	----	----	O&M Manual Attachment 12 No manufacturer's Maintenance Manual Available

Franklin Cleaners Site
Hempstead, New York

MAINTENANCE SCHEDULES

Over and above maintenance schedule suggested below, daily visual inspection of all equipment, piping, flanges, valves, instruments, etc. shall be performed for leakage, unusual noise and proper working.

Typical Maintenance Schedule			
Item	Action	Frequency	Remarks
Influent Flow Sensing System	Inspection	Annually	O&M Manual Attachment 13
Flow Meter	Inspection	Annually	O&M Manual Attachment 14
Sump Pump	Inspection	Annually	O&M Manual Attachment 15
Ventilation Equipment	Inspection	Periodically 2,000 hours	O&M Manual Attachment 16 Inspect the belts for tension. Check periodically for wear and tightness.
Alarm System			Available under separate O&M cover
Unit Heater - Electrical			Available under separate O&M cover
Control Station			Available under separate O&M cover
Roll-up Door (Alpine)	Inspection	Annually	O&M Manual Attachment 20 Inspect counter balancing springs for adjustment. Check tension of springs.

Franklin Cleaners Site
Hempstead, New York

LUBRICATION SCHEDULES

Typical Lubrication Schedule			
Item	Manufacturers Recommendation	Type Lubricant	Frequency
Flygt Submersible Pump	Oil Change	Oil	Replace oil when oil housing contains 30% water (indicated by CLS-30 alarm)
NYB Pressure Blower Motor & Fan	Grease	NLGI #2 Grease	Bi-monthly Lithium Based
Sump Pump	Do not operate dry	---	Prelubricated at factory No lubrication required
Pressure Washer	Oil Change	Oil	Water pump oil change should be made after the first 50 hrs, then every 100 hrs after initial oil change (under normal operating conditions).
Roll-up Door	Lubricate curtain guides and teeth of gears.	Grease	Semi- Annually

APPENDIX B

PERMITS AND DOCUMENTATION

1. SPDES Discharge to Groundwater Permit

TABLE 01651-1 Site No.: 1-30-050

Part 1, Page 1 of 1

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning February 1, 2001

and lasting until January 31, 2006

the discharges from the treatment facility to water index number HB-233, Class SC, RECEIVING WATER shall be limited and monitored by the operator as specified below:

Outfall Number and Parameter	Discharge Limitations			Minimum Monitoring Requirements	
	Daily Avg.	Daily Max.	Units	Measurement Frequency	Sample Type
Outfall 001 - Treated Groundwater Remediation Discharge:					
Flow	Monitor	Monitor	GPD	Continuous	Meter
pH (range)		6.5 to 8.5	SU	2/Month	Grab
Tetrachloroethene		5	ug/L	2/Month	Grab
1,1 Dichloroethene		10	ug/L	2/Month	Grab
1,1,1 Trichloroethane		10	ug/L	2/Month	Grab
Trichloroethene		10	ug/L	2/Month	Grab
cis 1,2 Dichloroethene		10	ug/L	2/Month	Grab
Iron		1.0	mg/L	2/Month	Grab
Manganese		1.0	mg/L	2/Month	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:

Chief - Operation Maintenance and Support Section
Bureau of Hazardous Site Control
Division of Environmental Remediation
NYSDEC
50 Wolf Road
Albany, NY 12233-7010

With a copy sent to:

R Schneck, Reg. 1

(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 ug/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 or biocidal-type compounds 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 attached General Conditions.

APPENDIX C

WRITTEN PERMISSION FOR USE OF COPYRIGHTED DOCUMENTS

1. Spears Manufacturing Company
2. Dresser Instruments
3. Dwyer
4. Carbonair
5. The New York Blower Company
6. Omron
7. Tetrasolv Filtration
8. +GF+ Signet
9. Greenheck

SPEARS® MANUFACTURING CO.
Corporate Offices
15853 Olden Street
Sylmar, California 91342
818-364-1611
www.spearsmfg.com

October 6, 2003

Tarek Jaroudi
URS Corporation - Remedial Operations
201 WillowBrook Boulevard
Wayne, NJ 07470

Dear Sir:

Pursuant to your request, Spears Manufacturing Co. authorizes the use of copyrighted documents or manuals for the Franklin Cleaners Operations and Maintenance Manual prepared by URS Corporation.

Sincerely,

SPEARS MANUFACTURING CO.
Jim Lubas

Jim Lubas
Vice President of Sales
Eastern Zone

JL/dt

From: "Matthews
To: "'Bjorn_Cuento@URSCorp.com'" <Bjorn_Cuento@URSCorp.com>
Date: Monday, October 06, 2003 01:42PM
Subject: RE: Written Permission for Copyrighted Documents

Hello Bjorn,

You have permission to reproduce the documents mentioned below providing you do not make any changes to them.

If you are giving credit for the documents please show our company as:

Dresser Instruments

Thank you and good luck with your publication.

Sue

Susan M. Matthews
Communications Director
Dresser Instruments
250 East Main St.
Stratford, CT 06614-5145
Phone: 203-385-0624
Fax: 203-385-0408
susan.matthews@dresser.com

> ----------
> From: Bjorn_Cuento@URSCorp.com
> Sent: Monday, October 6, 2003 11:14 AM
> To: susan.matthews@dresser.com
> Subject: Written Permission for Copyrighted Documents
> Importance: High
>
> Susan,
>
> Good Day!
>
> We have purchased Ashcroft presuure gauges for our Franklin Cleaners Site
> Treatment Facility. In line with this, we are preparing O[peration and
> Maintenance Manuals for the client and the client requires that we obtain
> written permission for the use manufacturer's copyrighted documents.
>
> We included the following documents in our O&M Manual:
>
> 1. Bulletin DU-1 for 1270 Pressure Gauges
> 2. Pressure Gauge Installation, Operation and Maintenance Booklet (with
> picture of man installing pressure gauge)
> 3. Installation and Maintenance Instrucion pamphlet (2-page document)
>
> We are scheduled to submit the manual tomorrow evening. If you could,
> please e-mail or fax me the written permission through this address or fax
> shown below.
>
> Thanks for your support and assistance and we hope to continue using and
> working with your company for our needs in our Remediation Operating
> Services business.
>

> Sincerely,
>
>
> Bjorn Cuento
> URS Corporation - Remediation Operating Services
> 201 Willowbrook Boulevard
> Wayne, New Jersey 07470
>
> Office: 973-812-6828
> Fax: 973-785-1956
> Cell: 973-723-0503
> bjorn_cuento@urscorp.com
>
>

Hello,

Thank you for your request to use reproduced portions of our product literature.

It is our policy to allow reproduction of our catalog material, instruction manuals and/or photos with proper credit, only when the end results will not in any way be detrimental to the interest of Dwyer Instruments, Inc. On this basis, preliminary permission for use is granted. Final permission will be granted upon our review of your reproduced copy.

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e-mail: csexton@dwyermail.com

I agree to the above terms and conditions of use.

Bjorn Cuento
Name

October 6, 2003
Date

CARBONAIR ENVIRONMENTAL SYSTEMS, INC.
2731 NEVADA AVENUE NORTH
NEW HOPE, MINNESOTA
55427-2864
763-544-2154 800-526-4999
FAX 763-544-2151

Project Memo

Date: October 3, 2003
To: URS
Re: Permission to use Carbonair cut sheets or other data

To whom it may concern,
This letter is to authorize the use of Carbonair cuts sheets or O&M's for the Franklin Cleaners project.

Sincerely,

Mark Hansen
Project Manager

nyb | The New York Blower Company®

7660 Quincy Street • Willowbrook, IL 60527-5530 • Tel: 630-794-5700 • fax: 630-794-5776

October 6, 2003

Bjorn Cuento
URS Corporation - Remediation Operating Services
201 Willowbrook Boulevard
Wayne, New Jersey 07470

Dear Mr. Cuento:

We've received your request to reprint copyrighted New York Blower literature in the collection of maintenance literature that you distribute with your equipment. You are granted permission to reproduce the following literature items for such purposes.

nyb Documents
Fan-to-Size fan performance curve for Pressure Blowers
Product Bulletin 451 for Pressure Blowers
Installation, Maintenance, Operation Instructions for Pressure Blowers

Sincerely,

James J. McGrath
VP Legal Counsel
The New York Blower Company

OMRON ELECTRONICS, INC.
One Commerce Drive, Schaumburg, IL 60173 **Phone** (847) 843-7900 **FAX** (847)-843-7787/8568 **WEB** www.omron.com

October 29, 2003

Mr. Bjorn Cuento
URS Corporation – Remediation Operating Services
201 Willowbrook Boulevard
Wayne, New Jersey 07470

Dear Mr. Cuento:

Thank you for your recent request for reproduction rights of the Omron 3G3JV AC Inverter user manual for use in your operator's guide.

Please accept this letter as approval for limited, non-exclusive reproduction rights for Omron document number I527-E3-2.

Please don't hesitate to contact us if we may be of any further assistance.

Best regards,

Mark Lewis
Corporate Communications Manager
Omron Electronics LLC

36 Taylor Ave.
Plymouth MA 02360
508-224-1784 Phone
508-224-5997 Fax
jbarbour@tetrasolv.com

Bjorn Cuento
URS Corp.
201 Willowbrook Blvd.
Wayne, NJ 07470

Dear Bjorn,

As we discussed today, Tetrasolv Filtration, Inc. gives you and URS permission to use our copyrighted material for your O & M Manuals.

This material may be used but it cannot be changed in any way and our name and contact information must also be used with any copied material.

If you have any questions, please don't hesitate to call.

Sincerely,

Jeff Barbour
Eastern Manager

+GF+ SIGNET

October 7, 2003

Mr. Tarek Jaroudi
URS Corporation - Remedial Operations
201 Willow Brook Boulevard
Wayne, NJ 07470

Fax: (973) 785-1956

Dear Mr. Jaroudi,

As per your request, GF Signet authorizes the use of copyrighted documents or manuals for the Franklin Cleaners Operations and Maintenance Manual prepared by URS Corporation. The copyright is specific for the following +GF+ SIGNET products:

+GF+ Signet 515/2536 Rotor-X Flow Sensors; and
8550 Flow Transmitters.

If you have any further questions, please do not hesitate to contact me.

Sincerely,

Niklas Hallberg
Vice President and CFO

NH/lso

Signet Scientific Company, 3401 Aerojet Avenue, El Monte, California 91731-2882 USA
Phone: 626/571-2770, Fax: 626/573-2057, E-mail: info@gfsignet.com

GEORGE FISCHER +GF+ Piping Systems

GREENHECK

AUTHORIZATION TO PUBLISH BROCHURES IN FRANKLIN CLEANERS OPERATION AND MAINTENANCE MANUAL

In connection with the Franklin Cleaners Project located at 206-208B South Franklin Street, Hempstead, Nassau County, New York, Greenheck Fan Corporation consents to allowing the following brochures to be used in the Franklin Cleaners Operations and Maintenance Manual.

Submittal-WD-323, Rev. 2, 2000
Models CW/CWB Centrifugal Sidewall Exhaust Fan Instructions (PN 457691)

The brochures shall not be accompanied by any text, which indicates Greenheck Fan Corporation's endorsement or representation(s) as to the facility and its operation, and shall be used for operations and maintenance purposes only.

Dated this 8th day of October, 2003.

GREENHECK FAN CORPORATION

Robert A. Greenheck
Vice President and General Counsel

I have read the above authorization and agree to comply with the provisions of the authorization before any brochures/literature are published in the Franklin Cleaners Operations and Maintenance Manual.

Dated this _____ day of October, 2003.

URS CORPORATION

By:_____
Tarek Jaroudi
Title:_____

List of Attachments

Attachment	Description	Specification #
1	Epoxy Resin Coating	9821
2	Paint	09900
3	Hand Operated Hoist	14310
4	Large Diameter Valves, Specials and Appurtenances	15099
5	Submersible Pumps	15160
6	Submersible Pump Controls	15161
7	Air Stripper	15200
8	Pressure Blower	15300
9	Extraction Well Pumps	15400
10	Extraction and Treatment System Controls	15401
11	Carbon Vessels	15500
12	Containment Island Pressure Washer Utility Sink Sink Drain Jet Pump Water Tank	15600
13	Influent Flow Sensing System	15700
14	Flow Meter	15800
15	Sump Pump	15990
16	Ventilation Equipment	17100
17	Alarm System	16761
18	Unit Heater - Electrical	16770
19	Control Station	16925
20	Roll - up Doors	08360

-Sikagard 62

Product Data Sheet
Edition 1.2003
Identification no. 601
Version no. 1
Sikagard 62

Construction

Sikagard® 62

High-build, protective, solvent-free, colored epoxy coating

Description	Sikagard 62 is a 2-component, 100% solids, moisture-tolerant epoxy resin. It produces a high-build, protective, dampproofing, and waterproofing vapor-barrier system.
Where to Use	Use as a high build, corrosion-resistant, protective coating. Protective lining for secondary containment structures, or as a seamless flooring system.
Advantages	■ Exceptional tensile strength. ■ Good chemical resistance for long-term protection. ■ Convenient A:B = 1:1 mixing ratio. ■ Easy, paint-like viscosity. ■ Available in 3 standard colors: gray, red, and tan. Special color matches available upon request. ■ Excellent bonding to all common structural substrates. ■ Super abrasion resistance for long-term wear. ■ Sikagard 62, gray, after cure, is approved for contact with potable water.
Coverage	Approximately 150-250 sq. ft./gal. depending on condition of substrate.
Packaging	4-gal. units; 1-qt. units, 12/case.

How to Use

Surface Preparation	Surface must be clean and sound. It may be dry or damp, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, and any other contaminants. **Preparation Work:Concrete** - Should be cleaned and prepared to achieve a laitance and contaminant free, open textured surface by blastcleaning or equivalent mechanical means. **Steel** - Should be cleaned and prepared thoroughly by blast cleaning.
Mixing	**Pre-mix each component.** Proportion equal parts by volume of Components 'A' and 'B' into a clean mixing container. Mix with a low-speed (400-600 rpm) drill using a Sika paddle for 3 minutes, until uniform in color.
Application	Apply coating using high-quality roller, brush, or spray. Two coats are recommended. Apply second coat as soon as the first coat is tack-free and the traffic of application will not damage the first coat. The second coat, however, **must** be applied within 48 hours since a longer delay will require additional surface preparation. **Do not spray with Sikagard 62 granules in the coating.**

Typical Data *(Material and curing conditions @ 73°F (23°C) and 50% R.H.)*

Shelf Life	2 years in original, unopened containers.
Storage Conditions	Store dry at 40°-95°F (4°-35°C). **Condition material to 65°-75°F (18°-24°C) before using.**
Color	Gray, red, tan.
Mixing Ratio	Component 'A' : Component 'B'=1:1 by volume.
Viscosity	Approximately 2,700 cps.
Pot Life	Approximately 35 minutes. (60 gram, mass).
Tack-Free Time	Approximately 4 hours.
Open Time	Light foot traffic: 5-7 hours. Rubber-wheel traffic: 8-10 hours.
Immersion and Chemical Exposure	Minimum cure: 3 days

Tensile Properties (ASTM D-638)
14 days Tensile Strength 6,400 psi (44.1 MPa)
Elongation at Break 2.7 %

Abrasion (Taber Abrader)
7 days Weight loss, 1,000 cycles (H-22 wheel, 1,000 gm. weight) 0.61 gm.

Abrasion Resistance (ASTM D-968)
14 days Abrasion Coefficient 51 liters/mil.

Adhesion (ASTM D-3359)
1 day Adhesion Classification 4A

Water Absorption (ASTM D-570)
7 days Total Water Absorption (2-hour boil) 0.9%

Construction

Limitations

- Minimum substrate and ambient temperature for application 50°F (10°C).
- Do not apply over wet, glistening surface.
- Material is a vapor barrier after cure.
- Do not apply to porous surfaces exhibiting moisture-vapor transmission during the application. Consult Technical Service.
- Minimum age of concrete prior to application is 21-28 days, depending on curing and drying conditions.
- Do not apply to exterior, on-grade substrates.
- Use oven-dried aggregate only.
- Do not thin with solvents.
- Color may alter due to variations in lighting and/or UV exposure.
- On 'green or 'damp' concrete, EpoCem can be used as a pore filler to reduce vapor drive and potential osmotic blistering.

Caution

Component 'A' - Irritant; Sensitizer - Contains epoxy resin. Can cause sensitization after prolonged or repeated contact. Skin and eye irritant. Vapors may cause respiratory irritation. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. In case of high vapor concentrations, use an appropriate NIOSH/MSHA approved respirator. Remove contaminated clothing. HMIS Hazard Rating: H-2, F-0, R-0, PPE-C.

Component 'B' - Sensitizer- Contains amines. Contact with eyes or skin may cause severe burns. Can cause sensitization after prolonged or repeated contact. Skin and eye irritant. Vapors may cause respiratory irritation. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. In case of high vapor concentrations, use an appropriate NIOSH/MSHA approved respirator. Remove contaminated clothing. HMIS Hazard Rating: H-3, F-0, R-0, PPE-C.

First Aid

In case of skin contact, wash immediately and thoroughly with soap and water. For eye contact, flush immediately with plenty of water for at least 15 minutes; contact physician immediately. For respiratory problems, remove person to fresh air. Wash clothing before re-use.

Clean Up

Ventilate area. Confine spill. Collect with absorbent material. Dispose of in accordance with current, applicable local, state, and federal regulations. Uncured material can be removed with approved solvent. Cured material can only be removed mechanically.

Chemical Resistance
Specimen: Two Coats - 10 mils Total
Cured 10 days
Substrate: asbestos cement

Chemical	Test Temp.	Storage Time and Evaluation				
		1 Day	1 Month	2 Months	6 Months	12 Months
Water	75°F (24°C)	A	A	A	A	A
	100°F (38°C)	A	A	A	A	A
	140°F (60°C)	A	A	A	A, D	A, D
Sodium Chloride Solution (Saturated)	75°F (24°F)	A	A	A	A	A
	100°F (38°C)	A	A	A	A	A
Sodium Hydroxide 30%	75°F (24°C)	A	A	A	A	A
Cement Water (Saturated)	75°F (24°C)	A	A	A	A	A
Detergent Solution (5% Ajax)	75°F (24°C)	A	A	A	A	A
	140°F (60°C)	A	A	A	A, D	A, D
Hydrochloric Acid 10%	75°F (24°C)	A	A	A	A	A
Sulfuric Acid 10%	75°F (24°C)	A	A	A	B	B
Oxalic Acid 10%	75°F (24°C)	A	A, D	A, D	A, D	A, D
Citric Acid 10%	75°F (24°C)	A	A, D	A, D	A, D	A, D
Fuel Oil (Home Heating)	75°F (24°C)	A	A	A	A	A, D
Gasoline (Unleaded)	75°F (24°C)	A	A	A	A	A, D
Iso-Octane	75°F (24°C)	A	A	A	A	A, D
Toluol	75°F (24°C)	A	A	A	A	A, D
Silage	75°F (24°C)	A	A	A, D	A, D	B, D
Synthetic Silage	75°F (24°C)	A	A	B, D	B, D	B, D
Ethyl Alcohol	75°F (24°C)	A	C	-	-	-

A: Resistant in permanent contact
B: Temporary resistance
C: Destroyed
D: Discolored

KEEP CONTAINER TIGHTLY CLOSED — KEEP OUT OF REACH OF CHILDREN
NOT FOR INTERNAL CONSUMPTION — FOR INDUSTRIAL USE ONLY
CONSULT MATERIAL SAFETY DATA SHEET FOR MORE INFORMATION

Sika warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current technical data sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor.

NO OTHER WARRANTIES EXPRESSED OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEOR Y FOR SPECIAL OR CONSEQUENTIAL DAMAGES.

Visit our website at www.sikausa.com **1-800-933-SIKA NATIONWIDE**

Regional Information and Sales Centers. For the location of your nearest Sika sales office, contact your regional center.

Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
Phone: 800-933-7452
Fax: 201-933-6225

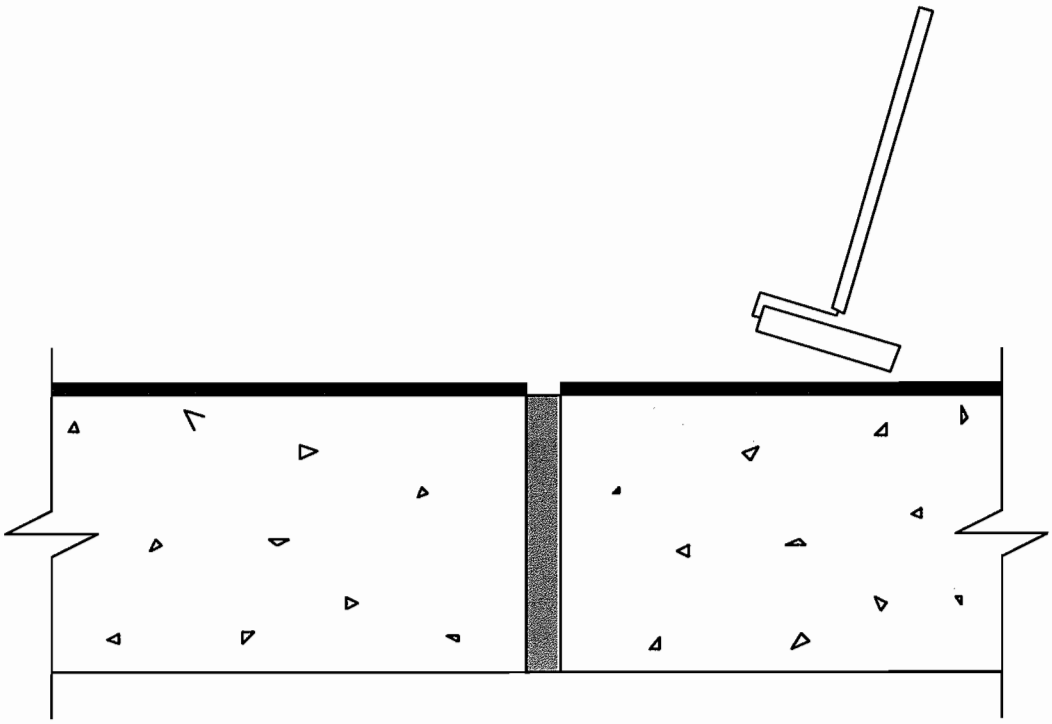
Sika Canada Inc.
601 Delmar Avenue
Pointe Claire
Quebec H9R 4A9
Phone: 514-697-2610
Fax: 514-694-2792

Sika Mexicana S.A. de C.V.
Carretera Libre Celaya Km. 8.5
Corregidora, Queretaro
C.P. 76920 A.P. 136
Phone: 52 42 25 0122
Fax: 52 42 25 0537

QUALITY ISO 9001 9002 ACHIEVEMENT

Quality Certification Numbers: Lyndhurst: 93-062B, Marion: 93-086B, Kansas City: 94-258B, Santa Fe Springs: 94-195C

SC-054 Sikagard 62 Coating



1. Apply Sikagard 62 with high quality brushes or rollers. Care should be taken to avoid sags or runs.

2. When applying the coating, never stop the application until the entire surface has been coated.

3. Subsequent coats shall be applied within 48 hours of the previous coat.

4. For a slip-resistant surface, aggregate shall be incorporated into the mixed epoxy resin coating at a ½ lb./gal.

Note: When applying Sikagard 62 always end at an edge, corner or joint. Do not apply 62 directly over joint filler.

-Carboline Carboguard 561 & 561 LT
-Carboline Carboguard 890 & 890 LT Glass Flake
-Carboline Carboguard 893 SG
- Carboline Carboguard 954 SG

Paint Maintenance and Cleaning Procedures

1. Prepare the surrounding area.
2. De-energize any equipment that may come into contact with wet paint or preparation and cleanup activities.
3. Protect all adjacent surfaces.
4. Read all paint and cleaning materials MSDS.
5. Wear the proper PPE noted in the MSDS or applicable URS SMS's.
6. Clean all areas to be painted with dilute soap and water, rinse area if needed clean with approved solvent.
7. Wipe dry with clean lint free cloth.
8. Remove loose and flaked paint with scraper.
9. Using coarse sand paper or grinding wheel, remove all foreign material and rust bring the surface to a clean condition.
10. Follow manufacturer's recommendations for primer requirements and application procedures.

Paint Manufacturer's Information

Carboline Company
350 Hanley Industrial Court
St. Louis, MO 63144
Phone: (314) 644-1000
Fax: (314) 644-4617

March 16, 2003

3

URS PROJECT AT MALLOY COLLEGE

UPDATED CARBOLINE/KOPCOAT REFERENCES

Para. 1.2	**Update manufacturer name from KopCoat to Carboline**	
Para. 2.4.A.2.1	Carboline Bitumastic 300M	7-10 mils per coat
	Carboline Bitumastic 300M	7-10 mils per coat
Para. 2.4.A.2.1.2	**CONCRETE BLOCK**	
Epoxy Block Filler	Carboline Carboguard 954HB	10 mils
Finish	Carboguard 893SG	3-4 mils per coat
	Carboguard 893SG	3-4 mils per coat
Para. 2.4.B.1	**FERROUS PIPING**	
Shop Primer	Carboguard 888	2.0-3.5 mils
Field Primer Touch-Up	Carboguard 888	2.0-3.5 mils
Finish	Carboguard 893SG	3.0-4.0 mils
Para. 2.4.C.2.a.1	**FERROUS,NON-FERROUS,FIBERGLASS,GALV (EXTERIOR)**	
FERROUS PRIMER	Carboguard 893SG	2.0-3.5 mils
PRIMER (FIBERGLASS/GALV.	-	-
INTERMEDIATE	Carboguard 893SG	4.0-5.0 mils
FINISH	Carbothane 134HG	2.0-2.5 mils
Para.2.4.D.2.a.1	**GALVANIZED & NON-FERROUS INT. (NON-SUBMERGED)**	
FERROUS PRIMER	Carboguard 893SG	2.0-3.5 mils
PRIMER (FIBERGLASS/GALV.	-	-
INTERMEDIATE	Carboguard 893SG	2.0-3.5 mils

Para. 2.4.E.2.a.1 SUBMERGED & INTER. SUBMERGED FERROUS METAL (INTERIOR & EXTERIOR)

PRIMER	Carboguard 888	2.0-3.5 mils
INTERMEDIATE	Carboguard 561/561LT	4.0-6.0 mils per coat
FINISH	Carboguard 561/561LT	4.0-6.0 mils per coat

Para. 2.4.F.2.a.1 SUBMERGED & INTERMITTENT SUBMERGED GALVANIZED FERROUS METAL (INTERIOR & EXTERIOR)

SURFACE PREPARATION Abrade the surface to a 1.0 mil minimum profile

PRIMER	Carboguard 561/561lt	4.0-5.0 mils
FIELD FINISH	Carboguard 561/561LT	4.0-6.0 mils per coat

Para. 2.4.G.2.a.1 ALUMINUM IN CONTACT WITH DISIMILIAR MATERIALS

SURFACE PREPARATION Abrade the surface to a 1.0 mil minimum profile & solvent wipe with Thinner #2 to remove surface contaminents

FIELD FINISH	Carboguard 561/561LT	2.0-3.0 mils per coat
	Carboguard 561/561LT	2.0-3.0 mils per coat

Para. 2.4.H.2.a.1 FERROUS METAL BURIED EXTERIOR

Shop Primer	Carboguard 888	2.0-3.5 mils
FIELD PRIMER/TOUCHUP	Carboguard 888	2.0-3.5 mils
INTERMEDIATE	Bitumastic 300M	8.0-10.0 milS/coat
FINISH	Bitumastic 300M	8.0-10.0 milS/coat

Para. 2.4.I.2.a.1 WOODWORK INTERIOR

SURFACE PREPARATION Abrade the surface to a 1.0 mil minimum profile & solvent wipe with Thinner #2 to remove surface contaminents

FIELD PRIME:	Carboguard 890/890LT	2.0-3.5 mils per coat
FIELD FINISH	Carboguard 890/890LT	2.0-3.0 mils per coat

Para. 2.4.G.2.a.1 **ALUMINUM IN CONTACT WITH DISIMILIAR MATERIALS**

SURFACE PREPARATION Abrade the surface to a 1.0 mil minimum profile & solvent wipe with Thinner #2 to remove surface contaminents

FIELD FINISH	Carboguard 561/561LT	2.0-3.0 mils per coat
	Carboguard 561/561LT	2.0-3.0 mils per coat

Para. 2.4.J.2.a.1 updated reference

FIBERGLASS, FIBERGLASS INSULATION COVERING (INTERIOR)

SURFACE PREPARATION Abrade the surface to a 1.0 mil minimum profile & solvent wipe with Thinner #2 to remove surface contaminents

FIELD FINISH	Carboguard 893SG	2.0-3.0 mils per coat
	Carboguard 893SG	2.0-3.0 mils per coat

product data

Carboguard®561 & 561 LT

Selection & Specification Data

Generic Type
Epoxy Polyamide

Description
User-friendly potable water coating with a proven track record and excellent application characteristics. Self-priming coating available in conventional (561) and low-temperature (561 LT) versions. Offers excellent application properties with extended recoat times.

Features
- Conventional and low-temperature versions
- Ready to apply after mixing; no sweat-in time required
- User-friendly; extended recoat times
- VOC compliant to current AIM regulations
- Meets or exceeds all requirements of:
  - **ANSI/NSF Std. 61 for potable water tanks of 1000 gallons or larger**
  - **AWWA D102 Inside System 1 and 2**
  - **AWWA C210-92 for use on interior and exterior of steel water pipe**

Color
White (S800);Gray (0794); Blue (4169)

Finish
Satin

Primers
Self-priming

Topcoats
Acrylics, Alkyds, Epoxies, Polyurethanes

Dry Film Thickness
4.0-6.0 mils (100-150 microns) per coat
Do not exceed 10 mils in a single coat or 17 mils for total system

Solids Content
By Volume: 58% ± 2%

Theoretical Coverage Rate
930 mil ft^2 (23.0 m^2/l at 25 microns)
Allow for loss in mixing and application

VOC Values
As supplied: 3.00 lbs/gal (360 g/l)
Thinned:
10 oz/gal w/ #10: 3.20 lbs/gal (387 g/l)
15 oz/gal w/ #10: 3.40 lbs/gal (413 g/l)
16 oz/gal w/ #33: 3.50 lbs/gal (420 g/l)
These are nominal values and may vary slightly with color.

Dry Temp. Resistance
Continuous: 200°F (93°C)
Non-Continuous: 250°F (121°C)
Discoloration and loss of gloss is observed above 200°F (93°).

Wet Temp. Resistance
Immersion temperature resistance depends upon exposure. Consult Carboline Technical Service for specific information. It is recommended that metal tanks operating above 140°F (60°C) be insulated.

Limitations
- Epoxies lose gloss, discolor and eventually chalk in sunlight exposure. Discoloration is more pronounced with 561 LT.

Substrates & Surface Preparation

General
Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.

Steel
Immersion: SSPC-SP10
Non-Immersion: SSPC-SP6
Surface Profile: 1.5-3.0 mils (38-75 microns)

Concrete
Immersion:
Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.

Performance Data

561

Test Method	System	Results	Report #
ASTM D4541 Adhesion	Blasted Steel 2 ct. 561	1600 psi (Pneumatic)	09453
ASTM D522 Flexibility	Blasted Steel 1 ct. 561	90° bend produced no cracking, ¾" Cylindrical Mandrel Bend	09453

561 LT

ASTM D4541 Adhesion	Blasted Steel 2 ct. 561 **LT** (cured at 35°F)	1900 psi (Pneumatic)	09453
ASTM D522 Flexibility	Blasted Steel 1 ct. 561 LT (cured at 35°F)	90° bend produced no cracking, ¾" Cylindrical Mandrel Bend	09453

Test reports and additional data available upon written request.

December 2002 replaces October 2001

0966/0968

Carboguard® 561 & 561 LT

Application Equipment

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results. General guidelines:

Spray Application (General) The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.

Conventional Spray Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .070" I.D. fluid tip and appropriate air cap.

Airless Spray

Pump Ratio:	30:1 (min.); 45:1 (min) for LT
GPM Output:	2.5 (min.)
Material Hose:	3/8" I.D. (min.)
Tip Size:	.017"-.021"
Output PSI:	2100-2300; 3000 psi for LT
Filter Size:	60 mesh

Teflon packings are recommended and available from the pump manufacturer.

Brush & Roller (General) Not recommended for tank lining applications except when striping welds. Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling. For best results, tie-in within 10 minutes at 75°F (24°C).

Brush Use a medium bristle brush.

Roller Use a short-nap synthetic roller cover with phenolic core.

Mixing & Thinning

Mixing Power mix separately, then combine and power mix. DO NOT MIX PARTIAL KITS.

Ratio 561 and 561 LT 1:1 Ratio (A to B)

Thinning Normally not required but may thin as follows:
Spray: Up to 15 oz/gal (12%) w/ #10
#33 Thinner up to 16 oz/gal (12%) may be used for brush & roll applications for non-NSF applications. Use of thinners other than those supplied by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.

Pot Life
561 4 Hours at 75°F (24°C)
561 LT 3 Hours at 75°F (24°C)
Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures.

Cleanup & Safety

Cleanup Use #2 Thinner or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.

Safety Read and follow all caution statements on this product data sheet and on the MSDS for this product. Employ normal workmanlike safety precautions. Hypersensitive persons should wear protective clothing, gloves and use protective cream on face, hands and all exposed areas.

Ventilation When used as a tank lining or in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved supplied air respirator.

Caution This product contains flammable solvents. Keep away from sparks and open flames. All electrical equipment and installations should be made and grounded in accordance with the National Electric Code. In areas where explosion hazards exist, workmen should be required to use non-ferrous tools and wear conductive and non-sparking shoes.

Application Conditions

561

Condition	Material	Surface	Ambient	Humidity
Normal	60°-85°F (16°-29°C)	60°-85°F (16°-29°C)	60°-90°F (16°-32°C)	0-80%
Minimum	50°F (10°C)	50°F (10°C)	50°F (10°C)	0%
Maximum	90°F (32°C)	125°F (52°C)	110°F (43°C)	80%

561 LT

Normal	60-85°F (16-29°C)	60-85°F (16-29°C)	60-90°F (16-32°C)	0-80%
Minimum	40°F (5°C)	35°F (2°C)	35°F (2°C)	0%
Maximum	90°F (32°C)	125°F (52°C)	110°F (43°C)	80%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions.

Curing Schedule

561

Surface Temp. & 50% Relative Humidity	Dry to Recoat & Topcoat w/ Other Finishes	Final Cure for Immersion Service	Maximum Recoat Time
50°F (10°C)	24 Hours	N/A	120 Days
60°F (16°C)	10 Hours	10 Days	90 Days
75°F (24°C)	7 Hours	7 Days	90 Days
90°F (32°C)	4 Hours	5 Days	45 Days
561 LT			
35°F (2°C)	24 Hours	21 Days	120 Days
50°F (10°C)	18 Hours	12 Days	120 Days
75°F (24°C)	6 Hours	5 Days	90 Days

For Non-Immersion, maximum recoat time may be extended up to 1 year. These times are based on a 4.0-6.0 mil (100-150 micron) dry film thickness. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or blush must be removed by water washing before recoating. If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or sanding prior to the application of additional coats. For force curing, contact Carboline Technical Service for specific requirements.

Packaging, Handling & Storage

Shipping Weight (Approximate)	2 Gallon Kit 32 lbs (15 kg)	10 Gallon Kit 150 lbs (68 kg)

Flash Point (Setaflash) 80°F (27°C) for Parts A & B; 561 & 561 LT

Storage (General) Store Indoors.

Storage Temperature & Humidity 40° - 110°F (4°- 43°C)
0-100% Relative Humidity

Shelf Life Part A & B: Min. 36 months at 75°F (24°C)

***Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.**

carboline

350 Hanley Industrial Court, St. Louis, MO 63144-1599
314/644-1000 314/644-4617 (fax) www.carboline.com

An RPM Company

December 2002 replaces October 2001

product data carboline®

Carboguard® 890 & 890 LT Glass Flake

Selection & Specification Data

Generic Type
Cycloaliphatic Amine Epoxy with Glass Reinforcement

Description
A glass reinforced chemically resistant epoxy coating with wide versatility in all industrial markets. It is self-priming and suitable for application over tightly adherent rust. Glass reinforcement improves internal film strength, hardness, impact, and abrasion resistance.

Features
- Excellent chemical resistance
- Surface tolerant characteristics
- Conventional and low-temperature versions
- Self-priming and primer/finish capabilities
- Excellent abrasion resistance & hardness
- VOC compliant to current AIM regulations

Color
Refer to Carboline Color Guide. Certain colors may require multiple coats for hiding. Note: The low temperature formulation will cause most colors to yellow or discolor more than normal in a short period of time. (Epoxies lose gloss, discolor and chalk in sunlight exposure.)

Finish
Flat

Primers
Self-priming. May be applied over inorganic zinc primers and other tightly adhering coatings. A mist coat may be required to minimize bubbling over inorganic zinc primers.

Topcoats
Acrylics, Epoxies, Polyurethanes

Dry Film Thickness
8.0-20.0 mils (200-500 microns) in a single coat

Solids Content
By Volume (890 GF): 77% ± 2%
(890 LT GF): 81% ± 2%

Theoretical Coverage Rate
890 GF:123 ft² at 10 mils (3.1 m²/l at 250 microns)
890 LT GF: 130 ft² at 10 mils (3.1 m²/l at 250 microns)
Allow for loss in mixing and application

VOC Values

	890 GF	890 LT GF
As supplied	1.6 lbs/gal (192 g/l)	1.4 lbs/gal (168 g/l)
Thinned w/#2 at 13 oz/gal*:	2.1 lbs/gal (252 g/l)	1.9 lbs/gal (230 g/l)
Thinned w/#33 at 16 oz/gal*:	2.2 lbs/gal (269 g/l)	2.1 lbs/gal (248g/l)

*Use Thinner #76 up to 8 oz/gal for 890 GF and 16 oz/gal for 890 LT GF where non-photochemically reactive solvents are required.

Dry Temp. Resistance
Continuous: 250°F (121°C)
Non-Continuous: 300°F (149°C)
Discoloration and loss of gloss is observed above 200°F (93°C).

Selection & Specification Data Cont.

Limitations
Do not apply over latex coatings. Carboguard 890 LT should not be used for immersion and should only be used as a primer or intermediate coat. Discoloration may be objectionable if used as a topcoat.

Substrates & Surface Preparation

General
Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.

Steel
SSPC-SP6
2.0-3.0 mils (50-75 microns)
SSPC-SP2 or SP3 are suitable cleaning methods for mild environments.

Galvanized Steel
Prime with specific Carboline primers as recommended by your Carboline Sales Representative. Refer to the specific primer's Product Data Sheet for substrate preparation requirements.

Concrete
Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing. Prime with Carboguard® 1340.

CMU
Mortar joints should be thoroughly cured for a minimum of 15 days at 75°F (24°C) and 50% relative humidity or equivalent. Prime with a suitable block filler or Carboguard 1340.

Drywall & Plaster
Joint compound and plaster should be fully cured prior to coating application. Prime with Carbocrylic® 120 or Carboguard 1340.

Previously Painted Surfaces
Lightly sand or abrade to roughen surface and degloss the surface. Existing paint must attain a minimum 3B rating in accordance with ASTM D3359 "X-Scribe" adhesion test.

Carboguard® 890 & 890 LT Glass Flake

Application Equipment

.sted below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results. **General Guidelines:**

Spray Application (General) This is a high solids coating and may require adjustments in spray techniques. Wet film thickness is easily and quickly achieved. The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.

Conventional Spray Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .110" I.D. fluid tip and appropriate air cap.

Airless Spray

Pump Ratio:	30:1 (min.)*
GPM Output:	3.0 (min.)
Material Hose:	3/8" I.D. (min.)
Tip Size:	.035"-.041"
Output PSI:	2200-2500

*Teflon packings are recommended and available from the pump manufacturer.

Brush & Roller (General) Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling. For best results, tie-in within 10 minutes at 75°F (24°C).

Brush Use a medium bristle brush.

Roller Use a short-nap synthetic roller cover with phenolic core.

Mixing & Thinning

Mixing Power mix A & B separately, then combine and power mix. Then slowly add Part C. DO NOT MIX PARTIAL KITS.

Ratio 890 and 890 LT Glass Flake 1:1 Ratio (A to B)
1 bag (3.62 lbs/2 gal mix)

hinning* Spray: Up to 13 oz/gal (10%) w/ #2
Brush: Up to 16 oz/gal (12%) w/ #33
Roller: Up to 16 oz/gal (12%) w/ #33
Thinner #33 can be used for spray in hot/windy conditions. Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.
*See VOC values for thinning limits.

Pot Life 890 GF 3 Hours at 75°F (24°C)
890 LT GF 2 Hours at 75°F (24°C)
Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures.

Cleanup & Safety

Cleanup Use Thinner #2 or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.

Safety Read and follow all caution statements on this product data sheet and on the MSDS for this product. Employ normal workmanlike safety precautions. Hypersensitive persons should wear protective clothing, gloves and use protective cream on face, hands and all exposed areas.

Ventilation When used as a tank lining or in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved supplied air respirator.

Caution This product contains flammable solvents. Keep away from sparks and open flames. All electrical equipment and installations should be made and grounded in accordance with the National Electric Code. In areas where explosion hazards exist, workmen should be required to use non-ferrous tools and wear conductive and non-sparking shoes.

Application Conditions

890 GF

Condition	Material	Surface	Ambient	Humidity
Normal	60°-85°F (16°-29°C)	60°-85°F (16°-29°C)	60°-90°F (16°-32°C)	0-80%
Minimum	50°F (10°C)	50°F (10°C)	50°F (10°C)	0%
Maximum	90°F (32°C)	125°F (52°C)	110°F (43°C)	80%

890 LT GF

Normal	60-85°F (16-29°C)	60-85°F (16-29°C)	60-90°F (16-32°C)	10-80%
Minimum	40°F (4°C)	35°F (2°C)	35°F (2°C)	0%
Maximum	90°F (32°C)	125°F (52°C)	110°F (43°C)	80%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions.

Curing Schedule

890 GF (Based on 4–8 mils, 100-200 microns dry film thickness.)

Surface Temp. & 50% Relative Humidity	Dry to Recoat	Dry to Topcoat w/ Other Finishes	Final Cure
50°F (10°C)	12 Hours	24 Hours	3 Days
60°F (16°C)	8 Hours	16 Hours	2 Days
75°F (24°C)	4 Hours	8 Hours	1 Day
90°F (32°C)	2 Hours	4 Hours	16 Hours

890 LT GF (Based on 5 mils, 125 microns dry film thickness.)

Surface Temp. & 50% Relative Humidity	Dry to Touch	Dry to Handle	Dry to Recoat & Topcoat w/ Others	Final Cure
35°F (2°C)	5 Hours	18 Hours	20 Hours	7 Days
40°F (4°C)	4.5 Hours	15.5 Hours	16 Hours	5 Days
50°F (10°C)	3.5Hours	6.5 Hours	12 Hours	3 Days
60°F (16°C)	2 Hours	5 Hours	8 Hours	2 Days
75°F (24°C)	1.5Hours	2 Hours	4 Hours	24 Hours
90°F (32°C)	1 Hour	1.5 Hours	2 Hours	16 Hours

Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or blush must be removed by water washing before recoating. During high humidity conditions, it is recommended that the application be done while temperatures are increasing. **Maximum recoat/topcoat times are 30 days for epoxies and 90 days for polyurethanes at 75°F (24°C).** If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or sanding prior to the application of additional coats. 890 LT applied below 50°F (10°C) may temporarily soften as temperatures rise to 60°F (16°C). This is a normal condition and will not effect performance.

Packaging, Handling & Storage

Shipping Weight (Approximate) 2 Gallon Kit
33 lbs (15 kg)

Flash Point (Setaflash) 89°F (32°C) for Part A; 890 GF & 890 LT GF
73°F (23°C) for Part B; 890 GF & 890 LT GF
N/A for Part C

Storage Temperature & Humidity 40° -110°F (4°-43°C) Store indoors.
0-100% Relative Humidity

Shelf Life: 890 GF & 890 LT GF Part A: Min. 36 months at 75°F (24°C)
890 GF Part B: Min. 15 months at 75°F (24°C)
890 LT GF Part B: Min. 15 months at 75°F (24°C)
890 GF Part C – 60 months at 75°F (24°C)

***Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.**

carboline
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An RPM Company

September 2003

product data carboline® **Carboguard®893 SG**

Selection & Specification Data

Generic Type Epoxy Polyamide

Description Versatile corrosion resistant coating. Used either as a primer, intermediate coat, or self-priming finish over steel and inorganic zinc primers. May be topcoated with itself, or a broad variety of high performance finish coats. Has surface tolerant properties.

Features
- Ready to apply after mixing; no sweat-in time or thinning required.
- Economical fit for use epoxy
- Available in a variety of rapid tint colors
- Attractive low sheen for tank exteriors
- Used as a primer, an intermediate or finish coat
- Can be applied over power tool cleaned surfaces
- VOC compliant to current AIM regulations

Color Primer color (0700) gray. Variety of other finish coat colors in rapid tint service. Use Bright White (F800) for tank exterior finish.

Finish Low sheen

Primers Self-priming. May be applied over organic and inorganic zinc rich primers. A mist coat may be required to minimize bubbling over zinc rich primers.

Topcoats Acrylics, Alkyds, Epoxies, Polyurethanes

Dry Film Thickness 3.0-5.0 mils (75-125 microns) per coat as a primer or an intermediate. Two coats at 3-5 mils (75-125 microns) per coat may be used direct-to-metal.
4.0-6.0 mils (100-150 microns) per coat as a finish coat over a primer. Do not exceed 10 mils (250 microns) in a single coat. Excessive film thickness over inorganic zincs may increase damage during shipping or erection.

Solids Content By Volume: 60% ± 2%

Theoretical Coverage Rate 962 mil ft^2 (24.0 m^2/l at 25 microns)
320 ft^2 at 3 mils (8.0 m^2/l at 25 microns)
Allow for loss in mixing and application

VOC Values
As supplied: 2.87 lbs./gal (345 g/l)
Thinned:
10 oz/gal w/ #10: 3.18 lbs./gal (382 g/l)
15 oz/gal w/ #10: 3.32 lbs./gal (398 g/l)
16 oz/gal w/ #33: 3.37 lbs./gal (405 g/l)
These are nominal values and may vary slightly with color.

Dry Temp. Resistance
Continuous: 200°F (93°C)
Non-Continuous: 250°F (121°C)
Discoloration and loss of gloss is observed above 200°F (93°).

Limitations
- Epoxies lose gloss, discolor and eventually chalk in sunlight exposure.
- Not recommended for immersion service.

Substrates & Surface Preparation

General Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.

Steel For most applications:
SSPC-SP6 to obtain a blast profile of 1.0-2.0 mils (25-50 microns). May also be applied over SSPC-SP 3 for certain applications.

Concrete Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.

Performance Data

Test Method	System	Results	Report #
ASTM D4541 Adhesion	Blasted Steel 2 ct. 893 SG	1600 psi (Pneumatic)	09453
ASTM D522 Flexibility	Blasted Steel 1 ct. 893 SG	90° bend produced no cracking, ¾" Cylindrical Mandrel Bend	09453

Test reports and additional data available upon written request.

Carboguard® 893 SG

Application Equipment

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

General Guidelines:

Spray Application (General) The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.

Conventional Spray Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .070" I.D. fluid tip and appropriate air cap.

Airless Spray

Pump Ratio:	30:1 (min.)*
GPM Output:	2.5 (min.)
Material Hose:	3/8" I.D. (min.)
Tip Size:	.017"-.021"
Output PSI:	2100-2300
Filter Size:	60 mesh

*Teflon packings are recommended and available from the pump manufacturer.

Brush & Roller (General) Not recommended for tank lining applications except when striping welds. Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling. For best results, tie-in within 10 minutes at 75°F (24°C).

Brush Use a medium bristle brush.

Roller Use 3/8" nap phenolic core roller.

Mixing & Thinning

Mixing Power mix separately, then combine and power mix. DO NOT MIX PARTIAL KITS.

Ratio 1:1 Ratio (A to B)

Thinning Normally not required but may thin as follows:
Spray: Up to 15 oz/gal (12%) with Thinner #10.
Brush & Roller: Up to 16 oz/gal (12%) with Thinner #33.
Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.

Pot Life 4 Hours at 75°F (24°C)
Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures.

Cleanup & Safety

Cleanup Use Thinner #2 or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.

Safety Read and follow all caution statements on this product data sheet and on the MSDS for this product. Employ normal workmanlike safety precautions. Hypersensitive persons should wear protective clothing, gloves and use protective cream on face, hands and all exposed areas.

Ventilation When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

Caution This product contains flammable solvents. Keep away from sparks and open flames. All electrical equipment and installations should be made and grounded in accordance with the National Electric Code. In areas where explosion hazards exist, workmen should be required to use non-ferrous tools and wear conductive and non-sparking shoes.

Application Conditions

Condition	Material	Surface	Ambient	Humidity
Normal	60°-85°F (16°-29°C)	60°-85°F (16°-29°C)	60°-90°F (16°-32°C)	0-80%
Minimum	50°F (10°C)	50°F (10°C)	50°F (10°C)	0%
Maximum	90°F (32°C)	125°F (52°C)	110°F (43°C)	80%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions.

Curing Schedule

Surface Temp. & 50% Relative Humidity	Dry to Recoat Or Topcoat	Maximum Recoat Time
50°F (10°C)	24 Hours	1 Year
60°F (16°C)	10 Hours	1 Year
75°F (24°C)	7 Hours	1 Year
90°F (32°C)	4 Hours	1 Year

These times are based on a 4.0-6.0 mil (100-150 micron) dry film thickness for non-immersion. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or blush must be removed by water washing before recoating. If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or sanding prior to the application of additional coats. For force curing, contact Carboline Technical Service for specific requirements.

Packaging, Handling & Storage

Shipping Weight (Approximate)	2 Gallon Kit 26 lbs. (12 kg)	10 Gallon Kit 127 lbs. (58 kg)
In White Base (WITE)	1.97 Gallon Kit (Short Filled) Part A	9.84 Gallon Kit (Short Filled) Part A
Flash Point (Setaflash)	Part A: Part B:	75°F (24°C) 75°F (24°C)
Storage (General)	Store Indoors.	
Storage Temperature & Humidity	40° - 110°F (4°- 43°C) 0-100% Relative Humidity	
Shelf Life	Part A & B: Min. 36 months at 75°F (24°C)	

***Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.**

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An RPM Company

April 2003 replaces June 2002

product data carboline® **Carboguard®954 HB**

Selection & Specification Data

Generic Type Polyamido-Amine Epoxy

Description All-purpose, solvent-free, spray, brush & roll epoxy mastic coating with applications in all industrial markets and for almost all substrates requiring user-friendly, single-coat protection from abrasion, chemicals, and high levels of moisture. This material represents the next generation of high-performance protective coatings.

Features
- Surface tolerant characteristics to existing finishes and SP2, SP3-cleaned steel
- Single-coat application in most instances
- High-build capability
- Self-priming and primer/finish capabilities
- Excellent abrasion and moisture resistance
- True brush & roll characteristics
- VOC compliant to current AIM regulations

Color White (1864) and Gray (C705) are standard colors

Finish Gloss

Primers Self-priming. May be applied over inorganic zinc primers and other tightly adhering coatings. A mist coat may be required to minimize bubbling over inorganic zinc primers. Do not apply over latex coatings.

Topcoats Acrylics, Epoxies, Polyurethanes

Dry Film Thickness 3.0-12.0 mils (75-300 microns) per coat depending on application and amount of thinning.
Do not exceed 18.0 mils (450 microns) per coat with 954 HB. Film build decreases with pot life.

Solids Content By Volume: 99.5% ± .5%

Theoretical Coverage Rate 1604 mil ft^2 (39.0 m^2/l at 25 microns)
Allow for loss in mixing and application

VOC Values
As supplied: Trace (5 g/l)
EPA Method 24: Trace (10 g/l)
Thinned:
20 oz/gal w/ #2: 0.9 lbs/gal (112 g/l)
20 oz/gal w/ #76:* 1.7 lbs/gal (205 g/l)
These are nominal values and may vary slightly with color.
*Use Thinner #76 for projects requiring non-photochemically reactive solvents.

Dry Temp. Resistance
Continuous: 200°F (93°C)
Non-Continuous: 250°F (121°C)
Discoloration and loss of gloss is observed above 200°F (93°C).

Substrates & Surface Preparation

General Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.

Steel SSPC SP6 with a 2.0-3.0 mil (50-75 micron) surface profile for maximum protection. Self-priming or prime with specific Carboline primers as recommended by your Carboline sales representative.
SSPC-SP2 or SP3 for previously painted or weathered surface.

Galvanized Steel For optimum performance sweep blast cleaning is recommended. Consult your Carboline Sales Representative for specific recommendations.

Concrete Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.

CMU Mortar joints should be thoroughly cured for a minimum of 15 days at 75°F (24°C) and 50% relative humidity or equivalent. Self-priming or prime with suitable block filler.

Drywall & Plaster Joint compound and plaster should be fully cured prior to coating application. Self-priming or prime with specific Carboline primers as recommended by your Carboline sales representative.

Previously Painted Surfaces Sand or abrade to roughen and degloss the surface. Existing paint must attain a minimum 3B rating in accordance with ASTM D3359 "X-Scribe" adhesion test.

Performance Data

Test Method	System	Results	Report #
ASTM D4541 Adhesion	Blasted Steel 1 ct. 954 HB	2124 psi (Pneumatic)	09207
ASTM 4060 Abrasion	Blasted Steel 1 ct. 954 HB	105 mg. loss after 1000 cycles, CS17 wheel, 1000 gm. load	03239
ASTM B117 Salt Fog	Blasted Steel 1 ct. 954 HB	No effect on plane, rust in scribe. 6 mm. avg. undercutting at scribe after 2000 hours	03347
ASTM D1735 Water Fog	Blasted Steel 1 ct. 954 HB	No effect on plane, rust in scribe; less than 2 mm. undercutting at scribe	03347
ASTM D1653 Water Vapor Transmission	1 ct. 954 HB	.77 US perms. Method B Wet Cup, Condition C 0% RH, 73.1°F	03333
ASTM D522 Flexibility	Blasted Steel 1 ct. 954 HB	No cracking when bent over the 1/8" conical mandrel	09207
ASTM D2794 Impact Resistance	Blasted Steel 1 ct. 954 HB	No cracking or delamination beyond ¾" of the point of impact	03239
ASTM D4213 Scrub Resistance	Blasted Steel 1 ct. 954 HB	Erosion rate: 0.0016 ml after 100 cycles with Abrasive scrub medium	03403

Test reports and additional data available upon written request.

April 2003 replaces June 2002

0950

Carboguard® 954 HB

Application Equipment

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

General Guidelines:

Spray Application (General) This is a high solids coating and may require adjustments in spray techniques. Wet film thickness is easily and quickly achieved. The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.

Conventional Spray Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .052" I.D. fluid tip and appropriate air cap.

Airless Spray

Pump Ratio:	45:1 (min)*
GPM Output:	3.0 (min.)
Material Hose:	½" I.D. (min.)
Tip Size:	.019"-.027"
Output PSI:	3000-3500
Filter Size:	60 mesh; 30 mesh for 954HB

*Teflon packings are recommended and available from the pump manufacturer.
Heated plural component spray equipment or thinning will aid in application of 954 HB.

Brush & Roller (General) Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling.

Brush Use a medium natural bristle brush.

Roller Use a short-nap synthetic roller cover with phenolic core.

Mixing & Thinning

Mixing Power mix separately, then combine and power mix. DO NOT MIX PARTIAL KITS.

Ratio 1:1 Ratio (A to B)

Thinning May be thinned up to 20 oz/gal (15%) with Thinner #2 or Thinner #76. Additive 8506 may be used to reduce dry times. Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.

Pot Life 90 minutes at 75°F (24°C). When using Additive 8506, pot life is 45 minutes at 75°F (24°C). Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures.

Cleanup & Safety

Cleanup Use Thinner #2 or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.

Safety Read and follow all caution statements on this product data sheet and on the MSDS for this product. Employ normal workmanlike safety precautions. Hypersensitive persons should wear protective clothing, gloves and use protective cream on face, hands and all exposed areas.

Ventilation When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

Caution This product contains flammable solvents. Keep away from sparks and open flames. All electrical equipment and installations should be made and grounded in accordance with the National Electric Code. In areas where explosion hazards exist, workmen should be required to use non-ferrous tools and wear conductive and non-sparking shoes.

Application Conditions

Condition	Material	Surface	Ambient	Humidity
Normal	70°-80°F (21°-27°C)	70°-80°F (21°-27°C)	70°-90°F (21°-32°C)	0-75%
Minimum	60°F (16°C)	45°F (7°C)	45°F (7°C)	0%
Maximum	90°F (32°C)	110°F (43°C)	110°F (43°C)	85%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions. For best results on rough cementitious surfaces, spray apply at 16 to 20 wet mils (400-500 microns) and then back roll into the surface.

Curing Schedule

Surface Temp. & 50% Relative Humidity	Dry to Recoat & Topcoat	Maximum Recoat Time	Final Cure
45°F (7°C)	72 Hours	120 Days	28 Days
60°F (16°C)	32 Hours	90 Days	14 Days
75°F (24°C)	24 Hours	60 Days	7 Days
90°F (32°C)	12 Hours	30 Days	4 Days
105°F (41°C)	8 Hours	15 Days	24 Hours
w/ additive 8506 (2 oz/gl)			
75°F (24°C)	17 Hours	30 Days	4 Days

These times are based on a 12.0 mil (300 micron) dry film thickness. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or blush must be removed by water washing before recoating. During high humidity conditions, it is recommended that the application be done while temperatures are increasing. If the maximum recoat time is exceeded, the surface must be abraded by sweep blasting or sanding before the application of additional coats.

Packaging, Handling & Storage

Shipping Weight (Approximate) 2 Gallon Kit: 25 lbs (12 kg); 10 Gallon Kit: 125 lbs (57 kg)

Flash Point (Setaflash) Part A: >205°F (96°C); Part B: >205°F (96°C)

Storage Temperature & Humidity 40° -110°F (4°-43°C) Store indoors. 0-90% Relative Humidity

Shelf Life Part A: Min. 24 months at 75°F (24°C); Part B: 12 months at 75°F (24°C)

***Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.**

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An RPM Company

April 2003 replaces June 2002

-Fulton K1550 Work Winch

TECHNICAL SPECIFICATIONS

FULTON MODEL NUMBER	CAPACITY RATING (*1) 1st LAYER LBS. (kN)	FULL DRUM LBS. (kN)	GEAR RATIO	MAXIMUM MECHANICAL ADVANTAGE (*2)	HANDLE LENGTH	HUB SIZE	DRUM STORAGE (*3)
K1550/KX1550	1,500 (6.7)	700 (3.1)	5.1:1	32:1	11"	2-1/2"	70' x 1/4" Cable (Max. 6 layers)

*1 - Capacity Rating - Based on direct line pull on first layer of line on the drum. Capacity is reduced as layers of line builds up on the drum.
*2 - Maximum Mechanical Advantage - Based on first layer of recommended line on the drum. For maximum efficiency use only the amount of line required.
*3 - Breaking strength of cable must be greater than 4,721 lbs (21,0 kN).

OPERATING INSTRUCTIONS

Turning the handle counter-clockwise actuates the brake. The brake system is designed to hold the load whenever the handle is released.

TO PULL CABLE IN OR RAISE LOAD

1) The cable must be securely fastened to the object being lifted and to the winch drum.
2) Always be sure that the cable and cable attachments are not damaged and are strong enough for the load. Assure there is adequate safety factor, of at least three times the maximum load for all components used.
3) Referring to the "Cable In/Cable Out" decal on the winch, turn the handle clockwise to lift. The ratchet MUST make a loud clicking sound.

TO LET CABLE OUT OR LOWER LOAD

1) Referring to the "Cable In/Cable Out" decal on the winch, turn the handle counter-clockwise to lower. No clicking will be heard because the brake system is activated.

MAINTENANCE

Do not get oil or grease on the friction disks. This could allow the load to slip or fall.
1) Maintain a film of automotive type grease on all gear teeth and to the O.D. of drum bearing, item #23, at all times.
2) Keep ratchet pawl pivot, bushings and pinion threads lubricated with automotive engine oil at all times.
3) Check brake friction disks for wear. If less than 1/16" thick, cracked, or broken, they must be replaced.
4) During each usage, check for proper ratchet operation. When cranking cable in, a loud clicking sound must be heard from the ratchet. If a loud clicking sound is not heard, do not use and replace damaged components immediately. When cranking cable out, there is no clicking and the ratchet pawl must be fully engaged into the ratchet gear teeth.
5) Before each usage, inspect fasteners for proper tightness.

LIMITED THREE YEAR WARRANTY

Warranty. Fulton Performance Products, Inc. ("We") warrants to the original consumer purchaser ("You") that the product will be free from defects in material and workmanship for a period of three years under normal use and service, ordinary wear and tear excepted. If the product does not comply with this warranty, We will replace the product without charge to You and within a reasonable time or, at Fulton's option, refund the purchase price. This warranty is not transferable.

Limitations on the Warranty. The warranty does not cover the following: (a) normal wear and tear; (b) damage through abuse, neglect, misuse, or as a result of any accident or in any other manner; (c) damage from misapplication, overloading, or improperly installed; (d) improper maintenance; (e) a product altered in any manner by anyone other than us.

Obligations of Purchaser. To make a claim, contact us at 50 Indianhead Drive, Mosinee, WI, (715) 693-1700, identify the product, and follow the instructions that will be provided. Any returned product that is replaced or refunded becomes the property of Fulton. You will be responsible for shipping costs to us. Please retain your purchase receipt to verify date of purchase. This must be produced to honor warranty claim.

Remedy Limits. Repair or replacement is the purchaser's sole remedy under this or any other warranty on the product, whether express or implied. We shall not be liable for service or labor charges incurred in removing or replacing a product or any incidental or consequential damages of any kind. We expressly disclaim any implied warranty of merchantability or fitness for particular purpose after the three-year warranty period. Some states do not allow the exclusion of incidental or consequential damages or limitation of an implied warranty so the above exclusion and limitation may not apply to you.

Legal Rights. This warranty gives you specific legal rights, and You also may have other rights which vary from state to state. **ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON ANY PRODUCT SHALL BE LIMITED TO THREE YEARS FROM THE DATE OF RETAIL PURCHASE BY YOU.** Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to You.

This warranty is governed by the laws of the United States of America and is void where prohibited.

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FULTON
Performance Products
K1550/KX1550 Work Winch Owner's Manual

READ, UNDERSTAND, AND SAVE THESE INSTRUCTIONS

⚠ WARNING ⚠

Read, understand and follow all instructions before installing and/or using product. NEVER allow anyone unfamiliar with the operating instructions to use this product.
Read, understand and follow all instructions provided by the manufacturer of the product(s) that this winch will be installed on.
Installation, use and maintenance of these Fulton winches must conform to the following instructions only. Fulton cannot be held liable for improper installation, use, or maintenance of this product.
Do not get oil or grease on the friction disks. This could allow the load to slip or fall.
Obey crank rotation decal and operating instructions. Disregard could cause bodily harm or property damage and/or death.
DO NOT use this winch as a human hoist. NEVER allow anyone to be positioned on, around or under the load being lifted or moved.
Never exceed the maximum rated capacities.
Always inspect the cable and hook before each use to make sure that they are not damaged. If the cable or hook breaks, the cable will whip violently and can inflict serious injury and/or property damage.
Never use worn, kinked, or frayed cable. Replace the cable immediately.
Always maintain a minimum of three complete wraps of cable on the drum.
The cable on the winch must be strong enough to support the load to be moved.
A loud clicking sound from the ratchet must be heard when lifting the load. If a loud clicking sound is not heard do not use and replace ratchet components immediately.
Never release the crank handle unless the ratchet pawl is fully engaged and the load is supported.
Never operate with slippery, wet or oily hands and always maintain a firm grip on the winch handle.
Never leave a weight hanging from the winch while the winch is unattended, as another person may attempt to operate the winch, thereby creating an unsafe condition.
Failure to follow these warnings and instructions will result in property damage, serious bodily injury and/or death.

MOUNTING INSTRUCTIONS

1) Assemble handle onto input shaft end. Tighten the 1/2-13 locknut against handle. Note: Do not remove or adjust the double locknuts on long end of input shaft. They are an important part of the braking system and must be intact. See Fig.1
2) Mount the winch to a structure capable of supporting at least 5 times the load the winch will be pulling.

Note: When bolting the winch down, use three grade 5, 3/8" diameter bolts, flat washers and locknuts (not supplied).

Note: Always use outer most slots at the end opposite the direction of line pull. Use large flat washer if using center slot at opposite end.

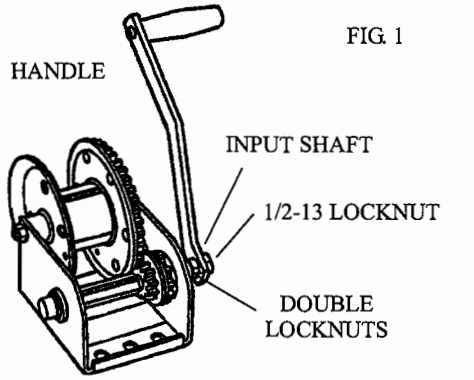


FIG. 1

CABLE ATTACHMENT TO DRUM

1) Feed the cable over the top of drum, through drum side hole, and through cable clamp with one inch extending past clamp.
2) With keeper nuts and lock washers outside the drum side, tighten nuts snug until cable is adequately clamped (approx. 20 - 30 lb-in).
3) Always be sure the cable is pulling straight off the winch, not at an angle. This will prevent the cable from rubbing against the sides of the drum, which can damage the cable.

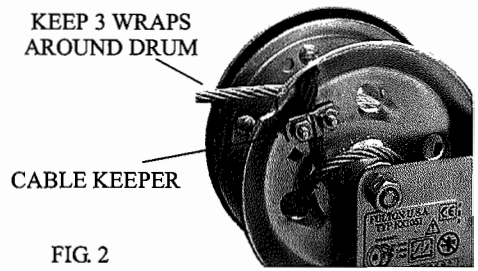


FIG. 2

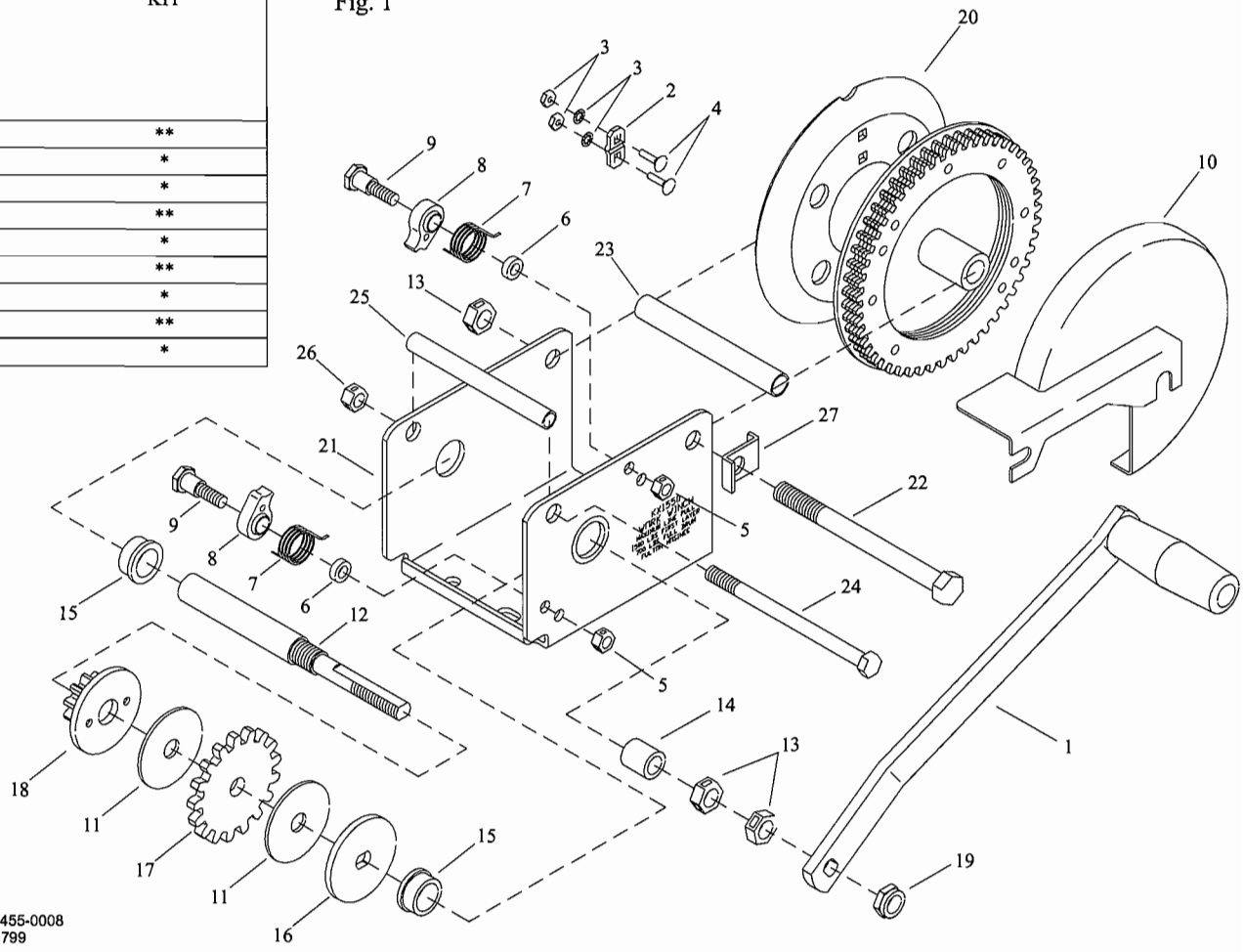
SERVICE PARTS AND ACCESSORIES

ITEM	DESCRIPTION	QUANTITY	K1550	KX1550
1	HANDLE ASSEMBLY	1	2461S01	2461S01
2	CABLE CLAMP	1	5621-01	5621-01
3	LOCKWASHER & NUT	2	CABLE KEEPER	CABLE KEEPER
4	CARRIAGE BOLT	2	KIT	KIT
5	LOCKNUT - 5/16-18	1	6730S00	6730S00
6	RATCHET SPACER	1	RATCHET	RATCHET
7	RATCHET SPRING	1	KIT	KIT
8	RATCHET PAWL	1		(2 REQUIRED)
9	SHOULDER BOLT - 5/16-18	1		
10	COVER ASSEMBLY	1	N/A	12124S01
11	FRICTION DISK KIT	2	1588S00	1558S00
12	INPUT SHAFT	1	1563S01	1564S01
13	LOCKNUT - 1/2-13	2	INPUT SHAFT	INPUT SHAFT
14	SPACER	1	KIT	KIT
15	BUSHING	2		
16	SHAFT BRAKE DISC	1		
17	RATCHET GEAR	1		
18	PINION & DISC ASSEMBLY	1		
19	LOCKNUT - 1/2-13	1	**	**
20	DRUM ASSEMBLY	1	*	*
21	FRAME	1	*	*
22	CAPSCREW - 1/2-13	1	**	**
23	DRUM SPACER	1	*	*
24	CAPSCREW - 3/8-16	1	**	**
25	FRAME SPACER	1	*	*
26	LOCKNUT - 3/8-16	1	**	**
27	BOLT LOCK	1	*	*

* Not Sold Separately
** Standard Hardware - May Be Purchased Locally

When repairing the winch, mark all parts in the order of disassembly to insure proper reassembly.

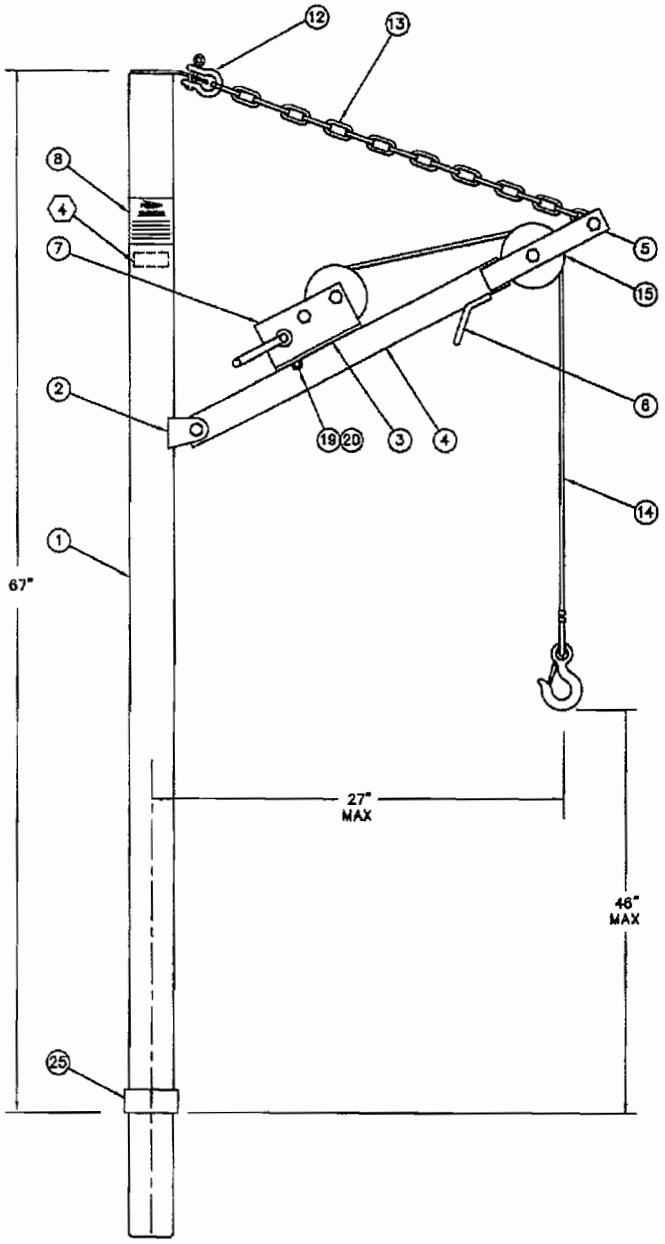
Fig. 1



HOW TO ORDER PARTS

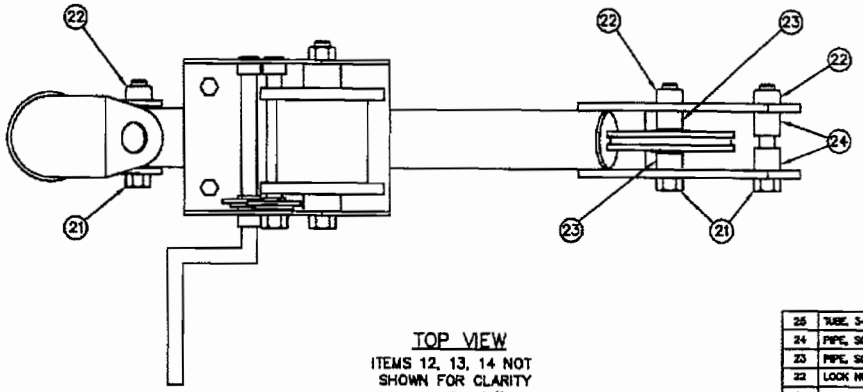
Always replace broken, bent or worn parts before using this product. Use only Fulton Performance Products' parts or parts of equal quality for repair. Replacement parts are available through Fulton Performance Products' Customer Service Department, 715-693-1700. Please specify product model number, name of parts, and part number. A two digit year code is stamped into the frame to aid in model identification.

FULTON
Performance Products, Inc.
50 Indianhead Dr., P.O. Box 8 Mosinee, WI 54455-0008
800/604-9466 715/693-1700 Fax 715/693-1799
www.fultonperformance.com
fulton@fultonperformance.com



NOTES:

1. MATERIAL: 316 STAINLESS STEEL, EXCEPT WINCH ASSEMBLY.
2. MAXIMUM LOAD: 650 LBS.
3. FOR DETAILS, SEE DRAWING 14-68 06 03.
4. VENDOR TO AFFIX CRANE PART NUMBER TO MAIN MAST BY PERMANENT DECAL.



TOP VIEW
ITEMS 12, 13, 14 NOT SHOWN FOR CLARITY
SCALE: 1/2

ITEM NO.	DESCRIPTION	PART NUMBER	QUAN.
25	TUBE, 3-1/2 OD x 2.938" ID x 1-1/2 LG.		1
24	PIPE, SCH. 40, 1/2ø x 3/4 LG.		2
23	PIPE, SCH. 40, 1/2ø x 9/16 LG.		2
22	LOCK NUT, NYLON TYPE, 1/2-13		3
21	SCREW, HEX HD. CAP, 1/2-13 x 3-1/2		3
20	NUT, HEX, 3/8-16		2
19	SCREW, HEX HD. CAP, 3/8-16 x 1"		3
15	SHEAVE, 4"ø x 5/8 THK. x 1/2ø		
	CENTER HOLE, S.ST.		1
14	CABL ASSY, 1/4ø 316 SST	14-58 70 05	40 FT
13	CHAIN, 316 SST, 1/4ø		2 FT
12	ANCHOR SHACKLE W/SCREW PIN, 3/8		1
8	SAFETY DECAL, MYLAR	14-58 78 13	1
7	WINCH, FULTON, K1500	14-46 77 22	1
③ 6	STATIC LOOP, 3/8ø x 8" LG.		1
③ 5	PLATE, 1/4 x 1-1/2 x 8-3/4		2
③ 4	PIPE, SCH. 40, 1-1/2ø x 23-1/4 LG.		1
③ 3	PLATE, 1/4 x 6" x 8 1/4		1
③ 2	PLATE, 1/4 x 2-5/8 x 2" MIN.		2
③ 1	MAST, PIPE, SCH. 40, 2-1/2ø x 75" LG.		1

UNLESS OTHERWISE NOTED TOLERANCE ON:
FRACTIONS ± 1/32
1 PLACE DEC. ± .1
2 PLACE DEC. ± .02
3 PLACE DEC. ± .005
ANGLES ± 2°

ITT FLYGT CORPORATION, NORWALK, CONNECTICUT 06856

REV.	DESCRIPTION	BY	DATE	APVD.	DATE
B	ANGLES NOTE 4, DIMENSIONS 23", 49" 67", ITEM 14				
	ITEM 24 REVISED, REMOVED ITEMS 8,10,11,14,17,18	DP	97/3	GL	97/3

DRAWN 02/11/98 D.C.
CHKD 02/12/98 D.P.
APPVD 02/9/98 M.L.

PORTABLE HOIST ASSY. 316 STAINLESS STEEL

14-58 70 17 REV. B

CAD DRAWING (D)

-M&H AWWA C500 Double Disk Gate Valve
-M&H AWWA C508 Swing Check Valve
-Colonial Engineering Ball Valves (Small Valves)
-Spears True Union Ball Valves (Small Valves)
-Crispin DL Series Deep Well Air Release Valves (Small Valves)
-Ashcroft Duragauge Type 1279 Pressure Gauge
-Dwyer 61000 Series Pressure Gauges
-Dwyer 2000 Series Magnehelic Differential Pressure
-Dwyer 4000 Series Capsuhelic Differential Pressure
-Dwyer DS Series In-line Flow Sensors
-Dwyer BT Series Bimetal Thermometers
-George Fischer Type 570 Butterfly Valve

O & M MANUAL

FOR

DOUBLE DISK GATE VALVES

M&H VALVE COMPANY
P.O. BOX 2088, ANNISTON, ALABAMA 36202 • (205) 237-3521

INSTALLATION, OPERATION & MAINTENANCE MANUAL
DOUBLE DISC GATE VALVES
AWWA C500

General:

Inspect all valves at time of delivery for shipping damage and to confirm compliance with specifications. Valves are completely tested per the appropriate standards and specifications by the manufacturer. The valves should be stored in such manner to protect them from weather and blowing dirt and debris. In cold climates, if water is allowed to freeze in the valve, severe damage to the valve components could result. Any packaging should be replaced if removed for inspection. Proper slinging and handling methods should be used when moving valves. Do not place slings or other devices around operating stem or through the valve port opening.

I. Installation

1. Check that valve and end joints are clean. Again check for damage to the valve. Open and close valve to insure proper operation. Close valve plug before placing in trench.

2. Handle valve carefully. Do not drop into position. Do not sling through the port opening.

3. Prepare pipe ends according to manufacturer's instructions. Install valve per proper methods according to end joint type. All piping should be properly supported to avoid line stress on the valve. Do not use the valves as a jack to force a pipeline into position.

4. A valve box or vault should be provided for each valve used in buried service application. These should be installed such that no load is transferred to the valve.

5. Before pressurization of the pipeline and valve, all pressure containing bolting (cover, follower plate, end connection) should be inspected for adequate tightness (usually 90 ft. lb.).

6. Buried valves should be pressurized before backfilling.

7. With the valve in position, the entire system should be thoroughly flushed to clean the system. Debris in the valve could prevent the valve from closing or possibly damage the seating surface on the gates or in the body.

8. Upon completion of the installation, gate valve location, size, type, date of installation, number of turns to open, direction of opening, and any other special information should be entered on permanent records.

II. Operation

1. Do not operate valves in systems that exceed the rated working pressure of the valve, 200 psi (sizes 2" thru 12") and 150 psi (sizes 14" thru 48").

2. System should be completely flushed before valve is operated in normal cycle.

3. The double disc gate valve opens and closes by turning the main valve stem with an operating nut of a handwheel. When closing the valve, the gates move freely downward, to a position opposite their seats. As the gates approach the bottom of the valve, the iron hooks come into contact with stops which prevent further downward movement of the hooks. The bronze wedges riding in the hooks spread the gates apart and force them against their seats.

   Turning the stem in the opposite (opening) direction releases the wedging pressure on the gates allowing them to move away from their seats before starting upward travel. Further turning of the stem raises the gates to the fully open position.

4. If the valve should fail to seal after necessary number of turns, open the valve four or five turns and reseat.

III. Inspection and Maintenance

1. Frequency of inspection should be based on frequency of operation. Semi annual inspections are minimum recommended. Valves should not be disassembled unless a breakdown has occurred.

2. During inspection, the valve should be opened and closed with pressure in the pipeline. The valve should function freely with no

binding or vibration. Count the number of turns to full closed, this will reveal an obstruction is correct number of turns are not achieved. See table:

TURNS TO OPEN

3"	7	16"	52
4"	15	18"	58
6"	21	20"	64
8"	27	24"	76
10"	33	30"	63
12"	39	36"	75
14"	45	42"	88
		48"	100

NOTE: Turns to open are for valves without gearing. For valves with gearing multiply turns by:

14" thru 24"	x 2
30" & 36"	x 3
42"	x 4
48"	x 8

3. All gaskets and joints should be checked for leakage and tightness.

4. With the valve closed and pressure against the disc, a check for leakage is possible by "listening" to the valve for flow. A stethoscope will help in this procedure.

5. Attached actuators should be inspected per manufacturer's recommendations provided with those units.

6. OS&Y valves should have the exposed stem lubricated at each inspection. Check stuffing box bolts for tightness.

7. A permanent record of the period inspections should be maintained for each valve.

8. IMPORTANT EFFECTS OF PROGRAM

   a. Dislodge sediment.
   b. Dislodge products of corrosion and maintain clearances. Because of dissimilar metals used in valve construction corrosion, or ion exchange, can be expected in the presence of water having very high, or low pH values. This can be

especially troublesome if moving parts are not disturbed periodically.

c. Disturb water that sometimes lies dormant in the bonnet and other cavities in the valve.

NOTE: An effective procedure for clearing the inside of a valve, prior to closing and opening as in 2 and 3 above, is to close a valve downstream. Then open a hydrant downstream and adjacent to the valve being tested. This causes water to rush through the valve at high velocity while it is being closed and reopened. It creates maximum disturbance of unwanted sediment and etc.

RECORDS

1. Trouble can be anticipated with a good Inspection Program. Such a program cannot exist without good records. Poor records are worse than none.

2. A printed 5 x 8 record card for each valve and hydrant in the system is most convenient.

   a. Identification of each valve and hydrant is essential. Setting up a numbering system is one of the first steps to take. A reasonable simple method is to assign a number to each street intersection, then identify each valve or hydrant numerically or alphabetically between intersection numbers.

      For instance: I9-I10 would be the number of second valve from street intersection number 9 in going toward street intersection number 10.

      Another convenient device is to assign only odd numbers to existing hydrants. When hydrants are added later they can be given numbers which will fit in the numerical sequence.

   b. Location should be recorded first. Measurements must be made from property lines or street center lines - not power poles, fence lines, or the like.

****

VALVE RECORD

No._____

Location _____ ft. _____ of _____ Prop. Line of _____

and _____ ft. _____ of _____ Prop. Line of _____

Size _____ Make _____ Type _____ Gearing _____ Bypass _____

Opens _____ Turns to Operate _____ Depth to Nut _____

Remarks _____

_____

MAINTENANCE AND INSPECTION RECORD

Date	Work Done	O.K.	By	Date	Work Done	O.K.	By

M&H VALVE COMPANY
P.O. BOX 2088, ANNISTON, ALABAMA 36202 • (205) 237-3521

TROUBLESHOOTING
GATE VALVES

POSSIBLE MALFUNCTION	SYMPTOMS-CAUSES	CORRECTIVE ACTION
Joint Leakage	Bolt Tension Relaxing	Tighten bolts
Seat Leakage	Foreign material caught in seat.	Operate valve to flush out debris.
	Seats Dirty-Corroded	Flush or disassemble and clean.
	Seats damaged	Inspect - repair or replace
Leak Past Stem	Bolts loose	Tighten bolts
	(NRS) O-rings worn/ damaged	Inspect/Replace
	(OS&Y) Packing worn/ damaged	Inspect/Replace

Inspection for the above should be done semi-annually at the minimum.

There are no lubrication requirements.

M&H VALVE COMPANY
P.O. BOX 2088, ANNISTON, ALABAMA 36202 • (205) 237-3521

DISASSEMBLY INSTRUCTIONS FOR M&H OS&Y DOUBLE DISC GATE VALVE

****

1. Remove hold down nut (120)
2. Remove handwheel (122)
3. Remove OS&Y retainer plate capscrews (135) and plate (123)
4. Remove OS&Y stem nut (124)
5. Remove OS&Y yoke nuts & bolts (136)
6. Remove OS&Y yoke (125)
7. Remove follower plate nuts (127), follower plate (128), and gland (129)
8. Remove neck flange nuts & bolts (112, 110)
9. Lift off cover (108)
10. Grasp stem (126) & lift out gate assembly
11. Lay gate assembly on a piece of cloth or cardboard, so as not to damage the gate ring (115)
12. Lift off the top gate (117)
13. Stem & bottom nut (126), hooks (119) and wedges (118) are now accessible for easy removal.
14. Reassembly in the reverse order replacing cover gasket and packing if necessary.

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DISASSEMBLY INSTRUCTIONS FOR M&H N.R.S. DOUBLE DISC GATE VALVE

****

1. Remove capscrew (101)
2. Remove handwheel (122) or operating nut (102)
3. Remove O-ring plate nuts (103)
4. Remove O-ring plate (105)
5. Remove stem (109) by turning the stem in the opposite direction for opening the valve.
6. Remove neck flange bolts & nuts (112 & 110)
7. Lift off cover (108)
8. Grasp stem (114) & lift out gate assembly
9. Lay gate assembly on a piece of cloth or cardboard, so as not to damage the gate ring (115)
10. Lift off the top gate (117)
11. Gate nut (114), hooks (119), and wedges (118) are now accessible for easy removal.
12. Reassembly in the reverse order replacing cover gasket and stem O-rings if necessary.

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DISASSEMBLY INSTRUCTIONS FOR M&H BEVEL GEAR OPERATOR

****

1. Remove capscrews (CC) and bolts and nuts (BB) from cover flange.
2. Remove cover (E).
3. Remove capscrews (A) and retainer washer (B) from top of bevel gear.
4. Lift off bevel gear (D) and key (C). Note: If brass shims are under bevel gear, remove and retain for re-installation. These are necessary for correct alignment of bevel and pinion gears.
5. Remove bolts and nuts (FF) from base of grease case.
6. Grease case can be lifted off of valve stem.
7. Loosen packing gland nuts (Z).
8. Valve can be disassembled following above disassembly instructions, starting with step 3.
9. Re-assemble in reverse order.

M&H VALVE COMPANY
Product Specifications

ITEM NO.	DESCRIPTION		
A	CAPSCREW 3/4" 10NC-2 X 1 1/2"	1	RUST PROOF STEEL
B	RETAINER WASHER	1	CAST IRON
C	KEY	1	STEEL
D	NO. 3 BEVEL GEAR	1	STEEL
E	COVER	1	CAST IRON
F	SET SCREW 3/8" 16NC-2 X 3/4"	1	RUST PROOF STEEL
G	SPACERS	2	BRONZE
H	1/2" NPT PLUG	3	MALLEABLE CAST IRON
J	BUSHING	1	BRONZE
K	OPERATING NUT	1	CAST IRON
L	CAPSCREW 1 1/2" 13NC-2 X 1 1/4"	1	RUST PROOF STEEL
M	FLAT WASHER 1/2"	1	STEEL
N	PINION SHAFT	1	BRONZE
P	KEY 3/8" SQ. X 2 3/4"	1	STEEL
R	EXTENDED TYPE GREASE CASE	1	CAST IRON
S	PACKING O-RINGS NO. 218	2	RUBBER
T	STUFFING BOX	1	CAST IRON
U	BUSHING	1	BRONZE
V	BOLTS & NUTS	4	RUST PROOF STEEL
W	BUSHING	1	BRONZE
X	FOLLOWER GLAND	1	BRASS
Y	FOLLOWER PLATE	1	CAST IRON
Z	FOLLOWER STUDS	2	RUST PROOF STEEL
AA	PACKING O-RING	1	RUBBER
BB	BOLTS & NUTS 5/8" 11NC-2 X 2"	10	RUST PROOF STEEL
CC	CAPSCREW 5/8" 1NC-2 X 1 1/4"	2	RUST PROOF STEEL
DD	RODS & NUTS 1/2" 13NC-2 X 9 3/4"	2&4	STEEL
EE	SIDE PLATES	2	CAST IRON
FF	BOLTS & NUTS 5/8" 11NC-2 X 3"	8	RUST PROOF STEEL
GG	NO. 3 BEVEL PINION GEAR	1	STEEL

Title: SUB-ASSEMBLY GATE VALVE GEARING EXTENDED GREASE CASE NO. 3 BEVEL GEARS

Drawn_____ Date Issued:

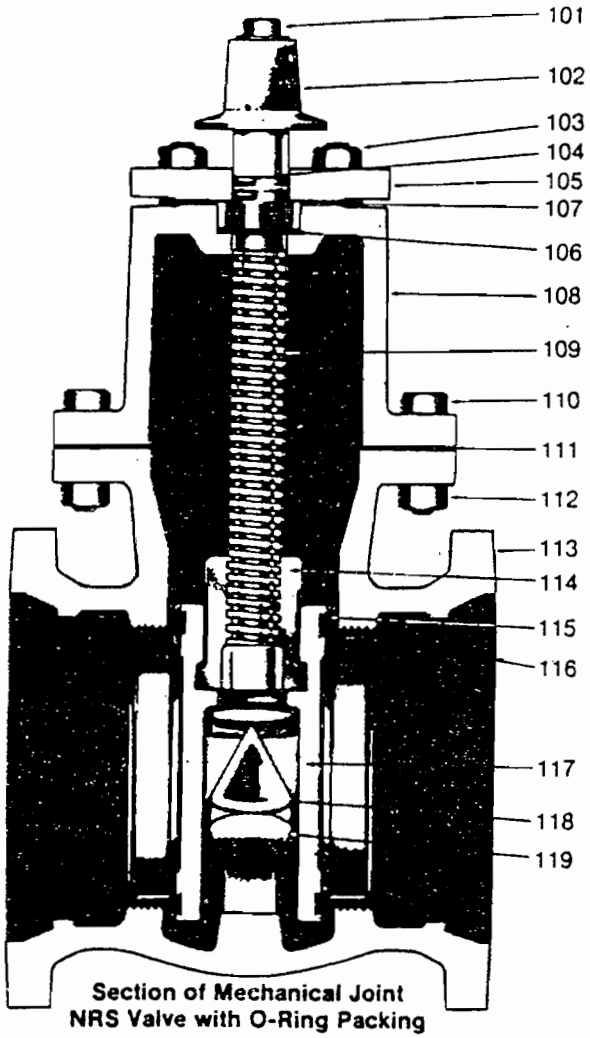
Checked_____ Section:

Reference_____ Page: A-18811-3

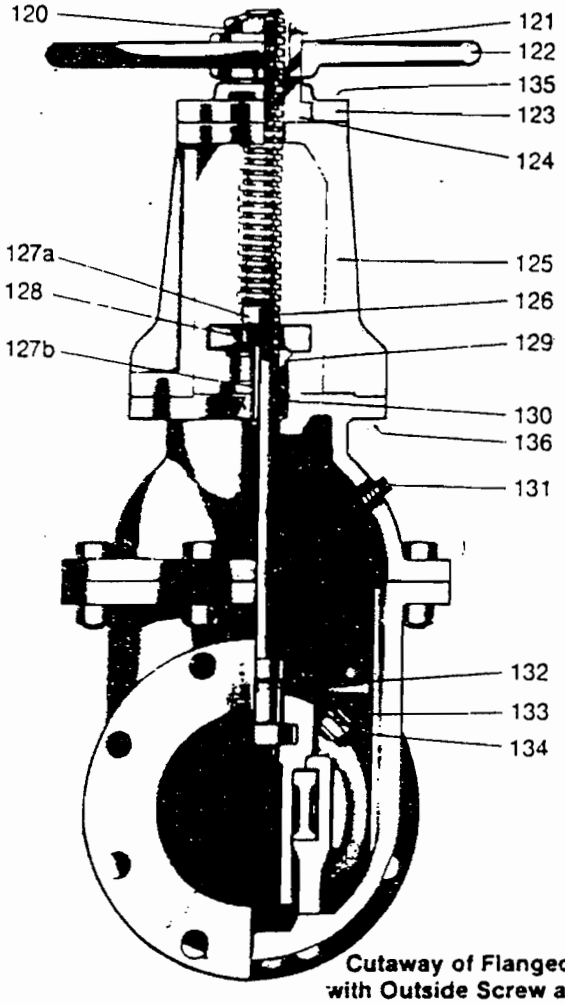
AWWA DOUBLE DISC GATE VALVES PARTS LIST

M&H VALVE COMPANY

*Recommended Spare Parts



Section of Mechanical Joint
NRS Valve with O-Ring Packing



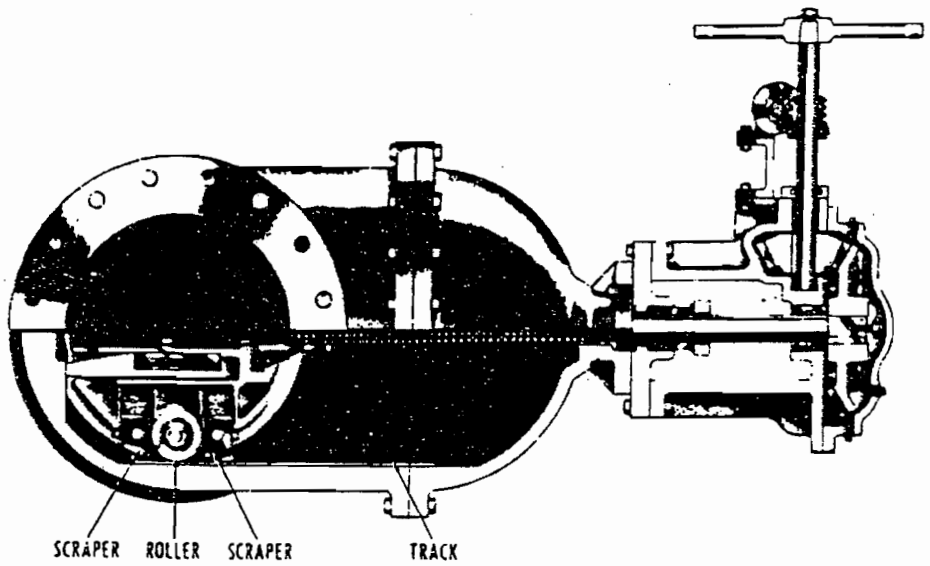
Cutaway of Flanged Valve
with Outside Screw and Yoke

DET	QTY	DESCRIPTION	MATERIAL	DET	QTY	DESCRIPTION	MATERIAL
101	1	Cap Screw	Steel	*120	1	Hold Down Nut	Bronze
102	1	Operating Nut	Cast Iron	121	1	Handwheel Key	Steel
*103		O-Ring Plate Bolts & Nuts	Steel	122	1	Handwheel	Cast Iron
*104	2	O-Rings	Rubber	123	1	O.S.&Y. Retainer Plate	Cast Iron
105	1	O-Ring Plate	Cast Iron	*124	1	O.S.&Y. Stem Nut	Bronze
106	1	Low Torque Bearing		125	1	O.S.&Y. Yoke	Cast Iron
*107	1	Stuffing Box Gasket		*126	1	Rising Stem	Bronze
108	1	Cover	Cast Iron	127a	2	Follower Nuts	Bronze
*109	1	Non-rising Stem	Bronze	127b	2	Follower Studs	Steel - Rust-proofed
*110		Neck Flange Bolts	Steel - Rust-proofed	128	1	Follower Plate	Cast Iron
*111	1	Neck Flange Gasket	Composition	129	1	Follower Gland	Bronze
*112		Neck Flange Bolt Nuts	Steel	*130		Packing	Acrylic Graphite
113	1	Body	Cast Iron	131	1	Test Plug	Teflon-coated Steel
*114	1	Gate Nut	Bronze	*132	1	Stem Nut Pin	Bronze
115	2	Gate Ring		*133	4	Pegs	Bronze
116	2	Case Ring	Bronze	*134	2	Straps	*Stainless or Bronze
*117	2	Gate	Cast Iron	*135		O.S.&Y. Cap Screws	*Stainless 10"&12" only Steel - Rust-proofed
*118	2	Wedge	Bronze	136		O.S.&Y. Yoke Bolts & Nuts	Steel - Rust-proofed
*119	2	Hook	Cast Iron				

M&H GATE VALVES ROLLERS, TRACKS, AND SCRAPERS • SLIDES

M&H VALVE COMPANY

For 14-inch and Larger Diameter Gate Valves Installed Horizontally



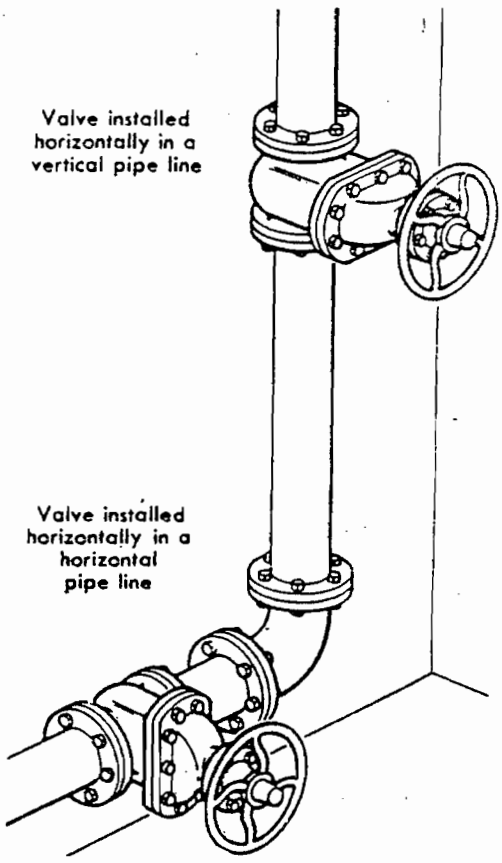
Cutaway view of valve showing rollers, tracks, and scrapers

Slides

Valves 14" and larger installed in vertical pipe lines with their stems horizontal should be fitted with slides to assist the travel of the gate assembly.

As the valve is opened, shoes fastened to lugs cast integrally at the center line on the lower gate, contact the tapered end of the tracks on which the gates slide for their entire travel. In closing, the shoes carry the gates down the tracks to a point opposite their seats, where the wedging mechanism operates to close the valve.

Slides, tracks and shoes are bronze.



Valve installed horizontally in a vertical pipe line

Valve installed horizontally in a horizontal pipe line

Rollers, Tracks and Scrapers

Valves 14" and larger installed in a horizontal pipe line with their stems horizontal should be equipped with rollers, tracks and scrapers, as illustrated. The rollers assist the travel of the gate assembly along tracks set into the valve body, retaining it in alignment, and promoting ease of operation, not otherwise possible. Scrapers are provided ahead of the rollers to clear the track of obstruction or foreign matter.

When required, rollers, tracks and scrapers are bronze.

O & M MANUAL

FOR

CHECK VALVES

M & H VALVE COMPANY
P.O. BOX 2088, ANNISTON, ALABAMA 36202 • (205) 237-3521

M&H CHECK VALVES

INSTALLATION INSTRUCTIONS:

Check valves can be furnished with various types of end connections which meet American standards. The same care should be used in installation as any other cast iron fitting.

MAINTENANCE INSTRUCTIONS:

The M&H swing, lever and weight, spring and lever check valves are rugged in design and produced from selected materials for dependable operation and freedom from repair.

The lever and weight is externally mounted on hinge pin to aid in closing clapper.

The spring and lever is also externally mounted on valve and is designed with sufficient spring strength and adjustment to close valve with a minimal amount of noise and to keep valve closed against a vacuum condition on downstream side of clapper.

These valves do not require lubrication as the operating area is wetted with line content.

After initial start-up, if valves are subjected to high cycling operations, some wear can be expected in the bearing area. If wear is found excessive, affected parts (side plugs, seals, and hinge pin) should be replaced. Grease fittings can be factory or field installed for lubricating purposes as an aid to reducing wear.

To replace worn parts, shut line down and isolate valve from reverse flow. If valve has an outside arm it should be removed and then remove hatch cover or lid. Loosen set screws holding clapper arm to hinge pin, remove side plugs or packing gland from body, and remove hinge pin. With valve down this far it would be well to check seating surface of disc and body ring for scoring from line content.

To reassemble, place clapper assembly in valve and install hinge pin with clapper arm key in place aligning key with keyway in clapper arm. Install side plugs or packing glands in body and tighten to provide pressure seal. Center clapper on hinge pin and tighten the set screws. Install hatch cover or lid and tighten to provide pressure-tight seal. Re-install outside arm, insert key and dog down set screw. Return line to service and check valve operation for performance requirements.

Repairing Information - For replacement parts give quantity, size of valve, type (swing, lever & weight, spring & lever) and markings cast on valve.

NOTE: Water hammer, hydraulic pulsation, and excessive operating noise are results of system design rather than valve design. Consequently, M&H assumes no responsibility for same.

NOTE:

The following is a guide to convert lever and weight check valve to lever and spring closing aid.

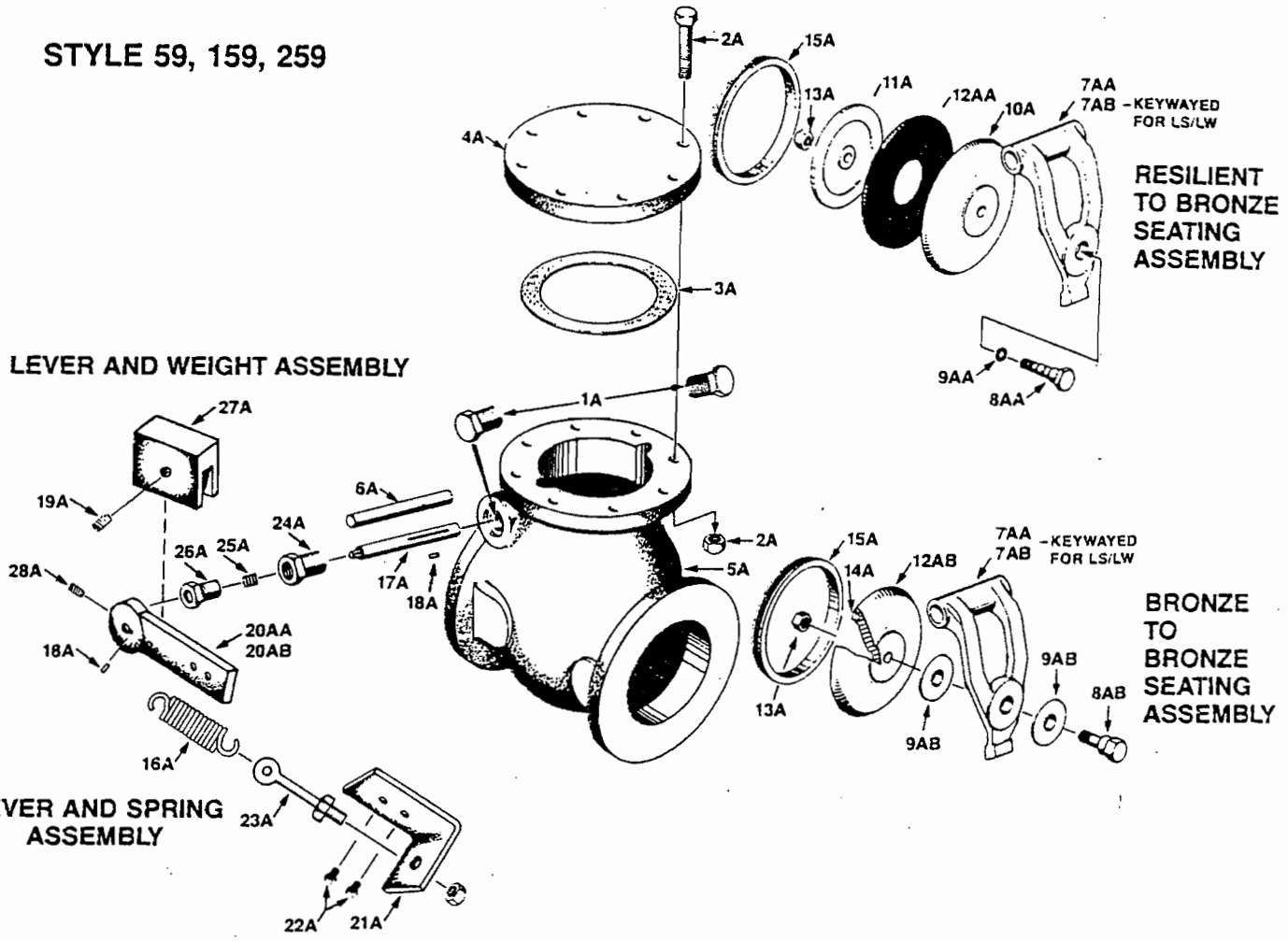
On the 14" through 20" valves, it is not necessary to change hinge pin but the 24" & 30" require different length hinge pin, and for this consult factory.

In most cases the 14" through 30" valve bodies are drilled and tapped on one side for mounting spring bracket. It is only necessary to remove weight arm and install spring arm, attach bracket, and hook up spring.

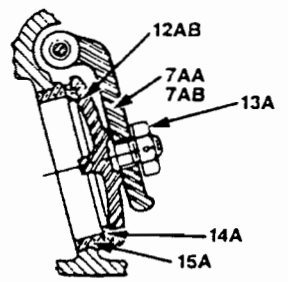
On the 12" and smaller valves, the spring bracket can be used as a spot drilling template, but size and depth of holes will have to be obtained from factory.

Recommended spare parts:
- O-Rings for side plugs
- Cover gaskets
- Rubber clapper seat

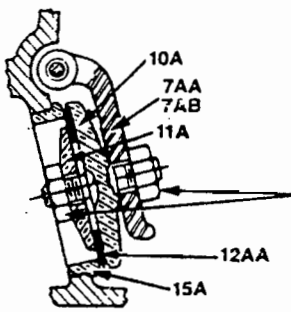
STYLE 59, 159, 259



Disc Arrangement 2"-3"



BRONZE DISC



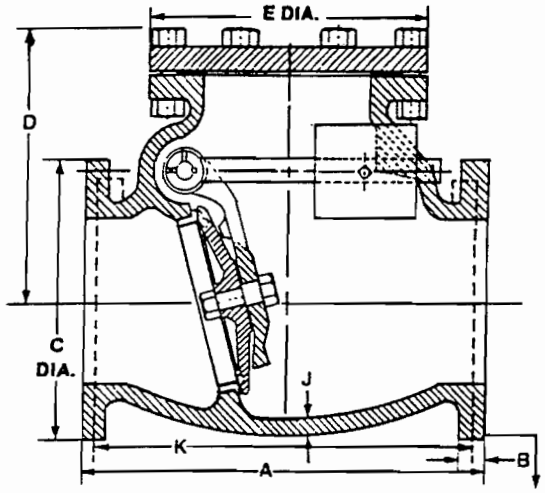
RESILIENT DISC

Part No.	Qty.	Description	Material & ASTM Spec.
1A	2 1 for LS/LW	Side Plug	Bronze
2A	*	Cap Bolts and Nuts	Rustproof Steel A-307
3A	1	Cap Gasket	
4A	1	Cap	C.I. A-126 Cl.B
5A	1	Body	C.I. A-126 Cl.B
6A	1	Hinge Pin	SS A-276 (304)
7AA	1	Hinge	Bronze (2"-3") D.I. A-536 (4"-12")
7AB	1	Hinge w/keyway for LS/LW	Bronze (2"-3") D.I. A-536 (4"-12")
8AA	1	Disc Bolt (4"-12")***	Bronze (10"-12") Steel (4"-8")
8AB	1	Disc Bolt (4"-12")***	Bronze (10"-12") Steel (4"-8")
9AA	1	Disc Bolt O-Ring (10", 12")	Syn. Rubber
9AB	2	Disc Bolt Washer (4"-8")	
10A	1	Disc Holder	Bronze (2"-3") C.I. A-126 Cl.B (4"-12")
11A	1	Disc Plate	Bronze
12AA	1	Disc	Syn. Rubber
12AB**	1	Disc	Bronze (2"-3") C.I. A-126 Cl.B (4"-12")
13A	1 2 w/resilient disc (2"-3")	Disc Nut	Rustproof Steel Bronze
14A**	1	Disc Ring (4"-12")	Bronze
15A	1	Seat Ring	Bronze
16A	1	Spring	Steel
17A	1	Extended Hinge Pin for LS/LW	SS A-276 (304)
18A	2	Key for LS/LW	SS A-276 (304)
19A	1	Set Screw	Steel
20AA	1	Lever Arm for LS	Steel
20AB	1	Lever Arm for LW	Steel
21A	1	Bracket	Steel
22A	2	Hex Head Bracket Bolt	Steel
23A	1	Eye Bolt w/2 Hex Nuts	Steel
24A	1	Stuffing Box	Bronze
25A	-	Packing	Graphite Filled
26A	1	Gland	Bronze
27A	1	Weight	C.I. A-126 Cl.B
28A	1	Set Screw	Steel

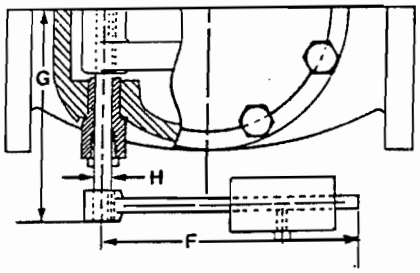
** Denotes that part is available only as part of an assembly

Dimensional Data STYLE 59, 159, 259

2" - 12"

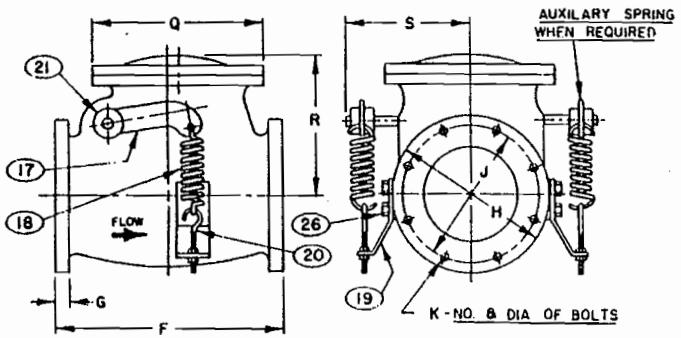


DETAIL LW/LS



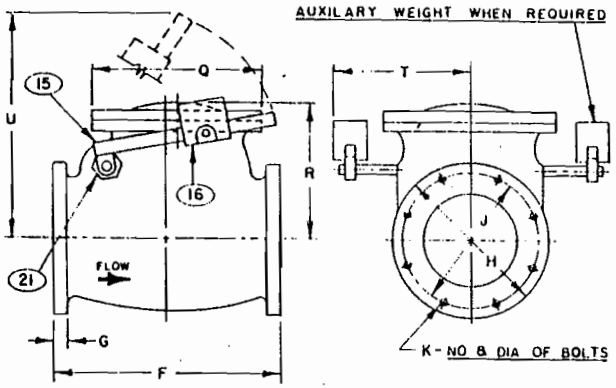
L—BOLT CIRCLE DIA. END FLANGES
M—NO. OF BOLTS PER FLAT END FLANGES
N—BOLT HOLE DIA.
END FLANGES CONFORM TO ANS1 B16.1

SIZE	A	B	C	D	E	F	G	H	J	K**	L	M	N	Q*
2"	8.00	.65	6.00	6.00	6.00	6.00	4.72	.50	.34	8.00	4.75	4	.75	4
2½"	8.50	.72	7.00	6.62	7.00	6.00	4.94	.50	.41	8.50	5.50	4	.75	4
3"	9.50	.78	7.50	7.06	7.50	6.00	5.34	.50	.44	9.50	6.00	4	.75	4
4"	11.50	1.00	9.00	8.31	9.00	8.25	8.19	.62	.50	11.50	7.50	8	.75	8
5"	13.00	.94	10.00	8.31	10.00	9.50	8.50	.62	.62	11.50	8.50	8	.87	8
6"	14.00	1.06	11.00	10.06	11.00	10.25	9.00	.75	.62	–	9.50	8	.87	8
8"	19.50	1.25	13.50	12.38	13.50	14.50	10.18	.87	.75	–	11.75	8	.87	8
10"	24.50	1.31	16.00	13.93	16.75	18.00	11.62	1.00	.81	–	14.25	12	1.00	12
12"	27.50	1.37	19.00	18.18	19.00	18.00	13.75	1.00	.87	–	17.00	12	1.00	12
14"	31.00	1.50	21.00	18.63	21.88	18.00	16.13	1.50	1.00	–	18.75	12	1.13	16
16"	33.00	1.56	23.50	20.13	24.63	24.00	17.94	1.50	1.06	–	21.25	16	1.13	16
18"	36.00	1.56	25.00	22.13	26.75	24.00	20.13	1.75	1.06	–	22.75	16	1.25	18
20"	40.00	1.75	27.50	25.38	29.38	24.00	22.25	2.00	1.18	–	25.00	20	1.25	22
24"	45.50	1.94	32.00	28.50	35.00	30.00	24.75	2.12	1.25	–	29.50	20	1.38	26



SPRING AND LEVER CHECK VALVE

STYLE NO. 259-02-0200

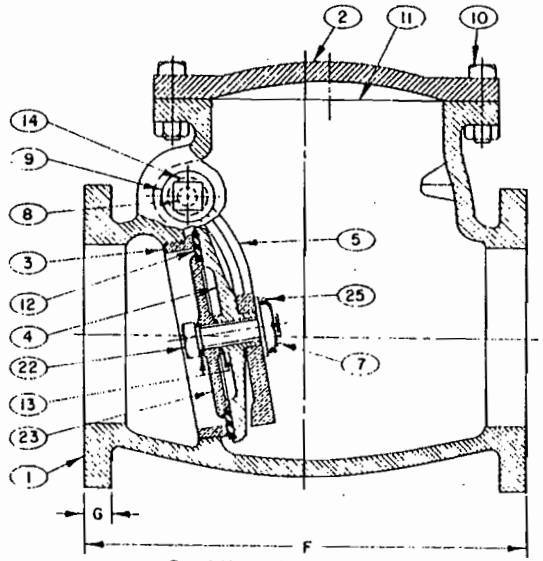


LEVER AND WEIGHT CHECK VALVE

STYLE NO. 159-02-0200

DIMENSION IN INCHES

VALVE SIZE	14
F	30
G	1¾
H	21
J	18¾
K	12-1
Q	23½
R	18¾
S	15½
T	17
U	32½



PLAIN CHECK VALVE

14"

STYLE NO. 0059-02-0200

PARTS LIST

PART NO.	NO. REQ'D	PART	MATERIAL	A.S.T.M. SPEC. NO.
1	1	BODY	CAST IRON	A-126 CL. B
2	1	COVER	CAST IRON	A-126 CL. B
3	1	BODY RING	BRONZE	CDA 84400
4	1	CLAPPER ①	SEE NOTE NO. 1	
5	1	CLAPPER ARM	BRONZE	B-132
6	1	CLAPPER STUD	BRONZE	B-21
7	VARIES	CLAPPER NUT	BRONZE	CDA 84400
8	1	HINGE PIN	STN. STL.	A-276-303
9	2	SIDE PLUG (PLAIN VALVE)	BRONZE	CDA 84400
10	VARIES	COVER BOLTS & NUTS	STEEL	A-307 GR. B
11	1	COVER GASKET	NON-ASBESTOS	—
12	1	CLAPPER RING	NEOPRENE	—
13	2	GASKET	COPPER NON-ASBESTOS	
14	2	SIDE PLUG GASKET	COPPER NON-ASBESTOS	
15	1	WEIGHT LEVER ARM ②	CAST IRON	A-126 CL. B
16	1	WEIGHT	CAST IRON	A-126 CL. B
17	1	SPRING LEVER ARM ①	SEE NOTE NO. 3	
18	1	SPRING	STEEL	—
19	1	SPRING BRACKET	STEEL	—
20	1	SPRING EYEBOLT	STEEL	A-307 GR. B
21	2	STUFFING BOX ASSEMBLY	BRONZE	CDA 84400
22	1	CAPSCREW OR BOLT	BRONZE	B-21
23	1	CLAMPING RING	BRONZE	CDA 84400
24	1	LOCKWASHER	STEEL	—
25	VARIES	COTTER PIN	BRONZE	—
26	2	SPRING BRACKET CAP SCREW	STEEL	A-307 GR. B
27	2	"O"-RING SIDE PLUG	BRONZE	CDA 84400
28	2	"O"-RING	RUBBER	—

NOTES:

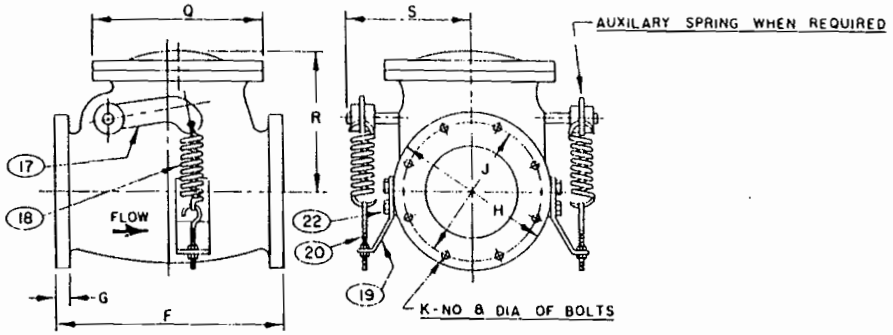
1 A-126 CL. B CAST IRON
2 WEIGHT LEVER ARM ON 14" VALVE- STEEL.
3 A-126 CL. B CAST IRON
4 ALL STEEL BOLTS & NUTS ARE ELECTRO-ZINC PLATED

	14"
WATER WORKING PRESSURE	150 PSI
HYDROSTATIC TEST PRESSURE	300 PSI

14" SWING CHECK VALVE-RUBBER FACED-FLANGED END

M&H Valve Co.
Anniston, Alabama

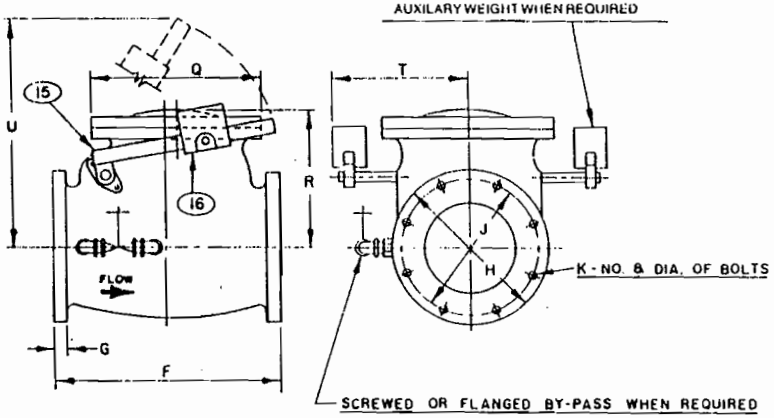
DRAWN BY K.M.	DATE 2-28-74
CHECKED	SCALE NONE
APPROVED	
DWG NO 11802	REV E



SPRING AND LEVER CHECK VALVE

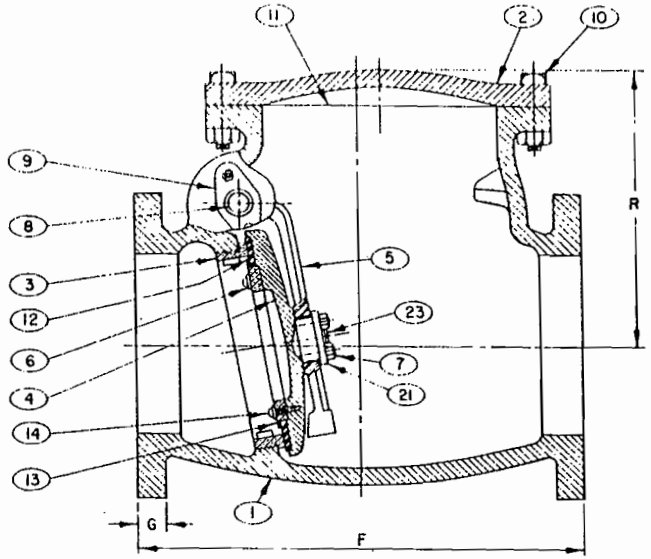
STYLE NO. 259-02-0200

PARTS LIST				
PART NO.	NO. REQ'D	PART	MATERIAL	A.S.T.M. SPEC. NO.
1	1	BODY	CAST IRON	A-126 CL. B
2	1	COVER	CAST IRON	A-126 CL. B
3	1	BODY RING	BRONZE	CDA 84400
4	1	CLAPPER	CAST IRON	A-126 CL. B
5	1	CLAPPER ARM	BRONZE	CDA 86400
6	VARIES	LOCKWASHER	STEEL	—
7	VARIES	CAPSCREW	BRONZE	B-21
8	1	HINGE PIN	STN. STL.	A-276-303
9	2	GLAND (BRONZE BUSHED)	CAST IRON	A-126 CL. B
10	VARIES	COVER BOLTS AND NUTS	STEEL	A-307 GR. B
11	1	COVER GASKET	NON-ASBESTOS	—
12	1	CLAPPER RING	NEOPRENE	—
13	1	RING CLAMP	BRONZE	CDA 84400
14	VARIES	RING CLAMP CAPSCREW	BRONZE	B-21
15	1	WEIGHT LEVER ARM	BRONZE	B-62
16	1	WEIGHT	CAST IRON	A-126 CL. B
17	1	SPRING LEVER ARM	BRONZE	B-62
18	1	SPRING	STEEL	—
19	1	SPRING BRACKET	STEEL	—
20	1	SPRING EYEBOLT	STEEL	A-307 GR. B
21	1	CAP PLATE	CAST IRON	A-126 CL. B
22	VARIES	SPRING BRACKET CAPSCREW	STEEL	A-307 GR. B
23	1	LOCK WIRE	COPPER	B3-74



LEVER AND WEIGHT CHECK VALVE

STYLE NO. 159-02-0200



PLAIN CHECK VALVE

STYLE NO. 59-02-0200

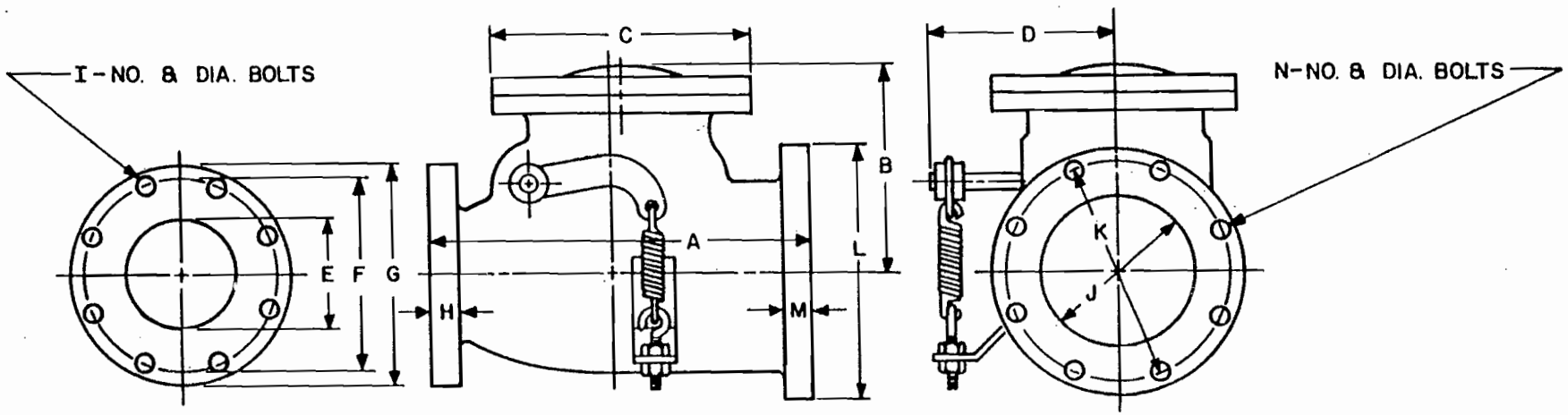
DIMENSIONS IN INCHES					
VALVE SIZE	16	18	20	24	30
E	25 3/8	—	—	—	—
F	35	36 1/2	37 5/8	44	49 1/2
G	1 7/16	1 9/16	1 11/16	1 7/8	2 1/8
H	23 1/2	25	27 1/2	32	38 3/4
J	21 1/4	22 3/4	25	29 1/2	36
K	16-1	16-1 1/8	20-1 1/8	20-1 1/4	28-1 1/4
Q	27 1/2	27 1/2	32	38 3/4	43 3/4
R	23	25	24 1/2	28	32 1/8
SPRING & LEVER VALVES					
S	17 3/4	18 5/8	20	22 1/2	25 1/8
LEVER & WEIGHT VALVES					
T	19 1/2	21	22 3/8	28 1/2	30 5/8
U	34 1/2	40	42	54 1/2	57 1/2

150 LBS—WATER WORKING PRESSURE
300 LBS—HYDROSTATIC TEST PRESSURE

16"-30" SWING CHECK VALVE-RUBBER FACED-FLANGED END

M&H Valve Co.
Anniston, Alabama

DRAWN BY K.M	DATE 10-22-73
CHECKED	SCALE NONE
APPROVED	
DWG. NO 11804	REV B



SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3x4	11	6½	7⅜	5½	3	6	7½	¾	4-⅝	4	7½	9	15/16	8-⅝
4x6	13½	8	9¼	7	4	7½	9	15/16	8-⅝	6	9½	11	1	8-¾
4x8	15	8	9¼	7	4	7½	9	15/16	6-⅝	8	11¾	13½	1⅛	6-¾
6x8	17	9¾	12¼	8 5/16	6	9½	11	1	8-¾	8	11¾	13½	1⅛	8-¾
6x10	17½	9¾	12¼	8 5/16	6	9½	11	1	8-¾	10	14¼	16	1 3/16	12-⅞
8x10	20	12	14¾	10 11/16	8	11¾	13½	1⅛	8-¾	10	14¼	16	1 3/16	12-⅞
8x12	21	12	14¾	10 11/16	6	11¾	13½	1⅛	8-¾	12	17	19	1¼	12-⅞
10x12	22½	14¼	19	13¼	10	14¼	16	1 3/16	12-⅞	12	17	19	1¼	12-⅞
10x16	24¼	14¼	19	13¼	10	14¼	16	1 3/16	12-⅞	16	21¼	23½	1 7/16	16-1

SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N
12x16	26½	16¾	21	13⅞	12	17	19	1¼	12-⅞	16	21¼	23½	1 7/16	16-1
16x20	35	21⅝	27¾	17¾	16	21¼	23½	1 7/16	16-1	20	25	27½	1 11/16	20-1⅛
20x24	38½	24½	32	20	20	25	27½	1 11/16	20-1⅛	24	29½	32	1⅞	20-1¼

INCREASING TYPE CHECK VALVE WITH SPRING & LEVER

M&H Valve Co.
Anniston, Alabama

DRAWN BY J R B	DATE 4-25-79
CHECKED	SCALE NONE
APPROVED	
DWG. NO 8764	REV

Cushion Check

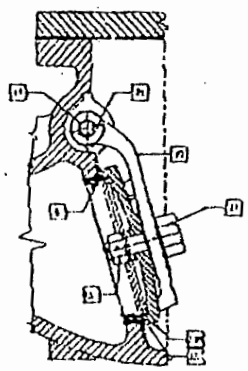
If possible, it is preferable to eliminate water hammer. The best way to eliminate water hammer is in the design of the piping system. For most cases where water hammer exists it is preferable to reduce its effects by causing the check valve to close so quickly that the flow is not able to reverse. Kennedy Valve makes a Figure 706 Wafer Check Valve that is intended as an anti-water hammer valve. Kennedy Valve also has available lever and weight and lever and spring arrangements on the Figure 106 Check Valve.

In some cases the customer may want an arrangement that retards the closing of the check valve. The customer may want such an arrangement for those cases where the water column actually has an opportunity to reverse or even separate, such as might occur when the check valve is not at the lowest elevation in the system.

For those customers, Kennedy Valve makes available the Figure 206 Cushion Check Valve. The Figure 206 Cushion Check Valve is a Figure 106, AWWA valve with a lever and weight and a pneumatic cylinder arrangement. The pneumatic cylinder has a needle valve that allows the customer to adjust the time required for the valve to close.

The Figure 206 Check Valve may be ordered from the factory either as flow horizontal or flow up. The cylinder arrangement is available mounted on either side unless specified the Figure 206 valve will be supplied with the cylinder on the right side (when facing the inlet) and for horizontal flow.

The Figure 206 has internal components identical to the Figure 106 except that the hinge pin is made from heat treated, type 431 stainless steel and is unique to the Figure 206.

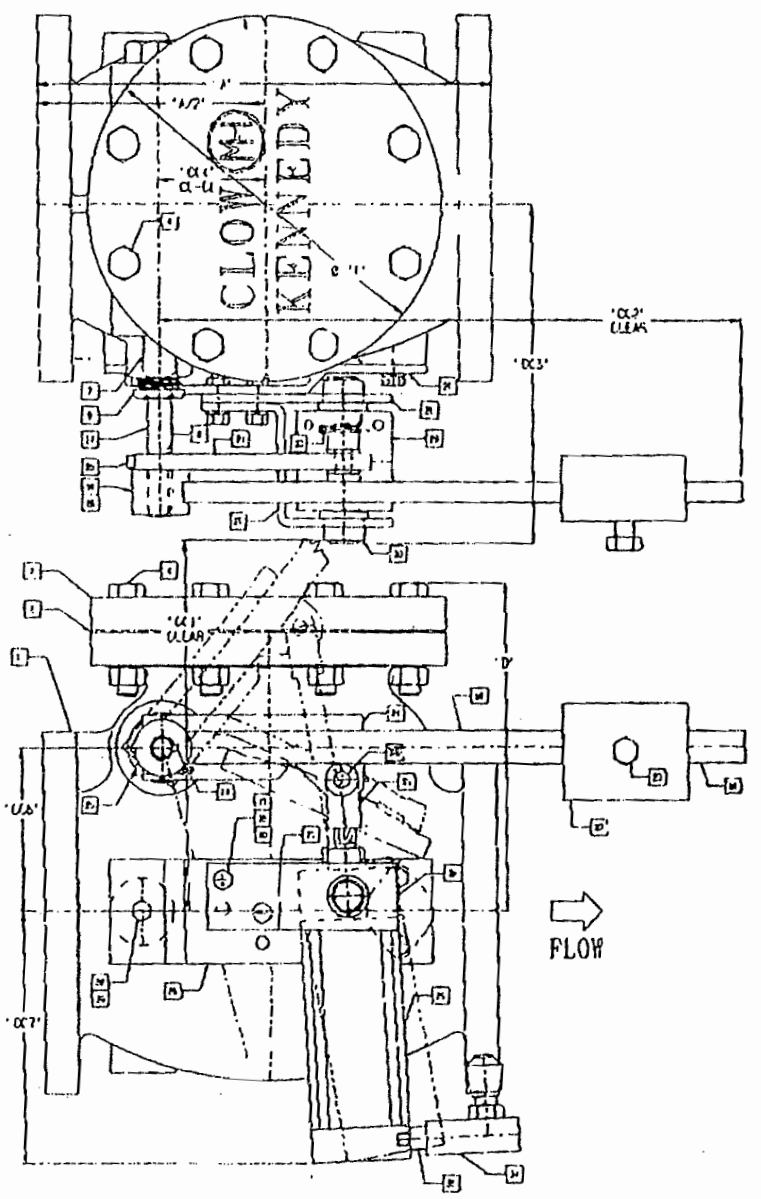


TYP SECTION
4-12"

NOTES:

1. 6" VALVE SHOWN
2. VALVE SHOWN WITH CUSHION ARRANGEMENT ON RIGHT HAND SIDE (FACING INLET) LEFT HAND VERSION AVAILABLE
3. VALVE OPENING IS SUDDEN INSTALL GUARDS OR OTHERWISE ASSURE THAT PERSONS ARE WELL CLEAR
4. DIMENSIONS ARE APPROXIMATE and FOR LAYOUT PURPOSES ONLY
5. CONFIGURATION FOR VERTICAL INSTALLATION DIFFERENT THAN SHOWN-See Drawing

ITEM NO.	DESCRIPTION			
1	Body	Gray Iron	A126 B	Special Boss Drill & Tap
2	Cap	Gray Iron	A126 B	
3	Cap Gasket	Rubber Reinforced	by GARLOCK	
4	Cap Bolts & Nuts	Steel, Plated	A307	
5	Seat Ring	Bronze	CDA 844	
6				
7	Stuffing Box	Bronze	B16	
8	Packing (not shown)	Non-Asbestos	by GARLOCK	
9	Gland Follower	Bronze	B16	
10	Hinge (Keyed)	Ductile Iron		
11M	Disc - Metal	Iron		
11R	Disc Holder	Iron		
12M	Disc Facing Ring	Bronze	CDA 844	Integral with Disc
12R	Disc, Resilient	Rubber		
13R	Disc Plate	Bronze	CDA 844	
14	Disc Bolt	---		Sizes 2-8" Steel 10&12" Bronze
15	Nut, Disc Bolt	---		Sizes 2-8" Steel 10&12" Bronze
16	Disc Bolt Gasket	Fibre		10&12" Sizes Use O-Ring
17	Hinge Pin (Special)	Stainless	431	Heat Treated
18	Lever (Special)	Steel		
19	Key for Lever	Stainless		
20	Set Screw for Lever	Steel		
21	Key for Hinge	Stainless		
22	Weight	Gray Iron	A126 B	
23	Set Screw for Weight	Steel, Plated	A307	
24	Cylinder Arm	Steel		
25	Set Screw for Arm	Steel		
26	Body Bracket	Steel		
27	Outer Cylinder Bracket	Steel		
28	Inner Cylinder Bracket	Steel		4 & 6" Sizes
29	Cylinder	Per Catalogue		
30	Bushing(s)	Bronze		
31	Rod End	Steel		
32	Pin	Steel		
33	Cotter Pin	Stainless		
34	Control Valve	Per Catalogue		
35	Nipple	Brass		
36	Muffler	Per Catalogue		
37	Body Bracket Bolts	Steel, Plated	Grade 5	
38	Cylinder Bracket Bolts	Steel, Plated	Grade 5	



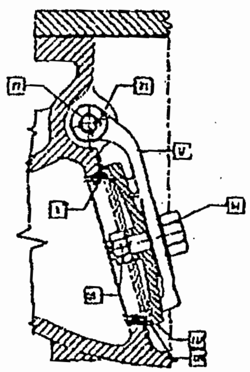
SIZE	A	D	E	CC1	CC2	CC3	CC4	CC5	CC6	CC7
4	11.50	8.31	9.00	13.77	12.00	9.56	2.44	—	3.75	8.89
6	14.00	10.06	11.00	19.28	18.00	10.38	3.31	—	5.00	7.52
8	19.50	12.38	13.50	22.24	18.00	11.75	4.88	—	6.25	6.40
10	24.50	13.93	16.75	23.62	18.00	13.68	6.19	—	7.12	11.46
12	27.50	16.18	19.00	24.57	18.00	14.94	8.38	—	6.19	10.40

Dimensions Approximate--For Checking Clearances Only
Allow Clearance Two Sides to Remove Side Plug & Access Hinge Pin

ASSEMBLY DRAWING CUSHION CHECK SIZES 4"-12"
FLOW HORIZONTAL

Kennedy Valve

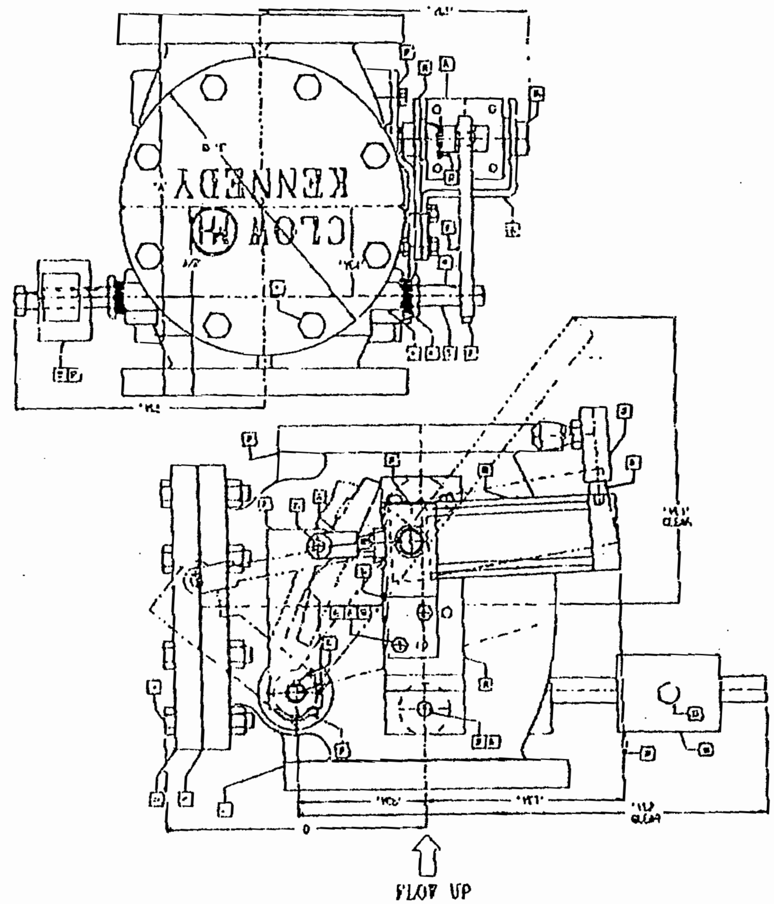
DRAWN BY | DATE
CHECKED | SCALE NONE
APPROVED | SIZE D | NO 54106



TYP SECTION
4-12"

NOTES:

1. 6" VALVE SHOWN
2. VALVE SHOWN WITH CUSHION ARRANGEMENT ON RIGHT HAND SIDE (FACING INLET) LEFT HAND VERSION AVAILABLE
3. VALVE OPENING IS SUDDEN INSTALL GUARDS OR OTHERWISE ASSURE THAT PERSONS ARE WELL CLEAR
4. DIMENSIONS ARE APPROXIMATE and FOR LAYOUT PURPOSES ONLY
5. CONFIGURATION FOR VERTICAL INSTALLATION DIFFERENT THAN SHOWN-See Drawing



SIZE	A	D	E	VC1	VC2	VC3	VC4	VC5	VC8	VC7
4	11.50	8.31	9.00	8.00	12.00	9.56	2.44	9.69	3.75	8.89
6	14.00	10.06	11.00	11.00	18.00	10.36	3.31	10.21	5.00	7.52
8	19.50	12.38	13.50	12.00	18.00	11.75	4.88	11.69	6.25	6.40
10	24.50	13.93	16.75	NA	18.00	13.68	6.19	13.13	7.12	11.46
12	27.50	16.18	19.00	NC	18.00	14.94	6.38	15.25	8.19	10.40

Dimensions Approximate-For Checking Clearances Only
Allow Clearance Two Sides to Remove Side Plug & Access Hinge Pin

ITEM NO.	DESCRIPTION			
1	Body	Gray Iron	A126 B	Special Boss Drill & Tap
2	Cap	Gray Iron	A126 B	
3	Cap Gasket	Rubber Reinforced	by GARLOCK	
4	Cap Bolts & Nuts	Steel, Plated	A307	
5	Seal Ring	Bronze	CDA B44	
6				
7	Stuffing Box	Bronze	B16	
8	Packing (not shown)	Non-Asbestos	by GARLOCK	
9	Gland Follower	Bronze	B16	
10	Hinge (Keyed)	Ductile Iron		
11M	Disc – Metal	Iron		
11R	Disc Holder	Iron		
12M	Disc Facing Ring	Bronze	CDA B44	Integral with Disc
12R	Disc, Resilient	Rubber		
13R	Disc Plate	Bronze	CDA B44	
14	Disc Bolt	---		Sizes 2-8" Steel 10&12" Bronze
15	Nut, Disc Bolt	---		Sizes 2-8" Steel 10&12" Bronze
16	Disc Bolt Gasket	Fibre		10&12" Sizes Use O-Ring
17	Hinge Pin (Special)	Stainless	431	Heat Treated
18	Lever (Special)	Steel		
19	Key for Lever	Stainless		
20	Set Screw for Lever	Steel		
21	Key for Hinge	Stainless		
22	Weight	Gray Iron	A126 B	
23	Set Screw for Weight	Steel, Plated	A307	
24	Cylinder Arm	Steel		
25	Set Screw for Arm	Steel		
26	Body Bracket	Steel		
27	Outer Cylinder Bracket	Steel		
28	Inner Cylinder Bracket	Steel		4 & 6" Sizes
29	Cylinder	Per Catalogue		
30	Bushing(s)	Bronze		
31	Rod End	Steel		
32	Pin	Steel		
33	Cotter Pin	Stainless		
34	Control Valve	Per Catalogue		
35	Nipple	Brass		
36	Muffler	Per Catalogue		
[illegible]	[illegible] Bracket Bolts	Steel, Plated	Grade 5	
38	Cylinder Bracket Bolts	Steel, Plated	Grade 5	
[illegible]	Lock Washer (Hi-Collar)	Steel, Plated		
[illegible]	[illegible]	[illegible]		

ASSEMBLY DRAWING CUSHION CHECK SIZES 4"-12
FLOW UP

Kennedy Valve

DRAWN BY 12C		DATE 9/15/95	
CHECKED		SCALE NONE	
APPROVED		DWG NO [illegible]	R[illegible]

Kennedy Valve/Swing Check Valve

JAN 04 '01 15:29

KENNEDY VALVE

SWING CHECK VALVE

MAINTENANCE MANUAL

REVISED 1-23-96

I. SELECTION

Check valves are for the prevention of backflow. Particular check valves may perform additional services as follows:

1. Wafer check valves reduce the effect of water hammer (FM approved for such service).

2. Outside lever check valves may be fitted with a limit switch to detect flow.

A. General Service by Product

1. Figure 106 Check Valve

For service in other than fire protection lines and other than a connection to a potable water system where there is the possibility of a pollutant in the users system backflowing into the potable water system. The 106 check valves should not be used if water hammer is known to be a problem.

a. Standard Figure 106 brass to brass seating - General service, cold water, non-shock up to 200 PSI. Allows backflow (when new) up to 1 oz/hr/in nominal size at 200 PSI back pressure (possibly more at low back pressure).

b. Figure 106 - Resilient rubber to brass seating for General service, cold water, non-shock, at temperatures not exceeding 125°F. Provide drip tight sealing (when new). May allow some backflow at conditions of low back pressure (less than 5 ft. H_2O back pressure) preferred for service when water hammer might be a problem and anti-water hammer check cannot be used. Not for steam service.

c. Outside lever (lever & spring / lever & weight) - occasionally used where water hammer might be a problem. Occasionally fitted with limit switches to detect flow. Rarely arranged to counter balance disc and reduce head loss at low flows. Levers may be a safety hazard for personnel if the valve opens suddenly.

2. Figure 126 Check Valves

UL/FM approved for fire protection service. All other remarks for Figure 106 valves apply. Differ from 106 valves in body length and primary pressure rating.

3. Figure 706 Wafer Checks

UL/FM approved for service where hammer is a problem. Fit between standard 125# flanges. Drip tight sealing at back pressures greater than 5 fl. H_2O. Recommended for service where water hammer is a problem. Not for steam service.

B. General Selection Information

1. For swing check valves to function properly and not be a source of chatter and water hammer, there must be at least 1/2 PSI differential across the valve under normal flow conditions. When in doubt, undersize check valves.

2. For service in normal environments (clean water or dry air) at temperatures less than 100°F, resilient seated valves will allow less backflow and minimize water hammer vice metallic seated valves.

3. For service other than clean water, consult the factory.

4. Levers may injure personnel and may be misused by persons to open the valve and allow backflow.

II. INSTALLATION

All Kennedy AWWA and UL/FM check valves bolt between ASA 125# flanges.

A. Swing Check Valves

1. Orientation

a. Swing check valves are always installed with the hinge pin parallel to the plane of the horizon and above the pipe centerline. Incorrect installation may result in binding, high head loss and/or hanging open.

b. Figure 106/126 check valves must be installed with the flow horizontal or the flow up.

c. Outside lever swing check valves must be installed with the end of the lever that is fixed to the hinge pin higher than the opposite end. Failure to do this will certainly void the function of the check and may result in backflow.

2. Lifting

Lift swing check valves with a sling around the body. Never lift valves by placing a bar or fork through the valve.

3. Clearances

a. Allow two pipe diameters clearance minimum from the top of the cover for removal of the disc without removing the valve from the line.

b. Allow a minimum of one pipe diameter on one side of the valve and two and a half (2-1/2) pipe diameters on the opposite side for removal of the hinge pin.

c. If space is limited, consult factory for space limitations with outside lever valves. Levers may be a safety hazard for personnel and lever valves should be installed where personnel will not normally be in the area or guards should be installed.

4. Start-Up

The lines should be bled of air.

5. Gaskets

See page 10.

B. Wafer Check Valves - C508

1. Orientation

a. The hinge pin should be roughly parallel to the plane of the horizon and above the centerline of the pipe.

b. Wafer check may be installed horizontally or vertically with the flow up or down.

2. Gaskets

The wafer check bolts between ASA 125# flanges and does not require gaskets (o-rings being provided).

3. Fasteners

Threaded rods are usually used to fasten up the wafer check.

4. Lifting

8" wafer checks are provided with a threaded hole for an eyebolt for lifting.

III. SERVICE LIMITATIONS (Pressure Temperatures)

All valves, all services 32°F minimum working temperature non-shock.

A. UL/FM (Figure 126 and detector check) valves are for service at 175 PSI maximum and 125°F maximum, water only.

B. Figure 106A (Resilient Seated Checks)

1. Cold water service (125°F maximum)

Sizes: 2" to 12" - 200 PSI maximum
Sizes: 14" to 24" - 150 PSI maximum

C. Figure 106 (Metallic Seated Checks)

1. Cold water service (150°F maximum)

Sizes: 2" to 12" - 200 PSI maximum
Sizes: 14" to 24" - 150 PSI maximum

IV. MAINTENANCE, CHECKING AND TESTING

A. Swing Checks

Excepting misuse and severe service, maintenance should be limited to the following:

1. seating services;
2. bearing surfaces (hinge pins, hinges and side plugs);
3. replacement of parts subject to corrosion; and
4. lubrication and repacking of hinge pin stuffing boxes and o-ring stuffing boxes for outside lever valves.

Replacement of resilient disc rings (1. above) and lubrication and repacking of stuffing boxes for outside lever valves (4. above) are the only items subject to regular replacement maintenance or repair.

Replacement of parts subject to corrosion is unpredictable as corrosion conditions are unknown and subject to many variables. Only the field service representative is qualified to judge when a part is corroded beyond use or safe limits and should be replaced; for replacement procedures see the section on replacing disc rings.

Kennedy Valve is not aware of a case where the bearing surfaces have been worn beyond use, but the possibility remains.

The field service representative must decide what item has worn and replace it.

1. Resilient Discs

a. When to replace

1. Replace resilient disc rings whenever leakage is judge excessive or at scheduled intervals.

b. Replacement parts (order from factory for correct size)

1. Disc ring

2. Cover gasket (advisable, but not always required see Schedule Page 9 for sizes).

3. Anaerobic sealant low strength "Loctite" or equal.

4. O-ring or gasket for disc bolt (advisable, but not always required).

c. Special tools

None

d. Procedure (see 22 below for lever valves)

1. Remove cover.

2. Remove side plugs. Use an appropriate size socket or box wrench not an adjustable or pipe wrench.

3. Drive hinge pin out with wood dowel.

4. Lift hinge/disc assembly from valve ("V" notches in side of valve provide clearance for disc assembly).

5. Remove nut retaining disc plate. At this time, it might be advisable to remove the disc bolt and replace the o-ring or gasket on the disc ball.

6. Lift the disc plate off. If the disc plate sticks, try tapping the back of the disc assembly with a soft faced mallet. Pry it off only as a last resort.

7. Remove the resilient disc ring.

8. Clean the "pocket" where the disc ring seats in the disc holder.

9. Replace the resilient disc ring with a new one, seating it flat in the "pocket" in the disc holder. Do not use gasket sealant.

10. Clean the back of the disc plate.

11. Polish the seat ring in the valve body with crocus cloth or 600 grit wet/dry sand paper (see Page 8).

12. If the disc bolt has been removed, lubricate the hole in the disc holder and the disc bolt with clean grease. Then carefully insert the disc bolt through the hinge and disc holder taking care not to twist or cut the o-ring.

13. Replace the disc holder on the hinge.

14. Replace the disc bolt nut and use a low strength anaerobic sealant. Do not over tighten the disc bolt nut. Tighten the nut only to the point that the disc plate makes a very slight impression into the resilient disc ring.

15. Drop the disc/hinge assembly in the valve and insert hinge pin.

16. Replace the side plugs, starting by hand, then tighten with 300 in-lb torque.

17. Inspect the cover sealing surfaces and clean if needed.

18. Inspect the cover gasket and replace if needed (order from Kennedy Valve or see Schedule on Page 9).

19. Tighten the cover bolts. Tightening two bolts at 180° snug, then tightening two bolts 90° to the first two and 180° to each other, finally tightening all bolts tight. (See Schedule on Page 9 for specific torques.)

20. Pressurize and bleed the valve, tightening any leaks. It may be necessary to loosen and retighten a few cover bolts.

21. Procedure for outside lever valves; same as for valves without outside lever except:

    a. Remove spring or weight before removing cover.

    b. Loosen set screw on lever and remove lever and key.

    c. Remove side plug packing gland.

    d. Remove side plug opposite hinge pin.

    e. If set screws are used on hinge, remove them.

    f. Lubricate extended hinge pin.

    g. Back side plug stuffing box out of valve.

    h. Drive the hinge pin out with a hardwood dowel. (It may be necessary to heat the hinge, but this should be avoided.)

    i. Replace resilient disc ring as above.

    j. Lubricate hinge pin and start hinge pin and key into the hinge.

    k. Replace the side plug (normally on left hand side as seen facing valve inlet).

    l. Drive hinge pin in with a soft tool (make certain that key and key seats remain lined up).

m. Replace set screws in hinge (if any).

n. Repack or replace rings in the side plug stuffing box.

o. Start packing gland into side plug stuffing box.

p. Replace lever, lever key, and set screw on extended hinge pin.

q. Tighten side plug stuffing box. Tighten slowly and move lever frequently so as to not overtighten and cause valve to hang open.

r. Replace cover.

s. Replace spring or weight.

t. Pressurize and bleed.

2. Seat Rings/Disc Rings

a. When to polish

Leakage is considered excessive.

b. Replacement parts

(See Page 9.)

c. Supplies

Crocus cloth or very fine (600 grit maximum) wet/dry sand paper or valve lapping compound.

d. Procedure

1. See Page 6 - Steps d.1 through d.6.

2. Inspect seat ring and disc ring (on metal to metal valves). Polish away any scale and check for nicks or scratches.

3. For metal to metal valves - lay a piece of wet/dry paper on a very flat surface and polish the disc ring (with a wiping and rotating motion) until the entire brass disc ring is smooth, flat and free of scratches.

4. Wipe the entire surface of the seat ring. It must be smooth, flat, and free from radial scratches.

5. For a better than usual seal, use some valve lapping compound on the seat ring. Rub the disc on the seat

ring with a rotating and wiping motion. Clean the compound from the seat and disc and replace it several times.

6. See Page 6 - Steps d.13 through d.21.

RECOMMENDED SPARE PARTS FOR C.I. CHECK VALVES

FIGURE 106, 106A, 126, AND 126A

NECESSARY:

1. Cap gasket
2. Resilient disc (for rubber faced valves only).
3. Packing for lever & spring and lever & weight valves.

USEFUL:

1. Hinge pin, hinge, and disc assembly
2. Bolts and nuts
3. Disc bolt o-ring (106A/126A/126 valves)
4. Disc bolt gasket (106 valves)

Valve Size	Bolt Size	Torque ft-lbs
2", 2-1/2", 4", 6"	5/8 UNC	100
6" & 8"	3/4 UNC	150
10" & 12"	7/8 UNC	230

Gaskets (CAP):

2" to 12" valves use a cap gasket identical to the end flange gasket.

SIZING OF SWING CHECK VALVES

To assure reliable, stable, chatter-free operation, it is recommended that s[illegible]g check valves be sized to assure that the disc will open full during [illegible]al flow conditions. The head loss during normal flow conditions should exceed (1) one PSI for valves 4" and smaller and exceed (1/2) one-half PSI for the remaining larger sizes. The data below provides an estimate of what should be the minimum design flow rates:

SIZE	DESIGN MIN. FLOW G.P.M.	REFERENCE CV *
2"	150	141
2-1/2"	250	235
3"	350	347
4"	650	643
6"	1100	1532
8"	2100	2836
10"	3300	4573
12"	4800	6756

* CV values are based partially on extrapolated data and in any case only apply to flows greater than the minimum flows specified.

KENNEDY VALVE
1021 E. Water St.
Elmira, NY 14902
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fax 607-734-1883

PNEUMATIC CUSHIONED LEVER& WEIGHT SWING CHECK VALVES
FIGURE 206
SELECTION, INSTALLATION & MAINTENANCE

SELECTION & SIZING:

It is not desirable to oversize Swing Check Valves. Under normal flow conditions a Swing Check Valve should be fully open. When Swing Check Valves are oversized they constantly "hunt", moving open and closed in short, frequent cycles. Valves in such installations wear quickly. It is suggested that under normal flow conditions that there be at least ½ psi of head loss across a Swing Check Valve.

Both resilient and metal to metal seated valves can be expected to give long, trouble free service.

When a bubble tight seal against back-flow is required a resilient seat is to be preferred. In general, resilient seated Swing check Valves require more maintenance than metal to metal seated swing check valves do, as the resilient seat must be replaced upon occasion. However, resilient seated valves are more resistant to grit in the water.

GENERAL:

Valves should be inspected at time of delivery for shipping damage and to assure that the valves conform to the customer's specifications.

Valves should be protected from the elements to the greatest extent possible. Debris should not be allowed to accumulate inside a valve.

LIFTING:

When moving a valve experienced persons should be employed. It is suggested that valves be lifted by a "choker" sling around the neck of the valve. **The external cylinder, lever, and brackets must never be used for lifting the valve. Valve must never be lifted or moved by running a fork or a chain through the waterway of the valve.** Valves are heavy and caution should be used. When lifting a valve all persons should stand well clear.

TOOLS:

a. Box, Socket or Open End Wrenches in standard (inch) dimensions
   (It never desirable to use adjustable wrenches, pipe wrenches or pliers when working on Swing Check Valves)
b. A Sling of adequate capacity and arranged to "choke"
c. A chain or other type of Hoist found to be suitable and of adequate capacity
d. Rigging equipment

INSTALLATION:

1. Verify that the flanges of the valve conform the existing pipe flanges.
2. Inspect the insides of the valve and pipes to assure that no debris is present. If debris is present it must be removed.

3. Check the flange faces to assure that they are clean. If dirt, old gaskets, lumps of paint, etc. are present they must be removed before installing the valve.
4. Remove all packaging and assure that the valve operates freely.
5. When lifting the valve follow the cautions noted above. **Do not utilize the external Lever, Cylinder or Brackets to lift the valve.**
6. Assure that the valve is installed with the proper orientation, so that the normal flow opens the valve and reverse flow is prevented.
7. Use standard (inch) wrenches to tighten the flange bolts. Do not use a "cheater" on the standard wrenches. Follow good practice and "snug" one bolt, then tighten the bolt opposite with slightly more torque, working side to side and around. It is preferred to go around the bolt pattern several times, increasing the torque each time.
8. Assure that pipe is adequately supported. Do not use the valve to pull the pipe ends into alignment.

SETUP:

1. If the Packing Gland is too tight the Swing Check Valve may not close properly.
   After the Swing Check Valve is installed in the line BUT BEFORE THE LINE IS PUT INTO SERVICE assure that the Swing Check Valve opens and closes smoothly.
   If the Swing Check Valve hesitates in the opening or closing directions, first open the flow control valve on the cushioning Cylinder (see below).
   If, after fully opening the flow control valve the Swing Check Valve still hesitates when opening or closing, loosen the Gland Follower in the Packing Gland. A small amount of leakage out of the Gland will do no harm to the Swing Check Valve.
2. The cushioning Cylinder has a Flow Control Valve. The Figure 206 Swing Check Valve is shipped with the Flow Control Valve in the closed position.
   After the Swing Check valve is installed in the line BUT BEFORE THE LINE IS PUT INTO SERVICE first assure that the Flow Control Valve has been installed correctly with the arrow on the Flow Control Valve pointing away from the Cylinder and then move the Flow Control Valve to about the mid position.
   THE FLOW CONTROL VALVE MUST NEVER BE COMPLETELY CLOSED.
   Opening the flow control valve decreases the damping and speeds the closing of the Swing Check Valve.
   Closing the Flow Control Valve increases dampening and slows the closure of the Swing Check Valve.
3. If after the line is put in service there is leakage out of the Packing Gland and such leakage is undesirable, gently tighten the Gland Follower in the Packing Gland until the leakage stops.
4. Under normal circumstances the Weight on the Lever should be at the end of the Lever. If the Valve does not open fully under normal flow conditions the Weight may be moved towards the Hinge Pin but the Valve may be oversize and a smaller Valve should be considered.

MAINTENANCE:

It suggested that Figure 206 Cushion Swing Check Valves be inspected cleaned and lubricated at least semi-annually.

ASSURE THAT THERE IS NO FLOW IN THE LINE.

The Rod of Cylinder should be wiped free of dirt then sprayed with light oil and wiped clean again.

The Filter in the top of the Cylinder should be removed and cleaned. When the Filter is out of the Cylinder some light oil should sprayed into the Cylinder.

A few drops of penetrating type of machine oil should be run into the pivot points at the rod end of the Cylinder and at the Cylinder Trunnions.

If leakage past the Hinge Pin of the valve is considered excessive the Gland Follower should be gently tightened.

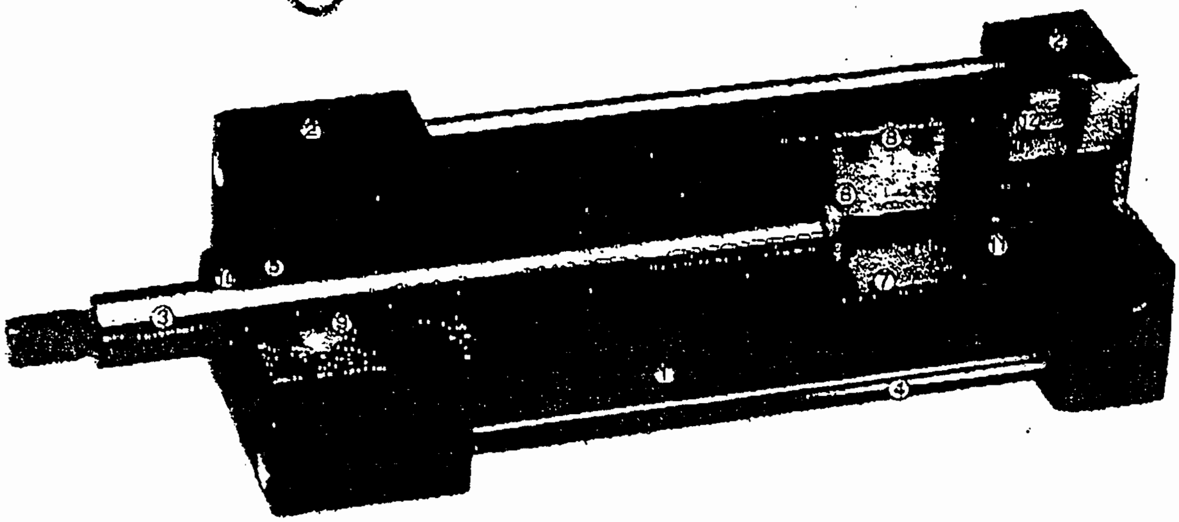
PNEUMATIC CUSHIONED LEVER & WEIGHT SWING CHECK VALVES

FIGURE 208

SELECTION, INSTALLATION & MAINTENANCE

Dimensions Approximate-For Checking Clearances Only
Allow Clearance Two Sides to Remove Side Plug & Access Cover

KENNEDY VALVE



SERIES I MATERIAL AND DESIGN SPECIFICATIONS

1. **Tube:** 6063-T832 grade aluminum alloy with hard coated I.D. This anodic coating provides extreme hardness, excellent wear, low coefficient of friction, and high corrosion resistance to ensure longer, trouble-free cycle life.

2. **Head and Cap:** Precision machined from extruded 6061-T6 grade aluminum alloy. Hard coated as standard on 1½" through 5" bores. (Optional on 6" and 8" bores.)

3. **Piston Rod:** Hard chrome plated steel ground and polished to a smooth finish.

4. **Tie Rods:** High strength 1215 grade zinc clear chromate plated steel.

5. **Rod Bushing:** Continuous cast SAE 660 grade bronze bushing is piloted into the head and is securely held in with an aluminum retaining plate (1½" through 5" bores) to provide maximum load bearing support.

6. **Piston:** High grade aluminum alloy.

7. **Piston Seals:** Block-Vee type, Buna N material is furnished as standard.

8. **Piston Bearing Strip:** A low friction, dimensionally stable nylon wear band constitutes an excellent bearing surface.

9. **Rod Seal:** Block-Vee type is self-adjusting to ensure proper seal.

10. **Rod Wiper:** Lip type urethane seal cleans piston rod and prevents foreign particles from entering cylinder.

11. **Cushion:** Self-adjusting urethane cup moves into the head/cap to insure a positive seal and allows air to meter across the cushion screw. This method provides a fast breakaway and more precise adjustment. (Optional)

12. **Tube Seal:** Buna N "O" ring in head and cap provides tight seal.

THE KENNEDY VALVE MFG. CO.
ELMIRA, N. Y.

ND-435-2

PART MACHINE DIMENSIONS FOR LEVER & SPRING BOSS

1, 2½, 3" ADDED
DR 8/28/61

4" + 5" (E)
AS 5/8" DEPTH
CN 1246
GR 3-8-79

D = no. of holes
E = drill depth
F = size tap

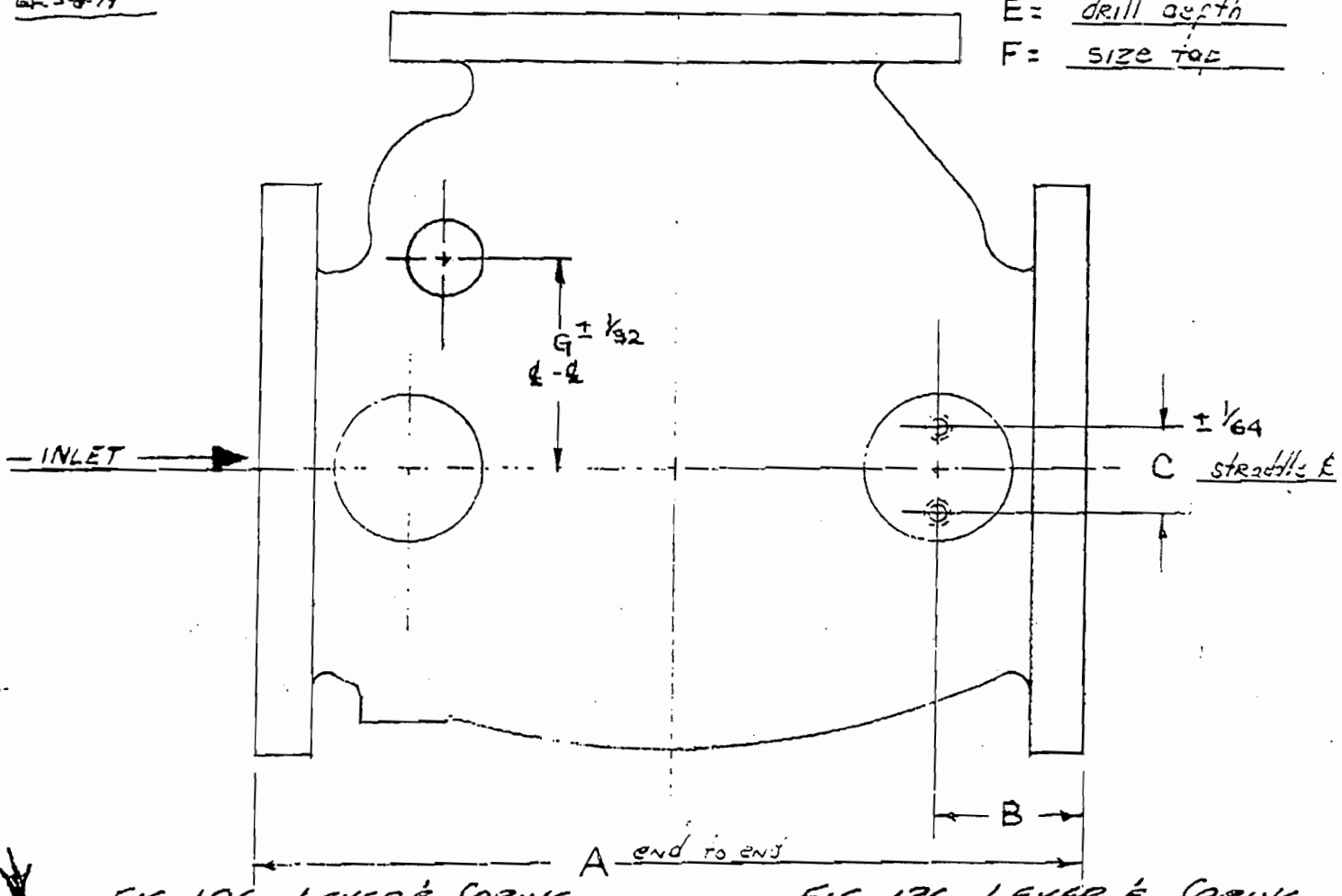


FIG. 106 LEVER & SPRING

SIZE	A	B	C	D	E	F	G
2	8	1¾	1¼	2	½	¼-20	2 15/32
2½	8½	1⅞	1¼	2	½	¼-20	2 25/32
3	9½	2⅛	1¼	2	½	¼-20	2 25/32
3½	10½	2½	2	2	⅝	⅜-16	3 3/32
4	11½	2⅞	2	2	¾ ②	⅜-16	3¾
5	13	3⅛	2	2	¾ ②	⅜-16	4½
6	14	3	2	2	1	⅜-16	5
8	19½	3½	2	2	1	⅜-16	6¼
10	24½	5¼	2	2	1	⅜-16	7⅛
12	27½	5½	2	2	1	⅜-16	8 3/16

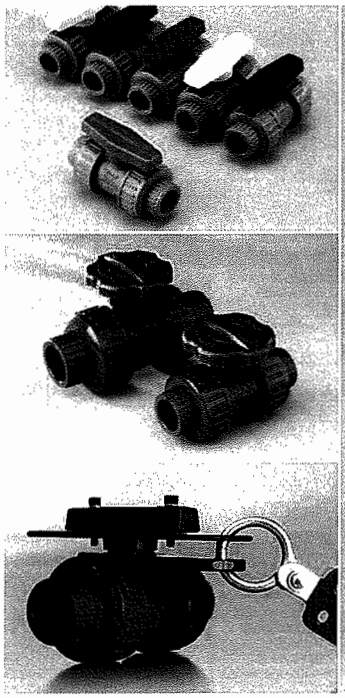
FIG. 126 LEVER & SPRING

SIZE	A	B	C	D	E	F	G
2	NOT MADE						
2½	10	2⅛	F¼	2	½	¼-20	2 13/16
3	10½	2	F¼	2	½	¼-20	2 27/32
3½	NOT MADE						
4	13	2⅞	2	2	⅝	⅜-16	4
5	13	3⅛	2	2	⅝	⅜-16	4½
6	16	3	2	2	1	⅜-16	5⅛
8	19	3½	2	2	1	⅜-16	6¼
10	22	4	2	2	F	⅜-16	7⅛
12	26	5	2	2	1	⅜-16	8 3/16

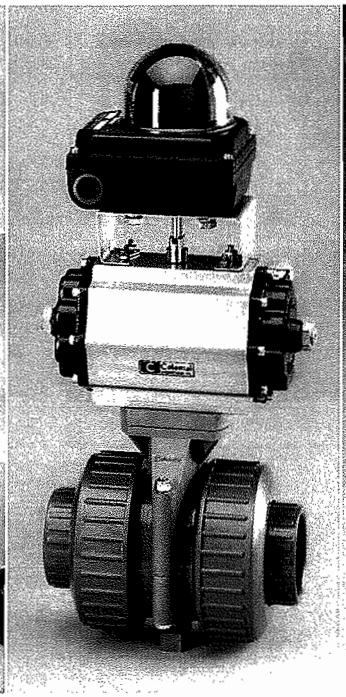
DR. BY D.R.W. CH. BY _____ APP. BY _____ DATE _____ SCALE

Colonial's true union ball valves are premium quality and ideally suited for the most demanding industrial, commercial, agricultural and irrigation environments. Four different body materials and two different o-ring materials are available.

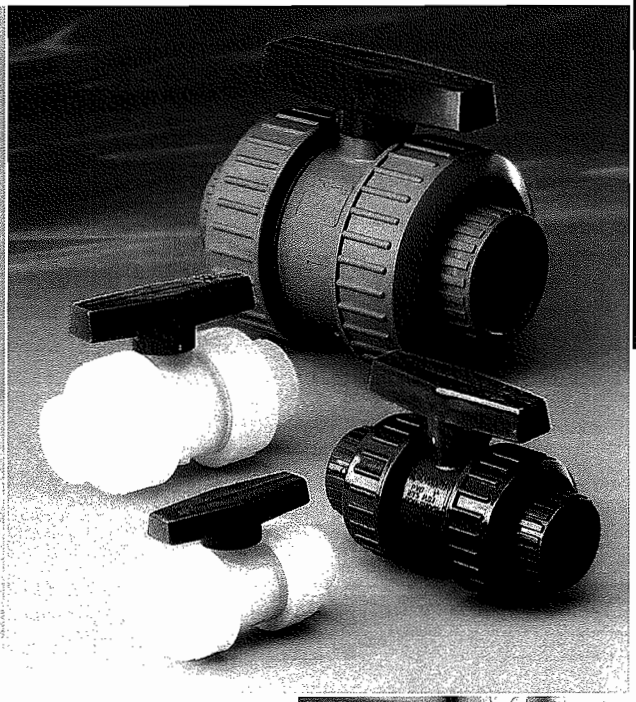
A patented polymeric locking strip allows safe operation even when installed in the reverse direction. Ideally suited where full port, full flow and reparability are required.



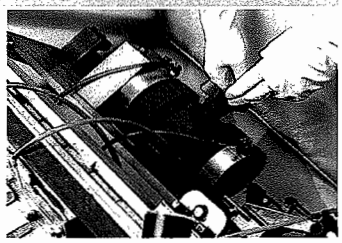
New accessories available.



See page 73 for valve actuation.



This catalog contains information on parts offered at the date of printing. Please refer to our current list price sheets for any additional parts or sizes now offered.



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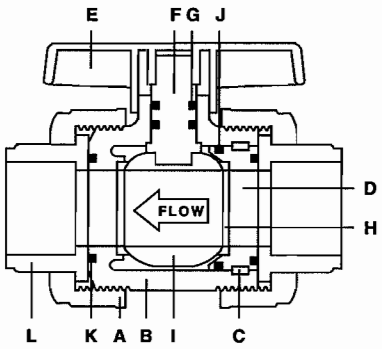
- Thermoplastic design eliminates process and atmospheric corrosion.
- Exclusive patented polymeric locking ring assures seal carrier retention.
- Double "D" stem design.
- Pressure rated up to 235 psi at 73°F (non-shock water).
- Socket dimensions meet all ASTM requirements. PVC: D-2467, D-2464; CPVC: F-439, F-437.
- Two stem o-rings for double leak protection.
- Full flow design—same I.D. as schedule 80 pipe—minimizes turbulence at high flow rates.



COMPONENTS AND MATERIALS

Part Letter	Component	Quantity	Material
A	Union Nut	2	PVC, CPVC, PP, PVDF
B	Body	1	PVC, CPVC, PP, PVDF
C	Locking Ring	1	PVDF
D	Carrier	1	PVC, CPVC, PP, PVDF
E	Handle	1	ABS
F	Stem	1	PVC, CPVC, PP, PVDF
G	Stem O-Ring	2	EPDM, Viton®
H	Ball Seal	2	Teflon®
I	Ball	1	PVC, CPVC, PP, PVDF
J	Carrier O-Ring	1	EPDM, Viton®
K	Face O-Ring	2	EPDM, Viton®
L	Connector	2	PVC, CPVC, PP, PVDF

Teflon® is a registered trademark of DuPont. Only DuPont makes Teflon. Viton® is a registered trademark of Dupont Dow Elastomers.

COLORED AND ROUND REPLACEMENT HANDLES FOR TRUE UNION AND SUPER C BALL VALVES

In many industrial or irrigation applications, it is beneficial to employ a simple, yet reliable method of identifying one pipeline from another. In addition to marking the pipe or valves, a color-code method can be implemented. Colonial's color replacement handles are available for 1/2 – 2" sizes of True Union and Super C Compact Ball Valves.

Round handles are offered for 1/2 – 1" True Union and Super C Ball Valves. Since the Open/Close Torque on these small diameter valves is low, the round handles are offered to prevent accidental movement of the handle from the bump of an arm or the catch of a pant leg.

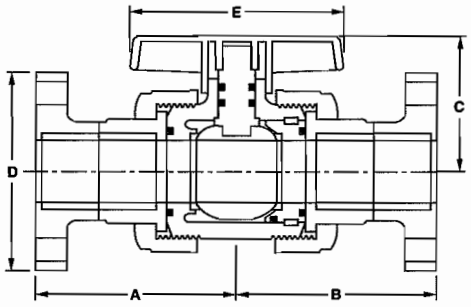
COMPRESSED AIR WARNING

The products in this catalog are only intended for use in transferring or storing chemically compatible pressurized liquids. **Do not test or use products in this catalog with compressed air or other gases.** Doing so is dangerous and could cause injury or great bodily harm should a system fail under compressed air. Only use products that are specifically designed for compressed air/gas service. Call Colonial technical service for more information.

COLORED AND ROUND REPLACEMENT HANDLES

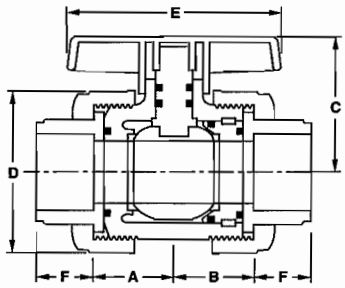
Color/Style	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Black	V07101KBK	V08101KBK	V10101KBK	V14101KBK	V17101KBK	V20101KBK
Blue	V07101KBL	V08101KBL	V10101KBL	V14101KBL	V17101KBL	V20101KBL
Green	V07101KG	V08101KG	V10101KG	V14101KG	V17101KG	V20101KG
Yellow	V07101KY	V08101KY	V10101KY	V14101KY	V17101KY	V20101KY
White	V07101KW	V08101KW	V10101KW	V14101KW	V17101KW	V20101KW
Orange*	V07101K	V08101K	V10101K	V14101K	V17101K	V20101K
Round	V07101KR	V08101KR	V10101KR	N/A	N/A	N/A

*Stock Replacement



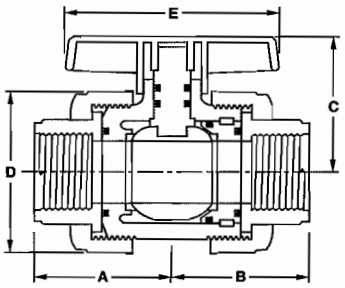
TRUE UNION BALL VALVES
Flanged

	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"
A	3-1/8	4-1/32	3-31/32	4-7/16	4-13/16	5-19/32	7-7/32	8-19/32
B	3-1/8	4-1/32	3-31/32	4-7/16	4-13/16	5-19/32	7-7/32	8-19/32
C	1-29/32	2-3/8	2-19/32	3-19/32	3-19/32	4-9/32	5-13/32	6-17/32
D	3-15/32	3-7/8	4-1/4	4-19/32	5	6	7-1/2	9-1/32
E	3-7/32	3-7/16	4	5	5	5-31/32	7-5/8	9-15/32



TRUE UNION BALL VALVES
Slip x Slip

	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"
A	1-1/8	1-9/16	1-17/32	1-15/16	1-27/32	2-5/16	3-3/16	3-13/16
B	1-1/8	1-9/16	1-17/32	1-15/16	1-27/32	2-5/16	3-3/16	3-13/16
C	1-29/32	2-3/8	2-19/32	3-19/32	3-19/32	4-9/32	5-13/32	6-17/32
D	2-1/32	2-15/32	2-27/32	4-3/32	4-3/32	5-5/16	7-7/32	8-9/16
E	3-7/32	3-7/16	4	5	5	5-31/32	7-5/8	9-15/32
F	15/16	1	1-5/32	1-3/32	1-13/32	1-17/32	1-15/16	2-9/32



TRUE UNION BALL VALVES
FPT x FPT

	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"
A	1-27/32	2-5/32	2-15/32	3-1/32	2-7/8	3-11/32	5-1/8	6-3/32
B	1-27/32	2-5/32	2-15/32	3-1/32	2-7/8	3-11/32	5-1/8	6-3/32
C	1-29/32	2-3/8	2-19/32	3-19/32	3-19/32	4-9/32	5-13/32	6-17/32
D	2-1/32	2-15/32	2-27/32	4-3/32	4-3/32	5-5/16	7-7/32	8-9/16
E	3-7/32	3-7/16	4	5	5	5-31/32	7-5/8	9-15/32

- Two stem stops for positive shut off.
- Full block design allows for external adjustment for seat wear.
- Floating ball design for positive seal.
- True union design permits easy removal of valve body for service.
- Easily reparable.
- For factory-customized, vented ball, see Valve Problems and Solutions on page 87.

ACCESSORIES AVAILABLE

	Ball Valve
Stem Extensions	X
2" Operating Nut	X
Locking Handles	X

Please contact customer service for information.

MAXIMUM TORQUE VALUES (in-lbs)

Valve Size	Opening Torque
1/2"	5
3/4"	35
1"	60
1-1/4"	100
1-1/2"	110
2"	180
3"	600
4"	1000
6"	1000

FLUID FLOW COEFFICIENT

Valve Size	Cv*
1/2"	22
3/4"	55
1"	112
1-1/4"	178
1-1/2"	285
2"	540
3"	1348
4"	2602
6"	2602

*Gallons per minute @ 1 psi pressure drop.

MAXIMUM PRESSURE/TEMPERATURE

See **Table 4** (page 10) **& Table 5** (page 11) for maximum pressure at various temperatures.

PP WITH VITON® O-RINGS

Style	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
Socket*	V07106N	V08106N	V10106N	V14106N	V17106N	V20106N

*1/2" thru 2" valves supplied with socket and thread connectors.

PVDF WITH VITON® O-RINGS

Style	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
Socket	V07108N	V08108N	V10108N	V14108N	V17108N	V20108N
Thread	V07118N	V08118N	V10118N	V14118N	V17118N	V20118N

PVC WITH EPDM O-RINGS

Style	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"	6"
Socket*	V07101N	V08101N	V10101N	V14101N	V17101N	V20101N	V30101N	V40101N	V60101N#
Thread*							V30111N	V40111N	
Flange	V07121N	V08121N	V10121N	V14121N	V17121N	V20121N	V30121N	V40121N	V60121N#

*1/2" thru 2" valves supplied with socket and thread connectors. # 6" ball valve is assembled (venturied; not full port).

PVC WITH VITON® O-RINGS

Style	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"	6"
Socket*	V07102N	V08102N	V10102N	V14102N	V17102N	V20102N	V30102N	V40102N	V60102N#
Thread*							V30112N	V40112N	
Flange	V07122N	V08122N	V10122N	V14122N	V17122N	V20122N	V30122N	V40122N	V60122N#

*1/2" thru 2" valves supplied with socket and thread connectors. # 6" ball valve is assembled (venturied; not full port).

CPVC WITH VITON® O-RINGS

Style	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"	6"
Socket*	V07104N	V08104N	V10104N	V14104N	V17104N	V20104N	V30104N	V40104N	V60104N#
Thread*							V30114N	V40114N	
Flange	V07124N	V08124N	V10124N	V14124N	V17124N	V20124N	V30124N	V40124N	V60124N#

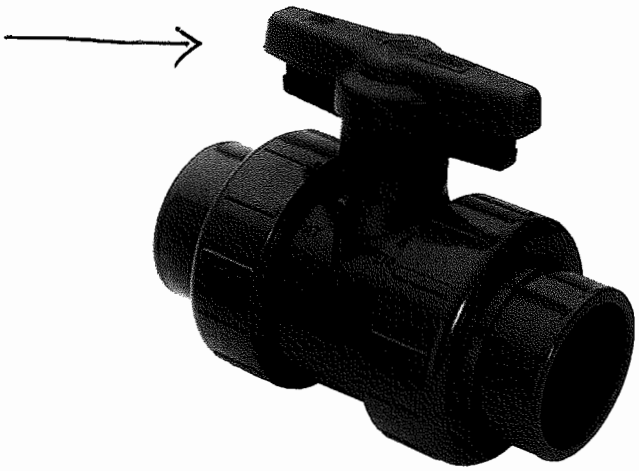
*1/2" thru 2" valves supplied with socket and thread connectors. # 6" ball valve is assembled (venturied; not full port).

PVC & CPVC TRUE UNION 2000 VALVES

TU2000-2-0801

One of the Most Versatile, Compact Valve Designs Available

Spears True Union 2000 Ball Valves, 3-Way Ball Valves and Ball Check Valves provide maximum versatility with fully interchangeable valve cartridges. Provides for easier system design modifications and upgrades in multiphase projects, or anywhere changes in valve types are desired. Simply exchange any True Union 2000 valve in-line using existing union nuts. Also mates with Spears new Schedule 80 Unions and Diaphragm Valves. All True Union 2000 valves feature a low profile, compact design for minimal space requirements. Available in PVC or CPVC with choice of EPDM or Dupont Dow Genuine Viton® O-ring seals and socket, flanged, or optional Spears patented Type 316 Stainless Steel Reinforced (SR) threaded end connectors. Additionally, Spears offers valve Retrofit Kits for easy in-line replacement of other valves and factory installed Actuation Packages. Assembled with silicone-free lubricant.



True Union 2000 Industrial Ball Valve

- Multi-featured Industrial Grade
- Built-in Handle Lockout
- Fully Serviceable, Replaceable Components
- Safe-T-Blocked Seal Carrier - Full Rated Pressure
- ISO Pattern Actuation Mounting Option
- Spears Dual O-ring Safe-T-Shear® Stem
- Self Adjusting PTFE Floating Seat Design
- Sizes 1/2" - 2" pressure rated to 235 psi @ 73°F, sizes 2-1/2" - 4" and all flanged to 150 psi @ 73°F
- NSF Certified for Potable Water Use
- Also Available in **SPEARS LXT™** High Purity, Low Extractable PVC Material
- Produced in IPS sizes 1/2" - 4" with Socket, Flanged or SR Threaded End Connectors

True Union 2000 Industrial 3-Way Valve

- Industrial Grade, Multiport, Diverter, L-Pattern & T-Pattern configurations Vertical 3-Way or Horizontal Diverter (shown)
- Built-in Handle Lockout
- Fully Serviceable, Replaceable Components
- Safe-T-Blocked Seal Carrier - Full Rated Pressure
- ISO Pattern Actuation Mounting Option
- Spears Dual O-ring Safe-T-Shear® Stem
- Self Adjusting PTFE Floating Seat Design
- Sizes 1/2" - 2" pressure rated to 235 psi @ 73°F, sizes 2-1/2" - 4" and all flanged to 150 psi @ 73°F
- NSF Certified for Potable Water Use
- Produced in IPS sizes 1/2" - 4" with Socket, Flanged or SR Threaded End Connectors

MADE IN THE U.S.A. WITH PRIDE

PROGRESSIVE PRODUCTS FROM SPEARS
INNOVATION & TECHNOLOGY

Visit our web site:
www.spearsmfg.com

LPCB Loss Prevention Certification Board — National Accreditation of Certification Bodies

Quality Systems Certificate No. 293
Corporate Facilities, Sylmar, CA
Assessed to ISO 9001

True Union 2000 Industrial Ball Check Valve

- Industrial Grade
- Flow-Tested for Minimum Turbulence
- Fully Serviceable, Replaceable Components, uses Standard O-ring Seat
- Safe-T-Blocked Seal Carrier - Full Rated Pressure
- Easily Converted to Foot Valve
- NSF Certified for Potable Water Use
- Also Available in **SPEARS LXT™** High Purity, Low Extractable PVC Material
- Sizes 1/2" - 2" pressure rated to 235 psi @ 73°F, sizes 2-1/2" - 4" and all flanged to 150 psi @ 73°F
- Produced in IPS sizes 1/2" - 4" with Socket, Flanged or optional SR Threaded End Connectors
- Also available in PVC White

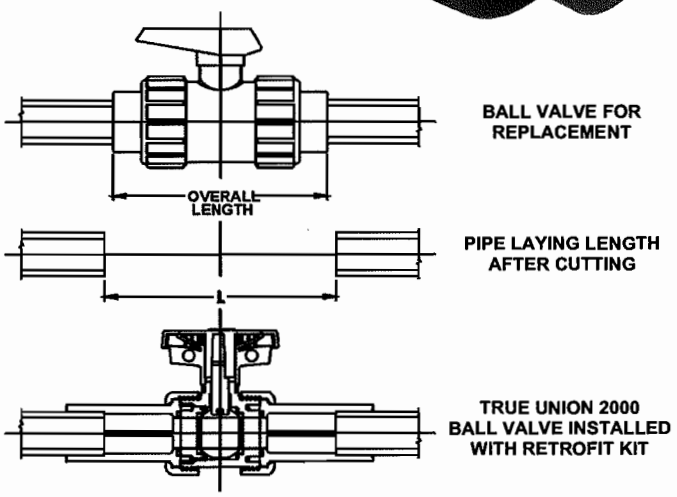
Check Valve Size	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
C_V	6.3	17	25	65	86	130	200	275	500

Economical True Union 2000 Standard Ball Valve

- High quality Standard Ball Valve
- Allows future system upgrade
- Excellent for OEM Applications
- Replaceable Seats
- Safe-T-Blocked Seal Carrier - Full Rated Pressure
- Spears Safe-T-Shear® Stem
- Self Adjusting Floating Seat
- Sizes 1/2" - 2" pressure rated to 235 psi @ 73°F sizes 2-1/2"-4" and all flanged to 150 psi @ 73°F.
- NSF Certified for Potable Water Use
- Produced in IPS sizes 1/2" - 4" with Socket, Flanged, or SR Threaded End Connectors
- Also available in PVC White

True Union 2000 Retrofit Kits

Easily converts any system over to all True Union 2000 style valves for consistent valve type and uniform maintenance. Special extended socket style End Connectors (2) allow retrofit replacement of other brand valves in existing piping systems with a new True Union 2000 valve. Simply cut out old valve according to specified dimension and install retrofit end connectors. End connectors are provided with either EPDM or Viton® O-rings.

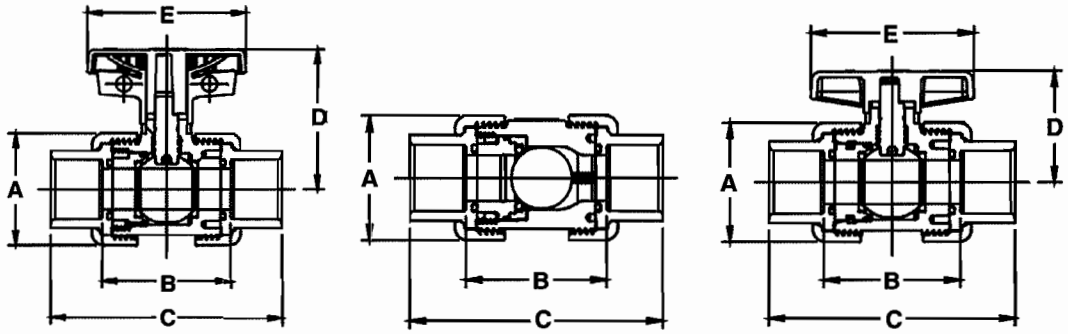


Size	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
L	4-7/8	5-7/16	6	7-1/4	7-1/2	8-1/2	10-3/4	11-3/8	14-5/16

L ± 1-1/16

True Union 2000 Valve Dimensional Data

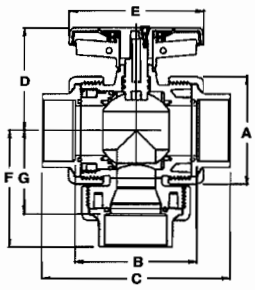
Industrial Ball Valve, Ball Check Valve & Standard Ball Valve



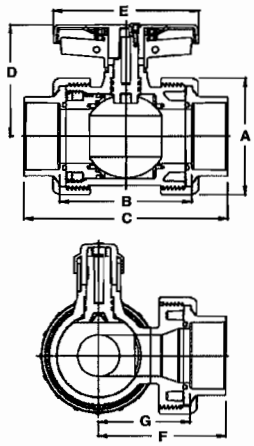
Nominal Size	A	B	C		D		E	
			Socket	Thread	Standard	Industrial	Standard	Industrial
1/2	1-7/8	2-7/16	4-3/16	3-13/16	1-5/8	2-9/16	2-1/2	2-13/16
3/4	2-1/4	2-3/4	4-3/4	4-1/4	2	2-7/8	3	3-5/16
1	2-1/2	2-7/8	5-1/8	4-11/16	2-5/16	3-1/8	3-7/16	3-7/16
1-1/4	3-1/16	3-1/4	5-3/4	5-3/16	2-13/16	3-5/8	3-9/16	3-13/16
1-1/2	3-1/2	3-1/2	6-1/4	5-7/16	3-1/16	4	3-7/8	4-3/16
2	4-1/4	4-3/4	7-3/4	6-3/4	3-3/4	4-1/2	5	5-1/8
2-1/2*	5-3/8	5-7/8	9-5/16	8-1/2	5-7/8	5-1/8	7-5/16	6-1/4
3	6-3/16	6-7/8	10-11/16	9-3/4	5-7/8	5-7/8	7-5/16	7-5/8
4	7-1/2	7-1/4	11-13/16	10-1/4	6-3/4	6-3/4	8-3/8	9-3/16

*Estimate from layout

Industrial 3-Way Ball Valve



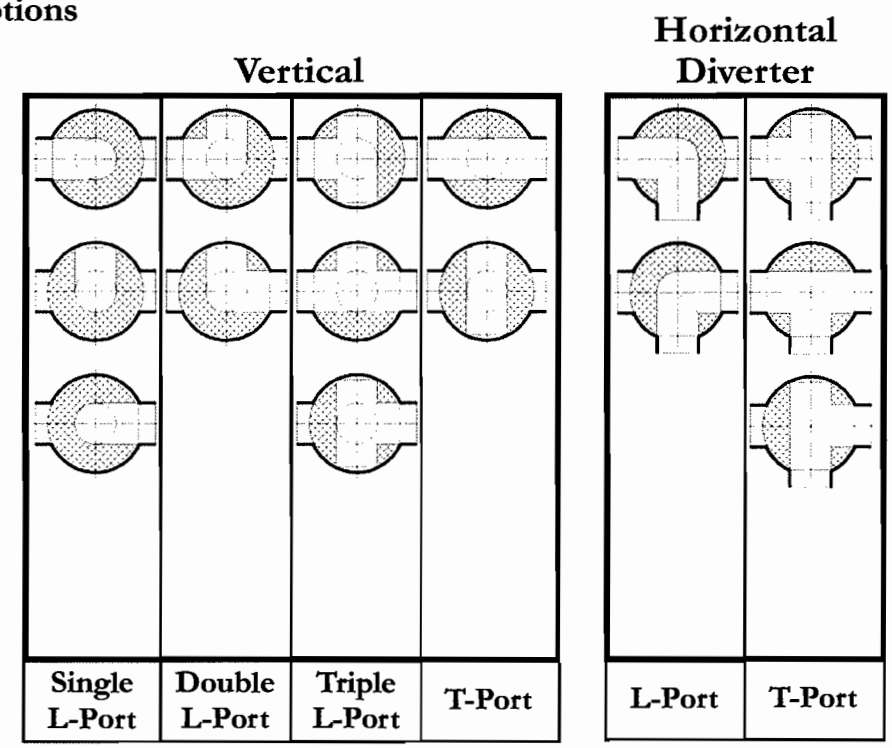
Vertical 3 Way Ball Valves									
Nominal Size	A	B	C		D	E	F		G
			Socket	Thread			Socket	Thread	
1/2	1-7/8	2-7/16	4-3/16	3-13/16	2-9/16	2-13/16	2-9/16	2-3/8	1-11/16
3/4	2-1/4	2-3/4	4-3/4	4-1/4	2-7/8	3-5/16	3	2-3/4	2
1	2-1/2	2-7/8	5-1/8	4-11/16	3-1/8	3-7/16	3-1/4	3	2-1/8
1-1/4	3-1/16	3-1/4	5-3/4	5-3/16	3-5/8	3-13/16	3-3/4	3-3/8	2-3/8
1-1/2	3-1/2	3-1/2	6-1/4	5-7/16	4	4-3/16	4-3/16	3-13/16	2-3/16
2	4-1/4	4-3/4	7-3/4	6-3/4	4-1/2	5-1/8	5	4-1/2	3-1/2
2-1/2	5-3/8	5-7/8	9-5/16	8-1/2	5-1/8	6-1/4	5-7/8	5-1/2	4-1/8
3	6-3/16	6-7/8	10-11/16	9-3/4	5-7/8	7-5/8	6-11/16	6-3/16	4-3/4
4	7-1/2	7-1/4	11-13/16	10-1/4	6-3/4	9-3/16	7-1/8	6-3/4	5-7/8



Horizontal Diverter Ball Valves*									
Nominal Size	A	B	C		D	E	F		G
			Socket	Thread			Socket	Thread	
1/2	1-7/8	2-7/16	4-3/16	3-13/16	2-9/16	2-13/16	2-9/16	2-3/8	1-11/16
3/4	2-1/4	2-3/4	4-3/4	4-1/4	2-7/8	3-5/16	3	2-3/4	2
1	2-1/2	2-7/8	5-1/8	4-11/16	3-1/8	3-7/16	3-1/4	3	2-1/8
1-1/4	3-1/16	3-1/4	5-3/4	5-3/16	3-5/8	3-13/16	3-3/4	3-3/8	2-3/8
1-1/2	3-1/2	3-1/2	6-1/4	5-7/16	4	4-3/16	4-3/16	3-13/16	2-3/16
2	4-1/4	4-3/4	7-3/4	6-3/4	4-1/2	5-1/8	5	4-1/2	3-1/2
2-1/2	5-3/8	5-7/8	9-5/16	8-1/2	5-1/8	6-1/4	5-7/8	5-1/2	4-1/8
3	6-3/16	6-7/8	10-11/16	9-3/4	5-7/8	7-5/8	6-11/16	6-3/16	4-3/4
4	7-1/2	7-1/4	11-13/16	10-1/4	6-3/4	9-3/16	7-1/8	6-3/4	5-7/8

* No shut off on branch

3-Way Port Options



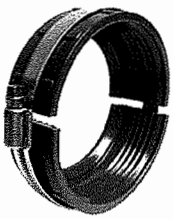
True Union 2000 Actuated Valves

Universal ISO Actuator Mounting Pattern Option

Spears offers optional actuator mounting with standard ISO Mounting Pattern for user actuation of True Union 2000 Ball Valves.

Factory Actuated Valve Packages

Spears Electric or Pneumatic Actuation Packages eliminate customer's having to determine proper valve and actuator mating. Pre-matched packages insure proper torque, coupling and mount for optimum performance - all factory installed and tested for proper alignment and operation. Actuation packages can be custom built to user specifications from Spears wide selection of options, voltages and accessories. Contact Spears for additional information.



Split Nut Kit for True Union 2000 Valves & Union 2000 Schedule 80 Fittings

Split Nut Kits are designed to replace broken union nuts on Spears True Union 2000 Ball Valves and Union 2000 Schedule 80 Unions. Kit includes SS316 Gear Clamp and 2-Split Nut halves. Can also be used if nut was not in place during end connector installation. Split Nut is fully serviceable to original valve pressure rating.

NOT FOR USE WITH COMPRESSED AIR OR GASES

Spears Manufacturing Company DOES NOT RECOMMEND the use of thermoplastic products to transport or store compressed air or gas.

Viton® is a registered trademark of DuPont Dow Elastomers

SPEARS® MANUFACTURING COMPANY

CORPORATE OFFICES
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P.O. Box 9203, Sylmar, CA 91392
(818) 364-1611 • http://www.spearsmfg.com

GENERAL INSTALLATION

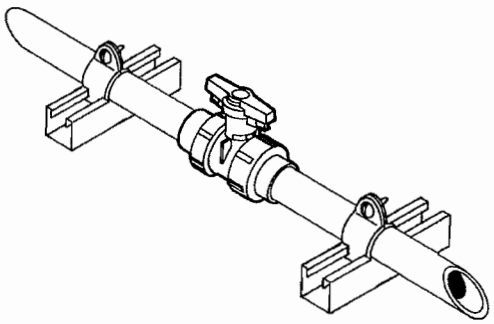
Ease of installation and maintenance is one of the major advantages of using thermoplastic valves. As with any product, certain procedures must be followed for successful installation, service and long life. This section specifies individual installation and maintenance service instructions for Spears valves. All applicable instructions and procedures should be read thoroughly before starting. Suitability of the intended service application should be determined prior to installation. Please review ***"Material Considerations in Application and System Design"***, in the ***"MATERIALS"*** section of this manual for important additional considerations related to valve installations.

Plastic piping systems should be engineered, installed, operated and maintained in accordance with accepted standards and procedures for plastic piping systems. It is absolutely necessary that all design, installation, operation and maintenance personnel be trained in proper handling, installation requirements and precautions for installation and use of plastic piping systems before starting.

Individual valve installation instructions specific to each product type are packaged with product. The following sections of this manual contain safety precautions and procedures for making solvent cement, threaded or flanged joints.

Precautions & Warnings for All Valve, Strainer & Accessories Installations

CAUTION: *The system shall be designed and installed so as not to pull the valve in any direction. Valve and strainers must be supported with conventional piping system support devices.*



Typical Valve Support Example

CAUTION: *All valve connectors and connecting pipe should be inspected for any breaking, chipping, gouging or other visible damage before proceeding. All joining components must be clean and dry. All valves and pipe shall be removed from their packaging or containers and exposed to the environment for a minimum of one hour in order to thermally balance all components. Installation temperatures should be between 40°F and 110°F.*

CAUTION: *All valves with fixed socket end connectors in the body must be installed in the open position to aid in evaporation of solvent vapors which can attack internal components.* ***WARNING: TAKE EXTRA CARE THAT NO PRIMER OR SOLVENT CEMENT IS ALLOWED TO COME IN CONTACT WITH THE BALL OR OTHER INTERNAL VALVE COMPONENTS.***

CAUTION: *Threaded pipe connections require application of a quality grade thread sealant to seal joint assembly. Sealant should be applied to male pipe threads.* ***WARNING: SOME PIPE JOINT COMPOUNDS OR TEFLON® PASTES MAY CONTAIN SUBSTANCES THAT COULD CAUSE STRESS CRACKING IN THERMOPLASTIC MATERIALS.*** *Spears Manufacturing Company recommends the use of Spears* ***BLUE 75™*** *thread sealant which has been tested for compatibility with Spears products. Please follow the sealant manufacturers' application / installation instructions. Choice of an appropriate thread sealant other than those listed above is at the discretion of the installer.*

CAUTION: ***BEFORE THE VALVE IS CYCLED,*** *all dirt, sand, grit or other material shall be flushed from the system. This is to prevent scarring of internal components; e.g., ball, cup, wedge, seats, etc.*

WARNING: ***Some Lubricants, including vegetable oils, are known to cause stress cracking in thermoplastic materials.*** *All lubricants should be checked for compatibility with PVC, CPVC or other thermoplastic products. Formulation changes by lubricant manufacturers may alter compatibility of previously acceptable materials and are beyond our control. Choice of lubricant is at the discretion of the installer.*

WARNING: *DO NOT USE COMPRESSED AIR OR GAS TO TEST ANY PVC OR CPVC THERMOPLASTIC PIPING PRODUCT OR SYSTEM. AND DO NOT USE DEVICES PROPELLED BY COMPRESSED AIR OR GAS TO CLEAR SYSTEMS. THESE PRACTICES MAY RESULT IN EXPLOSIVE FRAGMENTATION OF SYSTEM PIPING AND COMPONENTS CAUSING SERIOUS OR FATAL BODILY INJURY. All air must be bled from the system during initial fluid fill. Pressure testing of the system should not be made until all solvent cement joints have properly cured. Initial pressure testing should be made at approximately 10% of the system hydrostatic pressure rating to identify potential problems, prior to testing at higher pressures.*

WARNING: *Systems should not be operated or flushed out at flow velocities greater than 5 feet per second.*

VALVE SERVICE & REPLACEMENT KITS

For easy servicing and extended valve life, Spears provides numerous maintenance repair kits and replaceable components for all repairable valves. Repair Kits generally include applicable seats, O-ring seals, diaphragms and other components typically subjected to normal operational wear.

Full Cartridge Replacement Kits are available for all True Union style ball valves and ball check valves. These include complete valve assembly, less union nuts and end connectors. Replacement Cartridges can be directly installed in place of existing valve unit using existing union nuts and end connectors.

Individual valve replacement parts may be ordered from the factory. Complete maintenance service instructions for each valve are available. Please contact Spears Technical Services Department.

True Union 2000 Industrial Ball Valve
Seat & O-ring Repair Kit

All kits include PTFE Seats (2), End Connector O-rings (2), Seal Carrier O-ring (1), Stem Bushing (1) and Stem O-rings (2). Sizes 2-1/2" & larger includes Seat O-rings (2).

Size	Part Number	
	w/EPDM O-rings	w/Viton O-rings
1/2	TU2-ERK-005	TU2-VRK-005
3/4	TU2-ERK-007	TU2-VRK-007
1	TU2-ERK-010	TU2-VRK-010
1-1/4	TU2-ERK-012	TU2-VRK-012
1-1/2	TU2-ERK-015	TU2-VRK-015
2	TU2-ERK-020	TU2-VRK-020
2-1/2 & 3	TU2-ERK-030	TU2-VRK-030
4	TU2-ERK-040	TU2-VRK-040

True Union 2000 Industrial Ball Valve
Cartridge Replacement Kit

Includes valve assembly, less union nuts and end connectors

Size	PVC Part Number[1,2]	
	w/EPDM O-rings	w/Viton O-rings
1/2	1820-005	1830-005
3/4	1820-007	1830-007
1	1820-010	1830-010
1-1/4	1820-012	1830-012
1-1/2	1820-015	1830-015
2	1820-020	1830-020
2-1/2 & 3	1820-030	1830-030
4	1820-040	1830-040

1: For CPVC Cartridge Kit, add the letter "C" to the part numbers listed (e.g. 1820-005C)
2: For PP Cartridge Kit, add the letter "P" to the part numbers listed (e.g. 1820-005P)

True Union 2000 Industrial 3-Way Ball Valve
Seat & O-ring Repair Kit (Horizontal or Vertical)

All kits include PTFE Seats (2-no branch seal), End Connector O-rings (3), Seal Carrier O-ring (1), Stem Bushing (1) and Stem O-rings (2). Sizes 2-1/2" & larger includes Seat O-rings (2)

Size	Part Number	
	w/EPDM O-rings	w/Viton O-rings
1/2	TU3-ERK-005	TU3-VRK-005
3/4	TU3-ERK-007	TU3-VRK-007
1	TU3-ERK-010	TU3-VRK-010
1-1/4	TU3-ERK-012	TU3-VRK-012
1-1/2	TU3-ERK-015	TU3-VRK-015
2	TU3-ERK-020	TU3-VRK-020
2-1/2 & 3	TU3-ERK-030	TU3-VRK-030
4	TU3-ERK-040	TU3-VRK-040

True Union 2000 Industrial 3-Way Ball Valve
Cartridge Replacement Kit

Includes valve assembly, less union nuts and end connectors

Size	Horizontal PVC Part Number[1,2,3,4,5]		Vertical PVC Part Number[1,2,5]	
	w/EPDM O-rings	w/Viton O-rings	w/EPDM O-rings	w/Viton O-rings
1/2	4720L1-005	4730L1-005	4720L1-005	4730L1-005
3/4	4720L1-007	4730L1-007	4720L1-007	4730L1-007
1	4720L1-010	4730L1-010	4720L1-010	4730L1-010
1-1/4	4720L1-012	4730L1-012	4720L1-012	4730L1-012
1-1/2	4720L1-015	4730L1-015	4720L1-015	4730L1-015
2	4720L1-020	4730L1-020	4720L1-020	4730L1-020
2-1/2 & 3	4720L1-030	4730L1-030	4720L1-030	4730L1-030
4	4720L1-040	4730L1-040	4720L1-040	4730L1-040

1: For CPVC Cartridge Kit, add the letter "C" to the part numbers listed (e.g. 4720L1-005C)
2: For PP Cartridge Kit, add the letter "P" to the part numbers listed (e.g. 4720L1-005P)
3: For Double L-Port, change "L1" portion of part number to L2 (e.g. 4720L2-005)
4: For Tripple L-Port, change "L1" portion of part number to L3 (e.g. 4720L3-005)
5: For T-Port, change "L1" portion of part number to "T" (e.g. 4720T-005)

True Union 2000 Industrial Ball Check Valve

Seat & O-ring Repair Kit

All kits include PTFE Seats (2), End Connector O-rings (2), Seal Carrier O-ring (1), Stem Bushing (1) and Stem O-rings (2). Sizes 2-1/2" & larger includes Seat O-rings (2).

Size	Part Number	
	w/EPDM O-rings	w/Viton O-rings
1/2	CK2-ERK-005	CK2-VRK-005
3/4	CK2-ERK-007	CK2-VRK-007
1	CK2-ERK-010	CK2-VRK-010
1-1/4	CK2-ERK-012	CK2-VRK-012
1-1/2	CK2-ERK-015	CK2-VRK-015
2	CK2-ERK-020	CK2-VRK-020
2-1/2 & 3	CK2-ERK-030	CK2-VRK-030
4	CK2-ERK-040	CK2-VRK-040

True Union 2000 Industrial Ball Check Valve

Cartridge Replacement Kit

Includes valve assembly, less union nuts and end connectors

Size	PVC Part Number[1,2]	
	w/EPDM O-rings	w/Viton O-rings
1/2	4520-005	4530-005
3/4	4520-007	4530-007
1	4520-010	4530-010
1-1/4	4520-012	4530-012
1-1/2	4520-015	4530-015
2	4520-020	4530-020
2-1/2 & 3	4520-030	4530-030
4	4520-040	4530-040

1: For CPVC Cartridge Kit, add the letter "C" to the part numbers listed (e.g. 4520-005C)
2: For PP Cartridge Kit, add the letter "P" to the part numbers listed (e.g. 4520-005P)

Regular True Union Ball Valve

Seat & O-ring Repair Kit

All kits include End Connector O-rings (2), Seal Carrier O-ring (1), Stem Bushing (1) and Seat O-ring (1)

Size	Part Number	
	w/ EPDM O-rings	w/ Viton® O-rings
1/2	TU-ERK-005	TU-VRK-005
3/4	TU-ERK-007	TU-VRK-007
1	TU-ERK-010	TU-VRK-010
1-1/4	TU-ERK-012	TU-VRK-012
1-1/2	TU-ERK-015	TU-VRK-015
2	TU-ERK-020	TU-VRK-020
2-1/2 & 3	TU-ERK-030	TU-VRK-030
4 & 6	TU-ERK-040	TU-VRK-040

Regular True Union Ball Check Valve

O-ring Repair Kit

Includes ball seal O-ring (1), end-connector O-rings (2), and seal carrier O-ring (1).

Size		
	w/ EPDM O-rings	w/ Viton® O-rings
1/2	CK-ERK-005	CK-VRK-005
3/4	CK-ERK-007	CK-VRK-007
1	CK-ERK-010	CK-VRK-010
1-1/4	CK-ERK-012	CK-VRK-012
1-1/2	CK-ERK-015	CK-VRK-015
2	CK-ERK-020	CK-VRK-020
2-1/2 &3	CK-ERK-030	CK-VRK-030
4	CK-ERK-040	CK-VRK-040

Regular True Union Ball Valve

Cartridge Repair Kit

Includes valve assembly, less union nuts, and end connectors.

Size	PVC Part Number[1]	
	w/ EPDM O-rings	w/ Viton® O-rings
1/2	2320-005	2330-005
3/4	2320-007	2330-007
1	2320-010	2330-010
1-1/4	2320-012	2330-012
1-1/2	2320-015	2330-015
2	2320-020	2330-020
2-1/2 & 3	2320-030	2330-030
4 & 6	2320-040	2330-040

1 For CPVC Cartridge Kit, add the letter "C" to part numbers listed (e.g., 2320-005C)

Regular True Union Ball Check Valve

Cartridge Repair Kit

Includes valve assembly, less union nuts, and end connectors.

Size	PVC Part Number[1]	
	w/ EPDM O-rings	w/ Viton® O-rings
1/2	2220-005	2230-005
3/4	2220-007	2230-007
1	2220-010	2230-010
1-1/4	2220-012	2230-012
1-1/2	2220-015	2230-015
2	2220-020	2230-020
2-1/2 & 3	2220-030	2230-030
4	2220-040	2230-040

1 For CPVC Cartridge Kit, add the letter "C" to part numbers listed (e.g., 2220-005C)

Single Entry Ball Valve

Seat & O-ring Replacement Kit

Includes Teflon® seats (2), seat O-rings (2), and seal carrier O-ring (1).

Size	Part Number		
	w/ Buna-N O-rings	w/ EPDM O-rings	w/ Viton® O-rings
1/2	SE-BRK-005	SE-ERK-005	SE-VRK-005
3/4	SE-BRK-007	SE-ERK-007	SE-VRK-007
1	SE-BRK-010	SE-ERK-010	SE-VRK-010
1-1/4 & 1-1/2	SE-BRK-015	SE-ERK-015	SE-VRK-015
2	SE-BRK-020	SE-ERK-020	SE-VRK-020
3	SE-BRK-030	SE-ERK-030	SE-VRK-030
4	SE-BRK-040	SE-ERK-040	SE-VRK-040

Gate Valve

O-ring Repair Kit

1/2" through 2" Kit includes stem O-ring (1), body O-ring (1), wedge O-ring or gasket (1), stem bushing (1) and stem washer (1).

2" and 3" Kit includes seal carrier O-ring (1), stem O-ring (1), stem washer (1) and stem bushing (1).

4" Kit includes carrier O-ring (1), stem O-ring (1) and stem bushing.

Size	Part Number		
	w/ Buna-N O-rings	w/ EPDM O-rings	w/ Viton® O-rings
1/2	GT-BRK-005	GT-ERK-005	GT-VRK-005
3/4	GT-BRK-007	GT-ERK-007	GT-VRK-007
1	GT-BRK-010	GT-ERK-010	GT-VRK-010
1-1/4	GT-BRK-012	GT-ERK-012	GT-VRK-012
1-1/2	GT-BRK-015	GT-ERK-015	GT-VRK-015
2	GT-BRK-020	GT-ERK-020	GT-VRK-020
2-1/2 & 3	GT-BRK-030	GT-ERK-030	GT-VRK-030
4	GT-BRK-040	GT-ERK-040	GT-VRK-040

Gate Valve

Internal Component Replacement Cartridge

Includes complete internal assembly with bonnet and handle.

Size	Part Number [1]		
	w/ Buna-N O-rings	w/ EPDM O-rings	w/ Viton® O-rings
1/2	2010-005	2020-005	2030-005
3/4	2010-007	2020-007	2030-007
1	2010-010	2020-010	2030-010
1-1/4 & 1-1/2	2010-015	2020-015	2030-015
2	2010-020	2020-020	2030-020

1 For CPVC Cartridge Kit, add the letter "C" to part numbers listed (e.g., 2010-005C).

Butterfly Valve
Standard & True Lug Seat Repair Kit

Standard Valve and True Lug Kit through 12" includes Buna-N, EPDM or Viton® seat (1) and PVC or CPVC seal carrier (1) .

Sizes 14" and larger include EPDM or Viton® seat only.

Size	PVC Part Number[1,2]		
	w/ Buna-N	w/ EPDM	w/ Viton®
1-1/2	BF-BRK-015	BF-ERK-015	BF-VRK-015
2	BF-BRK-020	BF-ERK-020	BF-VRK-020
2-1/2	BF-BRK-025	BF-ERK-025	BF-VRK-025
3	BF-BRK-030	BF-ERK-030	BF-VRK-030
4	BF-BRK-040	BF-ERK-040	BF-VRK-040
6	BF-BRK-060	BF-ERK-060	BF-VRK-060
8	BF-BRK-080	BF-ERK-080	BF-VRK-080
10	BF-BRK-100	BF-ERK-100	BF-VRK-100
12	BF-BRK-120	BF-ERK-120	BF-VRK-120
14	—	BF-ERK-140	BF-VRK-140
16	—	BF-ERK-160	BF-VRK-160
18	—	BF-ERK-180	BF-VRK-180
20	—	BF-ERK-200	BF-VRK-200
24	—	BF-ERK-240	BF-VRK-240

For CPVC Seat Replacement Kit, add a "C" to the end of the part number shown (e.g., BF-BRK-015C).
2: For PP, add a "P" to the end of the part number (e.g., BF-BRK-015P)

Butterfly Valve
Standard Valve Overhaul Kit

For standard sizes through 12" includes stem nut (1), stem bushing (1), bushing O-ring (2), stem O-ring (2), stem washer - hex (1), stem washer - round (1), timing stop (1), seat (1) and seal carrier (1).

Sizes 14" and larger includes seat (1) and stem O-ring (2).

Size	PVC Part Number		
	w/ Buna-N	w/ EPDM	w/ Viton®
1-1/2	BF-BOK-015	BF-EOK-015	BF-VOK-015
2	BF-BOK-020	BF-EOK-020	BF-VOK-020
2-1/2	BF-BOK-025	BF-EOK-025	BF-VOK-025
3	BF-BOK-030	BF-EOK-030	BF-VOK-030
4	BF-BOK-040	BF-EOK-040	BF-VOK-040
6	BF-BOK-060	BF-EOK-060	BF-VOK-060
8	BF-BOK-080	BF-EOK-080	BF-VOK-080
10	BF-BOK-100	BF-EOK-100	BF-VOK-100
12	BF-BOK-120	BF-EOK-120	BF-VOK-120
14	—	BF-EOK-140	BF-VOK-140
16	—	BF-EOK-160	BF-VOK-160
18	—	BF-EOK-180	BF-VOK-180
20	—	BF-EOK-200	BF-VOK-200
24	—	BF-EOK-240	BF-VOK-240

1: CPVC Standard Valve Overhaul Kit available through 12" only. Add a "C" to the end of the part number shown (e.g., BF-BOK-015C).
2: For PP, add a "P" to the end of the part number (e.g., BF-BOK-015P)

Butterfly Valve
True Lug Valve Overhaul Kit

Includes stem nut (1), stem bushing (1), bushing O-ring (1), stem O-ring (1), stem washer - hex (1), stem washer - round (1), timing stop (1), seat (1), seal carrier (1) and seal carrier flange O-ring (1).

Size	PVC Part Number		
	w/ Buna-N	w/ EPDM	w/ Viton®
1-1/2	BFT-BOK-015	BFT-EOK-015	BFT-VOK-015
2	BFT-BOK-020	BFT-EOK-020	BFT-VOK-020
2-1/2	BFT-BOK-025	BFT-EOK-025	BFT-VOK-025
3	BFT-BOK-030	BFT-EOK-030	BFT-VOK-030
4	BFT-BOK-040	BTF-EOK-040	BFT-VOK-040
6	BFT-BOK-060	BFT-EOK-060	BFT-VOK-060
8	BFT-BOK-080	BFT-EOK-080	BFT-VOK-080
10	BFT-BOK-100	BFT-EOK-100	BFT-VOK-100
12	BFT-BOK-120	BFT-EOK-120	BFT-VOK-120

For CPVC True Lug Valve Overhaul Kit, add a "C" to the end of the part number shown (e.g., BFT-BOK-015C).

VALVE SERVICE & REPLACEMENT KITS

Butterfly Valve

Standard Valve Overhaul Kit with Disc

For standard sizes through 12" includes stem nut (1), stem bushing (1), bushing O-ring (2), stem O-ring (2), stem washer - hex (1), stem washer - round (1), timing stop (1), seat (1), seal carrier (1) and disc (1).

Sizes 14" and larger includes seat (1), stem O-ring (2) and disc (1).

Size	PVC Part Number[1,2]		
	w/ Buna-N	w/ EPDM	w/ Viton®
1-1/2	BF-BOKD-015	BF-EOKD-015	BF-VOKD-015
2	BF-BOKD-020	BF-EOKD-020	BF-VOKD-020
2-1/2	BF-BOKD-025	BF-EOKD-025	BF-VOKD-025
3	BF-BOKD-030	BF-EOKD-030	BF-VOKD-030
4	BF-BOKD-040	BF-EOKD-040	BF-VOKD-040
6	BF-BOKD-060	BF-EOKD-060	BF-VOKD-060
8	BF-BOKD-080	BF-EOKD-080	BF-VOKD-080
10	BF-BOKD-100	BF-EOKD-100	BF-VOKD-100
12	BF-BOKD-120	BF-EOKD-120	BF-VOKD-120
14	—	BF-EOKD-140	BF-VOKD-140
16	—	BF-EOKD-160	BF-VOKD-160
18	—	BF-EOKD-180	BF-VOKD-180
20	—	BF-EOKD-200	BF-VOKD-200
24	—	BF-EOKD-240	BF-VOKD-240

1: CPVC Standard Valve Overhaul Kit available through 12" only. Add a "C" to the end of the part number shown (e.g., BF-BOKD-015C).
2: For PP, add a "P" to the end of the part number (e.g., BF-BOKD-O15P)

Butterfly Valve

True Lug Valve Overhaul Kit with Disc

Includes stem nut (1), stem bushing (1), bushing O-ring (1), stem O-ring (1), stem washer - hex (1), stem washer - round (1), timing stop (1), seat (1), seal carrier (1), seal carrier flange O-ring (1) and disc (1).

Size	PVC Part Number		
	w/ Buna-N	w/ EPDM	w/ Viton®
1-1/2	BFT-BOKD-015	BFT-EOKD-015	BFT-VOKD-015
2	BFT-BOKD-020	BFT-EOKD-020	BFT-VOKD-020
2-1/2	BFT-BOKD-025	BFT-EOKD-025	BFT-VOKD-025
3	BFT-BOKD-030	BFT-EOKD-030	BFT-VOKD-030
4	BFT-BOKD-040	BFT-EOKD-040	BFT-VOKD-040
6	BFT-BOKD-060	BFT-EOKD-060	BFT-VOKD-060
8	BFT-BOKD-080	BFT-EOKD-080	BFT-VOKD-080
10	BFT-BOKD-100	BFT-EOKD-100	BFT-VOKD-100
12	BFT-BOKD-120	BFT-EOKD-120	BFT-VOKD-120

For CPVC True Lug Valve Overhaul Kit with Disc, add a "C" to the end of the part number shown (e.g., BFT-BOKD-015C).

Swing Check Valve

Seat & O-ring Repair Kit

All kits include Bonnet O-ring (1), Disc O-ring (1) and Seat O-ring.

Size	Part Number	
	w/EPDM O-rings	w/Viton O-rings
3/4	SK-ERK-007	SK-VRK-007
1	SK-ERK-010	SK-VRK-010
1-1/4	SK-ERK-012	SK-VRK-012
1-1/2	SK-ERK-015	SK-VRK-015
2	SK-ERK-020	SK-VRK-020
2-1/2 & 3	SK-ERK-030	SK-VRK-030
4	SK-ERK-040	SK-VRK-040
6	SK-ERK-060	SK-VRK-060
8	SK-ERK-080	SK-VRK-080

Butterfly Check Valve

Seat Repair Kit

All kits include Seat Membrane (1), Post O-rings (2).

Size	Part Number	
	w/EPDM O-rings	w/Viton O-rings
2	BK-ERK-020	BK-VRK-020
2-1/2	BK-ERK-025	BK-VRK-025
3	BK-ERK-030	BK-VRK-030
4	BK-ERK-040	BK-VRK-040
6	BK-ERK-060	BK-VRK-060
8	BK-ERK-080	BK-VRK-080
10	BK-ERK-100	BK-VRK-100
12	BK-ERK-120	BK-VRK-120

Y-Pattern Valve

Seat & O-ring Repair Kit

All kits include seat O-ring (1), and Stem O-ring (1).

Size	Part Number	
	w/EPDM O-rings	w/Viton O-rings
1/2	YV-ERK-005	YV-VRK-005
3/4	YV-ERK-007	YV-VRK-007
1	YV-ERK-010	YV-VRK-010
1-1/4	YV-ERK-012	YV-VRK-012
1-1/2	YV-ERK-015	YV-VRK-015
2	YV-ERK-020	YV-VRK-020
3	YV-ERK-030	YV-VRK-030
4	YV-ERK-040	YV-VRK-040

Diaphragm Valve

Diaphragm & End Connector O-ring Replacement Kit

Includes diaphragm (1), and end connector O-rings (2).

Size	Part Number				
	EPDM O-ring & DIAPHRAGM KIT	EPDM O-ring & PTFE* DIAPHRAGM KIT	Viton® O-ring & DIAPHRAGM KIT	Viton® O-ring & PTFE* DIAPHRAGM KIT	Viton® O-ring & Viton® Backed Diaphragm Kit
1/2	DV-ERK-005	DV-TERK-005	DV-VRK-005	DV-TVRK-005	DV-VTVRK-005
3/4	DV-ERK-007	DV-TERK-007	DV-VRK-007	DV-TVRK-007	DV-VTVRK-007
1	DV-ERK-010	DV-TERK-010	DV-VRK-010	DV-TVRK-010	DV-VTVRK-010
1-1/4 or 1-1/2	DV-ERK-015	DV-TERK-015	DV-VRK-015	DV-TVRK-015	DV-VTVRK-015
2	DV-ERK-020	DV-TERK-020	DV-VRK-020	DV-TVRK-020	DV-VTVRK-020

* Elastomer backed PTFE laminated diaphragm.

Diaphragm Valve

Replacement Diaphragm

Size	Part Number			
	EPDM DIAPHRAGM	Viton® DIAPHRAGM	PTFE* DIAPHRAGM	Viton® backed PTFE* DIAPHRAGM
1/2	27-39-00541	27-39-00542	27-39-00565	27-39-00566A
3/4	27-39-00741	27-39-00742	27-39-00765	27-39-00766A
1	27-39-01041	27-39-01042	27-39-01065	27-39-01066A
1-1/4 or 1-1/2	27-39-01541	27-39-01542	27-39-01565	27-39-01566
2	27-39-02041	27-39-02042	27-39-02065	27-39-02066
2-1/2 or 3	27-39-03041	27-39-03042	27-39-03065	27-39-03066
4	27-39-04041	27-39-04042	27-39-04065	27-39-04066
6	27-39-06041	27-39-06042	27-39-06065	27-39-06066
8	27-39-08041	27-39-08042	27-39-08065	27-39-08066

* Elastomer backed PTFE laminated diaphragm.

BALL VALVE TROUBLESHOOTING GUIDE

Spears True Union, Single Entry, and Compact Ball Valves are designed and produced for trouble-free operation and use. However, certain aspects of installation and application can result in valve malfunctions.

This guide identifies some of the more common problems encountered and their necessary corrective actions. Such problems have been categorized as External Leaks, Internal Leaks, Frozen Movements and Structural Breakage.

External Leaks

Location	Possible Cause	Corrective Action
At Thread/Socket Connections	Improper solvent cementing.	Replace end connector(s) according to installation instructions.
	Improper threads.	Check threads for proper size; replace or reinstall.
	Insufficient or improperly applied thread sealant; incompatible sealant (paste).	Reinstall thread connection according to proper procedures; check paste compatibility.
	Over-tightened thread joint splitting connector.	Replace cracked end connector(s).
	Insufficient valve support splitting connector.	Replace cracked end connector(s). Add support on each side of valve.
At Union Nuts	End connector misaligned.	Check system alignment - end connector(s) must be parallel. Check for adequate valve support.
	Displaced or damaged O-ring; particles in O-ring groove.	Remove valve and inspect O-ring for physical or chemical damage. Check O-ring compatibility, replace accordingly. Clean and re-seat O-ring.
	System contraction pulling end connectors; improper end connector spacing.	Check thermal variations; anchor pipe each side of valve; install expansion loop. Correct spacing.
	Loose Union Nut.	Re-tighten nut.
	Displaced or pinched seal carrier O-ring.	Remove and disassemble seal carrier; re-seat or replace O-ring.
At Stem	Damaged stem O-ring.	Remove and disassemble valve stem; inspect for physical or chemical damage. Check O-ring compatibility, clean and replace accordingly.

BALL VALVE TROUBLESHOOTING GUIDE

Internal Leaks — In-line Leakage Past Valve

Possible Cause	Corrective Action
Ball obstruction	Check that the valve is in its "full-closed" position. If not, remove valve and check for solids blocking the ball port. Clean and reinstall valve.
Broken Stem	Remove end connector and check for ball rotation while operating valve. Replace as necessary.
Seal Carrier Loose	True Union Valves - remove valve; CAREFULLY tighten seal carrier (located on inlet end of body). Single Entry Valves - CAREFULLY tighten single Union Nut. IMPORTANT: Generally only a slight adjustment is required (either valve). A properly adjusted valve should have significant resistance to operation without binding - AVOID OVER-TIGHTENING!
Teflon® Seat Damage or Debris Laden	Remove and disassemble valve seats. Check for excessive debris and physical damage (nicks, cuts, scoring, etc.). Clean and replace as necessary.
Seat O-ring Displaced, Damaged or Debris Laden	Remove and disassemble valve seat O-rings; check for physical or chemical damage. Check O-ring chemical compatibility; clean and replace accordingly. Check for excessive system flow rate.
Ball Damaged	Remove and disassemble valve ball. Check for physical damage (excessive nicks, scoring, etc.) at seat sealing surface (perpendicular to ball port). Clean surface; replace ball if necessary. Check for chemical damage and valve material (PVC, CPVC) compatibility.
Solvent-Cement (glue) Contamination from Installation Spillage	Remove valve and check for glue deposits on ball or seat areas. Clean, if possible; excessive damage may require component replacement.
Thermal Damage (component distortion)	Check system operating temperatures, external heat sources (including direct sun), and heat generated from system design or valve placement.

Frozen Movements — unable, or very difficult, to open/close; sometimes accompanied by stem break (shear)

Possible Cause	Corrective Action
Internal Obstructions; Sediment or Particle Buildup; Solvent Cement on Ball	Remove valve and check for solids, debris or solvent cement deposits blocking the ball or valve interior. Check for sediment particles lodged around ball-to-seat contact areas. Remove stem and check for the same. Clean and reinstall.
Over-tight Seal Carrier	True-Union Valves - remove valve; slightly loosen seal carrier (located on inlet end of body). Single Entry Valves - slightly loosen single Union Nut. IMPORTANT: Generally only a slight adjustment is required (either valve). A properly adjusted valve should have significant resistance to operation without binding.
Chemical Attack (generally appears as distortion, peeling, etching or bleaching of ball sealing surfaces or other internal components)	Check valve material (PVC, CPVC) chemical compatibility with system fluids. Be sure to consider operating temperatures with this determination.

BALL VALVE TROUBLESHOOTING GUIDE

Structural Breakage

Location	Possible Cause	Corrective Action
Handle broken	Frozen movements.	See "Frozen Movements" section. Replace.
	External impact.	Identify and correct source.
Handle Stripped	Overextending open/close range.	Replace handle.
	Excessive exposure to direct-sunlight has softened handle material.	Shield or screen valve from direct-sun exposure.
Stem Sheared / Broken	Frozen movements; external impact.	See "Frozen Movements" section.
Broken Union Nut	Nut has been over tightened to draw-up or align end-connectors; external impact.	Adjust spacing between end-connectors for proper valve lay-lengths. Check system alignment - end connector(s) must be parallel.
	Inadequate valve supports.	Provide system support on each side of valve.
	Excessive internal pressure / Hydraulic Shock	Check system pressures and surge pressures; check for entrapped air.
End Connector Break	System misalignment; external impact.	Check system alignment - end connector(s) must be parallel.
	Over-tighten thread-joint connection.	Install new end connector according to installation instructions.
	Inadequate valve support.	Provide system support on each side of valve.
Body Break	External impact.	Identify and correct source.
	Excessive internal pressure.	Check system pressures and surge pressures; check for entrapped air.
	System misalignment.	Check system alignment - end connector(s) must be parallel.
	Inadequate valve support.	Provide system support on each side of valve.
	Chemical attack.	Check chemical compatibility of system fluids.

NOTES: Certain corrective actions of this guide may not be feasible with the Compact Ball Valve (sealed unit).

Improper system operating temperatures and chemical incompatibly can cause a variety of functional and structural failures. Be sure to use proper valve material-types for both temperature and chemical resistance.

Most valve problems are traceable to improper system design or installation. Be sure to have all design performed by a qualified Engineer and installation made by properly trained personnel.

Spears valve Installation Instructions and Maintenance/Service Procedures should be followed in conjunction with all corrective actions.

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Except as otherwise mandated by law, Spears Manufacturing Company warrants that the goods which have been directly manufactured by them shall be free from defects in material and workmanship for a period of one (1) year, from the date of shipment. CUSTOMER AGREES THAT THIS WARRANTY SHALL BE EFFECTIVE SO LONG AS THE GOODS ARE USED SOLELY FOR THE NORMAL PURPOSES FOR WHICH THEY ARE INTENDED AND IN CONFORMANCE WITH INDUSTRY ESTABLISHED ENGINEERING, INSTALLATION, OPERATING, AND MAINTENANCE SPECIFICATIONS, RECOMMENDATIONS AND INSTRUCTIONS. VIOLATION THEREOF SHALL VOID THIS WARRANTY AND RELIEVE COMPANY FROM ANY OBLIGATION UNDER THIS WARRANTY. COMPANY CANNOT AND DOES NOT ASSUME RESPONSIBILITY, AND EXPRESSLY DISCLAIMS ANY LIABILITY, DUE TO CUSTOMER'S, ANY INSTALLER'S OR END USER'S FAILURE TO COMPLY WITH SUCH SPECIFICATIONS, RECOMMENDATIONS AND INSTRUCTIONS.

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Authorized Distributor

OPERATING GUIDE

Crispin Deep Well Air Valves

OPERATION

The CRISPIN Deep Well Air Valve is similar in operation to that of the CRISPIN Air and Vacuum Valve. The difference is the addition of a deep well top assembly/throttling device.

The CRISPIN Deep Well Air Valve permits the escape of air from the well column when the pump starts, and allows the float to seat without chattering, premature closure or other destructive forces associated with rapid closure. The throttling device presents resistance to the exhausting air and rising column of water, so that when the water reaches the valve, the float will slowly rise to its seat.

The CRISPIN Deep Well Air Valve is field adjusted to accommodate field requirements by screwing the deep well stem into or out of the deep well top assembly. The initial adjustment should locate the plug at a point in the deep well top assembly, so that it is 75 percent visible when viewed through the discharge outlet. If the float continues to slam upon closure or if excessive amounts of water exit the valve discharge, the stem should be adjusted further into the deep well top assembly.

MAINTENANCE

Inspect seating area for leaks while the valve is in service. Replace seat when required.

SEAT REPLACEMENT

Isolate or remove the valve from the system. Remove the deep well top assembly (Part No. 1D) which secures the Buna-N seat (Part No. 5) in place. With the proper size wrench, turn the deep well top assembly counter-clockwise.

Once the top is removed, the Buna-N Seat will be exposed so that you can make the replacement. It is important that for proper operation of the valve, the Buna-N Seat be replaced every five years under normal operating conditions.

It is always best to add a coating of suitable thread sealer to the threads of the deep well top assembly prior to reassembling the valve. Turn the deep well top assembly clockwise until it is snug, then tighten the assembly one-quarter turn, being careful not to deform the seat.

FLOAT REPLACEMENT

Isolate or remove the valve from the system. Remove all the top flange nuts and bolts from the valve. Lift the top flange (Part No. 2) from the body of the valve. Remove and inspect the float (Part No. 6) and make the replacement. Prior to connecting the top flange to the body, it is important that the gasket (Part No. 4) be inspected.

If the gasket shows wear or tear, replace it. Reposition the top flange on the valve body, and replace the top flange nuts and bolts.

Crispin Deep Well Air Valves (continued)

INSTALLATION

The CRISPIN Deep Well Air Valve should be installed at the pump discharge and mounted vertically. The valve should be protected from freezing. For detailed information on the proper sizing of CRISPIN Deep Well Air Valves, please refer to the CRISPIN Catalog and/or Technical Reference

Troubleshooting

Valve Leaking: Seating Problem

—If the valve is four to five years old, then the Buna-N Seat needs replacing.

—If the valve leaks on pressure less than 15 psig, then the seat material is too hard and needs to be replaced with soft seat material.

Valve Leaking: Float Damage

—Review application for proper sizing of Deep Well Air Release Valves. Refer to the CRISPIN Catalog.

—If valve has been installed on the pump discharge, the deep well top assembly (Part No. lD) must be applied to the valve to resolve this problem.

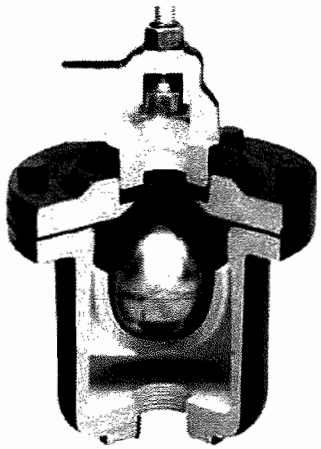
—If the valve inlet size is greater than 2", then a surge check valve may be added to the inlet of the valve to alleviate the problem. The damaged float will require replacement.

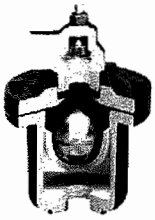
Valve Leaking

—Review application of this valve; valves may not be sized properly.

—If problem continues, please consult the factory.

** These valves are intended for use on municipal waste water systems or approved industrial applications.*





DL SERIES

Deep Well Valves

Crispin Deep Well Valves

Valve Function

- **Vents air from the pump column at the discharge point ahead of a check or control valve**

Features

- **Peripheral guide system for unobstructed closure**
- **Hydrostatically tested to 150% of maximum working pressure.**
- **Standard Buna-N seating material**
- **Available in sizes 1/2" thru 6"**

PUMP CAP. G.P.M.	VALVE SIZE	MODEL NO.
200	½"	D5
201-800	1"	DL10
801-3700	2"	DL20
3701-7000	3"	DL30
7001-14000	4"	DL40
14001-29000	6"	DL61

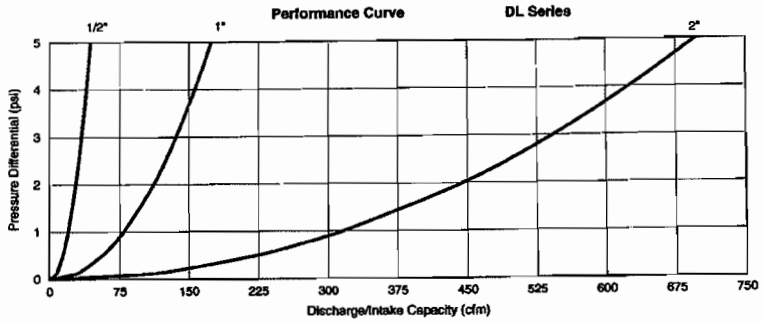
** The sizes above are recommended for normal installation*

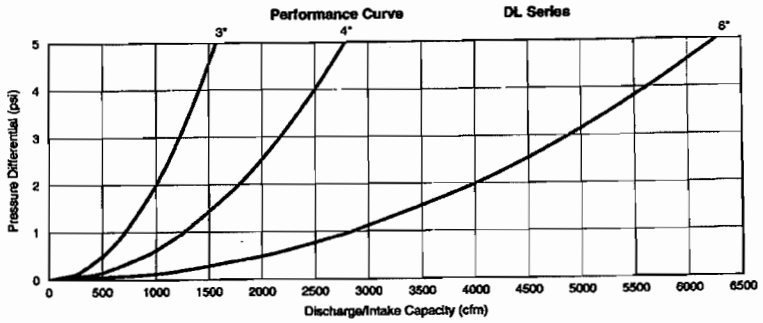
With Stainless Steel Trim or Bronze Trim and Stainless Steel Float

The Crispin Deep Well Air Valve is designed to vent air from the pump column at the discharge point ahead of the check or control valve. The air flow is controlled by screwing down the stem on the Deep Well top to a point where the float ceases to flutter. In the event of excessive water spillage or slamming of the float into its seat, further adjustment may be necessary. After the correct setting has been found, the jam nut is tightened.

Crispin Valve provides the same unique design in the Deep Well Valve as with its Air and Vacuum Valve. That is, the float is peripherally guided to the seat, which permits the float to self center and tightly seal the orifice. There are no shafts to bend or deform, which would prevent a drip tight seal.

Performance Curves





3", 4" can be furnished with flanged connection.
6" furnished with flanged connection only.

** See Surge Check Series for Surge Check options in sizes 3" and above*

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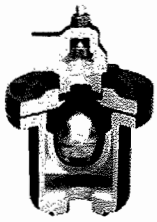
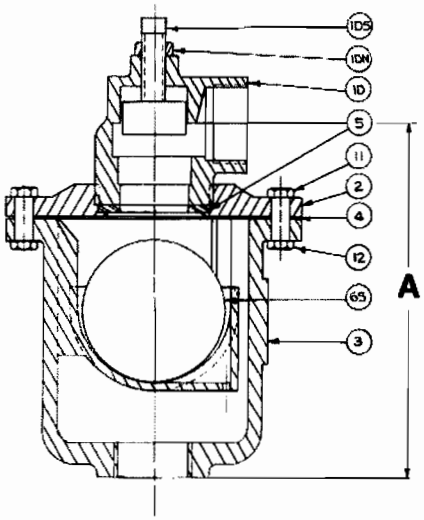


Crispin Deep Well Valves

Parts List for Deep Well 1/2" thru 6"

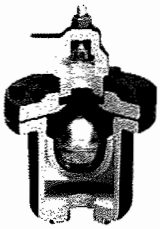
PART NO.	ITEM	MATERIAL 1/2" VALVE	MATERIAL 1" thru 6"
1D	Top, Deep Well	Cast Iron	Cast Iron
1DS	Stem, Deep Well	Cast Iron-Steel	Cast Iron-Steel
1DN	Jam Nut	Steel	Steel
2	Flange	Cast Iron	Cast Iron
3*	Body NPT Inlet	Cast Iron	Cast Iron
3F*	Body, 125 ANSI Flanged	Cast Iron	Cast Iron
3FH*	Body 250 ANSI Flanged	Cast Iron	Cast Iron
4	Gasket	Armstrong	Armstrong
5	Seat	Buna-N	Buna-N
6S	Float	Stainless Steel	Stainless Steel
7	Hanger	Stainless Steel	
8	Cup	Stainless Steel	
9	Rivet	Stainless Steel	
11	Bolt	Steel	Steel
12	Nut	Steel	Steel



* Part No's 3, 3F and 3FH are at customer's option **For ease of maintenance, some of the above parts are provided as kits or assemblies. Note: Prices and Materials are Subject to Change Without Notice

Deep Well Valve Detail

Model	Inlet	Outlet	Trim	Height	Width	Wt. (lbs)	Dim A
D5	1/2"	1/2"	IBBT	6 13/16"	4 3/4"	7 1/2	5"
DL10	1"	1"	S/S	9 1/16"	6 1/4"	18	6 5/8"
DL20	2"	2"	S/S	13 15/16"	8 3/4"	50	10 1/2"
DL21	2"	2" 125# Flg.	S/S	16 3/16"	8 3/4"	56	14"
DL22	2"	2" 250# Flg.	S/S	16 7/16"	8 3/4"	58	14 1/4"
DL30	3"	3"	S/S	18 5/8"	11 1/2"	109	12 3/4"
DL31	3"	3" 125# Flg.	S/S	22 5/8"	11 1/2"	132	16 3/4"
DL32	3"	3" 250# Flg.	S/S	23"	11 1/2"	141	17 1/8"
DL40	4"	4"	S/S	22 7/8"	14"	187	15 13/16"
DL41	4"	4" 125# Flg.	S/S	25 13/16"	14"	206	18 1/8"
DL42	4"	4" 250# Flg.	S/S	26 1/8"	14"	224	19 1/16"
DL61	6"	6" 125# Flg.	S/S	27 5/16"	15"	295	20"
DL62	6"	6" 250# Flg.	S/S	28"	15"	304	20 3/8"

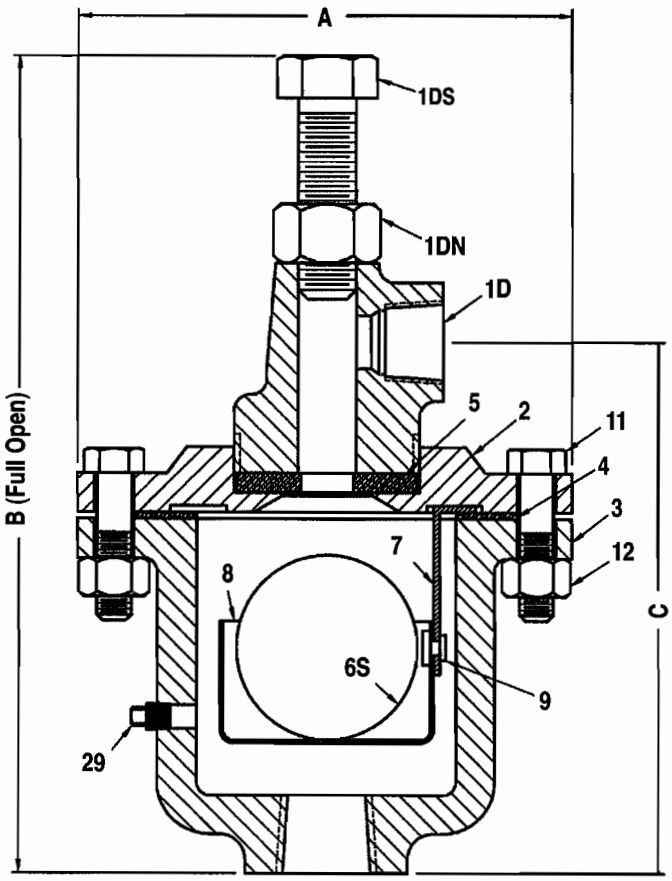


SUBMITTAL SHEET FOR DL SERIES

Submittal Sheet for Crispin DL Series

1/2" Deep Well Valve

Manufactured in compliance with ANSI/AWWA C512 **Date: October, 2001**



Size Specifications

MODEL	INLET SIZE	OUTLET SIZE	A	B	C	WEIGHT
D5	1/2" NPT	1/2" NPT	4.75	7.00	5.00	8

Specifications

The Deep Well Air Release Valve(s) shall be installed on the discharge side of the pump, so that the volume of air exiting the system can be easily vented and controlled without hampering the operation of the Air Release Valve. This shall be accomplished by means of a throttling device on the discharge side of the valve.

The valve(s) shall operate by sealing the Buna-N rubber orifice witha peripheral guided ball float as the air exits the valve at an adjustable and controlled rate, and the liquid enters the chamber to raise the float. All Crispin Valves are hydrostatically tested to 150% of their maximum working pressure.

The valve(s) shall be Crispin Model _____ Deep Well Air Valves as manufactured by Crispin-Multiplex Manufacturing Co., Berwick, PA.

The valve(s) shall be _____" NPT screwed inlet and outlet connection with cast iron body and top, stainless steel trim.

Option: Where pressures are greater than 300 PSIG, the valve(s) shall have a (steel, stainless steel, or ductile iron) body, top and inlet flange.

Standard operating pressure for Crispin Air Valves is 20 to 150 PSIG. Please check one of the following if your operating needs differ:

___ 2 to 40 PSIG
___ 151 to 300 PSIG

Deep Well Parts List

ITEM	DESCRIPTION	MATERIAL	ASTM
1 D	DEEP WELL TOP	CAST IRON	A126 CL. B
1 DS	DEEP WELL STEM	STEEL	A307/A36
1 DN	NUT	STEEL	A563
2	FLANGE	CAST IRON	A126 CL. B
3	BODY	CAST IRON	A126 CL. B
4	GASKET	ARMSTRONG N–8092	N/A
5	SEAT	BUNA–N RUBBER	D2000
6S	FLOAT	STAINLESS STEEL	A240
7	HANGER	STAINLESS STEEL	A240
8	CUP	STAINLESS STEEL	A312
9	RIVET	STAINLESS STEEL	A193
11	BOLT	STEEL	A307
12	NUT	STEEL	A563
29	PLUG	BRASS	B505

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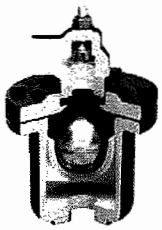
Submittal Sheet for Crispin DL Series



1"–6" Deep Well Valve

Manufactured in compliance with ANSI/AWWA C512 **Date: October, 2001**

Specifications

The Deep Well Air Release Valve(s) shall be installed on the discharge side of the pump, so that the volume of air exiting the system can be easily vented and controlled without hampering the operation of the Air Release Valve. This shall be accomplished by means of a throttling device on the discharge side of the valve.

The valve(s) shall operate by sealing the Buna-N rubber orifice witha peripheral guided ball float as the air exits the valve at an adjustable and controlled rate, and the liquid enters the chamber to raise the float. All Crispin Valves are hydrostatically tested to 150% of their maximum working pressure.

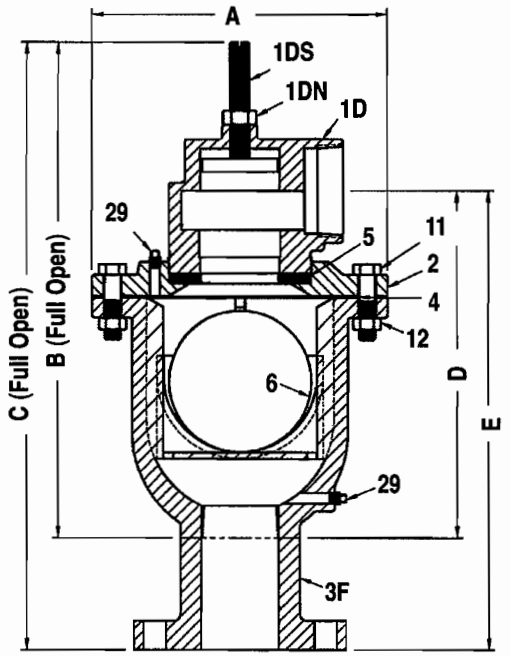
The valve(s) shall be Crispin Model _____ Deep Well Air Valves as manufactured by Crispin- Multiplex Manufacturing Co., Berwick, PA.

1"–6"—The valve(s) shall be _____" NPT screwed inlet and outlet or ANSI Class (125, 250) flanged inlet connection with cast iron body and top, stainless steel trim.

Option: Where pressures are greater than 300 PSIG, the valve(s) shall be ANSI Class _____ flanged inlet connection and shall have a (steel, stainless steel, or ductile iron) body, top and inlet flange.

Standard operating pressure for Crispin Air Valves is 20 to 150 PSIG. Please check one of the following if your operating needs differ:

____ **2 to 40 PSIG** ____ **151 to 300 PSIG**



Size Specifications

MODEL	INLET SIZE	OUTLET SIZE	A	B	C	D	E	WEIGHT
DL10	1" NPT	1" NPT	6.25	9.25		6.50		18
DL20	2" NPT	2" NPT	8.75	14.25		10.50		50
DL21	2" 125# FLG	2" NPT	8.75		17.75		13.00	57
DL22	2" 250# FLG	2" NPT	8.75		18.00		13.25	60
DL30	3" NPT	3" NPT	11.50	20.00		13.00		109
DL31	3" 125# FLG	3" NPT	11.50		23.50		17.00	132
DL32	3" 250# FLG	3" NPT	11.50		24.00		17.50	141
DL40	4" NPT	4" NPT	14.00	23.25		15.50		187
DL41	4" 125# FLG	4" NPT	14.00		26.00		18.50	206
DL42	4" 250# FLG	4" NPT	14.00		26.50		18.75	224
DL61	6" 125# FLG	6" NPT	15.50		26.00		20.00	295
DL62	6" 250# FLG	6" NPT	15.50		26.00		20.50	318

Deep Well Parts List

ITEM	DESCRIPTION	MATERIAL	ASTM
1 D	DEEP WELL TOP	CAST IRON	A126 CL. B
1 DS	DEEP WELL STEM	STEEL	A307/A36
1DN	NUT	STEEL	A563
2	FLANGE	CAST IRON	A126 CL. B
3F	BODY	CAST IRON	A126 CL. B
4	GASKET	ARMSTRONG N–8092	N/A
5	SEAT	BUNA–N RUBBER	D2000
6	FLOAT	STAINLESS STEEL	A240
11	BOLT	STEEL	A307
12	NUT	STEEL	A563
29	PLUG	BRASS	B505

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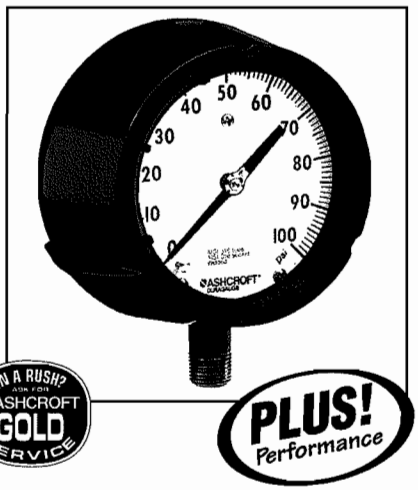


BOURDON SYSTEM SELECTION

Ordering Code	Bourdon Tube & Tip Material[1] (all joints TIG welded except "A")	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn.[2]
A	Grade A Phosphor Bronze Tube-Brass Tip, Silver Brazed	Brass	C-Tube	12/1000	¼, ½
B	4130 alloy steel	1019 steel	C-Tube	15/1500	¼,½
			Helical	2000/5000	¼,½
R	316L stainless steel	1019 steel	C-Tube	12/1500	¼,½
			Helical	2000/20,000	¼,½
S	316L stainless steel	316 stainless steel	C-Tube	12/1500	¼,½
			Helical	2000/20,000	¼,½
P[3]	K Monel	Monel 400	C-Tube	15/1500	¼,½
			Helical	2000/30,000	¼,½[4]

(1) For selection of the correct bourdon system material, see the media application table on page 178.
(2) Other connections available on application.
(3) Use for applications where NACE standard MR-01-75 is specified.
(4) 30,000 psi range supplied with ¼ high pressure connection, ½ NPT optional.

STANDARD RANGES

Pressure psi	Compound psi
0/15	30"Hg/15 psi
0/30	30"Hg/30 psi
0/60	30"Hg/60 psi
0/100	30"Hg/100 psi
0/160	30"Hg/150 psi
0/200	30"Hg/300 psi
0/300	
0/400	**Vacuum**
0/600	30/0 in.Hg
0/800	34/0 ftH₂O
0/1000	
0/1500	
0/2000	
0/3000	
0/5000	**NOTE:**
0/10,000	**Equivalent standard kg/cm², and kPa metric ranges are available.**
0/20,000	
0/30,000	

TO ORDER THIS 1279 DURAGAUGE:

Select: 45 1279 RS* 04L XXX 0/2000 psi

1. Dial size–4½"
2. Case type–1279
   Ring–threaded reinforced polypropylene
3. Bourdon system selection ordering code
4. Connection–¼ NPT (02), ½ NPT (04), Lower (L), Back (B)
5. Optional features–see page 108
6. Standard pressure range
7. Accessories–see pages 165-171

(*) "S" denotes solid front case design

Installation and Maintenance Instructions for ASHCROFT® Pressure Gauges, Gauge Parts and Ring Designs, Engineering Data

ASHCROFT®

SELECTION

Pressure Ranges – Select a gauge with a full scale pressure range of approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Failure to select a gauge range within this criteria may ultimately result in fatigue failure of the Bourdon tube component.

INSTALLATION

Always use a wrench on the flats of the gauge socket to screw the gauge in place. When a fitting is being screwed to the gauge, hold a wrench on the socket flats instead of twisting against the gauge socket screws which are intended to hold the gauge mechanism in the case.

When gauges are mounted on the wall or panel, make sure they are connected free from piping strains. Also see that the mounting surface is flat, or insert washers under the flange of the gauge case to obtain three-point suspension. Preferably, the last length of piping leading up to the gauge should be flexible tubing. This will ensure that the gauge is free from strain.

Install gauges where they will be free from the effects of mechanical vibrations as this will wear out any gauge quickly. Try to mount the gauge on a wall nearby and connect the gauge to the machine which vibrates badly by means of flexible line assembly.

Protect gauges from frequent pressure pulsations by using liquid-filled or Duragauge Plus® with a throttle screw in the socket of the gauge, needle valves, pulsation dampeners or pressure snubbers.

When any gauge is used for steam pressures, a siphon filled with water must be installed between the gauge and the line. When the system is subject to occasional vacuum, provide a leg of piping which cannot be emptied by the vacuum effect. A drain cock or plug should be installed at the bottom of this leg to enable occasional cleaning out of the sediment. The head effect of this piping leg should be compensated for by resetting the pointer of the gauge.

OPERATING CONDITIONS

The operating conditions to which a gauge will be subjected must be considered. If the gauge will be subjected to severe vibration or pressure pulsations, liquid filling the gauge may be necessary to obtain normal product life.Other than discoloration of the dial and hardening of the gasketing that will occur as ambient temperatures exceed 150°F, metal case Duragauges (that are not liquid filled) can withstand continuous ambient temperatures as high as 250°F. Liquid filled gauges can withstand 200°F but glycerin fill and acrylic window will tend to yellow. Accuracy will be affected by approximately 1.5% per 100°F. Gauges with welded joints will withstand 750°F (450°F with silver brazed joints) for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost. For temperature limits on other gauges see the appropriate bulletin.

PROPER USE

Apply pressure slowly. do not open gauge cock or valve too quickly – this imparts a severe strain on the Bourdon tube which may rupture it, or result in shortened life. When the service itself is subject to sudden pressure applications, use a needle valve or the Ashcroft Gauge Saver.

Avoid overpressure. See that the apparatus is provided with a relief valve and that the range of the gauge is higher than the set pressure of the relief valve.

Sudden pressure release has the same detrimental effect and should be compensated for in the same manner as for the pressure applications mentioned above. On hydraulic presses, Catalog Number 1056 or 1009DH Gauges with slotted link should be specified. See Special Service Bulletin SG-1.

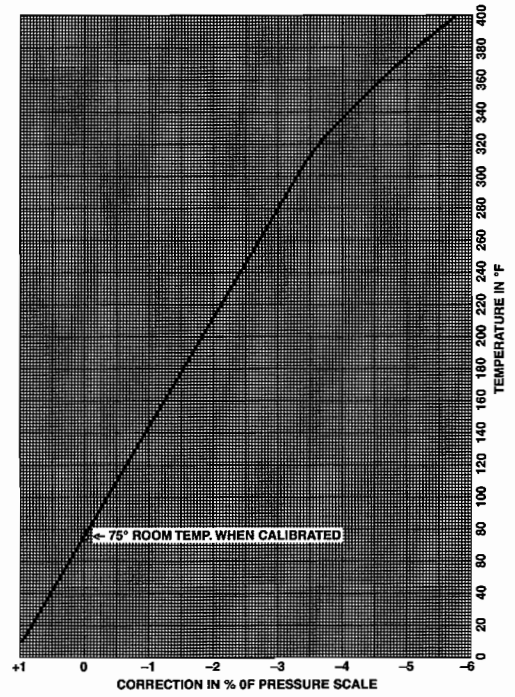
MAINTENANCE

Replace broken glasses and thus keep dirt out of the working bearings and teeth of the movement mechanism.

Never oil gauge movements or linkages except with high grade instrument oil. Regular oil attracts dirt and becomes gummy, thus causing the gauge to act sluggish and inaccurate.

HEAT AFFECTS GAUGE ACCURACY

Approximate error or change in calibration of a Bourdon tube type pressure gauge caused by changes in temperature.



Example: Gauge working at 500 psi pressure at 280°F. temperature would have a –3% correction and would read 3% or 15 psi fast.

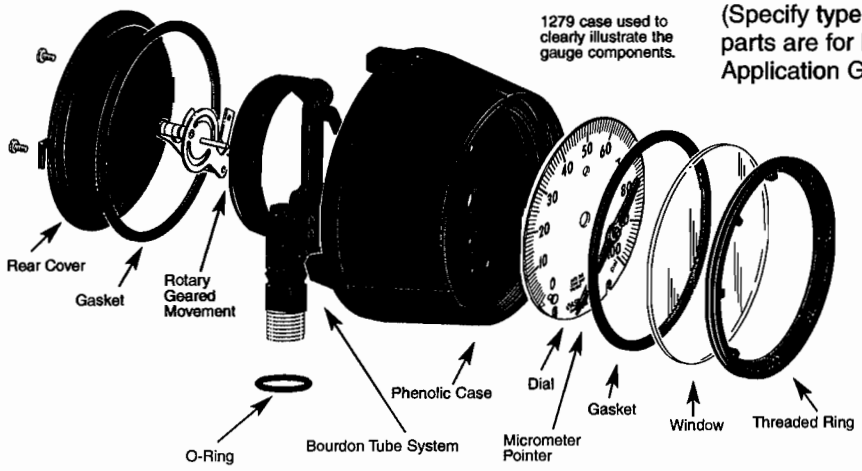
DRESSER Measurement

Installation and Maintenance Instructions for ASHCROFT® Pressure Gauges, Gauge Parts and Ring Designs, Engineering Data

ASHCROFT®

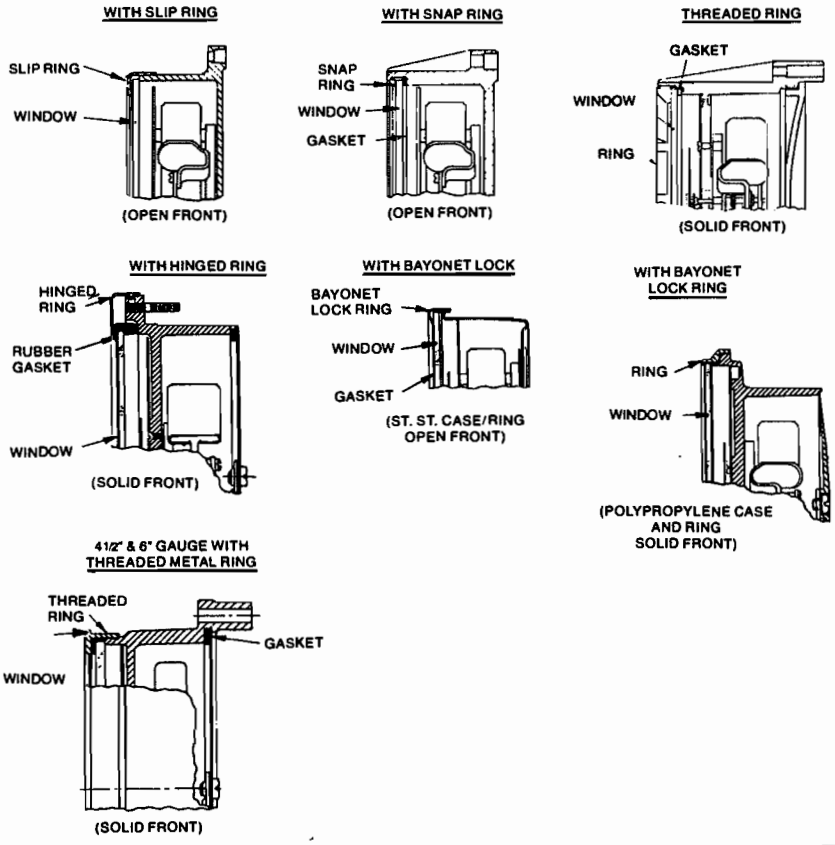
The drawing below shows a typical solid front, lower connection Duragauge with all of the parts designated by their standard names. The use of these names will facilitate the ordering of parts and eliminate any misunderstanding in describing gauge construction.

When ordering parts – specify as much of the following data as possible: *Size* (Dial Diameter); *Case Material* (Stainless Steel, Polypropylene, Aluminum or Phenol); *Case Type* (Open Front or Solid Front); *Ring Design* (Slip, Internal Threaded, External Threaded, Bayonet, Snap or Hinged); *Connection Location* (Lower or Back); *Connection Size* (¼″ or ½″); *Bourdon Tube/Socket* (Material Indicated on Dial); *Dial Range* (Specify type number if possible; otherwise, mention whether parts are for Duragauge, General Service Gauge, Special Application Gauge, Receiver Gauge or Test Gauge.)



Note: The socket, tube and tip assembly is furnished as one integral unit. The movement is supplied complete.

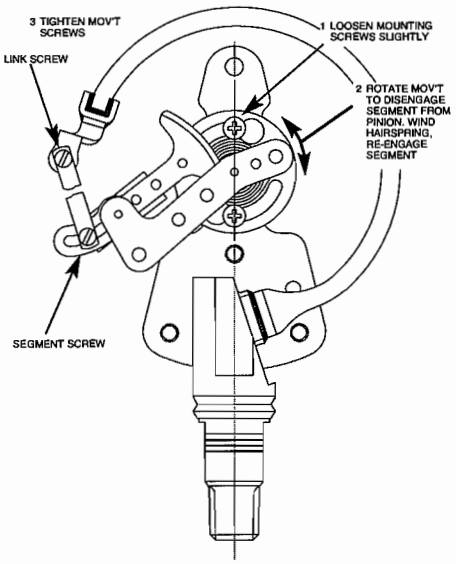
TYPICAL CONSTRUCTION DETAILS



CALIBRATION PROCEDURE

1. Preliminary Gauge Calibration Setting –

(SOLID FRONT GAUGE SHOWN)



2. Calibration –

a. At zero pressure (or at full vacuum for compound or vacuum gauges), assemble pointer to pinion shaft in the horizontal position.

b. Apply pressure equal to full range and adjust the slide in the segment slot until the pointer has rotated 270° (vertical position).

c. Reduce pressure to zero and reset pointer, if necessary, to horizontal position. If pointer adjustment was required, repeat step (b) above.

d. Apply pressure equal to mid-scale and drive pointer firmly onto pinion.

e. Recheck calibration at the lower and upper ends of the scale.

3. Linearity Adjustment –Although the procedure outlined above should produce a correctly calibrated gauge, linearity adjustment may be required. If the pointer reads correctly at the bottom of the scale and low at the top of the scale, rotate the movement to increase the angle between the link and the segment. If the pointer reads high, rotate the movement in the opposite direction.

DRESSER Measurement

ASHCROFT®

PRESSURE GAUGE INSTALLATION, OPERATION AND MAINTENANCE

DRESSER Instruments

I&M012-10098-5/02 (250-1353H)

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CONTENTS

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1.0 SELECTION & APPLICATION

Users should become familiar with ASME B40.1 (Gauges – Pressure Indicating Dial Type – Elastic Element) before specifying pressure measuring instruments. That document – containing valuable information regarding gauge construction, accuracy, safety, selection and testing – may be ordered from:

ASME International
Three Park Avenue
New York, N.Y. 10016-5990
800-843-2763 (US/Canada)
95-800-843-2763 (Mexico)
973-882-1167 outside North America
Email: infocentral@asme.org

WARNING: To prevent misapplication, pressure gauges should be selected considering media and ambient operating conditions. Improper application can be detrimental to the gauge, causing failure and possible personal injury, property damage or death. The information contained in this manual is offered as a guide in making the proper selection of a pressure gauge. Additional information is available from Dresser Instrument Division.

The following is a highlight of some of the more important considerations:

1.1 Range – The range of the instrument should be approximately twice the maximum operating pressure. Too low a range may result in (a) low fatigue life of the elastic element due to high operating stress and (b) susceptibility to overpressure set due to pressure transients that exceed the normal operating pressure. Too high a range may yield insufficient resolution for the application.

1.2 Temperature – Refer to page 2 of this manual for important information concerning temperature related limitations of pressure gauges, both dry and liquid filled.

1.3 Media – The material of the process sensing element must be compatible with the process media. Consult the Corrosion Guide available on the website: **www.dresserinstruments.com** or Dresser Instrument Division. Use of a diaphragm seal with the gauge is recommended for process media that (a) are corrosive to the process sensing element; (b) contain heavy particulates (slurries) or (c) are very viscous including those that harden at room temperature.

1.4 Oxidizing media – Gauges for direct use on oxidizing media should be specially cleaned. Gauges for oxygen service should be ordered to variation X6B and will carry the ASME required dial marking "USE NO OIL" in red letters. Gauges for direct use on other oxidizing media may be ordered to variation X6W. They will be cleaned but carry no dial marking. Plus!® gauges or Halocarbon filled gauge or diaphragm fill is required for use with oxidizing media; order variation XCF. See page 4 of the text of the Ashcroft Corrosion Guide mentioned in paragraph 1.4 above for more information.

1.5 Pulsation/Vibration – Pressure pulsation can be dampened by several mechanisms; the patented *PLUS! Performance* gauge will handle the vast majority of applications. One exception to this is high frequency pulsation which is difficult to detect. The only indication may be an upscale zero shift due to movement wear. These applications should be addressed with a liquid filled gauge, or in extreme cases, a remotely mounted liquid filled gauge connected with a length of capillary line. The small diameter of the capillary provides excellent dampening, but can be plugged. The Ashcroft 1106 pulsation dampener and 112 snubber are auxiliary devices which dampen pulsation with less tendency to plug.

1.6 Gauge fills. – Once it has been determined that a liquid filled gauge is in order, the next step is selecting the type of fill. **Glycerin** satisfies most applications. While being the least expensive fill, its usable temperature range is 20/250°F. **Silicone** filled gauges have a broader service range: –40/250°F. Oxidizing media require the use of **Halocarbon,** with a service range of –50/250°F. Pointer motion will be slowed at the low end of the low end of these temperature ranges.

1.7 Mounting – Users should predetermine how the gauge will be mounted in service: stem (pipe), wall (surface) or panel (flush). Ashcroft wall or panel mounting kits should be ordered with the gauge. See paragraph 3 Installation.

2.0 TEMPERATURE

2.1 Ambient Temperature – To ensure long life and accuracy, pressure gauges should preferably be used at an ambient temperature between –20 and +150F (–30 to +65C). At very low temperatures, standard gauges may exhibit slow pointer response. Above 150F, the accuracy will be affected by approximately 1.5% per 100F. Other than discoloration of the dial and hardening of the gasketing, non-liquid filled type 1279 (phenolic case) and 1379 (aluminum case) Duragauges, with standard glass windows, and Duralife gauges types 1008 and 1009, can withstand continuous operating temperatures up to 250F. Liquid filled gauges can withstand 200F but glycerin fill and the acrylic window of Duragauges will tend to yellow. Silicone fill will have much less tendency to yellow. Low pressure, liquid filled types 1008 and 1009 gauges may have some downscale errors caused by liquid fill expansion. This can be alleviated by "burping" the gauge by gently pushing the top fill plug to one side to admit air to the case.

Although the gauge may be destroyed and calibration lost, gauges can withstand short times at the following temperatures: gauges with all welded pressure boundary joints, 750F (400C); gauges with silver brazed joints, 450F (232C) and gauges with soft soldered joints, 250F (121C). For expected long term service below –20F (–30C) Duragauges and 4½″ 1009 gauges should be hermetically sealed and specially lubricated; add "H" to the product code for hermetic sealing. Add variation XVY for special lubricant. Standard Duralife gauges may be used to –50F (–45C) without modification.

2.2 Accuracy – Heat and cold affect accuracy of indication. A general rule of thumb for **dry gauges** is 0.5% of full scale change for every 40°F change from 75°F. Double that allowance for gauges with hermetically sealed or liquid filled cases, except for Duragauge® gauges where no extra allowance is required due to the elastomeric, compensating back. Above 250°F there may exist very significant errors in indication.

2.3 Steam service – In order to prevent live steam from entering the bourdon tube, a siphon filled with water should be installed between the gauge and the process line. Siphons can be supplied with ratings up to 4,000 psi. If freezing of the condensate in the loop of the siphon is a possibility, a diaphragm seal should be used to isolate the gauge from the process steam. Siphons should also be used whenever condensing, hot vapors (not just steam) are present. Super heated steam should have enough piping or capillary line ahead of the siphon to maintain liquid water in the siphon loop.

2.4 Hot or very cold media – A five foot capillary line assembly will bring most hot or cold process media within the recommended gauge ambient temperature range. For media above 750F (400C) the customer should use his own small diameter piping to avoid possible corrosion of the stainless steel. The five foot capillary will protect the gauges used on the common cryogenic (less than –300F (200C) gases, liquid argon, nitrogen, and oxygen. The capillary and gauge must be cleaned for oxygen service. The media must not be corrosive to stainless steel, and must not plug the small bore of the capillary.

2.5 Diaphragm seals – As mentioned above, a diaphragm seal should be used to protect gauges from corrosive media, or media that will plug the instrument. Diaphragm seals are offered in a wide variety of designs and corrosion resistant materials to accommodate almost any application and most connections. Request bulletin OH-1 for details. Recommended materials for corrosive service may be found in the Corrosion Guide available at **www.dresserinstruments.com**.

2.6 Autoclaving – Sanitary gauges with

clamp type connections are frequently steam sterilized in an autoclave. Gauges equipped with polysulfone windows will withstand more autoclave cycles than those equipped with polycarbonate windows. Gauges equipped with plain glass or laminated safety glass **should not be autoclaved.** Gauge cases should be vented to atmosphere (removing the rubber fill/safety plug if necessary) **before** autoclaving to prevent the plastic window from cracking or excessively distorting. If the gauge is liquid filled, the fill should also be drained from the case and the front ring loosened before autoclaving.

3.0 INSTALLATION

3.1 Location – Whenever possible, gauges should be located to minimize the effects of vibration, extreme ambient temperatures and moisture. Dry locations away from very high thermal sources (ovens, boilers etc.) are preferred. If the mechanical vibration level is extreme, the gauge should be remotely located (usually on a wall) and connected to the pressure source via flexible tubing.

3.2 Gauge reuse – ASME B40.1 recommends that gauges not be moved indiscriminately from one application to another. The cumulative number of pressure cycles on an in-service or previously used gauge is generally unknown, so it is generally safer to install a new gauge whenever and wherever possible. This will also minimize the possibility of a reaction with previous media.

3.3 Tightening of gauge – Torque should never be applied to the gauge case. Instead, an open end or adjustable wrench should always be used on the wrench flats of the gauge socket to tighten the gauge into the fitting or pipe. NPT threads require the use of a suitable thread sealant, such as pipe dope or teflon tape, and must be tightened very securely to ensure a leak tight seal.

CAUTION: Torque applied to a diaphragm seal or its attached gauge, that tends to loosen one relative to the other, can cause loss of fill and subsequent inaccurate readings. Always apply torque **only** to the wrench flats on the lower seal housing when installing filled, diaphragm seal assemblies or removing same from process lines.

3.4 Process isolation – A shut-off valve should be installed between the gauge and the process in order to be able to isolate the gauge for inspection or replacement without shutting down the process.

3.5 Surface mounting – Also known as wall mounting. Gauges should be kept free of piping strains. The gauge case mounting feet, if applicable, will ensure clearance between the pressure relieving back and the mounting surface.

3.6 Flush mounting – Also known as panel mounting. The applicable panel mounting cutout dimensions can be found in Ashcroft sales bulletins – see item 9.4 RESOURCES on page 14 of this manual. These dimensions are also on Ashcroft® gauge general dimension drawings which can be obtained from the Customer Service department in Stratford, Connecticut.

4.0 OPERATION

4.1 Frequency of inspection – This is quite subjective and depends upon the severity of the service and how critical the accuracy of the indicated pressure is. For example, a monthly inspection frequency may be in order for critical, severe service applications. Annual inspections, or even less frequent schedules, are often employed in non-critical applications.

4.2 In-service inspection – If the accuracy of the gauge cannot be checked in place, the user can at least look for (a) erratic or random pointer motion; (b) readings that are suspect – especially indications of pressure when the user believes the true pressure is 0 psig. Any gauge which is obviously not working or indicating erroneously, should be immediately valved-off or removed from service to avoid a possible pressure boundary failure.

4.3 When to check accuracy – Obviously any suspicious behavior of the gauge pointer warrants a full accuracy check be performed. Even if the gauge is not showing any symptoms of abnormal performance, the user may want to establish a frequency of bench type inspection.

4.4 When to recalibrate – This depends on the criticality of the application. If the accuracy of a 3-2-3% commercial type gauge is only 0.5% beyond specification, the user must decide whether it's worth the time and expense to bring the gauge back into specification. Conversely if the accuracy of a 0.25% test gauge is found to be 0.1% out of specification then obviously the gauge should be recalibrated.

4.5 Other considerations – These include (a) bent or unattached pointers due to extreme pressure pulsation; (b) broken windows which should be replaced to keep dirt out of the internals; (c) leakage of gauge fill; (d) case damage – dents and/or cracks; (e) any signs of service media leakage through the gauge including its connection; (f) discoloration of gauge fill that impedes readability.

4.6 Spare parts – As a general rule it is recommended that the user maintain in his parts inventory one complete Ashcroft instrument for every ten (or fraction thereof) of that instrument type in service.

5.0 GAUGE REPLACEMENT

It is recommended that the user stock one complete Ashcroft instrument for every ten (or fraction thereof) of that instrument type in service. With regard to gauges having a service history, consideration should be given to discarding rather than repairing them. Gauges in this category include the following:

a. Gauges that exhibit a span shift greater than 10%. It is possible the bourdon tube has suffered thinning of its walls by corrosion.

b. Gauges that exhibit a zero shift greater than 25%. It is likely the bourdon tube has seen significant overpressure leaving residual stresses that may be detrimental to the application.

c. Gauges which have accumulated over 1,000,000 pressure cycles with significant pointer excursion.

d. Gauges showing any signs of corrosion and/or leakage of the pressure system.

e. Gauges which have been exposed to high temperature or simply exhibit signs of having been exposed to high temperature – specifically 250°F or greater for soft soldered systems; 450°F or greater for brazed systems; and 750°F or greater for welded systems.

f. Gauges showing significant friction error and/or wear of the movement and linkage.

g. Gauges having damaged sockets, especially damaged threads.

h. Liquid filled gauges showing loss of case fill.

NOTE: ASME B40.1 does not recommend moving gauges from one application to another. This policy is prudent in that it encourages the user to procure a new gauge, properly tailored by specification, to each application that arises.

6.0 ACCURACY: PROCEDURES/DEFINITIONS

Accuracy inspection – Readings at approximately five points equally spaced over the dial should be taken, both upscale and downscale, before and after lightly rapping the gauge to remove friction. A pressure standard with accuracy at least 4 times greater than the accuracy of the gauge being tested is recommended.

Equipment – A finely regulated pressure supply will be required. It is critical that the piping system associated with the test setup be leaktight. The gauge under test should be

positioned as it will be in service to eliminate positional errors due to gravity.

Method – ASME B40.1 recommends that **known** pressure (based on the reading from the pressure standard used) be applied to the gauge under test. Readings including any error from the nominal input pressure, are then taken from the gauge under test. The practice of aligning the pointer of the gauge under test with a dial graduation and then reading the error from the master gauge ("reverse reading") can result in inconsistent and misleading data and should NOT be used.

Calibration chart – After recording all of the readings it is necessary to calculate the errors associated with each test point using the following formula: ERROR in percent = 100 times (TRUE VALUE minus READING) ÷ RANGE. Plotting the individual errors (Figure 1 on page 6) makes it possible to visualize the total gauge characteristic. The plot should contain all four curves: upscale – before rap; upscale – after rap; downscale – before rap; downscale – after rap. *Rap* means lightly tapping the gauge **before** reading to remove friction as described in ASME B40.1.

Referring to Figure 1 on page 6, several classes of error may be seen:

Zero – An error which is approximately equal over the entire scale. This error can be manifested when either the gauge is dropped or overpressured and the bourdon tube takes a permanent set. This error may often be corrected by simply repositioning the pointer. Except for test gauges, it is recommended that the pointer be set at midscale pressure to "split" the errors.

Span – A span error exists when the error at full scale pressure is different from the error at zero pressure. This error is often proportional to the applied pressure. Most Ashcroft gauges are equipped with an internal, adjusting mechanism with which the user can correct any span errors which have developed in service.

Linearity – A gauge that has been properly spanned can still be out of specification at intermediate points if the response of the gauge as seen in Figure 1 on page 6 is not linear. The Ashcroft Duragauge® is equipped with a rotary movement feature which permits the user to minimize this class of error. Other Ashcroft gauge designs (e.g., 1009 Duralife®) require that the dial be moved left or right prior to tightening the dial screws.

Hysteresis – Some bourdon tubes have a material property known as hysteresis. This material characteristic results in differences between the upscale and downscale curves. This class of error can **not** be eliminated by adjusting the gauge movement or dial position.

Friction – This error is defined as the difference in readings before and after lightly tapping the gauge case at a check point. Possible causes of friction are burrs or foreign material in the movement gearing, "bound" linkages between the movement and the bourdon tube, or an improperly tensioned hairspring. If correcting these potential causes of friction does not eliminate excessive friction error, the movement should be replaced.

(Continued on page 7)

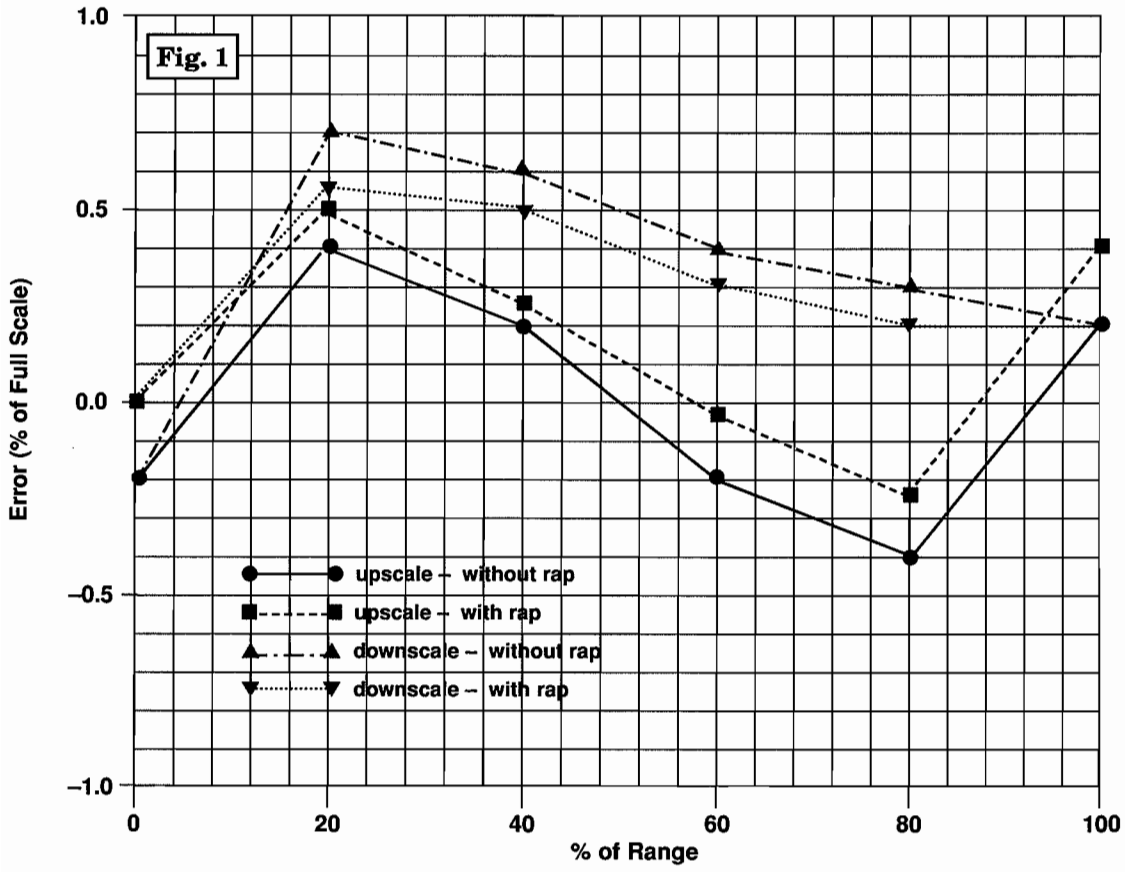
TYPICAL CALIBRATION CHART

INDICATED VALUE (PSI)

True Value – PSI	Increasing – Without RAP	Increasing – With RAP	Decreasing – Without RAP	Decreasing – With RAP
0	–.4	0	–.4	0
40	+.8	+1.0	+1.4	+1.1
80	+.4	+.5	+1.2	+1.0
120	–.4	–1.0	+.8	+.6
160	–.8	–.5	+.6	+.4
200	+.4	+.8	+.4	+.4

ERROR (% OF FULL SCALE)

True Value – % of Range	Increasing – Without RAP	Increasing – With RAP	Decreasing – Without RAP	Decreasing – With RAP
0	–.20	0	–.20	0
20	+.40	+.50	+.70	+.55
40	+.20	+.25	+.60	+.50
60	–.20	–.05	+.40	+.30
80	–.40	–.25	+.30	+.20
100	+.20	+.40	+.20	+.20



6.1 Calibration – Rotary Movement Gauges – Inspect gauge for accuracy. Many times gauges are simply "off zero" and a simple pointer adjustment using the micrometer pointer is adequate. If inspection shows the gauge warrants recalibration to correct span and/or linearity errors, proceed as follows:

a. Remove ring, window and, if solid front case, the rear closure assembly.

b. Pressurize the gauge **once** to full scale and back to zero.

c. Refer to Figure 2 on page 8 for a view of a typical Ashcroft system assembly with component parts identified.

d. For solid front gauges, adjust the micrometer pointer so that it rests at the true zero position. For open front gauges the pointer and dial must also be disassembled and the pointer should then be lightly pressed onto the pinion at the 9:00 o'clock position.

e. Apply full scale pressure and note the magnitude of the span error. With open front gauges, ideal span (270 degrees) will exist when at full scale pressure the pointer rests exactly at the 6:00 o'clock position.

f. If the span has shifted significantly (span error greater than 10%), the gauge should be replaced because there may be some partial corrosion inside the bourdon tube which could lead to ultimate failure. If the span error exceeds 0.25%, loosen the lower link screw and move the lower end of the link toward the movement to increase span or away to decrease span. An adjustment of 0.004 inch will change the span by approximately 1%. This is a repetitive procedure which often requires more than one adjustment of the link position and the subsequent rechecking of the errors at zero and full scale pressure.

g. Apply midscale pressure and note error in reading. Even though the gauge is accurate at zero and full scale, it may be inaccurate at the midpoint. This is called linearity error and is minimized by rotating the movement. If the error is positive, the movement should be rotated counter clockwise. Rotating the movement one degree will change this error by approximately 0.25%. Rotating the movement often affects span and it should be subsequently rechecked and readjusted if necessary according to step 6.1e and 6.1f.

h. While recalibrating the gauge, the friction error – difference in readings taken with and without rap – should be noted. This error should not exceed the basic accuracy of the gauge. If the friction error is excessive, the movement should be replaced. One possible cause of excessive friction is improper adjustment of the hairspring. The hairspring torque,or tension, must be adequate without being excessive. The hairspring should also be level, unwind evenly (no turns rubbing) and it should never tangle.

NOTES:

1 For operation of test gauge external zero reset, refer to Figure 3 on page 8.

2 For test gauge calibration procedure, refer to Figure 4 on page 9.

6.2 Calibration – 1009 Duralife® Gauge – Inspect gauge for accuracy. Many times gauges are simply "off zero" and a simple pointer adjustment using the adjustable pointer is adequate. If the inspection shows that the gauge warrants recalibration to correct span and/or linearity errors, proceed as follows:

Remove ring, window, gasket and pointer using Ashcroft tool kits 1205T and 1206T.

6.3 Positive Pressure Ranges –

a. Remove dial and lightly press pointer onto pinion at 9:00 o'clock position.

b. Apply full scale pressure and rotate span block as shown in Figure 5a on page 11 until pointer rests at 6:00 o'clock position.

c. Fully exhaust pressure and check that pointer still is at 9:00 o'clock position. If not repeat steps 1 and 2 until span is correct.

(Continued on page 10)

Fig. 2 **ASHCROFT SYSTEM ASSEMBLY**

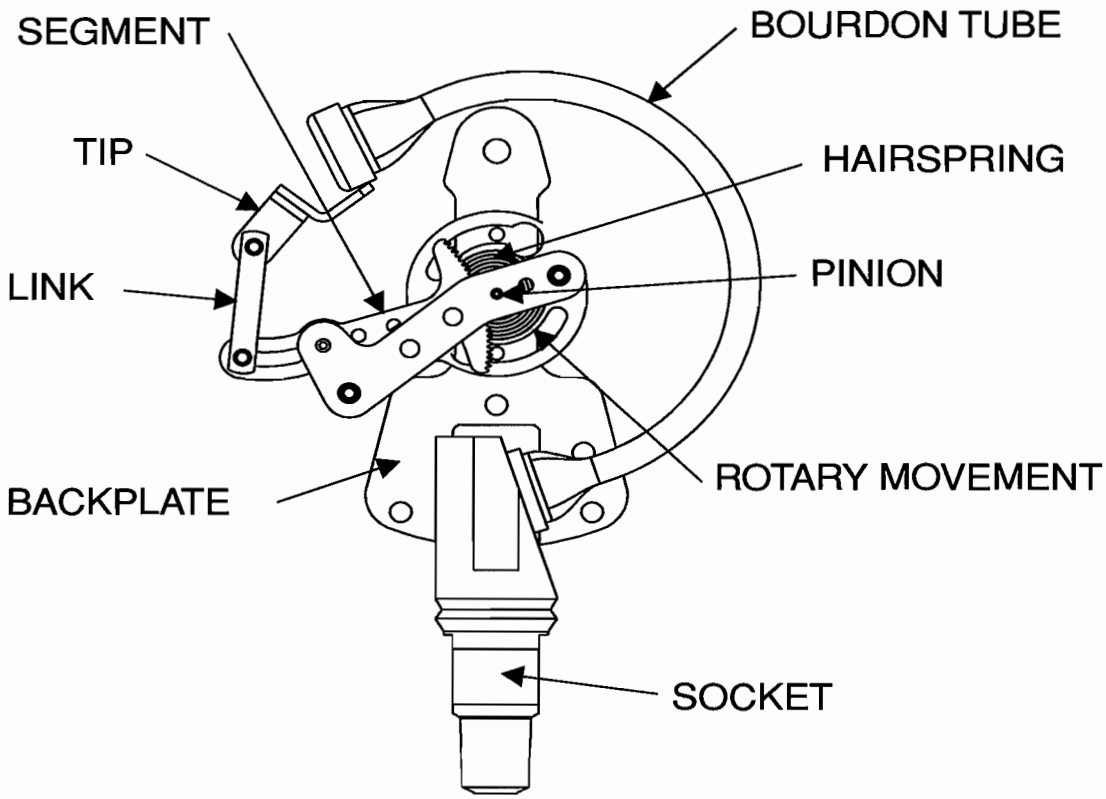
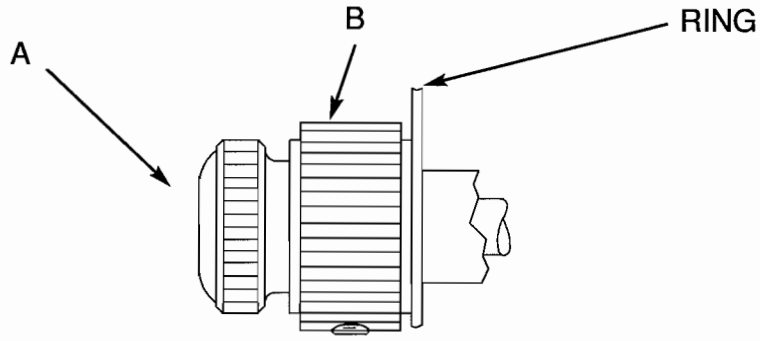


Fig. 3 **TYPE 1082 EXTERNAL ZERO ADJUST FEATURE***



INSTRUCTIONS FOR USE:

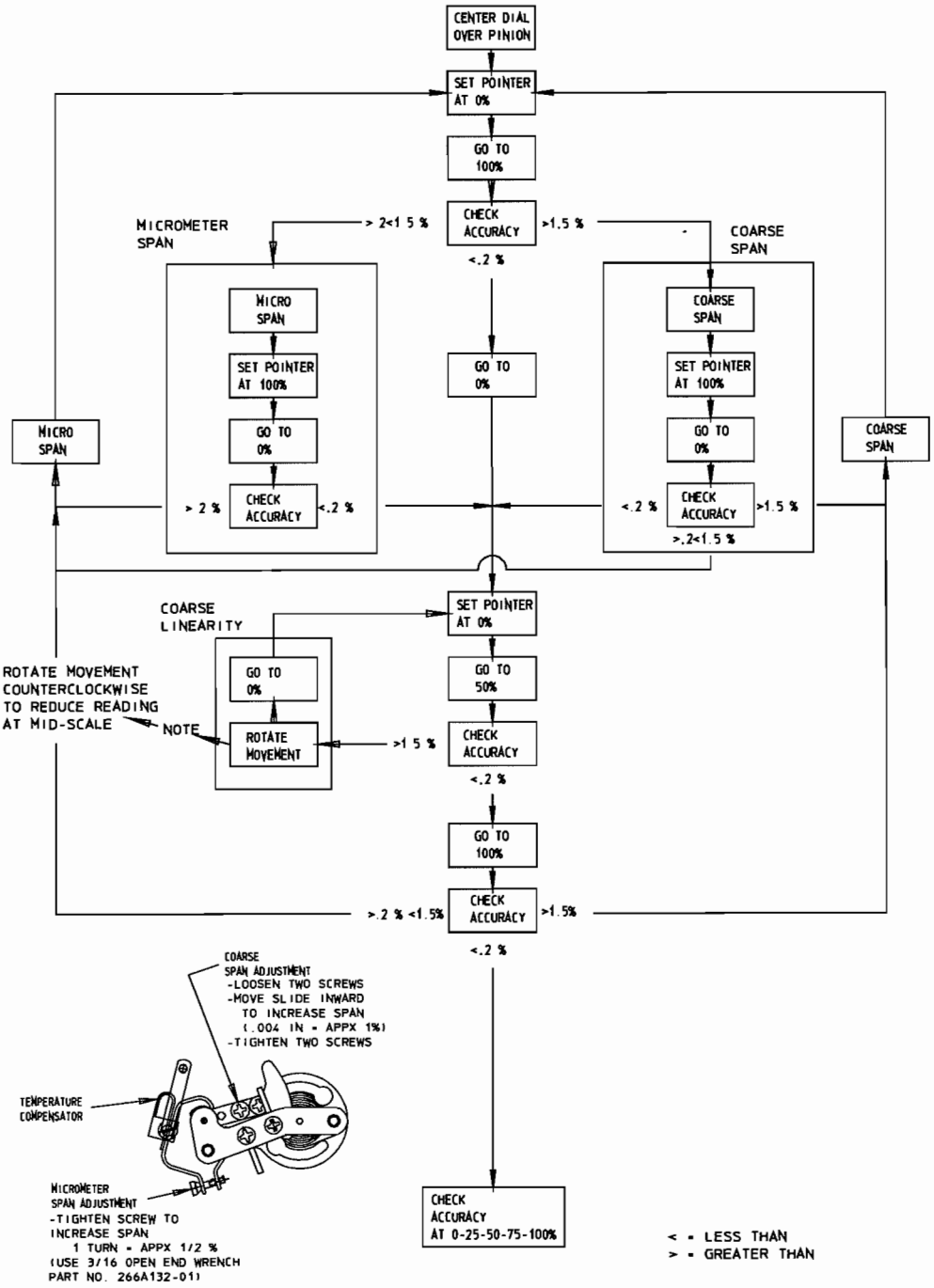
LOOSEN RING LOCKING **SCREW "A"**
OBTAIN REQUIRED ADJUSTMENT BY ROTATING
KNOB "B" CLOCKWISE OR COUNTER-CLOCKWISE.
TIGHTEN **SCREW "A"** DOWN ON **KNOB "B."**

*Applicable only for test gauge with hinged ring design.

Fig. 4

TYPE 1082 TEST GAUGE CALIBRATION PROCEDURE

THIS TEST GAUGE IS PROVIDED WITH A MICROMETER SPAN ADJUSTMENT. TO SIMPLIFY CALIBRATION. THE FLOW CHART BELOW OUTLINES THE RECOMMENDED CALIBRATION PROCEDURE.



d. Remove pointer and reassemble dial and dial screws (finger tight).

e. Lightly press pointer onto pinion.

f. Check accuracy at full scale. If error exceeds 1% return to step 1, otherwise proceed.

g. Check accuracy at midscale. If error exceeds 1% slide dial left or right to compensate.

h. Continue at * below.

Vacuum range –

a. Using a pencil, refer to dial and mark the 0 and 25 inch of Hg positions on the case flange.

b. Remove the dial.

c. Apply 25 inches of Hg vacuum.

d. Lightly press pointer onto pinion carefully aligning it with the 25 inch of Hg vacuum mark on case flange.

e. Release vacuum fully.

f. Note agreement of pointer to zero mark on case flange.

g. If span is high or low, turn span block as shown in Figure 5b on page 11.

h. Repeat steps 4 through 8 until span is correct.

i. Remove the pointer.

j. With 25 inches of Hg vacuum applied, reassemble dial, dial screws (finger tight) and pointer.

k. Apply 15 inches of Hg vacuum and note accuracy of indication. If required, slide dial left or right to reduce error to 1% maximum.

l. Continue at * below.

*Now complete calibration of the gauge as follows:

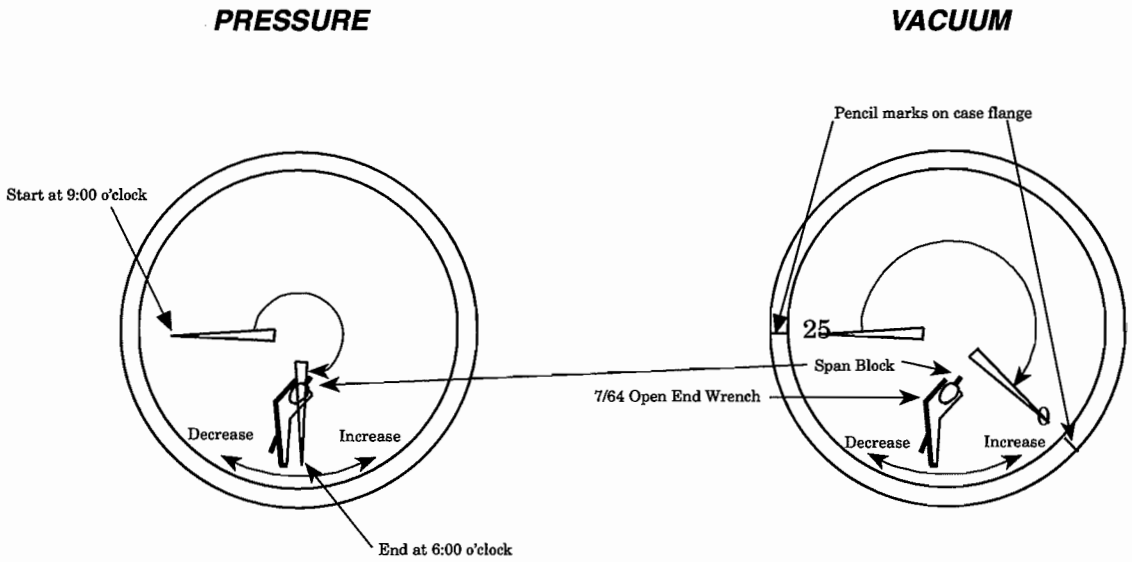
a. Firmly tighten dial screws.

b. Firmly tap pointer onto pinion, using brass back-up tool from Ashcroft kit 1205T if gauge has rear blow-out plug. If gauge has top fill hole no back-up is required.

c. Recheck accuracy at zero, midscale and full scale points (Figures 5a & 5b on page 11).

d. Reassemble window, gasket and ring.

1009 DURALIFE® PRESSURE GAUGE CALIBRATION



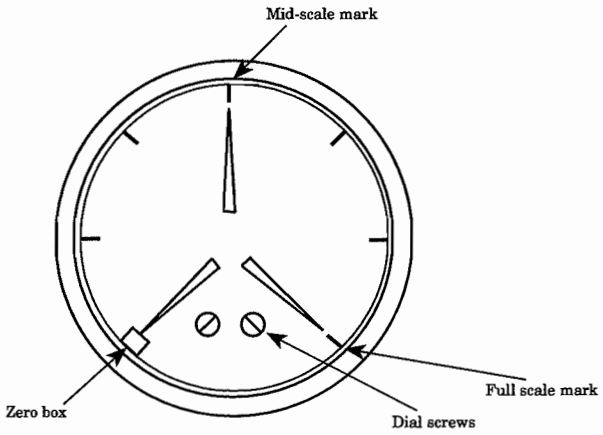


Fig. 5a

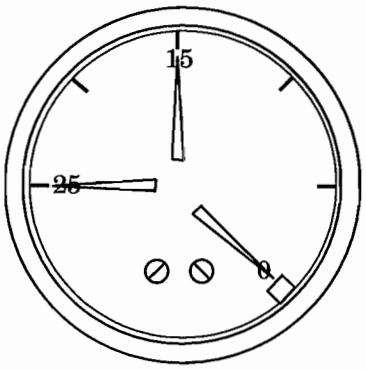


Fig. 5b

7.0 DIAPHRAGM SEALS

7.1 General – A diaphragm seal (isolator) is a device which is attached to the inlet connection of a pressure instrument to isolate its measuring element from the process media. The space between the diaphragm and the instrument's pressure sensing element is solidly filled with a suitable liquid. Displacement of the liquid fill in the pressure element, through movement of the diaphragm, transmits process pressure changes directly to a gauge, switch or any other pressure instrument. When diaphragm seals are used with pressure gauges, an additional 0.5% tolerance must be added to the gauge accuracy because of the diaphragm spring rate.

Used in a variety of process applications where corrosives, slurries or viscous fluids may be encountered, the diaphragm seal affords protection to the instrument where:

- The process fluid being measured would normally clog the pressure element.
- Pressure element materials capable of withstanding corrosive effects of certain fluids are not available.
- The process fluid might freeze due to changes in ambient temperature and damage the element.

7.2 Installation – Refer to sales bulletin OH-1 for information regarding (a) seal configurations; (b) filling fluids; (c) temperature range of filling fluids; (d) diaphragm material pressure and temperature limits; (e) bottom housing material pressure and temperature limits; (f) pressure rating of seal assembly; (g) accuracy/temperature errors of seal assembly; (h) diaphragm seal displacement. The volumetric displacement of the diaphragm must at least equal the volumetric displacement of the measuring element in the pressure instrument to which the seal is to be attached.

It is imperative that the pressure instrument/diaphragm seal assembly be **properly** filled prior to being placed in service. Ashcroft diaphragm seal assemblies should only be filled by a seal assembler certified by Dresser Industries. Refer to section 3.3 for a cautionary note about not applying torque on either the instrument or seal relative to the other.

7.3 Operation – All Ashcroft diaphragm seals, with the exception of Type 310 mini-seals, are continuous duty. Should the pressure instrument fail, or be removed accidentally or deliberately, the diaphragm will seat against a matching surface preventing damage to the diaphragm or leakage of the process fluid.

7.4 Maintenance – Clamp type diaphragm seals – Types 100, 200 and 300 – allow for replacement of the diaphragm or diaphragm capsule, if that ever becomes necessary. The Type 200 top housing must also be replaced with the diaphragm. With all three types the clamping arrangement allows field disassembly to permit cleaning of the seal interior.

7.5 Failures – Diaphragm failures are generally caused by either corrosion, high temperatures or fill leakage. Process media build-up on the process side of the diaphragm can also require seal cleaning or replacement. Consult Customer Service, Stratford CT for advice on seal failures and/or replacement. Refer also to Product Information page ASH/PI-14C containing drawing 96A121 *Corrosion Data Guide.*

WARNING: All seal components should be selected considering process and ambient operating conditions to prevent misapplication. Improper application could result in failure, possible personal injury, property damage or death.

8.0 DAMPENING DEVICES

8.1 General – Some type of dampening device should be used whenever the pressure gauge may be exposed to repetitive pressure fluctuations that are fairly rapid, high in magnitude and especially when transitory pressure spikes exceeding the gauge range are present (as with starting and stopping action of

valves and pumps). A restricted orifice of some kind is employed through which pressure fluctuations must pass before they reach the bourdon tube. The dampener reduces the magnitude of the pressure pulse thus extending the life of the bourdon tube and movement. This reduction of the pressure pulsation as "seen" by the pressure gauge is generally evidenced by a reduction in the pointer travel. If the orifice is very small the pointer may indicate the average service pressure, with little or no indication of the time varying component of the process pressure.

Commonly encountered media (e.g. – water and hydraulic oil) often carry impurities which can plug the orifice over time thus rendering the gauge inoperative until the dampener is cleaned or replaced.

Highly viscous media and media that tend to periodically harden (e.g., asphalt) require a diaphragm seal be fitted to the gauge. The seal contains an internal orifice which dampens the pressure fluctuation within the fill fluid.

8.2 Throttle Screws & Plugs – These accessories provide dampening for the least cost. They have the advantage of fitting completely within the gauge socket and come in three types: (a) a screwed-in type which permits easy removal for cleaning or replacement; (b) a pressed in, non-threaded design and (c) a pressed in, threaded design which provides a highly restrictive, helical flow path. Not all styles are available on all gauge types.

8.3 Ashcroft Gauge Saver – Type 1073 Ashcroft Gauge Saver features an elastomeric bulb that fully isolates the process media from the bourdon tube. In addition to providing dampening of pressure pulses, the bourdon tube is protected from plugging and corrosion. The space between the bulb and bourdon tube is completely filled with glycerin. Felt plugs located between the bulb and bourdon tube are first compressed some amount to restrict the flow of glycerin through an orifice and thus provide a degree of dampening. The greater the compression of the felts the greater the degree of dampening.

8.4 Ashcroft Pulsation Dampener – Type 1106 Ashcroft Pulsation Dampener is a moving pin type in which the restricted orifice is the clearance between the pin and any one of five preselected hole diameters. Unlike a simple throttle screw/plug, this device has a self-cleaning action in that the pin moves up and down under the influence of pressure fluctuations.

8.5 Ashcroft Pressure Snubber – The heart of the Type 1112 pressure snubber is a thick porous metal filter disc. The disc is available in four standard porosity grades.

8.6 Campbell Micro-Bean® – Type 1110 Micro-Bean is a precision, stainless steel, needle valve instantly adjustable to changing conditions of flow and viscosity. A very slight taper on the valve stem fits into tapered hole in the body. The degree of dampening is easily adjusted by turning the valve handle. A filter is built into the Micro-Bean to help prevent plugging.

8.7 Ashcroft Needle Valves – Type 7001 thru 7004 steel needle valves provide varying degrees of dampening similar to the Campbell Micro-Bean but with a less precise and less costly adjustability. Like the Micro-Bean these devices, in the event of plugging, can easily be opened to allow the pressure fluid to clear away the obstruction.

8.8 Chemiquip® Pressure Limiting Valves – Model PLV-255, PLV-2550, PLV-5460, PLV-5500 and PLV-6430, available with and without built-in snubbers, automatically "shut off" at adjustable preset values of pressure to protect the gauge from damage to overpressure. They are especially useful on hydraulic systems wherein hydraulic transients (spikes) are common.

9.0 RESOURCES

9.1 Training Videos

9.1.1 Test gauge calibration
9.1.2 1009 Duralife® calibration
9.1.3 Duragauge® calibration
9.1.4 Diaphragm seal filling

9.2 Pressure Instrument Testing Equipment

9.2.1 Type 1305D Deadweight Tester
9.2.2 Type 1327D Pressure Gauge Comparator
9.2.3 Type 1327CM "Precision" Gauge Comparator

9.3 Tools & Tool Kits

9.3.1 Type 2505 universal carrying case for 1082 test gauge
9.3.2 Type 266A132-01 span wrench for 1082 test gauge
9.3.3 Type 1280 conversion kit for 4½" lower connect 1279/1379
9.3.4 Type 1283 conversion kit for 4½" back connect 1279/1379
9.3.5 Type 1284 conversion kit for 6" lower & back connect
9.3.6 Type 1281 socket O-Ring kit for 1279/1379 lower connect
9.3.7 Type 1285 4½" ring wrench for 1279/1379 lower & back connect
9.3.8 Type 1286 6" ring wrench for 1379 lower & back connect
9.3.9 Type 1287 cone tool for installing diaphragm & spring on 1279/1379 back connect
9.3.10 Type 1105T calibration tool kit (all gauges except 1009 Duralife®)
9.3.11 Type 3220 pointer puller (all gauges except 1009 Duralife®)
9.3.12 Type. 3530 pinion back-up tool for 1009 Duralife®
9.3.13 Type 1230 throttle plug insertion (¼ NPT) for 1009 Duralife®
9.3.14 Type 1231 throttle plug insertion (½ NPT) for 1009 Duralife® (body only)
9.3.15 Type 1205T calibration hand tools for 1009 Duralife®
9.3.16 Type 1206T ring removal & assembly tools for 1009 Duralife®

9.4 Sales Bulletins

9.4.1 Pressure Instrument Testing Equipment – Bulletin TE-1
9.4.2 Type 1327CM Portable Precision Gauge Comparator – Bulletin TE-2
9.4.3 Test Gauges – Bulletin TG-2
9.4.4 Duragauge® Pressure Gauges – Bulletin DU-1
9.4.5 General Service Gauges – Bulletin IG-1
9.4.6 Type 1009 Duralife® Industrial Gauges – Bulletin SS-1
9.4.7 Type 1008 Metric Case Gauges – Bulletin SS-1
9.4.8 Duralife® Metric Process Gauges – Bulletin SS-1
9.4.9 Type 1032 Sanitary Pressure Gauges – Bulletin SG-2
9.4.10 Special Service Gauges – Bulletin IG-1
9.4.11 Diaphragm Seals – Bulletin OH-1

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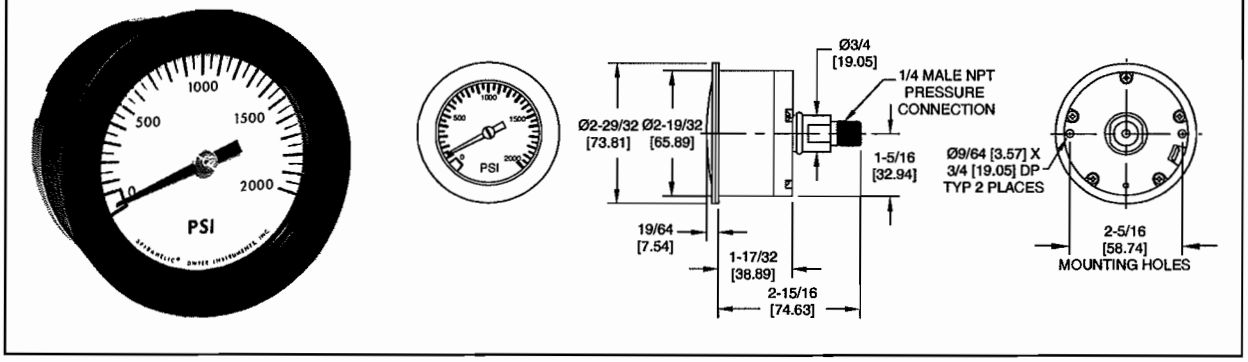
DRESSER
Instruments

Visit our web site www.ashcroft.com

Series 6000 Spirahelic® Pressure Gages

Reliability and accuracy in a 2½" solid-front gage



Series 6000 Spirahelic® high pressure gages are ideal for applications demanding reliability, operator safety.

POPULAR MODELS

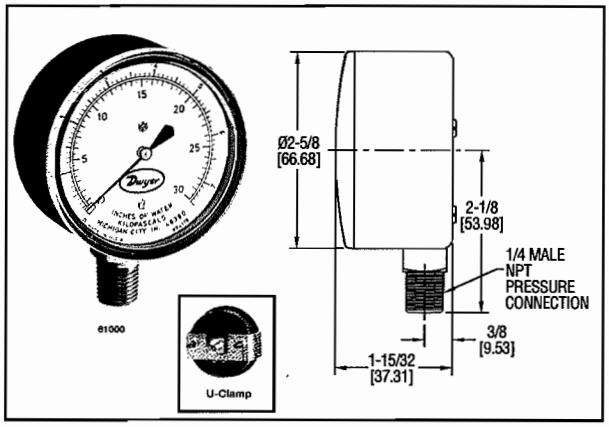
Model Numbers	Range, PSI	Minor Divisions
6010	0-1000	10
6020	0-2000	50
6030	0-3000	100
6060	0-6000	200
6080	0-8000	200

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: Beryllium Copper Bourdon Tube.
Housing: Mineral and glass filled nylon; high impact clear acrylic cover.
Accuracy: Grade A (2%-1%-2%).
Pressure Limit: 150% of full scale. Gage will maintain its specifications for overpressures up to 150% maximum range. Normal operation should be between 25% and 75% of full scale.
Temperature Limits: -65 to 180°F (-53.9 to 82.2°C).
Size: 2-1/2" (63.5 mm) dial face – Design conforms to ASME B40.1.
Process Connections: 1/2" male NPT, back connection.
Weight: 16 oz (453.6 g).
Standard Accessory: One 1/4" male NPT stainless steel plug.

Series 61000 Pressure Gages

Exceptional Value in a 2 ½" Gage



Series 61000 gages feature an extra sensitive bronze diaphragm for ASME Grade A accuracy in ranges to 100 inches w.c. The gage measures pressure of air, natural gas and other compatible gases and liquids.

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Phosphor bronze diaphragm, brass and polycarbonate.
Housing: Steel with black baked enamel finish.
Dial/Pointer: Aluminum.
Accuracy: 61000, ASME Grade A – 1% middle half of scale, 2% remainder: 61015 only – 1% middle half of scale, 3% remainder.
Pressure Limit: 110% FS.
Temperature Limits: -40 to 160°F (-40 to 71°C).
Size: 2-1/2".
Process Connection: 1/4" male NPT bottom-std. 1/4" male NPT back 61000U.
Weight: 6.5 oz. (184g).

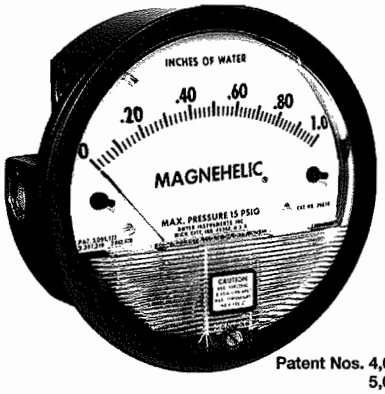
STOCKED MODELS

Model Number	Range IN.W.C.	Range kPa
61015	0-15	0-4
61030	0-30	0-7.5
→ 61060	0-60	0-15
61100	0-100	0-25

Options – Add options as a suffix. **U**-U-clamp (panel mount)

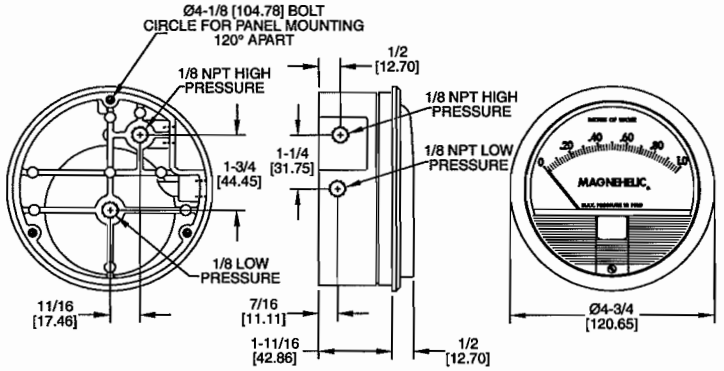
Series 2000 Magnehelic® Differential Pressure Gages

Indicate positive, negative or differential. Accurate within 2%.



Patent Nos. 4,030,365
5,012,678

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.

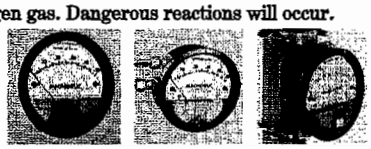


Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer 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® 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. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

NOTE: Do Not use with Hydrogen gas. Dangerous reactions will occur.



Flush ...Surface...or Pipe Mounted

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4⅝" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

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.

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4¹³⁄₁₆" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Weight 1 lb., 10 oz. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

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, Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: +/- 2% of full scale (±3% on - 0 and ±4% on - 00 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 kPa), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
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. (510g), MP & HP 2 Lb. 2 oz. (963g).
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 3 adapters in MP & HP gage accessories.)
*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent overlays

Furnished in red and green to highlight and emphasize critical pressures.

Adjustable signal flag

Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator

Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

Portable units

Combine carrying case with any Magnehelic® gage of standard range,except high pressure connection. Includes 9 ft. (2.7 m) of ⅜" I.D. rubber tubing, standhang bracket and terminal tube with holder.

Air filter gage accessory package

Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of ¼" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Dwyer Instruments, Inc./P.O. Box 373/Michigan City, Indiana 46361/Phone 219 879-8000/Fax 219 872-9057 • U.K. Phone (01494)-461707 • Australia Phone (02) 9756-5355

Quality design and construction features

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.

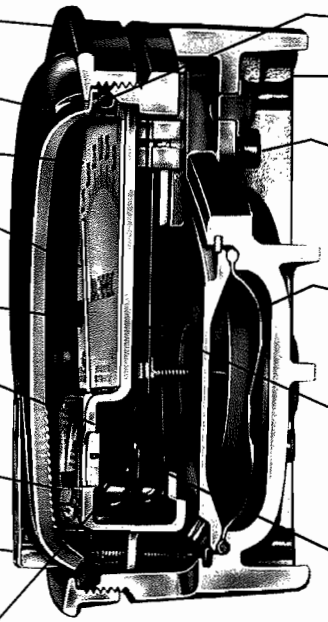
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

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.

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.

Blowout plug of silicone rubber protects against overpressure on 15 PSIG rated models. Opens at approximately 25 PSIG.

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.

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.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

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.

Dual Scale English/Metric Models		
Model Number	**Range, In. W.C.**	**Range, Pa or kPa**
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	0-700 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® — MODELS AND RANGES

STOCKED MODELS in bold

The models below will fulfill most requirements. Page 5 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	**Range Inches of Water**
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
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
2150	0-150

Model Number	**Range Zero Center Inches of Water**
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 Number	**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

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	**Range in W.C.I 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
2010AV	0-10/2000-12500

For use with pitot tube.

Model Number	**Range MM of Water**
2000-6MM†	0-6
2000-10MM	0-10
2000-25MM	0-25
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100

Zero Center Ranges

2300-20MM†	10-0-10

Model Number	**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

†These ranges calibrated for vertical scale position.

Model Number	**Range, Pascals**
2000-60 Pa†	0-60
2000-125 Pa†	0-125
2000-250 Pa	0-250
2000-500 Pa	0-500
2000-750 Pa	0-750

Zero Center Ranges

2300-250 Pa	125-0-125
2300-500 Pa	250-0-250

Model Number	**Range, Kilopascals**
2000-1 kPa	0-1
2000-1.5 kPa	0-1.5
2000-2 kPa	0-2
2000-3 kPa	0-3
2000-4 kPa	0-4
2000-5 kPa	0-5
2000-8 kPa	0-8
2000-10 kPa	0-10
2000-15 kPa	0-15
2000-20 kPa	0-20
2000-25 kPa	0-25
2000-30 kPa	0-30

Zero Center Ranges

2300-1 kPa	.5-0-.5
2300-3 kPa	1.5-0-1.5

Accessories

A-310A, 3-Way Vent Valve.....
A-321, Safety Relief Valve.....
A-432, Portable Kit.....
A-605, Air Filter Kit.....
A-610, Pipe Mount Kit

Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

Options — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator

Special Purpose Ranges

Scale No. 2401	Scale No. 2402
Square Root	Blank Scale
Specify Range	Specify Range

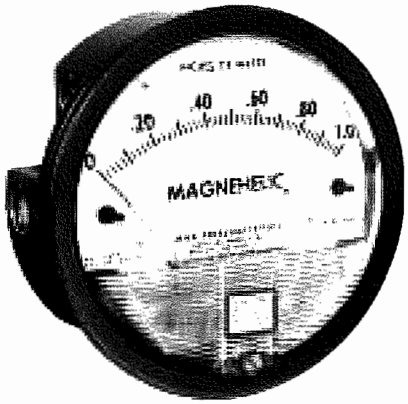
Model 2000-00N. range -.05 to +.20" W.C. For room pressure monitoring

1011R01-0298P

BULLETIN NO. **A-27**

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS



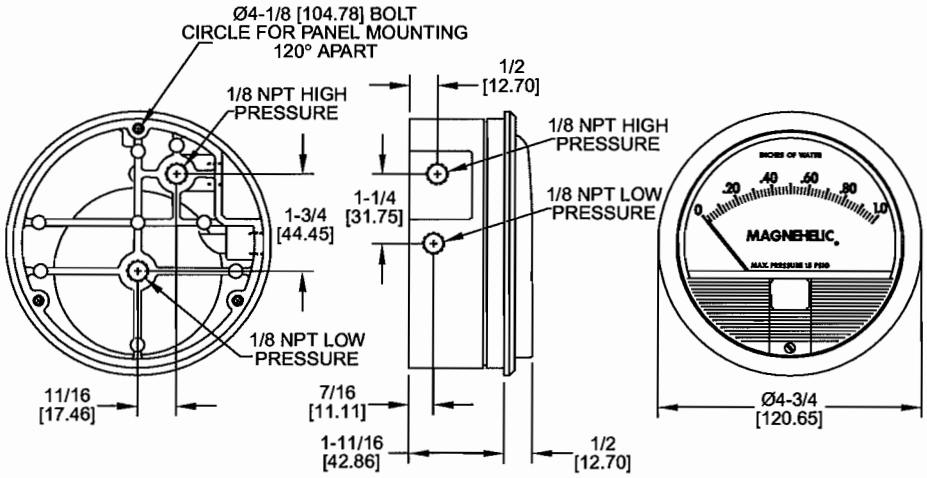
SPECIFICATIONS

Dimensions: 4-3/4″ dia. x 2-3/16″ deep.
Weight: 1 lb. 2 oz.
Finished: Baked dark gray enamel.
Connections: 1/8″ NPT high and low pressure taps, duplicated, one pair side and one pair back.
Accuracy: Plus or minus 2% of full scale, at 70°F. (Model 2000-0, 3%; 2000-00, 4%).
Pressure Rating: 15 PSI (0,35 bar)
Ambient Temperature Range: 20° to 140°F (-7 to 60°C).
Standard gage accessories include two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.

Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.



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Lit-by-Fax: 888/891-4963

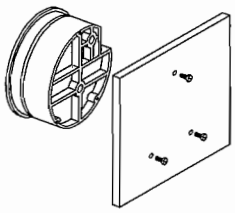
www.dwyer-inst.com
e-mail: info@dwyer-inst.com

MAGNEHELIC® INSTALLATION

1.Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F. Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines my 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.

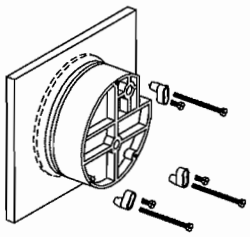
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8″ dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16″ dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4″-2″ pipe, order optional A-610 pipe mounting kit.

5. To zero the 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 rubber or Tygon tubing.

B. For permanent installation, 1/4″ O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

MAINTENANCE

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, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

Warning: Attempted field repair may void your warrenty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.

Attn: Repair Dept.

102 Indiana Highway 212

Michigan City, IN 46360

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, order gage with low temperature, (LT) option.

•Pointer stuck-gage can't be zeroed.

1. Scale touching pointer.
2. Spring/magnet assembly shifted and touching helix.
3. **Metallic particles clinging to magnet and interfering with helix movement.**
4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

Printed in U.S.A. 4/01 FR# 12-440212-00 Rev. 3

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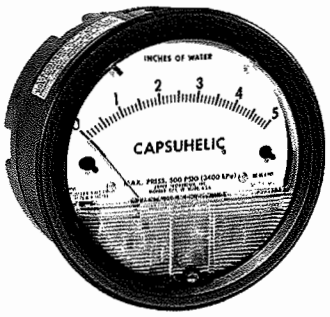
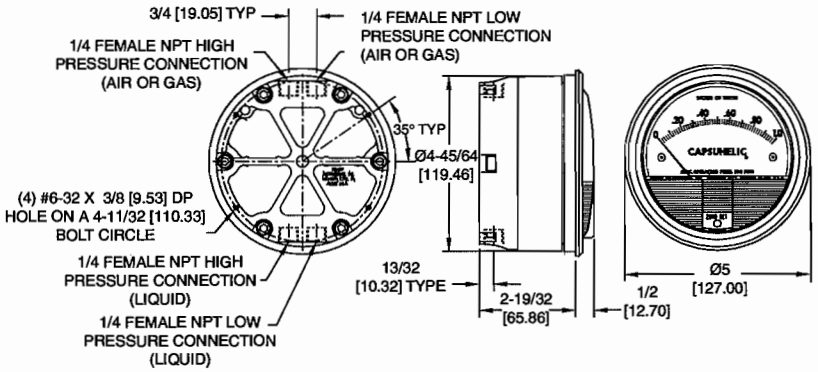
Series 4000 Capsuhelic® Differential Pressure Gages

Measures pressure, vacuum or differential, suitable for internal pressures to 500 psig.



Capsuhelic® Pressure Gage has a large, easy-to-read 4" (102 mm) dial.



Dimensions, Series 4000 Capsuhelic® Pressure Gages.

The Capsuhelic® gage is designed to give fast, accurate indication of differential pressures. The gage may be used as a read-out device when measuring flowing fluids, pressure drop across filters, liquid levels in storage tanks and many other applications involving pressure, vacuum or differential pressure.

Using the basic design of Dwyer's time-proven Magnehelic® gage, the Capsuhelic® contains a simple, frictionless movement that permits full scale readings as low as 0.5 inch water column. The pressure being measured is held within a capsule which is an integral part of the gage. This containment of the pressure permits the use of the gage on system pressures of up to 500 psig, even when differentials to be read are less than 0.1 inch W.C.

The diaphragm-actuated Capsuhelic® gage requires no filling liquid which might limit its outdoor applications. Zero and range adjustments are made from outside the gage, and there is no need to disassemble the gage in normal service. **NOTE: DO NOT use with hydrogen gas. Toxic and/or explosive gas may form due to reaction with rare earth magnet.**

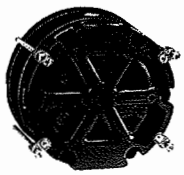
SPECIFICATIONS

Service: Aluminum Case: Air and compatible gases and oil based liquids. Brass Case: Air and compatible gases and water based liquids.
Wetted Materials: Consult Factory.
Housing: Die cast aluminum with impregnated hard coating, standard. Optional forged brass housing is required for water or water based fluids. For corrosive gases or liquids with special diaphragms, contact the factory.
Accuracy: ±3% of full scale at 70°F (21.1°C). (±2% on 4000S models, ±4% on 4200, 4210, 4215, 4220, 4300, 4400, and 4500).
Pressure Limits: -20" Hg to 500 psig. (-0.677 bar to 34.4 bar).
Temperature Limits: 20 to 200°F. (-6.67 to 93.3°C).
Size: 4" (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/4" female NPT high and, low pressure taps, duplicated -one pair top for air and gas, and one pair bottom for liquids.
Weight: 3 lbs., 3 oz. (1.45 kg) aluminum case; 7 lbs., 13 oz. (3.54 kg) brass case.
Standard Accessories: Two 1/4" NPT plugs for duplicate pressure taps, four flush mounting adapters with screws and four surface mounting screws.

MOUNTING

Capsuhelic® gages may be flush mounted in a panel or surface mounted. Hardware is included for either. For flush mounting, a 4 13/16" diameter cutout in panel is required. Where high shock or vibration are problems, order optional A-496 Heavy Duty flush mount bracket. Optional A-610 kit provides simple means of attaching gage to 1¼"-2" horizontal or vertical pipe. Installation is same as Magnehelic® gage shown on page 5. All standard models are calibrated for vertical mounting. Gages with ranges above 5 in. w.c. can be factory calibrated for horizontal or inclined mounting on special order.

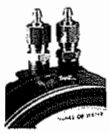
Flush mounted in panel.



Back view shows flush mounting adapters.

Back view for surface mounting.

OPTIONS AND ACCESSORIES



Adjustable signal flag — Integral with plastic gage cover; has external reset screw. May be ordered factory installed on gage or separately for field installation. Specify ASF suffix after model number.

A-314 bleed fitting — For easier, safer purging of trapped air when using gage with liquids. Also useful for draining condensate when installed in lower ports. To open, simply loosen hex nut. Solid brass.

Forged brass case — For applications involving water or water based liquids. To order, add suffix "B" after model number. Example: 4205B.

Transparent scale overlays — Available in bright red or green to accent critical pressure zones. Specify which color and portion of scale to be covered with each.

A-471 portable kit — Includes plastic case, mounting bracket, A-309 3-way manifold valve, (2) A-230 high pressure hoses and all necessary fittings. Assembly required. Gage not included.

Straightforward design assures maintenance-free performance

Top low pressure connection *(for Air or Gas)* connects to chamber in back of diaphragm. High pressure air or gas port (cut away; not shown) connects with chamber in front of diaphragm through passageways in case.

Precision made case is offered in two materials. Standard is die cast aluminum coated inside for resistance to most oils and similar fluids. Optional forged brass case is recommended when using water or water based liquids. One case size for all pressure ranges — can be either surface or flush mounted.

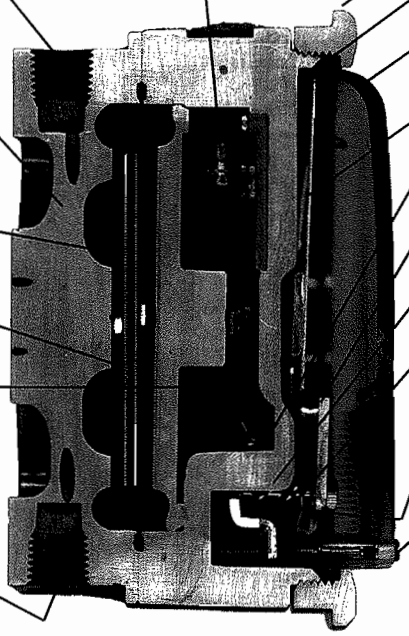
Silicone rubber diaphragm with integrally molded O-ring is sealed between the case and backplate. Diaphragm motion is restricted to prevent damage due to over-pressure.

Diaphragm support plate of stainless steel minimizes position or attitude sensitivity.

Calibrated range spring is a flat leaf of nickel plated spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length factory adjusted for calibration.

Bottom high pressure connection *(for Liquids)* connects to chamber in front of diaphragm. Low pressure liquid connection (not visible) connects with chamber in back of diaphragm through passageways in case.

Range spring calibration is set by custom camlock. Rate adjust and rate adjust lock are coaxial and are factory set and sealed.



Bezel provides flange for flush mounting in panel.

O-ring seal for cover assures dust tight integrity of case.

Clear plastic front cover is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision scale, screen printed on aluminum, is accurate and easy to read.

Samarium cobalt magnet mounted at end of range spring rotates helix without mechanical linkages.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Thin wall magnetic "window" is well braced and of minimum area for maximum pressure capability.

Jeweled bearings for helix are shock resistant mounted. They provide virtually friction-free rotation for helix. Rotation is damped with high viscosity silicone fluid.

Helix is precision milled from an alloy of high magnetic permeability, mounted in jeweled bearings, and rotates to align with magnetic field of magnet and transmit pressure indication to pointer.

Zero adjustment screw is conveniently located in plastic cover, accessible without removing cover. "O" ring seal provides dust seal.

Patent Nos. 4,011,759
4,030,365

SERIES 4000 CAPSUHELIC® — MODELS AND RANGES

Scales reading directly in flow, heights, etc., are also available.

STOCKED MODELS in bold

Model Number	Range, Inches of Water
*4000-0	0-.50
*4001	0-1.0
*4002	0-2.0
*4003	0-3.0
*4004	0-4.0
*4005	0-5.0
4006	0-6.0
4008	0-8.0
4010	0-10
4015	0-15
4020	0-20
4025	0-25
4030	0-30
4040	0-40
4050	0-50
4060	0-60
4080	0-80
4100	0-100
4150	0-150
4200	0-200
4300	0-300
4400	0-400
4500	0-500

Model Number	Range Feet of Water
4616B	0-16
4635B	0-35
Available with brass case only	

Model Number	Range Zero Center Inches of Water
*4302	1-0-1
*4304	2-0-2
4310	5-0-5
4320	10-0-10
4330	15-0-15

Model Number	Range PSI
4201	0-1
4202	0-2
4203	0-3
4204	0-4
4205	0-5
4210	0-10
4215	0-15
4220	0-20
†4230S	0-30
†4240S	0-40
†4260S	0-60
†4280S	0-80
†42100S	0-100
†42200S	0-200
†42300S	0-300

Model Number	Range MM of Water
*4000-25MM	0-25
*4000-50MM	0-50
4000-80MM	0-80
4000-100MM	0-100

Special Purpose Ranges

Scale No. 4401
Square Root
Specify Range

Scale No. 4402
Blank Scale
Specify Range

Model Number	Range, CM of Water
4000-15CM	0-15
4000-20CM	0-20
4000-25CM	0-25
4000-40CM	0-40
4000-50CM	0-50
4000-80CM	0-80
4000-100CM	0-100
4000-150CM	0-150
4000-200CM	0-200
4000-250CM	0-250
4000-300CM	0-300
Zero Center Ranges	
*4300-4CM	2-0-2
4300-10CM	5-0-5
4300-30CM	15-0-15

Model Number	Range, Pascals
*4000-125 Pa	0-125
*4000-250 Pa	0-250
*4000-500 Pa	0-500
4000-750 Pa	0-750
Zero Center Ranges	
*4300-500 Pa	250-0-250

Model Number	Range, Kilopascals
4000-1 kPa	0-1
4000-1.5 kPa	0-1.5
4000-2 kPa	0-2
4000-3 kPa	0-3
4000-4 kPa	0-4
4000-5 kPa	0-5
4000-8 kPa	0-8
4000-10 kPa	0-10
4000-15 kPa	0-15
4000-20 kPa	0-20
4000-25 kPa	0-25
4000-30 kPa	0-30
Zero Center Ranges	
4300-1 kPa	.5-0- .5
4300-3 kPa	1.5-0-1.5

Accessories

A-309 3-way manifold valve.....
A-314 Bleed Fitting .....
A-471 Portable Kit.....
A-496 Flush Mount Bracket .....
A-610 Pipe Mount Kit.....

Options

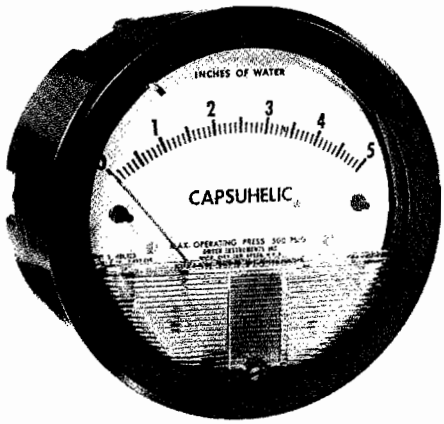
Add Options as Suffix, Example 4001-ASF
-ASF (Adjustable Signal Flag)
B (Brass Case).....
Scale Overlays - Red, Green, Mirrored or combination. Specify Locations .....

*These ranges available for vertical scale position only. †These ranges use Spiralhelic® movement.

BULLETIN NO. A-32

OPERATING INSTRUCTIONS and PARTS LIST

CAPSUHELIC® Differential Pressure Gage



CAUTION: Use of a line filter (Dwyer model A-391 or equivalent) is recommended to prevent entry of liquid borne particles into gage. Dwyer Instruments cannot assume responsibility for failure of gages due to clogging of internal passages.

SPECIFICATIONS

Dimensions: 5" diameter x $3^{3}/_{32}$" length

Weight: 3 lb., 3 oz. (Brass-7 lb., 13 oz.)

Finish: Baked dark gray hammerloid except for optional brass case which is uncoated

Housing: Die cast aluminum with Teflon® impregnated hard coat anodizing, standard or optional forged brass housing, (series 4000B).

Connections: ¼ NPT high and low pressure taps, duplicated — one pair top and one pair bottom

Accuracy: Plus or minus 3% of full scale at 70°F. (2% on 4000S models, 4% on 4215, 4220, and 4500).

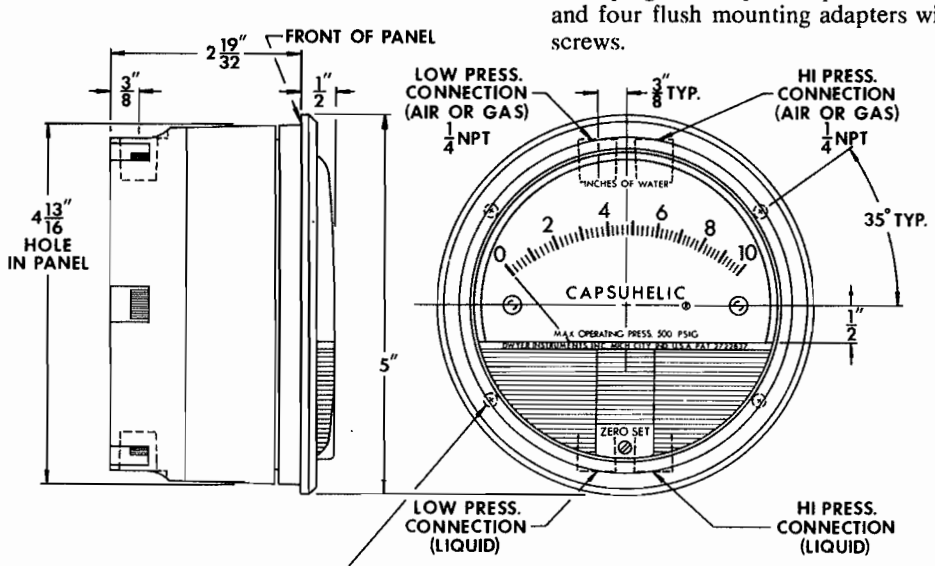
Pressure Rating: – 20" Hg. to 500 psig.

Differential Pressure (Scale) Ranges: ½" W.C. To 100 psi full scale.

Ambient Temperature Range: 20° to 200°F.

Service: Compatible gases or liquids. For water or water based liquids, use only series 4000B models with brass case. DO NOT use with hydrogen gas. Toxic and/or explosive gas may form due to reaction with rare earth magnet.

Standard gage accessories include two ¼" NPT plugs for duplicate pressure taps and four flush mounting adapters with screws.



DWYER INSTRUMENTS, INC.
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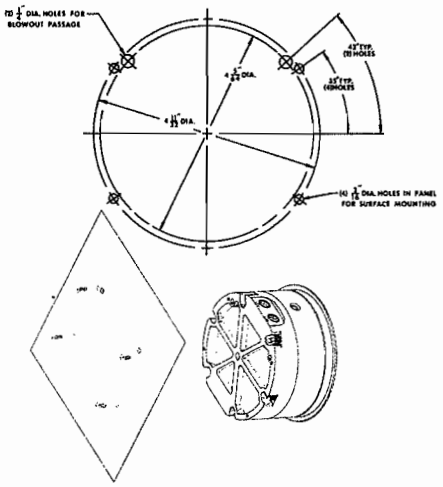
CAPSUHELIC® INSTALLATION

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 200°F. Sensing lines may be run any necessary distance. For example, 250 foot lines will not affect accuracy but will damp the reading slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult factory for means of providing additional damping.

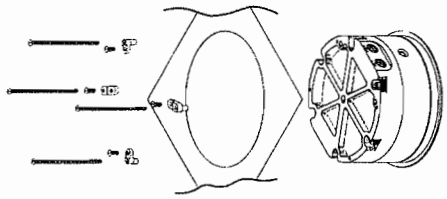
2. All standard models are calibrated for use with the diaphragm and scale in a vertical position. Special factory calibration is necessary for operation in an inclined or horizontal position. The exceptions are ranges under 5 in. w.c., (or metric equivalents) which can only be calibrated for vertical operation.

3. Surface Mounting



Locate 4 mounting holes, 35° from horiz. centerline on a $4^{11}/_{32}$" dia. circle. Use No. 6-32 machine screws of appropriate length.

Be sure to drill ¼" holes for blowout protection as shown in the diagram.



4. Flush Mounting

Provide a $4^{13}/_{16}$" dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with mounting lugs firmly secured in place.

5. To zero the 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.

Caution

Note location of blowout or vent holes in the surface mounting diagram. Do not block these holes as their function is to vent overpressure failure out the back of the gage rather than blowing off the front cover.

Important Notes:

Two pairs of high and low pressure taps are provided, one pair on the top and a duplicate pair on the bottom. These fittings may be utilized according to the type of service for which the gage will be used. For gas or vapor service the gage should be connected from the pressure source to the top pressure fittings so that any accumulation of condensate may be drained or bled out the bottom fittings. For liquid service the pressure source should be connected to the bottom taps so that any trapped gas may be vented out the top fittings. Optional bleed fittings may be obtained to replace the standard ¼ NPT plugs for installations requiring frequent draining or venting of the gage. Note that the unused pair of pressure taps must be plugged in order for the gage to operate. For straight pressure or vacuum applications where only one of a pair of high and low pressure taps are being utilized, the other tap must be open to atmosphere.

For portable use or temporary installation use ¼ male NPT to male flare fitting and connect to pressure source with high pressure hose or tubing with flare nut connectors.

For permanent installation ¼" OD copper or stainless steel tubing is recommended.

Proper installation of fittings and plugs is important. Sparingly apply pipe thread sealant to threads. Excessive amounts can fall into pressure passages and cause blockage. We recommend Loctite® 69-31 Hydraulic Sealant. Install using torque wrench. Tighten only to 20 ft/lbs. Over-tightening can damage case.

CAPSUHELIC® MAINTENANCE

Note: Capsuhelic® differential pressure gages are high precision instruments assembled and calibrated in a modern factory. If trained instrument mechanics are not available, we recommend that any instruments requiring repair be returned to the factory.

1. No lubrication or periodic servicing is required. If the interior is protected from dust, dirt, corrosive gases and fluids, years of trouble free service may be expected.

2. For service requiring a high degree of continued accuracy, periodic calibration checks are recommended, using the following procedure.

   a. As a comparison gage, use a hook gage, micromanometer or inclined gage of known accuracy.

   b. Connect the Capsuhelic® gage and test gage together with two legs from a "T" or "Y" fitting. Connect tubing to the third leg and impose the pressure, slowly.

   c. Be certain no leaks exist in the system and provide adequate time for comparison gages to reach equilibrium, since fluid drainage and different dynamic characteristics can affect the reading.

3. To recalibrate:

   Note: Capsuhelic gages in ranges of 30 PSI and above are not field adjustable and must be returned to the factory if recalibration is required.

   a. Remove ⅛ NPT hex plug located on top of gage exposing coaxial rate adjust/clamp screws.

   b. Insert $^{5}/_{32}$ hex driver and turn hex screw counterclockwise until resistance is felt (approximately four turns).

   c. Adjust rate by turning coaxial slotted screw with a .10 inch diameter jeweler's screwdriver. Clockwise rotation of rate adjust screw will decrease gage rate and counterclockwise rotation will increase the pressure rate.

   d. Reclamp system by turning hex screw clockwise until firm, taking care not to overtighten system.

   e. Replace ⅛ NPT plug to leak tight position.

   f. Check calibration as described in preceding comments.

   g. Repeat a. through f. until desired calibration is reached.

4. Trouble shooting.

   a. Gage sluggish or fails to indicate.

      1. Sensing lines may be plugged or leaking.

      2. Pressure ports plugged by particulate.

      3. Pointer may be touching scale.

      4. Jewels supporting helix over tightened.

   b. Gage fails to indicate zero properly.

      1. See comments above regarding sluggish readings.

      2. Iron particles in strong magnetic field between helix and pressure wall. If found, they may be removed by touching each particle and withdrawing it with a small screwdriver.

      3. Magnet shifted and touching inside of pressure wall.

   c. Apparent inaccuracy.

      1. See preceding comments.

      2. Improper connections to pick up desired pressure differential. For example, static pressure connections also sensing velocity pressure, pitot tube improperly located, etc.

      3. Gage connections leaking.

   d. Consult factory for unusual conditions of temperature, pressure, etc., and the effect on gage operation and accuracy.

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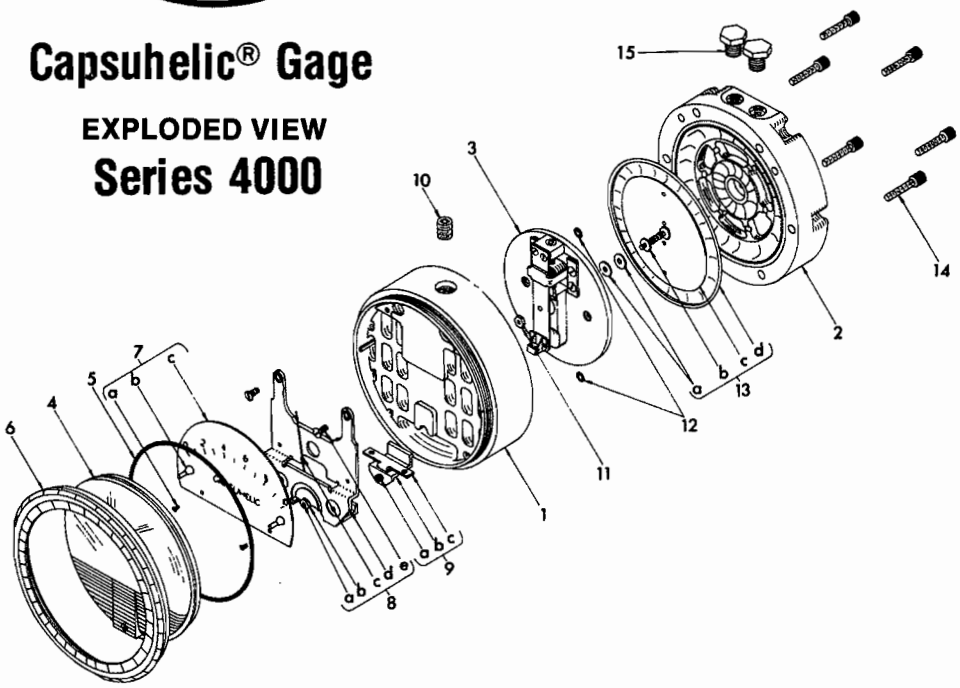
Capsuhelic® Gage

EXPLODED VIEW
Series 4000



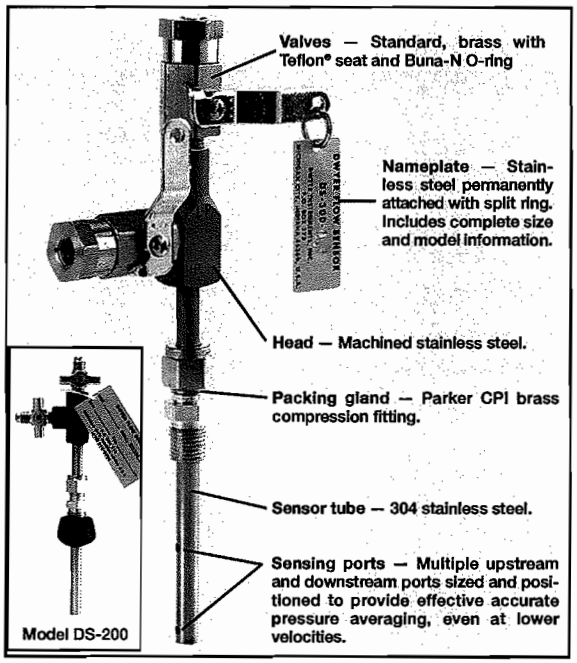
1. Case
2. Back plate
3. Range spring assembly
4. Cover with zero adjust assembly
5. "O" ring seal
6. Bezel
7. Scale assembly — consists of:
   a. Mounting Screws
   b. Bumper pointer stop
   c. Scale
8. Wishbone assembly — consists of:
   a. Front jewel
   b. Locking nut
   c. Pointer
   d. Wishbone
   e. Mounting screws
   f. Helix assembly
   g. Pivots
   h. Rear jewel
9. Zero adjust assembly
   a. Adjust screw
   b. Foot
   c. Bracket
10. Rate adjust plug
11. Connecting link nut
12. "O" ring
13. Diaphragm assembly — consists of:
   a. Washers
   b. Linkage assembly, complete
   c. Front plate
   d. Diaphragm
   e. Back plate (not shown)
14. Case bolts
15. Mounting hardware kit
   a. Pipe plug ¼ NPT
   b. Mounting lug
   c. Long screws
   d. Short screws

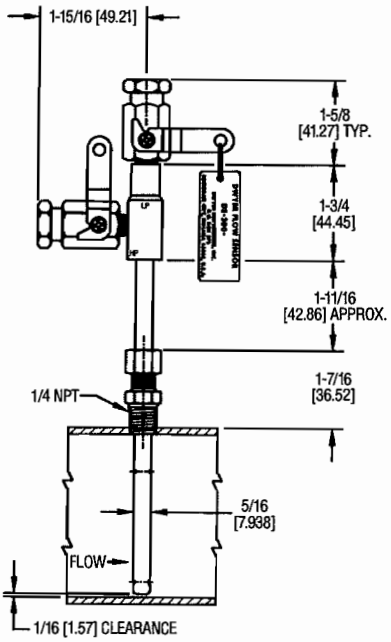
When corresponding with the factory regarding Capsuhelic® gage problems refer to the call out numbers in this view. Be sure to include the model number and range. Field repair is not recommended; contact the factory for repair service.

Note: The exploded view above depicts only Capsuhelic gages with ranges up to 20 PSI. Higher range gages employ a spirally wound Bourdon tube movement.

Series DS In-Line Flow Sensors

Use with the Dwyer Differential Pressure Gages or Transmitters





Dwyer Flow Sensors are averaging pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.

Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

Series DS-200 models are available in ten insertion lengths from 1" - 10". Operation is similar to DS-300 units. Basic differences are the multi-turn shut-off valves, ⅜" NPT mounting and installed ¼" SAE 45° flared pressure connections.

Dwyer Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with ⅛" female NPT connections. Accessories include adapters with ¼" SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic kit. Standard valves are 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. Series DS-300 flow sensors are available for pipe sizes from 1" to 10". If replacing a DS-200 flow sensor or using an A-160 thredolet with a DS-300, an optional ¼" × ⅜" bushing, P/N A-161 is required.

DS-400 Averaging Flow Sensors are quality constructed from extra strong ¾" dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are ⅛" female NPT. A pair of ⅛" NPT × ¼" SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a ¾" dia. compression fitting to lock in required insertion length and a ¾" male NPT thread for mounting in a thred-o-let (not included).

STOCKED MODELS in bold

— Select model with suffix which matches pipe size

DS-200-1"	**DS-300-1"**
DS-200-1¼"	**DS-300-1¼"**
DS-200-1½"	**DS-300-1½"**
DS-200-2"	**DS-300-2"**
DS-200-2½"	**DS-300-2½"**
DS-200-3"	**DS-300-3"**
DS-200-4"	**DS-300-4"**
DS-200-6"	**DS-300-6"**
DS-200-8"	**DS-300-8"**
DS-200-10"	**DS-300-10"**

DS-400-6"
DS-400-8"
DS-400-10"
DS-400-12"
DS-400-14"
DS-400-16"
DS-400-18"
DS-400-20"
DS-400-24"

Options and Accessories

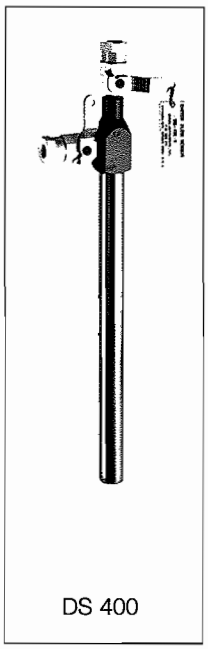
A-160 Thredolet,¾" NPT, forged steel, 3000 psi
A-161 Brass Bushing, ¼" x ⅜"
DS-200-VK Series DS Flow Sensors Valve Kit
Less Valves (DS-300) To order, add suffix -LV

How To Order

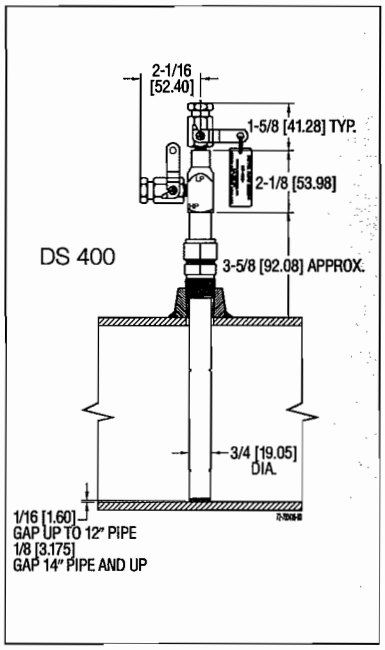
Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2" pipe would be a Model No. DS-300-2".

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.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



DS 400

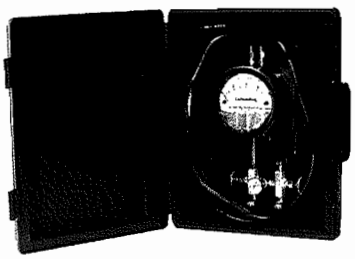


GAGE RANGE (IN. W.C.)	MEDIA @ 70°F	FULL RANGE FLOWS BY PIPE SIZE (APPROXIMATE)									
		1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"	10"
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
	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
	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
	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
	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
	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	
	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
	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		
	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

Model A-471 Portable Kit

The Dwyer Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 PSIG even when the flow sensor differential pressure to be read is less than 0.5" w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32°F to 200°F. Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1¼" - 2" horizontal or vertical pipe.

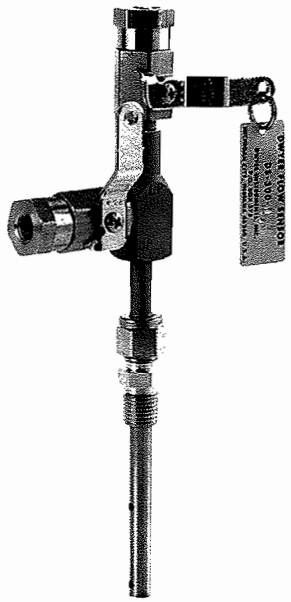
For portable operation, the A-471 Capsuhelic Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings. See pages 7 and 8 for complete information on the Capsuhelic gage . . . . .

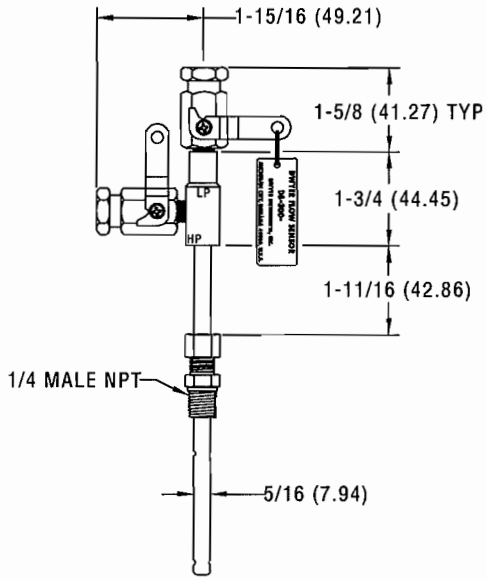


CAPSUHELIC GAGE SHOWN INSTALLED IN A-471 PORTABLE KIT

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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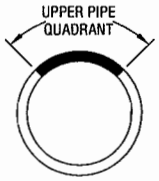
POSITION

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

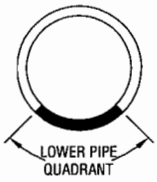
Install in upper quadrant of pipe



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

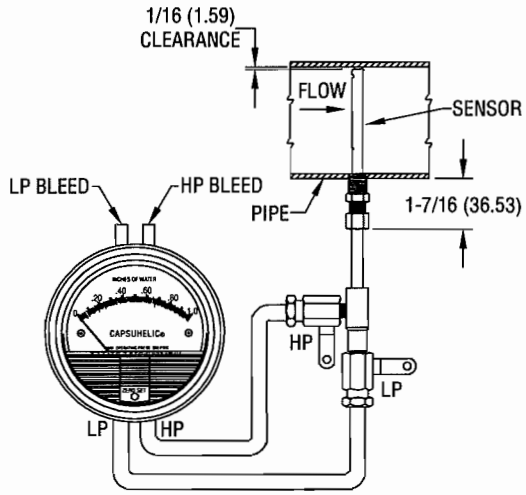
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

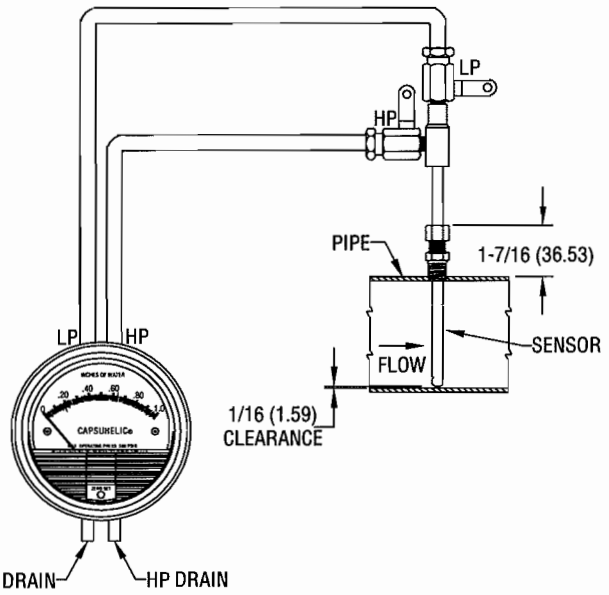
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

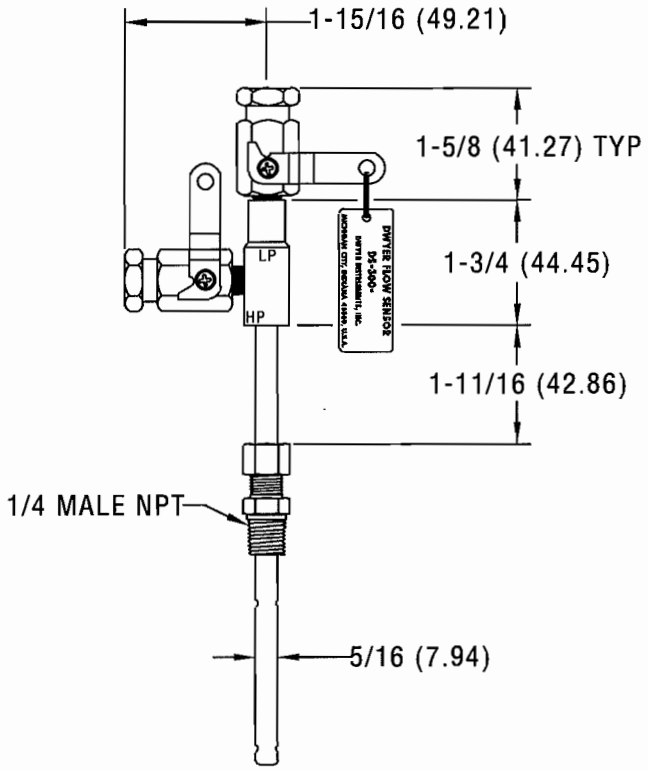
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

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 Air @ 60°F & 14.7 psia (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

Printed in U.S.A. 9/03 FR 72-440451-01 Rev. 1

DWYER INSTRUMENTS, INC.
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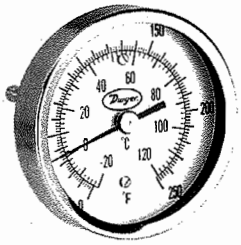
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

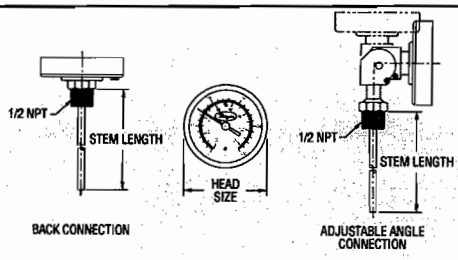
Series BT

Bimetal Thermometers

2", 3" or 5" Dial, Dual Scale, ±1% FS Accuracy, External Reset

NEW MODELS!





Series BT Bimetal Thermometers offer accurate, reliable service even in the toughest environments. These corrosion resistant units are constructed from stainless steel and are hermetically sealed to prevent crystal fogging. The bimetal element directly drives pointer, eliminating gears and linkage. An external reset screw allows field calibration and easy-to-read aluminum dial minimizes parallax error. Choose back connection, lower connection or adjustable angle for easy viewing and installation. Adjustable models can be rotated a full 360° and tilted over a 180° arc. NOTE: When using in pressurized applications, use a suitable thermowell.

SPECIFICATIONS

Accuracy: ±1% full scale.
Response Time: ≤ 40 seconds.
Temperature Limits: Head 200°F (93°C); **Stem** Not to exceed 50% over-range or 1000°F (538°C) or 800°F (427°C) continuously.
Immersion Depth: Minimum 2" in liquids, 4" in gas.
Stem Diameter: ¼" O.D.
Materials of Construction: 304 stainless steel stem, glass crystal, anodized aluminum dial, Series 300 stainless steel head, bezel, and mounting bushing.
Process Connection: ¼" NPT on 2" dial size; ½" NPT on 3" or 5" dial size.

STOCKED MODELS

	Dial Size, Stem Length	Temperature Range, °F(°C)	Degree Div., °F(°C)
Back Connection			
BTB22551*	2", 2-½"	0/250	2
BTB2405D	2", 4"	0/250(-20/120)	2(2)
BTB2409D	2", 4"	200/1000(100/550)	10(5)
BTB32510D	3", 2½"	0/200 (-20/100)	2(2)
BTB3255D	3", 2½"	0/250(20/120)	2(2)
BTB3257D	3", 2½"	50/550 (10/290)	5(5)
BTB34010D	3", 4"	0/200 (-20/100)	2(2)
BTB3405D	3", 4"	0/250(-20/120)	2(2)
BTB3407D	3", 4"	50/550(10/290)	5(5)
BTB3605D	3", 6"	0/250(-20/120)	2(2)

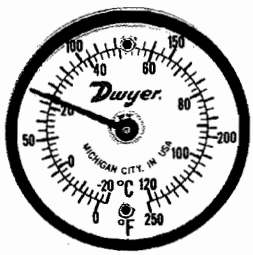
	Dial Size, Stem Length	Temperature Range, °F(°C)	Degree Div., °F(°C)
Adjustable Angle Connection			
BTA54010D	5", 4"	0/200(-20/100)	2(2)
BTA5405D	5", 4"	0/250(-20/120)	2(2)
BTA5407D	5", 4"	50/550(10/290)	5(5)
BTA56010D	5", 6"	0/200(-20/100)	2(2)
BTA5605D	5", 6"	0/250(-20/120)	2(2)
BTA5607D	5", 6"	50/550(10/290)	5(5)
Lower Connection			
BTC3255D	3", 2.5"	0/250(-20/120)	2(2)

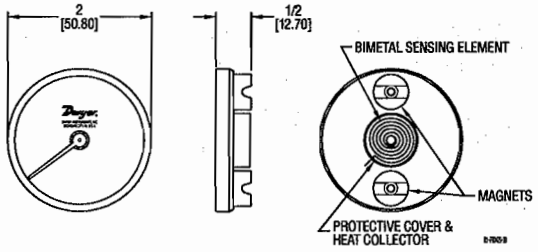
Temperature

Series ST

Surface Mount Thermometer

2" Dual Scale Dial, ±2% Full Scale Accuracy





Measure the temperature of boilers, air ducts, motors, bearings, furnaces or other surfaces with Series ST Surface Mount Thermometers. Dual magnet design allows easy mounting on any ferrous surface. Bi-metallic thermal sensing coil provides quick temperature measurement with ±2% full scale accuracy.

SPECIFICATIONS

Accuracy: ±2% full scale.
Sensing Element: Bimetal coil.
Response Time: Approximately one minute.
Head Size: 2" (5.08 cm).
Mounting: Two Alnico® magnets on back.
Height: 2" (1.27 cm).
Case: Aluminum with optically clear crystal.
Weight: 2 oz (56.7 g).

STOCKED MODELS

Model Number	Range
ST250	0 to 250°F (-20 to 120°C)
ST500	0 to 500°F (-20 to 260°C)
ST750	0 to 750 °F (-20 to 399°C)

APPLICATIONS

Manifolds, platens, boilers, air ducts, furnaces, engines, motors, bearings, enclosures, cabinets, drums, plumbing, piping, refrigerators, and other ferrous surfaces.

GEORGE FISCHER +GF+ 27.10.2003

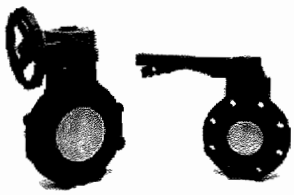
Piping Systems America

Home ▸ Engineering Info ▸ Product Information & Specification

Butterfly Valve Type 570

Description

Manual or gear operated, lug or wafer xstyle butterfly valve. Both disc and body are of the same material and are exposed to fluid stream to take maximum advantage of material properties.

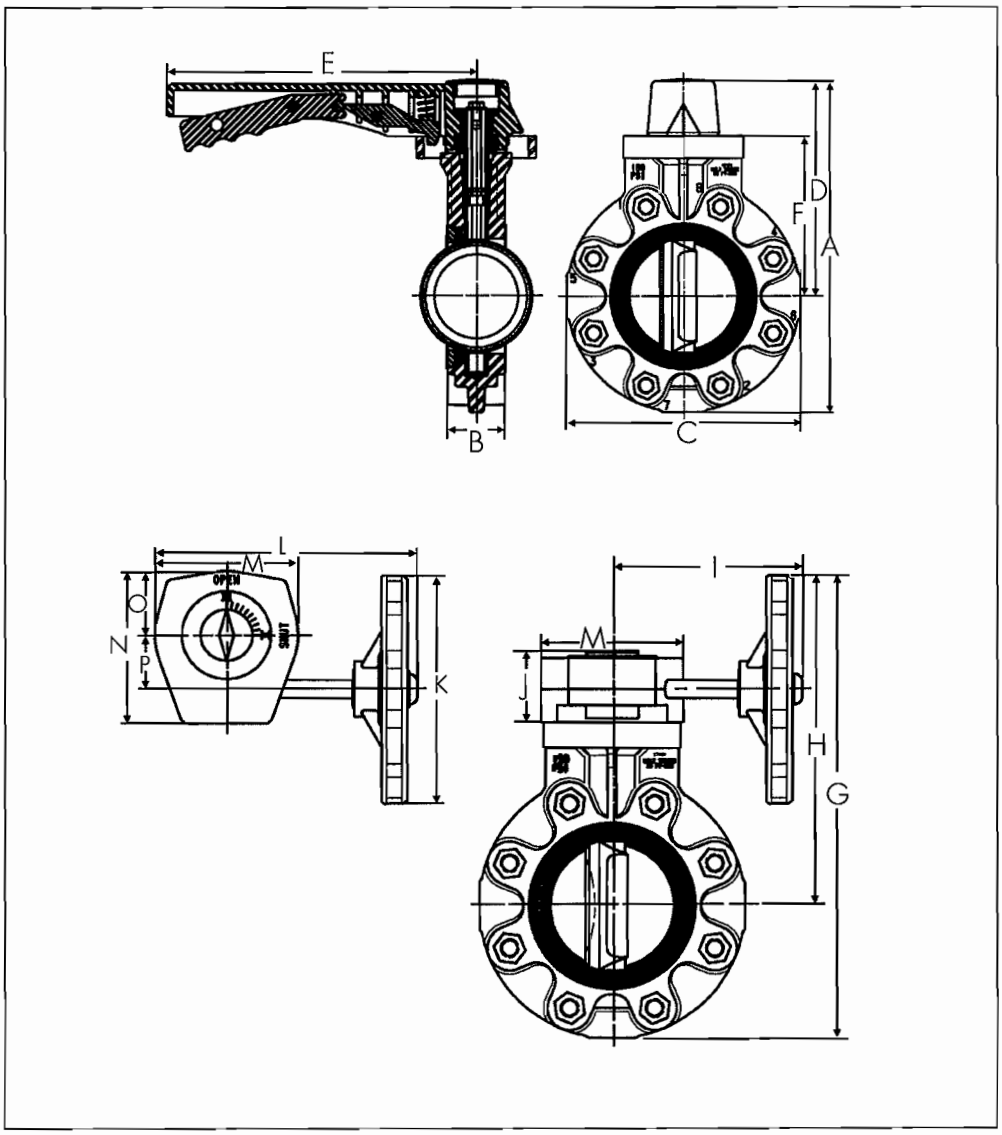


- Lug or wafer style
- Corrosion resistant
- Easy manual operation through 8"
- Optional gear operator, 1 1/2 - 8"; std. on 10, 12"
- Available 1 1/2"-12" in PVC and CPVC
- Disc, glass filled PVC/CPVC for high strength
- EPDM or FPM disc seals
- Hole patterns are class 150 to ANSI B16.5
- Good vacuum rating
- 316 stainless steel shaft, standard
- Multi-position, reversible handle, locks disc in position every 15 degrees
- Optional lug inserts (316 SS or zinc plated steel) enable dead-end service at full pressure rating
- Special offset disc design provides reduced seat wear and lower operating torque

Product Specifications (pdf)
Dimensional Data (pdf)
Technical Data (pdf)
Price List (pdf)
Manual Valves Table
Actuated Valves Table

2882 Dow Avenue, Tustin, CA 92780-7258 USA,
Phone (714) 731-8800, Toll Free (800) 854-4090, Fax (714) 731-6201

Dimensions for Type 570 Butterfly Valve



Inch size	A inch	B inch	C inch	D inch	E inch	F inch	G inch	H inch
1 1/2	8.28	1.56	5.00	5.78	9.25	4.25	11.16	8.66
2	9.28	1.94	6.00	6.28	9.25	4.75	13.13	10.13
2 1/2	10.28	2.00	7.00	6.78	9.25	5.25	13.13	9.63
3	11.22	2.00	7.50	7.47	12.00	5.28	14.16	10.41
4	12.69	2.25	9.00	8.19	12.00	6.00	15.63	11.13
6	16.25	2.81	11.00	10.75	14.00	8.63	19.25	13.75
8	18.50	2.94	13.50	11.75	14.00	9.63	21.50	14.75
10	N/A	3.13	16.00	N/A	N/A	11.00	26.63	18.63
12	N/A	3.38	19.00	N/A	N/A	12.00	29.13	19.63

Inch size	I inch	J inch	K inch	L inch	M inch	N inch	O inch	P inch
1 1/2	6.44	2.38	8.00	8.81	4.81	5.19	2.19	1.84
2	6.44	2.38	8.00	8.81	4.81	5.19	2.19	1.84
2 1/2	6.44	2.38	8.00	8.81	4.81	5.19	2.19	1.84
3	6.44	2.38	8.00	8.81	4.81	5.19	2.19	1.84
4	6.44	2.38	8.00	8.81	4.81	5.19	2.19	1.84
6	6.44	2.38	8.00	8.81	4.81	5.19	2.19	1.84
8	7.44	2.38	8.00	9.81	5.38	5.94	2.44	2.34
10	8.16	2.72	8.00	10.56	6.88	7.50	3.13	3.00
12	8.16	2.72	8.00	10.56	6.88	7.50	3.13	3.00

Product Specification

Type 570 Butterfly Valve

All Type 570 Butterfly Valves shall be supplied by George Fischer, manufactured from PVC, cell classification 12454-B or CPVC cell classification 23447-B, per ASTM D 1784, NSF approved for potable water services. Seats and seals shall be EPDM or FPM. Bolt patterns shall conform to ANSI B16.5 class 150. Disc shall be offset design with 316 s.s. shaft and hardware. Handles shall be high impact PP with lockout capability through 8". Gear operators shall be standard on sizes 10" and 12", optional on all other sizes, equipped with position indicator and PP handwheel. Optional lug inserts shall be either 316 s.s. or zinc plated steel (as specified).

Technical Data for Butterfly Valves Type 570

Temperature Pressure Rating

System Operating Temperature °F (°C)		100 (38)	110 (43)	120 (49)	130 (54)	140 (60)	150 (66)	160 (71)	170 (77)	180 (82)	190 (88)	200 (93)	210 (99)
Valve Pressure Rating psi (MPa)	PVC	150 (1.03)	135 (.93)	110 (.76)	75 (.52)	50 (.34)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)
	CPVC	150 (1.03)	140 (.97)	130 (.90)	120 (.83)	110 (.76)	100 (.69)	90 (.62)	80 (.55)	70 (.49)	60 (.41)	50 (.34)	-0- (-0-)

C_v Values and Operating Torque

Valve Size	Cv Degrees Open						Operating Torque (in.-lbs.)
	15°	30°	45°	60°	75°	90°	
1-1/2"	2	8	20	36	61	81	100
2"	3	11	27	49	82	109	110
2-1/2"	5	19	48	86	144	192	206
3"	9	35	86	155	259	345	360
4"	10	41	103	185	308	411	420
6"	28	113	281	506	844	1125	720
8"	56	225	562	1012	1687	2249	1200
10"	111	444	1110	1998	3330	4440	1320
12"	173	690	1726	3106	5177	6903	1920

-Flygt Submersible Pump
-Flygt ENM-10 Level Regulator

FLYGT

Installation, care and maintenance

3085/3102/3127

Flygt

ITT Industries

892062/13

CONTENTS

SAFETY

This manual contains basic information on the installation, operating and maintenance and should be followed carefully. It is essential that these instructions are carefully read before installation or commissioning by both the installation crew as well as those responsible for operation or maintenance. The operating instructions should always be readily available at the location of the unit.

Identification of safety and warning symbols

General Danger:

Non-observance given to safety instructions in this manual, which could cause danger to life have been specifically highlighted with this general danger symbol.

High Voltage:

The presence of a dangerous voltage is identified with this safety symbol.

WARNING! Non-observance to this warning could damage the unit or affect its function

Qualifications of personnel

An authorized (certified) electrician and mechanic shall carry out all work.

Safety regulations for the owner/operator

All government regulations, local health and safety codes shall be complied with.

All dangers due to electricity must be avoided (for details consult the regulations of your local electricity supply company).

Unilateral modification and spare parts manufacturing

Modifications or changes to the unit/installation should only be carried out after consulting with ITT Flygt.

Original spare parts and accessories authorized by the manufacturer are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation.

Dismantling and re-assembly

If the pump has been used to pump hazardous media, care must be taken that, when draining the leakage, personnel and environment are not endangered.

All waste and emissions such as used coolant must be appropriately disposed of. Coolant spills must be cleaned up and emissions to the environment must be reported.

The pumping station must be kept tidy and in good order at all times.

All government regulations shall be observed.

The pictures in this manual may differ somewhat from the delivered pump depending on the hydraulic end configuration.

SAFETY

NOTES FOR EX-PRODUCTS

— Only Ex-approved pumps may be used in an explosive or flammable environment.

— Do not open the pump when an explosive gas atmosphere may be present.

— Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and can not be energized. This applies to the control circuit as well.

— All mechanical work on the explosion-proof motor section must be performed by personnel authorized by ITT Flygt.

— Electrical connection on the explosion-proof motor must be made by authorized personnel.

— Thermal contacts must be connected to protection circuit intended for that purpose according to the approval of the product.

— The pump may be used only in accordance with the approved motor data stated on the data plates.

— Intrinsically safe circuits are normally required (Ex i) for the automatic level control system by level regulator if mounted in zone 0.

— This equipment must be installed in conformity to prescriptions in international or national rules (IEC/EN 60079-14).

— The maintenance operation must be made in conformity to the international or national standards (IEC/EN 60079-17).

— The yield stress of fastener elements in the product must be in conformity with the value specified in the table for "Material of fastener" on the approval drawing or the parts specified in the part list for the product.

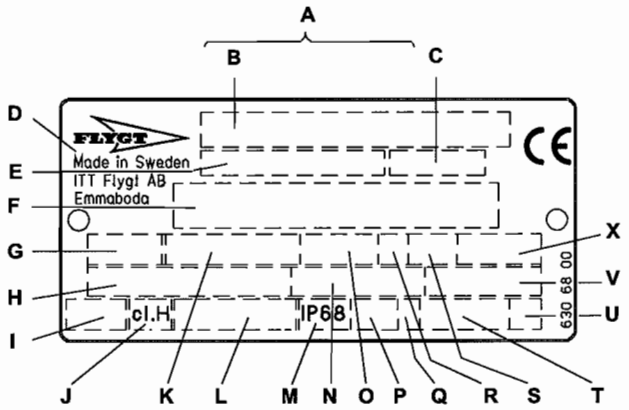
— According to the ATEX directive the Ex-pump must never run dry or snore. Permitted minimum water level, see dimensional drawing for the pump.

— The user must know about the risks due the electric current and the chemical and physical characteristics of the gas and/or vapours present in hazardous areas.

— ITT Flygt disclaims all responsibility for work done by untrained, unauthorized personnel.

DATA PLATE INTERPRETATION

General data plate

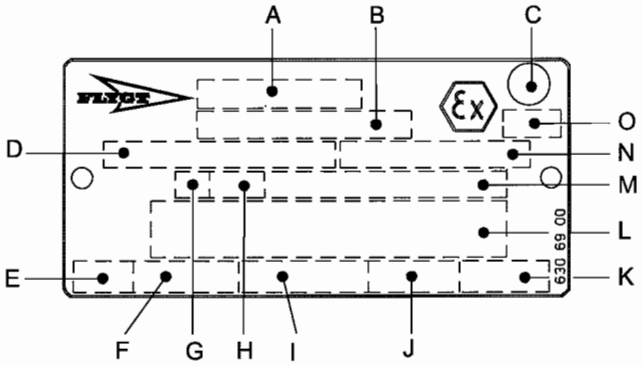


A Serial number
B Product code + Number
C Curve code / Propeller code
D Country of origin
E Product number
F Additional information
G Phase; Type of current; Frequency
H Rated voltage
I Thermal protection
J Thermal class
K Rated shaft power
L International standard
M Degree of protection
N Rated current
O Rated speed
P Max. submergence
Q Direction of rotation: L=left, R=right
R Duty class
S Duty factor
T Product weight
U Locked rotor code letter
V Power factor
X Max. ambient temperature

Approval plates

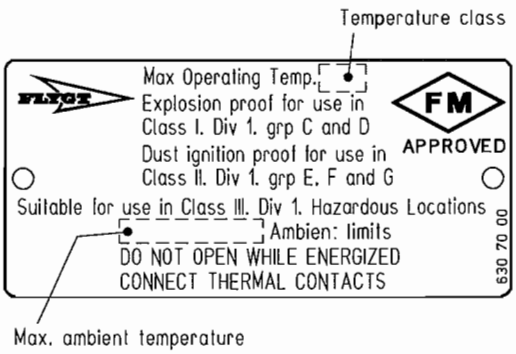
These approval plates apply to an explosion-proof submersible Flygt pump.
The plates are used together with the general data plate on the pump.

EN: European Norm
ATEX Directive
EN 50014, EN 50018, EN 1127-1
Ex II 2 G EEx dII T4



A Approval
B Approval authority + Approval Number
C Approval for Class I
D Approved drive unit
E Stall time
F Starting current / Rated current
G Duty class
H Duty factor
I Input power
J Rated speed
K Controller
L Additional information
M Max. ambient temperature
N Serial number
O ATEX marking

FM: Factory Mutual
Class I Div. I Grp C and D
Class II and III Div. I Grp E, F and G



PRODUCT DESCRIPTION

Introduction

Thank you for buying a submersible ITT Flygt pump. In this Installation, Care and Maintenance manual you will find general information on how to install and service the 3085, 3102 or 3127 pump to give it a long and reliable life. In the Parts List you will find all the specific technical data for your pump.

Application

This Installation, Care and Maintenance manual applies to a submersible ITT Flygt pump. If you have bought an Ex-approved pump (please see approval plate on your pump or Parts List) special handling instructions apply as described in this document.

Depending on the hydraulic end, the pump is intended to be used for:

— pumping of waste water

— pumping of light liquid manure and urine

— pumping of sludge

— pumping of ground water

— pumping of sewage if the solids need to be cut into small pieces.

The pumps must not be used in highly corrosive liquids. See pH limits below.

The pump is available for permanent installation in a sump or portable installation with hose connection and stand.

In some applications, the pump is also available for a dry stationary installation on a base stand directly connected to the inlet and outlet lines.

For further information on applications, contact your nearest ITT Flygt representative.

Specific technical data

For specific technical data regarding your pump, please see Parts List.

General technical data

Liquid temperature: max. 40°C (104°F). The pump can be operated at full load only if at least half the stator housing is submerged.

The pump can be equipped for operation at temperatures up to 90°C (195°F). At increased temperatures, the pump must be completely submerged when operated at full load.

Higher temperatures than 40°C (104°F) are not permitted for Ex-approved pumps.

Liquid density: max. 1100 kg/m^3 (9.2 lb per US gal.)

The pH of the pumped liquid: 5.5 - 14 (cast iron pumps).

The pH of the pumped liquid: 3—14 (stainless steel pumps).

Depth of immersion: max. 20 m (65 ft).

— **In some installations and at certain operating points on the performance curve, the noise level of 70 dB or the noise level specified for the actual pump may be exceeded.**

— **NOTE for Ex-version page 3.**

Warranty claim

ITT Flygt pumps are high quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, please contact your ITT Flygt representative.

GENERAL DESIGN OF A FLYGT PUMP

Design

The pump is a submersible, electric motor-driven product.

1. Impeller

The pump is available with a wide range of impellers for different applications and capacities.

2. Shaft seals

The pump has two mechanical face seals – one inner and one outer, with an intermediate oil housing.

3. Shaft

The shaft is delivered with the rotor as an integral part.

Shaft material: stainless steel.

4. Bearings

The support bearing of the rotor consists of a single-row ball bearing.

The main bearing of the rotor consists of a two-row angular contact ball bearing.

5. Oil housing

The oil lubricates and cools the seals and acts as a buffer between the pump housing and the electric motor.

6. Motor

Squirrel-cage 1-phase or 3-phase induction motor for 50 Hz or 60 Hz.

The motor can be started by direct on-line or star-delta starting.

The motor can be run continuously or intermittently with a maximum of 15 evenly spaced starts per hour.

ITT Flygt motors are tested in accordance with IEC 34-1.

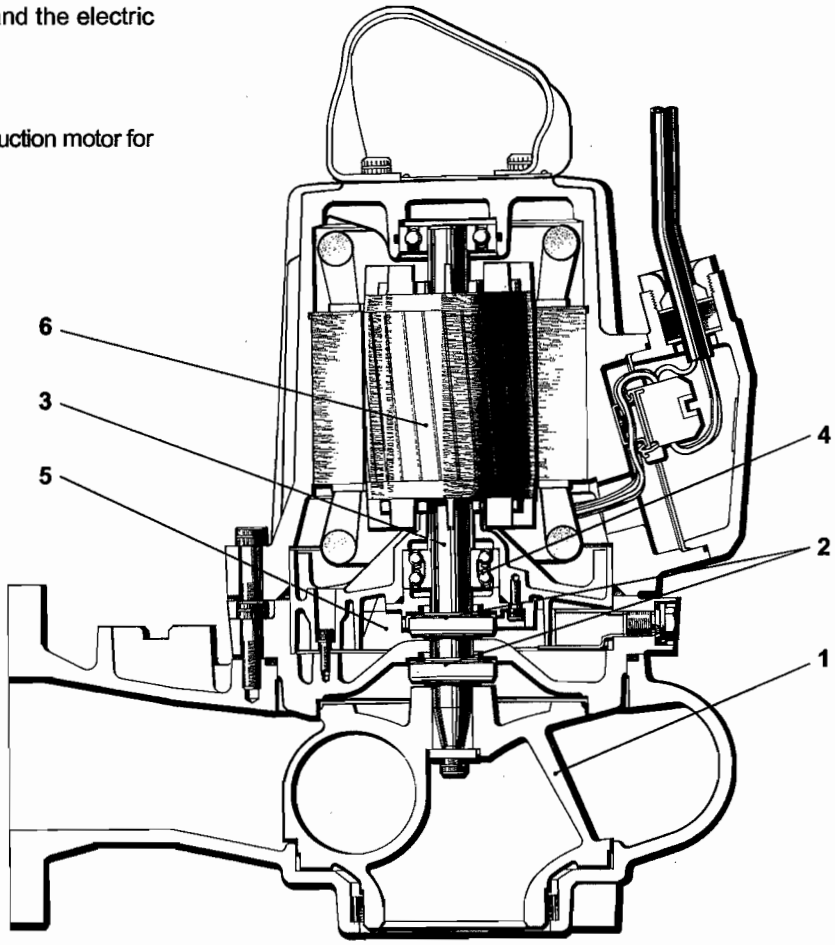
The stator is insulated in accordance with class H (180°C, 360°F). The motor is designed to deliver its rated output at ± 5% variation from the rated voltage. Without overheating the motor, ± 10% variation from the rated voltage can be accepted provided that the motor does not run continuously at full load. The motor is designed to operate at a voltage imbalance of up to 2% between the phases.

Monitoring equipment

The stator incorporates thermal contacts connected in series.

The pump can be equipped with sensors for sensing water in the oil* and/or stator housing.

*Not applicable to Ex-approved pumps.



INSTALLATION

Handling equipment

Lifting equipment is required for handling the pump.

— **Stay clear of suspended loads.**

— **Always lift the pump by its lifting handle - never by the motor cable or the hose.**

The minimum height between the lifting hook and the floor shall be sufficient to lift the pump out of the sump.

The lifting equipment shall be able to hoist the pump straight up and down in the sump, preferably without the need for resetting the lifting hook.

Oversize lifting equipment could cause damage if the pump should stick when being lifted.

Make sure that the lifting equipment is securely anchored.

General recommendations

To ensure proper installation, please see the dimensions on the dimensional drawing in the Parts List.

NOTE! The end of the cable must not be submerged. It must be above flood level, as water may penetrate through the cable into the junction box or the motor.

Check that the lifting handle and chain are in good condition.

For automatic operation of the pump (level control), it is recommended that the level regulators be used at low voltage. The data sheet delivered with the regulators gives the permissible voltage. Local rules may specify otherwise.

Clean out all debris from the sump before the pump is lowered down and the station is started.

NOTE for Ex version page 3.

— **Minimum stop level should be according to the dimensional drawing.**

— **The pump must never run dry.**

Safety precautions

In order to minimize the risk of accidents in connection with the service and installation work, the following rules should be followed:

1. Never work alone. Use a lifting harness, safety line and a respirator as required. Do not ignore the risk of drowning.
2. Make sure there are no poisonous gases within the work area.
3. Check the explosion risk before welding or using electric hand tools.
4. Do not ignore health hazards. Observe strict cleanliness.
5. Bear in mind the risk of electrical accidents.
6. Make sure that the lifting equipment is in good condition.
7. Provide a suitable barrier around the work area, e.g a guard rail.
8. Make sure you have a clear path of retreat!
9. Use safety helmet, safety goggles and protective shoes.
10. All personnel who work with sewage systems must be vaccinated against diseases to which they may be exposed.
11. A first-aid kit must be close at hand.
12. Note that special rules apply to installation in explosive athmosphere.

Follow all other health and safety rules and local codes and ordinances.

ELECTRICAL CONNECTIONS

— **Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and cannot be energized.**

— **If the pump is equipped with automatic level control, there is a risk of sudden restart.**

— **All electrical equipment must be earthed. This applies to both pump equipment and any monitoring equipment. Failure to heed this warning may cause a lethal accident. Make sure that the earth lead is correctly connected by testing it.**

— **If persons are likely to come into physical contact with the pump or pumped media (liquid), e.g on construction sites and farms, the earthed (grounded) socket must have an additional earth-(ground-) fault protection device (GFI) connected.**
When pumping near a lake (jetties, beaches, ponds, fountains etc) a safety-distance of at least 20 m (65 ft) between the person and the pump is applicable.
The pump must never be placed directly into a swimming pool. If used in connection with swimming pools, special safety regulations apply.

NOTE for Ex version page 3.

All electrical work shall be carried out under the supervision of an authorized electrician.

Local codes and regulations shall be complied with.

Check on the data plate which voltage supply is valid for your pump.

Check that the main voltage and frequency agree with the specifications on the pump data plate.

If the pump can be connected to different voltages, the connected voltage is specified by a yellow sticker.

Connect the motor cable to the starter equipment as illustrated in the wiring diagrams.

Conductors that are not in use must be isolated.

The cable should be replaced if the outer sheath is damaged. Contact an ITT Flygt service shop.

Make sure that the cable does not have any sharp bends and is not pinched.

Under no circumstances may the starter equipment be installed in the sump.

NOTE! For safety reasons, the earth conductor should be approx. 50 mm (2.0") longer than the phase conductors. If the motor cable is jerked loose by mistake, the earth conductor should be the last conductor to come loose from its terminal. This applies to both ends of the cable.

Thermal contacts are incorporated in the stator. The thermal contacts can be connected to max 250 V, breaking current max 4 A. ITT Flygt recommends that they be connected to 24 V over separate fuses to protect the other automatic equipment.

Make sure that the pump is correctly earthed (grounded).

When using a variable-frequency-drive (VFD) the shielded cable (type NSSHÖU.../3E+St) should be used in order to fulfil European CE requirements. Contact your ITT Flygt representative and ask your VFD-supplier for electrical limitations.

ELECTRICAL CONNECTIONS

Remember that the starting current in direct on-line starting can be up to six times higher than the rated current. Make sure that the fuses or circuit breakers are of the proper rating.

The Parts List gives rated current. Fuse rating and cable shall be selected in accordance with local rules and regulations. Note that with long cables, the voltage drop in the cable must be taken into consideration, since the motor's rated voltage is the voltage that is measured at the terminal board in the pump.

The overload protection (motor protection breaker) for direct on-line starting shall be set to the motor rated current as given on the data plate.

Check the phase sequence in the mains with the phase sequence indicator.

If intermittent operation is prescribed (see Data Plate), the pump shall be provided with control equipment that provides such operation.

Single phase operation

The ITT Flygt single phase pumps must be equipped with a starter which has start and run capacitors.

A special ITT Flygt designed starter is required for the operation of single phase pumps. The connection of the motor cable to the starter is shown in the wiring diagram.

NOTE! It is not possible to change the direction of rotation of a single phase pump by changing the cable conductors on the starter. Please contact your nearest ITT Flygt representative.

Monitoring equipment

A plate in the junction box shows if the pump is equipped with sensors.

CLS-30 is a leakage sensor for sensing water in the oil housing and initiates an alarm when the oil contains 30% water. Oil change is recommended after the alarm. If the sensor initiates an alarm shortly after the oil is changed, contact your nearest ITT Flygt representative. The CLS sensor is installed in the bearing housing and goes down into the oil housing. The sensor is not applicable to Ex-approved pumps.

CLS sensor body made of glass. Handle with care.

The **FLS** sensor consists of a small float switch for sensing water in the stator housing. Its design makes it suitable for pumps in vertical installations. The FLS sensor is installed in the bottom of the stator housing.

The two sensors, CLS and FLS, can be used in the same pump. They are connected in parallel. Follow the instructions for monitoring equipment.

The **MiniCas II** is a monitoring relay to which CLS and/or FLS are connected.

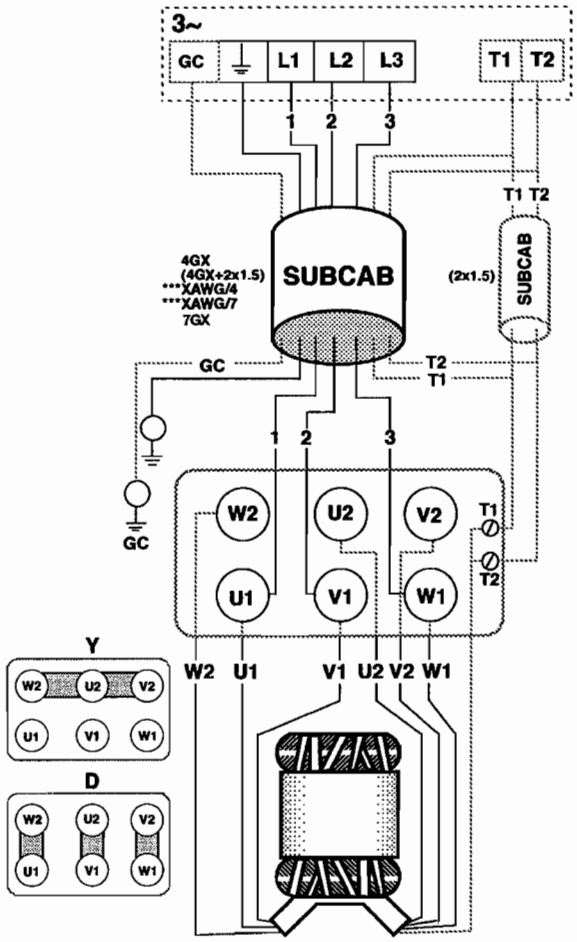
Check:

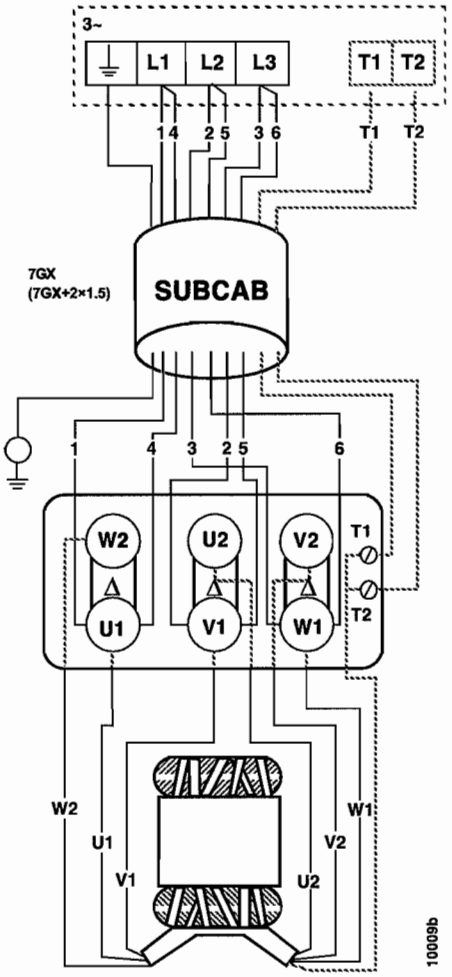
— signals and tripping function.

— that relays, lamps, fuses and connections are intact.

Replace defective equipment.

CABLE CHART





3-phase, direct-on-line starting

	Conductors	Connection starter
SUBCAB 4Gx	1 brown ***red	L1
***SUBCAB xAWG/4**	2 blue ***white	L2
HØ7RN-F 4Gx	3 black ***black	L3
BIHF 4Gx silicon	yellow/green	earth
SUBCAB 4Gx+2x1,5	1 brown	L1
	2 blue	L2
	3 black	L3
	yellow/green	earth
	T1 black	T1*
	T2 black	T2*
SUBCAB 7Gx	1 black	L1
HØ7RN-F 7Gx	2 black	L2
SO7E6E5-F 7x2.5	3 black	L3
	4 black	T1*
	5 black	T2*
	6 black	cut off
	yellow/green	earth
For Canada/USA	red	L1
***SUBCAB xAWG/7**	white	L2
	black	L3
	yellow	GC**
	yellow/green	earth
	orange	T1*
	blue	T2*

Stator leads

U1	=	red	V2	=	blue
V1	=	brown	W2	=	black
W1	=	yellow	U2	=	green

3-phase, direct-on-line Δ, 2 // connected cores

	Conductors	Connection starter
SUBCAB 7Gx	1 black	L1
SO7E6E5-F 7x2.5	2 black	L2
	3 black	L3
	4 black	L1
	5 black	L2
	6 black	L3
	yellow/green	earth
SUBCAB 7Gx+2x1,5	1 black	L1
	2 black	L2
	3 black	L3
	4 black	L1
	5 black	L2
	6 black	L3
	T1 black	T1*
	T2 black	T2*
	yellow/green	earth

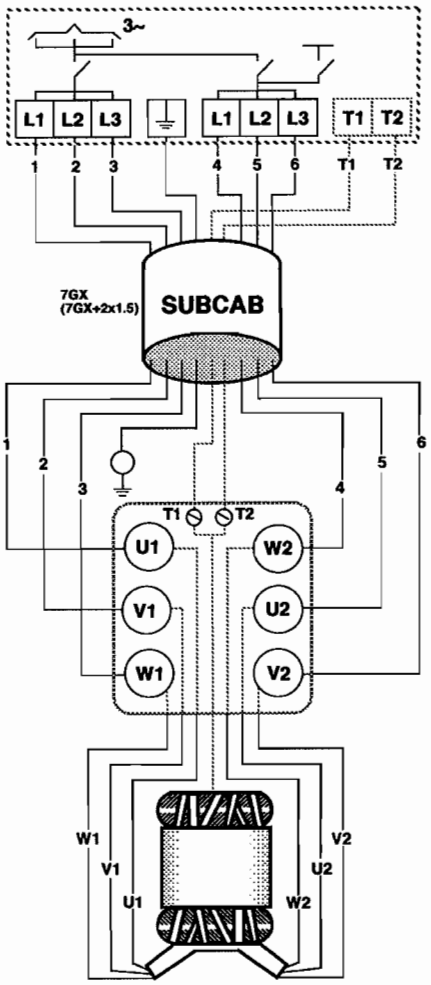
Stator leads

U1	=	red	V2	=	blue
V1	=	brown	W2	=	black
W1	=	yellow	U2	=	green

* Terminal for connection of thermal contacts in the motor and monitoring equipment.
** GC = Ground Check
*** SUBCAB/AWG

SUBCAB is a registered trademark of ITT Flygt AB for electrical cables.

CABLE CHART



3-phase, star-delta starting

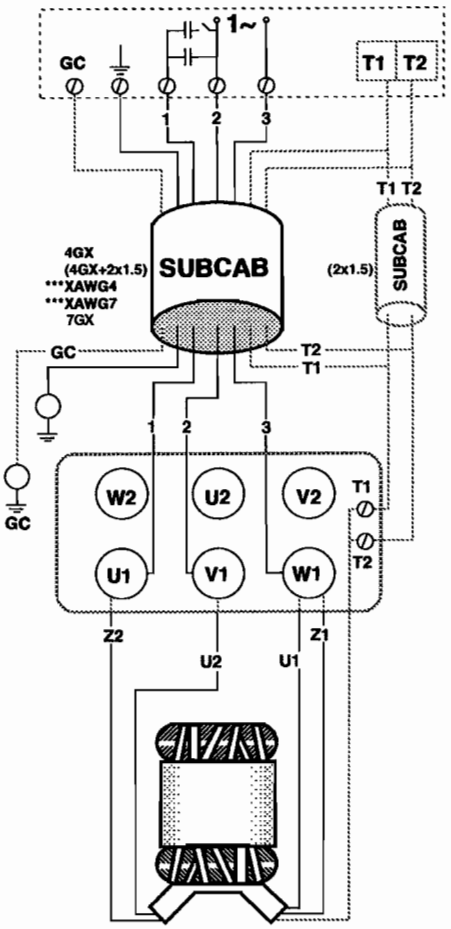
	Conductors	Connection starter
SUBCAB 7Gx	1 black	L1
HCR SO7E6E5-F 7x2.5	2 black	L2
	3 black	L3
	4 black	L1
	5 black	L2
	6 black	L3
	yellow/green	earth
SUBCAB 7Gx+2x1,5	1 black	L1
	2 black	L2
	3 black	L3
	4 black	L1
	5 black	L2
	6 black	L3
	T1 black	T1*
	T2 black	T2*
	yellow/green	earth

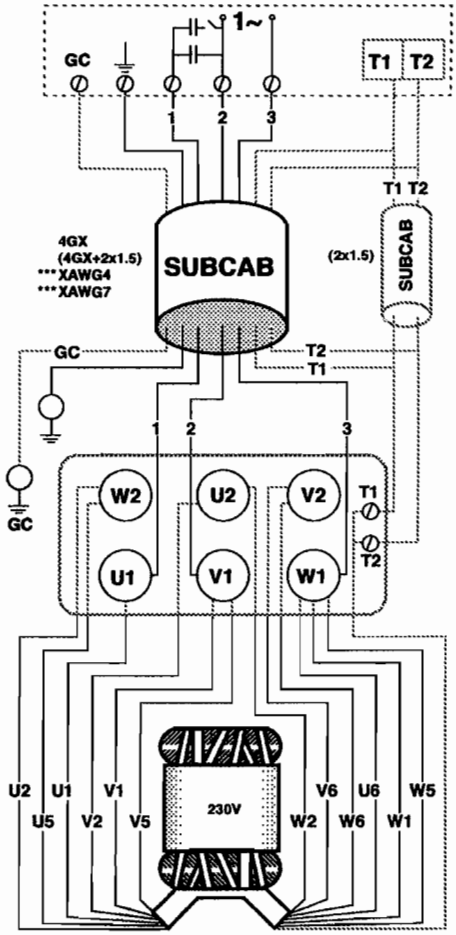
Stator leads					
	U1	= red		V2	= blue
	V1	= brown		W2	= black
	W1	= yellow		U2	= green

* Terminal for connection of thermal contacts in the motor and monitoring equipment.

SUBCAB is a registered trademark of ITT Flygt AB for electrical cables.

CABLE CHART





Single phase

	Conductors	Connection starter
SUBCAB 4Gx	1 brown ***red	1
*****SUBCAB xAWG/4**	2 black ***black	2
HØ7RN-F 4Gx	3 blue ***white	3
BIHF 4Gx silicon	yellow/green	earth
SUBCAB 4Gx+2x1,5	1 brown	1
	2 black	2
	3 blue	3
	yellow/green	earth
	T1 black	T1*
	T2 black	T2*
SUBCAB 7Gx	1 black	1
	2 black	2
	3 black	3
	4 black	T1*
	5 black	T2*
	6 black	cut off
	yellow/green	earth
For Canada/USA	red	1
*****SUBCAB xAWG/7**	black	2
	white	3
	yellow	GC**
	yellow/green	earth
	orange	T1*
	blue	T2*

Stator leads

U1	=	red	U2	=	brown
Z1	=	yellow	Z2	=	black

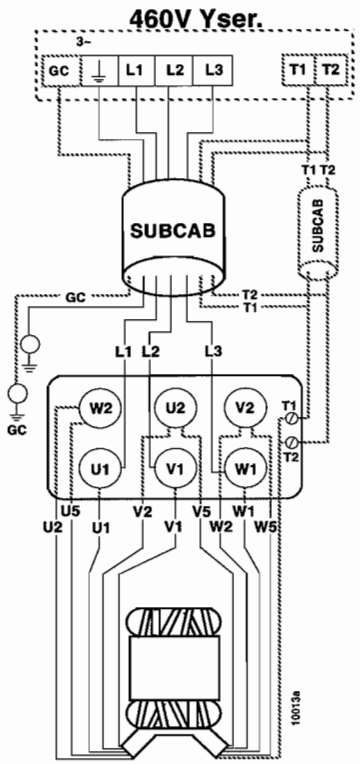
Stator leads

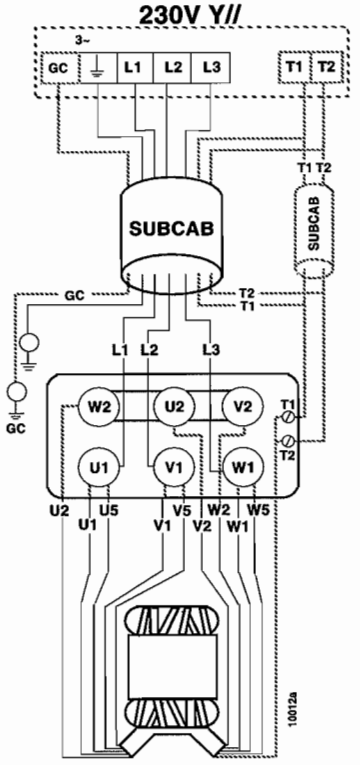
U1	=	red	U5	=	red
V1	=	brown	V5	=	brown
W1	=	yellow	W5	=	yellow
U2	=	green	U6	=	green
V2	=	blue	V6	=	blue
W2	=	black	W6	=	black

* Terminal for connection of thermal contacts in the motor and monitoring equipment.
** GC = Ground Check

*** SUBCAB/AWG

CABLE CHART





Mains	Lead	Pump terminal board
L1	Brown/(Red*)	U1
L2	Blue (White*)	W1
L3	Black (Black*)	V1
Earth (ground)	Yellow/Green	⏚
Groundcheck (GC)	Yellow*	

Stator leads **460V-Y SER** connection:	
Stator lead	Pump terminal board
U1, red	U1
W2, black	V2
V1, brown	V1
U2, green	W2
W1, yellow	W1
V2, blue	U2
V5, brown	U2
W5, yellow	V2
U5, red	W2

Control	Cable lead
T1	T1/orange*
T2	T2/blue*

Mains	Lead	Pump terminal board
L1	Brown/(Red*)	U1
L2	Blue (White*)	W1
L3	Black (Black*)	V1
Earth (ground)	Yellow/Green	⏚
Groundcheck (GC)	Yellow*	

Stator leads **230V-Y//** connection:	
Stator lead	Pump terminal board
U1, red	U1
U5, red	U1
V1, brown	V1
V5, brown	V1
W1, yellow	W1
W5, yellow	W1
U2, green	W2
V2, blue	U2
W2, black	V2

Control	Cable lead
T1	T1/orange*
T2	T2/blue*

* SUBCAB AWG

TRANSPORTATION AND STORAGE

The pump can be transported and stored in a vertical or horizontal position.

— **Always lift the pump by its lifting handle – never by the motor cable or the hose.**

— **Make sure that the pump cannot roll or fall over and injure people or damage property.**

The pump is frostproof as long as it is operating or is immersed in the liquid. If the pump is raised when the temperature is below freezing, the impeller may freeze.

The pump shall be run for a short period after being raised in order to discharge all remaining water.

A frozen impeller can be thawed by allowing the pump to stand immersed in the liquid for a short period before it is started. Never use a naked flame to thaw the pump.

For longer periods of storage, the pump must be protected against moisture and heat. The impeller should be rotated occasionally (for example every other month) to prevent the seals from sticking together.

After a long period of storage, the pump should be inspected before it is taken into operation. Pay special attention to the seals and the cable entry.

Follow the instructions under the heading "Before starting".

OPERATION

Before starting

— **Before starting work on the pump, make sure that the pump is isolated from the power supply and cannot be energized.**

— **Make sure that the pump cannot roll or fall over and injure people or damage property.**

Check that the visible parts on the pump and installation are undamaged and in good condition.

Check the oil level in the oil housing.

Remove the fuses or open the circuit breaker and check that the impeller can be rotated freely.

Check that the monitoring equipment (if any) works.

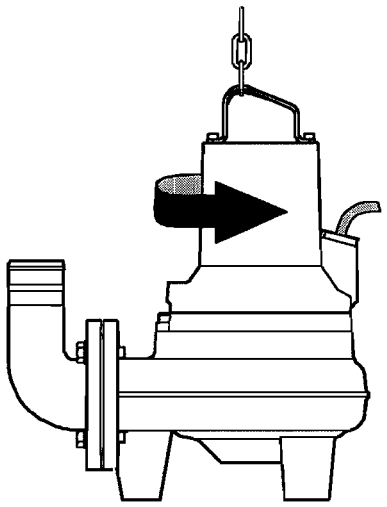
Check the direction of rotation. The impeller shall rotate clockwise, as viewed from above. When started, the pump will jerk in the opposite direction to the direction in which the impeller rotates. See the figure.

In the case of dry installation, check the direction of rotation through the inlet elbow access cover.

Transpose two phase leads if the impeller rotates in the wrong direction (3 ~).

In some installations the pump surface and the surrounding liquid may be hot. Bear in mind the risk of burn injuries.

Starting jerk



Watch out for the starting jerk, which can be powerful.

CARE AND MAINTENANCE

Before starting work on the pump, make sure that the pump is isolated from the power supply and cannot be energized.

This applies to the control circuit as well.

NOTE for Ex version page 3.

Make sure that the pump cannot roll or fall over and injure people or damage property.

The following points are important in connection with work on the pump:

— Make sure that the pump has been thoroughly cleaned.

— Beware of the risk of infection.

— Follow local safety regulations.

The pump is designed for use in liquids which can be hazardous to health. In order to prevent injury to the eyes and skin, observe the following points when working on the pump:

— Always wear goggles and rubber gloves.

— Rinse the pump thoroughly with clean water before starting work.

— Rinse the components in water after dismantling.

— The oil housing may be under pressure. Hold a rag over the oil screw (oil plug) to prevent splatter.

Proceed as follows if hazardous chemicals have splashed into your eyes:

— Rinse your eyes immediately in running water for 15 minutes. Hold your eyelids apart with your fingers.

— Contact an eye specialist.

On your skin:

— Remove contaminated clothes.

— Wash your skin with soap and water.

— Seek medical attention, if required.

Inspection

Regular inspection and preventive maintenance ensure more reliable operation.

The pump should be inspected at least once a year, but more frequently under severe operating conditions.

Under normal operating conditions, the pump should have a major overhaul in a service shop at least every third year for permanent installation and every year for portable pumps. This requires special tools and should be done by an authorized service shop.

If the seals have been replaced an inspection of the oil is recommended after one week of operation.

NOTE! Regular check of the condition of the lifting handle and chain is important.

Inspection of hot water applications

Pumps in hot water applications shall undergo inspection or overhaul at a service shop as follows, depending on the time they have been submerged in the hot water:

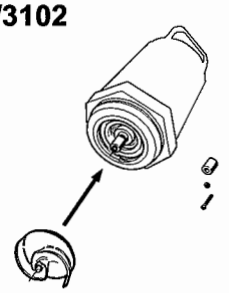
Temp.	Mode of operation	Inspection	Shop overhaul
≤70°C (160°F)	Continuous	1000 hours	4000 hours
≤70°C (160°F)	Intermittent	twice a year	once a year
≤90°C (195°F)	Cont./Int.	6 times a year	twice a year

CARE AND MAINTENANCE

N-type impeller - replacing and setting clearance

Warning! The impellers may have very sharp edges.
Use protective gloves.

N3085/3102



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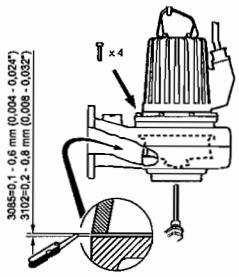

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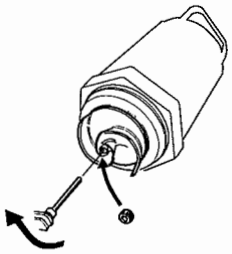

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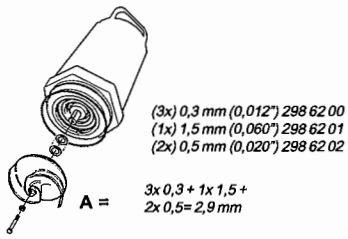

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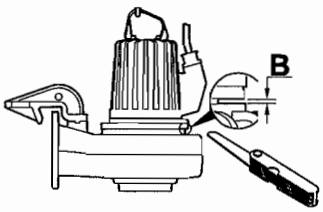

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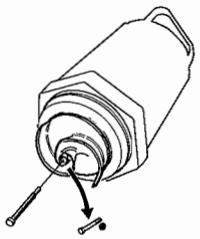

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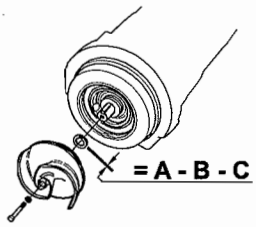

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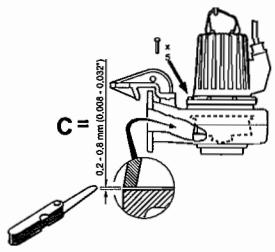

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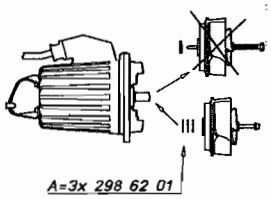
NT3127



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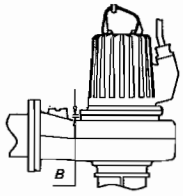

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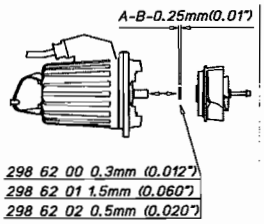

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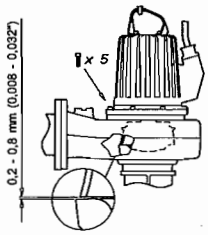


4.

OIL CHANGE

The oil housing may be under pressure. Hold a rag over the oil plug to prevent splatter.

1. Lay the pump on its side on a bench or over two supports. Unscrew the oil housing screw (oil plug) marked "oil out". Emptying the oil must be done through the "oil out" hole.

2. Turn the pump. Unscrew the "oil in" oil hole screw/ plug. In order to drain out all oil, the pump must be raised upright for a short while during drainage.

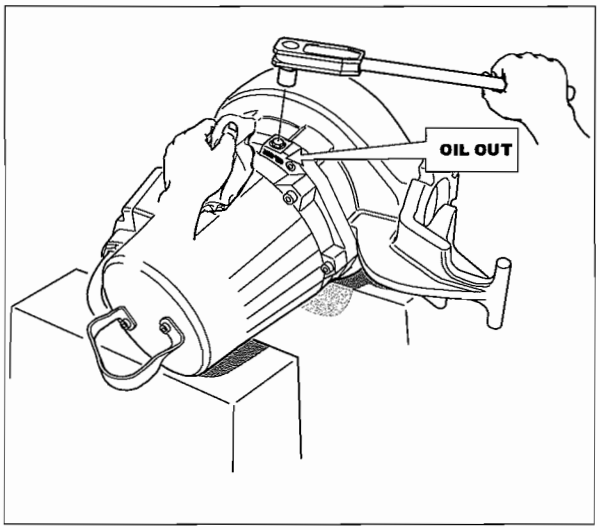
3. Replace the O-rings under the oil housing screws (plugs) with new ones.

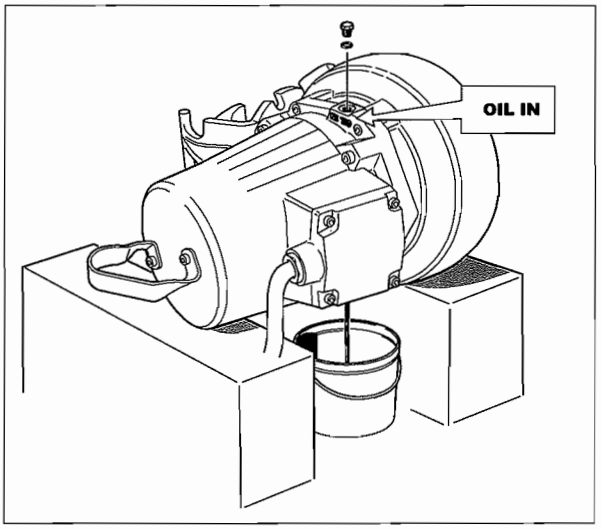
4. Install the "oil out" screw/plug and fill with oil through the other hole. It is important that the oil be added through the hole marked "oil in" since the oil housing must contain some air for pressure equalization. The pump should be tilted slightly and put down again horizontally in order to get the full amount of oil in.

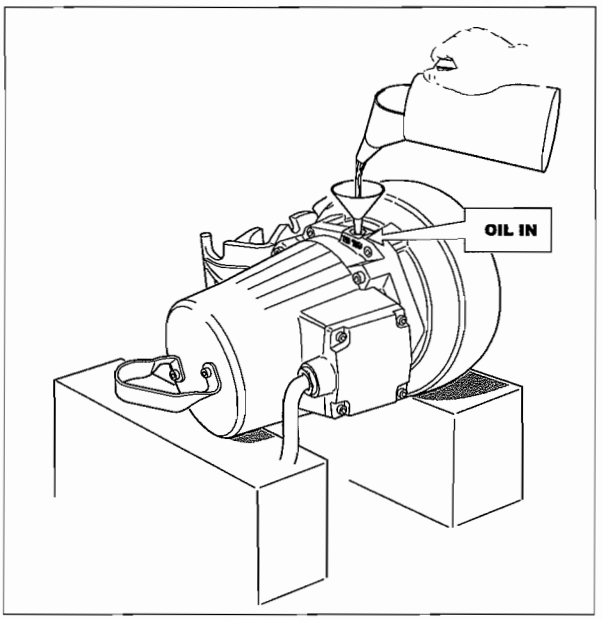
   A paraffin oil with viscosity close to ISO VG15 is recommended (e.g. Mobil Whiterex 309). The pump is delivered from factory with this type of oil.

   In applications where poisonous properties are of less concern, a mineral oil with viscosity up to ISO VG32 can be used.

Approx. oil quantity		
	l	US quarts
3085	1.0	1.1
3085.280/290	0.8	0.8
3102	1.0	1.1
3127	2.0	2.1







SERVICE LOG

Most recent service date	Pump No.	Hours of operation	Remarks	Sign.

FLYGT

Parts List

3085

Detaljlista
Ersatzteilliste
Liste des Pièces de Rechange
Lista de Piezas de Repuesto
Lista Parti di Ricambio

Flygt

ITT Industries

892216/11

FLYGT

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Inhalt
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Contenidos
Indice

3085

3085.092: **EEx d IIB T4**
FM: Class I Div. 1 Grp. C and D
Class II Div. 1 Grp. E, F and G
Suitable for use in Class III Div. 1

3085.182: **Standard**

3085.980 **Industrial version**

3085.172: **Grinder standard**

3085.891: **Grinder**
EEx d IIB T4
FM: Class 1 Div.1 Grp. C and D
Class II Div. 1 Grp. E, F and G
Suitable for use in Class III Div. 1

Exploded views with item Nos.
Sprängteckningar med pos. nr.
Explosionszeichnungen mit Pos.-Nrn.

Vues éclatées avec N°s de repérage
Despieces números de pos.
Disegno esploso con No di posizione

FLYGT	Sales codes Säljkoder Verkaufscode	Codes de vente Código de ventas Codici di vendita	3085

Ⓒ Ⓟ 3085.182 Ⓜ

HYDRAULIC PART	INSTALLATION	HEAD
HYDRAULDEL	INSTALLATION	TRYCK
HYDRAULIKTEILE	AUFSTELLUNGSART	DRUCK
PARTE HYDRAULIQUE	INSTALLATION	PRESSION
PARTE HIDRÁULICAS	INSTALACIÓN	PRESIÓN
PARTI IDRAULICHE	INSTALLAZIONE	REVALENZA

HYDRAULIC PART **HYDRAULIKTEILE** **PARTE HIDRÁULICAS**
HYDRAULDEL **PARTE HYDRAULIQUE** **PARTI IDRAULICHE**

C= Channel impeller
Kanalhjul
Kanalrad
(Curve Nos; 612-622, 632-636, 412-414, 432-440, 250-252)

Roue a canal/aux
Impulsor de canal

D = Swirl-type impeller version
Virvelhjulsutförande
Wirbelradausführung
(Curve Nos; 470-475, 477, 485-487, 276, 278, 280-284)

Version roue vortex
Versión de impulsor de torbellino

F = For pumping liquid manure
Pumphjul med skäranordning
Für Gülleförderung
(Curve Nos; 490-493)

Pour pompage de lisier
Versión para purines

G = Groundwater pump
Grundvattenpump
Grundwasserpumpe
(Curve Nos; 242-244)

Pour eau de souterraine
Bombas sumergibles para aguas subterraneas

L = Channel impeller
Kanalhjul
Kanalrad
(Curve Nos; 612-614, 412-414)

Roue a canal/aux
Impulsor de canal

M = Impeller with cutter wheel
Skärhjul för tuggerpump
Laufrad mit Schneidvorrichtung
(Curve Nos. 249, 250, 252-254, 257-259)

Roue de coupe
Rueda de corte

N = Semi-open self-cleaning multi-vane impeller and volute with cleaning groove for pumping of raw sewage, sludge and liquid manure. (Curve Nos. 460-463)

Halvöppet självrensande flerkanalhjul och pumphus med rensspår för pumpning av orenat avloppsvatten, avloppsslam och flytgödsel.

Offenes, selbstreinigendes Mehrkanalrad im Pumpengehäuse mit Entlastungsnut für kommunales und industrielles Abwasser mit hohem Faser- und Feststoffanteil.

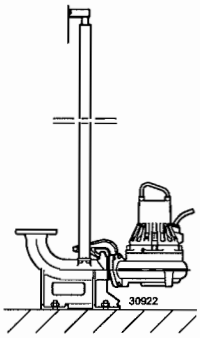
Roue à multi-canaux semi-ouverte et auto-nettoyante complétée par une volute incluant une rainure déchargeante brevetée. Recommandé pour le pompage de tous types de liquides allant de l'eau propre à ceux contenant une haute concentration de solides, tels qu'eaux d'égouts, boues, liquides fibreux et lisier.

Impulsor semi-abierto auto limpiante de dos canales y difusor con ranura limpiante para bombeo de agua residual bruta, lodos y purines líquidos.

Girante bicanale aperta antiintasamento su diffusore e corpo pompa con scanalatura a spirale autoespellente per il pompaggio di acque gregge, fanghi e liquami.N

FLYGT	Sales codes Säljkoder Verkaufscode	Codes de vente Código de ventas Codici di vendita	3085

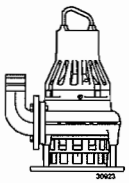
INSTALLATION
INSTALLATION
AUFSTELLUNGSART



P = Semi permanent wet well arrangement with pump installed on twin guide bars with automatic connection to discharge.

Halvstationär våt installation med pumpen fäst vid två gejdrör och med automatisk anslutning till utloppsröret.

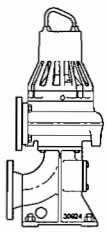
Stationär, nass mit schraubenlosem Kupplungssystem an Doppelführungsrohr.



S = Transportable version with hose coupling or flange for connection to discharge pipeline.

Flyttbar version med slangkoppling eller fläns för anslutning till utloppsrörledning.

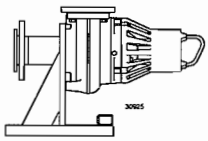
Transportabel, nass mit Flanschanschluss für Rohrleitung oder mit Druckstutzen für Schlauchanschluss.



T = Permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; vertical mounting.

Stationär torr installation med flänsanslutningar till sug- och tryckledningarna; vertikal uppställning.

Stationär, trocken mit Saugrohreinheit, saug- und druckseitig fest verschraubt, vertikale Aufstellung.



Z = Permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; horizontal mounting.

Sationär torr installation med flänsanslutningar till sug- och tryckledningarna; horisontell uppställning.

Stationär, trocken mit Saugrohreinheit, saug- und druckseitig fest verschraubt, horizontale Aufstellung.

INSTALLATION
INSTALACIÓN
INSTALLAZIONE

Permanente, installation immergée. Deux barres de guidage permettent la connexion automatique sur un pied d'assise.

Instalación fija extraíble, sumergida y con tubos guía. Acoplaimento por su propio peso a la conexión dedescarga.

Installazione semifissa in immersione, con piede di accoppiamento automatico e tubi guida.

Version trasportable avec raccord de tuyau souple ou bride pour canalisation rigide.

Instalación transportable, con salida para manguera y colador.

Installazione transportabile, in immersione, con cavalletto di sostegno e attacco per tubo di mandata flessibile o rigido.

Permanente, installation hors d'eau avec raccordement à bride à l'aspiration et au refoulement. Version verticale.

Instalación fija, en cámara seca, sobre punto de apoyo. Aspirando de pozo húmedo con codo de aspiración. Montaje vertical.

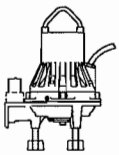
Installazione fissa in camera asciutta su basamento e collegamento diretto con le tubazioni di aspirazione e mandata; montaggio verticale.

Permanente, installation hors d'eau avec raccordement à bride à l'asiration et au refoulement. Version horizontale.

Instalación fija en cámera seca sobre bastidor de perfiles. Montaje horizontal.

Installazione fissa in camera asciutta su basamento e collegamento diretto con le tubazioni di aspirazione e mandata; montaggio orrizzontale.

FLYGT	Sales codes Säljkoder Verkaufscode	Codes de vente Código de ventas Codici di vendita	3085



(M)F = Free standing pump on legs with vertical discharge outlet.

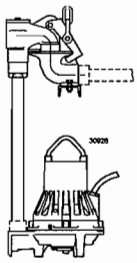
Transportabel pump på ben, med vertikal tryck-anslutning.

Freistehende Pumpe auf Beinen mit vertikalem Druckleitungsanschluss.

Installation indépendante sur pieds, avec orifice de refoulement vertical

Unidad transportable sobre patas con salida de descarga vertical.

Pompa per installazione mobile con piedini di appoggio e mandata verticale.



(M)H= For semi permanent installation in a sump, suspended from a discharge connection combined with a check valve.

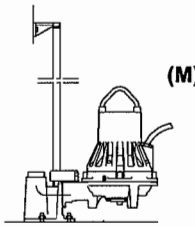
För halvstationär installation i en sump, upphängd i en kopplingsfot samt kombinerad med en back-ventil.

Für stationäre Hängemontage direkt über dem Boden des Pumpensumpfes mit einer schraubenlosen, wasserdichten Kupplungs-/Rückschlag-ventil-Einheit.

Para instalación semi-fija en un pozo, la bomba, con una válvula de retención, está suspendida de una conexión de descarga.

Pour installation semi-permanente dans un puisard, avec système "Hook up" équipé d'un clapet anti-retour.

Installazione sommersa fissa con uno speciale sistema di aggancio al tubo di mandata comprendente la valvola di intercettazione.



(M)P= Semi permanent wet well arrangement with pump installed on twin guide bars with automatic connection to discharge.

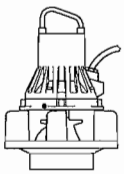
Halvstationär våt installation med pumpen fäst vid två gejdrör och med automatisk anslutning till utloppsröret.

Stationär, nass mit schraubenlosem Kupplungssystem an Doppelführungsrohr.

Permanente, installation immergée. Deux barres de guidage permettent la connexion automatique sur un pied d'assise.

Instalación fija extraíble, sumergida y con tubos guía. Acoplaimento por su propio peso a la conexión dedescarga.

Installazione semifissa in immersione, con piede di accoppiamento automatico e tubi guida.



L = Liftpump version
Lyftpumpsutförande
Hebepumpeausführung

Modèle pompe de levage
Versión de bomba elevable
Pompa di sollevamento

HEAD
TRYCK
DRUCK

PRESSION
PRESIÓN

LT = Low-head version
Lågtrycksutförande
Niederdruckausführung

Modèle basse pression
Modelo de baja altura de elevación
Versione per grande portata

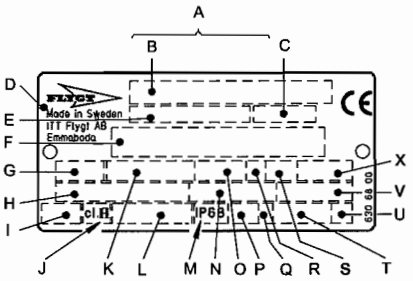
MT = Medium-head version
Medeltrycksutförande
Mitteldruckausführung

Modèle moyenne pression
Modelo de altura media de elevación
Versione per media prevalenza

HT = High-head version
Högtrycksutförande
Hochdruckausführung

Modèle haute pression
Modelo de gran altura de elevación
Versione per alta prevalenza

How to read the data plate | **Comment lire la plaque signalétique**
Hur man läser dataskylten | **Interpretación de la placa de características**
Erläuterungen zum Datenschild | **Come leggere la targhetta segnaletica**



Data plate interpretation

A Serial number
B Product code + Number
C Curve code / Propeller code
D Country of origin
E Product number
F Additional information
G Phase; Type of current; Frequency
H Rated voltage
I Thermal protection
J Thermal class
K Rated shaft power
L International standard
M Degree of protection
N Rated current
O Rated speed
P Max. submergence
Q Direction of rotation: L=left, R=right
R Duty class
S Duty factor
T Product weight
U Locked rotor code letter
V Power factor
X Max. ambient temperature

Dataskylt inskription

A Serienummer
B Produktkod + Nummer
C Kurv- / Propellerkod
D Tillverkningsland
E Produktnummer
F Kompletterande uppgifter
G Fastal; Strömart; Frekvens
H Märkspänning
I Termoskydd
J Isolationsklass
K Märkeffekt
L Internationell standard
M Skyddsklass
N Märkström
O Varvtal
P Max. nedsäkningsdjup
Q Rotationsriktning: L=vänster, R=höger
R Driftklass
S Driftfaktor
T Produktvikt
U Kodbokstav för låst rotor
V Effektfaktor
X Max. omgivningstemperatur

Erläuterungen zum Datenschild

A Serien-Nr
B Produktkode + Kennummer
C Kurven-Nr / Propellerkode
D Herstellungsland
E Produkt-Nr
F Komplettierende Angaben
G Phasenzahl; Stromart; Frequenz
H Nennspannung
I Thermischer Schütz
J Isolationsklasse
K Nennwellenleistung
L Internationale Norm
M Schutzart
N Nennstrom
O Nenndrehzahl
P Max. Eintauchtiefe
Q Drehrichtung: L=links, R=rechts
R Betriebsklasse
S Relative Einschaltdauer
T Produktgewicht
U Kodebuchstabe für blockierten Läufer
V Leistungsfaktor
X Max. Umgebungstemperatur

Légende de la plaque signalétique

A N° de série
B Code de produit + N°
C N° de courbe / Code d'hélice
D Pays de fabrication
E N° de produit
F Informations complementaires
G Phases; Type de courant; Fréquence
H Tension nominale
I Protection thermique
J Classe d'isolation
K Puissance nominale sur l'arbre
L Norme internationale
M Classe de protection
N Intensité nominale
O Vitesse de rotation
P Profondeur d'immersion maxi
Q Sens de rotation: L=gauche, R=droite
R Classe de fonctionnement
S Facteur de marche
T Poids de produit
U Code alphabétique rotor verrouillé
V Facteur de puissance
X Température ambiante maxi

Inscripción de la placa

A Nº fabricación
B Código de producto + Nº
C N° curva / Código de hélice
D País de origen
E Nº producto
F Información adicional
G Nº fases; Clase de corriente; Frecuencia
H Tensión nominal
I Protección térmica
J Clase de aislamiento
K Potencia de eje nominal
L Norma internacional
M Clase de protección
N Intensidad de corriente nominal
O Velocidad rotación nominal
P Profundidad inmersión máx.
Q Sentido de rotatión: L=izq, R=dcha
R Clase de funcionamiento
S Factor de funcionamiento
T Peso del producto
U Letra de código de rotor bloqueado
V Factor de potencia
X Temperatura ambiente máx.

Descrizione targhetta segnaletica

A No. di matricola
B Codice prodotto + Numero
C No. curva / Codice elica
D Paese di produzione
E No. di prodotto
F Ulteriori informazioni
G No. di fase; Tipo di corrente; Frequenza
H Tensione nominale di alimentazione
I Protezione termica
J Classe di isolamento
K Potenza resa nominale
L Standard internazionale
M Classe di protezione
N Assorbimento nominale
O Velocità di rotazione nominale
P Max profondità d'immersione
Q Senso di rotazione: L=sinistra, R=destra
R Classe di servizio
S Fattore di utilizzazione
T Peso del prodotto
U Lettera codice per rotore chiuso
V Fattore di potenza
X Max temperatura ambiente

Ordering spare parts
State serial number of the pump, spare part number and quantity when ordering.

Genuine Flygt parts must always be used for repairs if the pump is to fulfill requirements and obtain official approval.
Only Flygt or Flygt-authorized service personnel may undertake repair work on specially approved pumps.

Reservdelsbeställning
Ange pumpens serienummer, reservdelsnummer och antal vid beställning.
Om pumpen skall uppfylla kraven och uppnå officiellt godkännande, måste alltid Flygt-original reservdelar användas vid service. Endast Flygt eller Flygt- auktoriserad servicepersonal får utföra servicearbete på speciellt godkända pumpar.

Ersatzteilbestellung
Bei Bestellung bitte die Fabrikations-Nr, Ersatzteil-Nr und Anzahl der Pumpen angeben.

Wenn die Pumpe den Erfordernissen entsprechen und offizielle Zulassung erhalten soll, müssen immer Orginal-Flygt-Teile für Reparaturen verwendet werden. Nur Flygt oder Flygt-autorisiertes Wartungspersonal darf Wartung an speziell zugelassenen Pumpen ausführen.

Commander pièces détachées
Préciser à la commande le numéro de série de la pompe, les références des pièces détachées et les quantités.
Pour que le produit demeure conforme à la réglementation et aux différents agréments, il est indispensable d'utiliser uniquement des pièces détachées Flygt. La réparation de produits possédant un agrément spécial ne doit être effectuée que par un technicien Flygt ou un atelier agréé par Flygt.

Orden de Repuestos
Establecer el número de serie de la bomba, numeros de cada parte de repuesto y cantidad ordenada.
En caso de reparaciones, deben ser usadas partes genuinas Flygt para conservar la garantia. Solo personal autorizado de Flygt debe efectuar reparaciones para mantener la garantia del equipo.

Ordine parti di ricambio
Quando ordinate le parti di ricambio, citate sempre la matricola della pompa, il codice e la quantità della parte di ricambio.

Utilizzate solo parti di ricambio originali Flygt se volete che la pompa mantenga i requisiti richiesti per l'omologazione ufficiale. Qualsiasi riparazione su pompe antideflagranti dovrà essere effettuato da tecnici autorizzati dalla Flygt; in caso contrario Flygt declina ogni responsabilità.

Guarantee | Garantie | Garanzia
Garanti | Garantie | Garantía

Warranty Claim
Flygt pumps are high quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, please contact your Flygt representative.

Garantianspråk
Flygt tillverkar pumpar av hög kvalitet som fungerar pålitligt och har lång livslängd. Skulle emellertid ett garantianspråk bli aktuellt, kontakta närmaste Flygt-representant för information.

Gewährleistung
Flygt-Pumpen sind hochwertige Produkte, die für zuverlässigen Betrieb und lange Lebensdaur gebaut sind. Falls wider Erwarten dennoch Gewährleistungsanspruch auftreten sollte, wenden Sie sich bitte an Ihre Flygt-Vertretung.

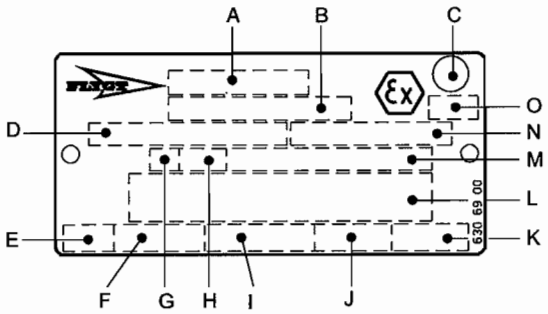
Garantie
Les pompes Flygt sont des produits de haute qualité, conçus pour fonctionner en toute fiabilité pendant de longues années. Toutefois, en cas de réclamation éventuelle sous le couvert de la garantie, veuillez contacter l'agence Flygt

Condizioni di garanzia
Le elettropompe ITT Flygt sono prodotti di qualità per i quali è prevista una durata di esercizio lunga e afidabile. Qualora fosse necessario presentare reclamo durante il periodo di garanzia, contattare il rappresentante ITT Flygt più vicino.

Reclamaciones por garantía
Las bombas Flygt son productos de alta calidad con un funcionamiento fiable y larga vida de servicio. Sin embargo, si hubiera motivos de reclamción por garantía, ponerse en contacto con el representante de Flygt más cercano.

FLYGT	Approval plate Godkännandeskylt Prüfschild	Plaque d'agrément Placa de aprobación Targhetta di approvazione	3085

EN: European Norm
ATEX Directive
European standards EN 50014, EN 50018 and EN 1127-1
EEx d II B T3 for ambient temperatures ≤40°C
EEx d II B T4 for ambient temperatures ≤25°C



Approval plate
- A Approval
- B Approval authority + Approval Number
- C Approval for Class I
- D Approved drive unit
- E Stall time
- F Starting current / Rated current
- G Duty class
- H Duty factor
- I Input power
- J Rated speed
- K Controller
- L Additional information
- M Max. ambient temperature
- N Serial number
- O ATEX marking

Godkännandeskylt
- A Godkännande
- B Provningsmynd. + Godkännandenummer
- C Godkännande för Klass I
- D Godkänd drivenhet
- E Fastbromsningstid
- F Startström / Märkström
- G Driftklass
- H Driftfaktor
- I Inmatad effekt
- J Varvtal
- K Kontrollant
- L Kompletterande uppgifter
- M Max. omgivningstemperatur
- N Serienummer
- O ATEX märkning

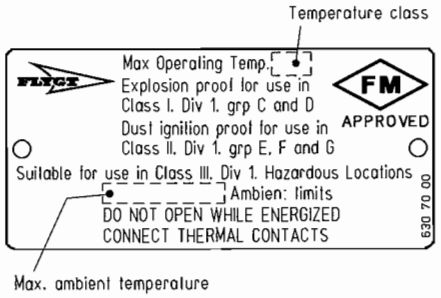
Zulassungsschild
- A Zulassung
- B Zulassungsstelle + Zulassungs-Nr
- C Zulassung für Klasse I
- D Zugelassener Antrieb
- E Abreißzeit
- F Anlaufstrom / Nennstrom
- G Betriebsklasse
- H Relative Einschaltdauer
- I Aufgenommene Leistung
- J Nenndrehzahl
- K Kontrollstelle
- L Komplettierende Angaben
- M Max. Umgebungstemperatur
- N Seriennummer
- O ATEX Markierung

Placque d'agrément
- A Agrément
- B Organisme ayant délivré l'agrément + N° d'agrément
- C Agrément pour classe I
- D Agrément moteur
- E Temps de réaction des thermosondes
- F Intensité au démarrage / Intensité nominale
- G Classe de fonctionnement
- H Facteur de marche
- I Puissance absorbée
- J Vitesse de rotation
- K Contrôleur
- L Informations complementaires
- M Température ambiante maxi
- N N° de série
- O Marque d' ATEX

Placa de aprobación
- A Aprobación
- B Autoridad homologadora + N° aprobación
- C Aprobación para clase I
- D Unidad de accionamiento aprobada
- E Tiempo de parada
- F Intensidad de corriente arranque/ Intensidad de corriente nominal
- G Clase de funcionamiento
- H Factor de funcionamiento
- I Potencia consumida
- J Velocidad rotación nominal
- K Controlador
- L Información adicional
- M Temperatura ambiente máx.
- N N° fabricación
- O Marcado ATEX

Targhetta approvazione
- A Approvazione
- B Autorità di approvazione + No. di approvazione
- C Classe di approvazione I
- D Motore approvato
- E Tempo di arresto
- F Corrente di spunto / Assorbimento nominale
- G Classe di servizio
- H Fattore di utilizzazione
- I Potenza assorbita
- J Velocità di rotazione nominale
- K Controllo
- L Ulteriori informazioni
- M Max temperatura ambiente
- N No. di matricola
- O Marcatura ATEX

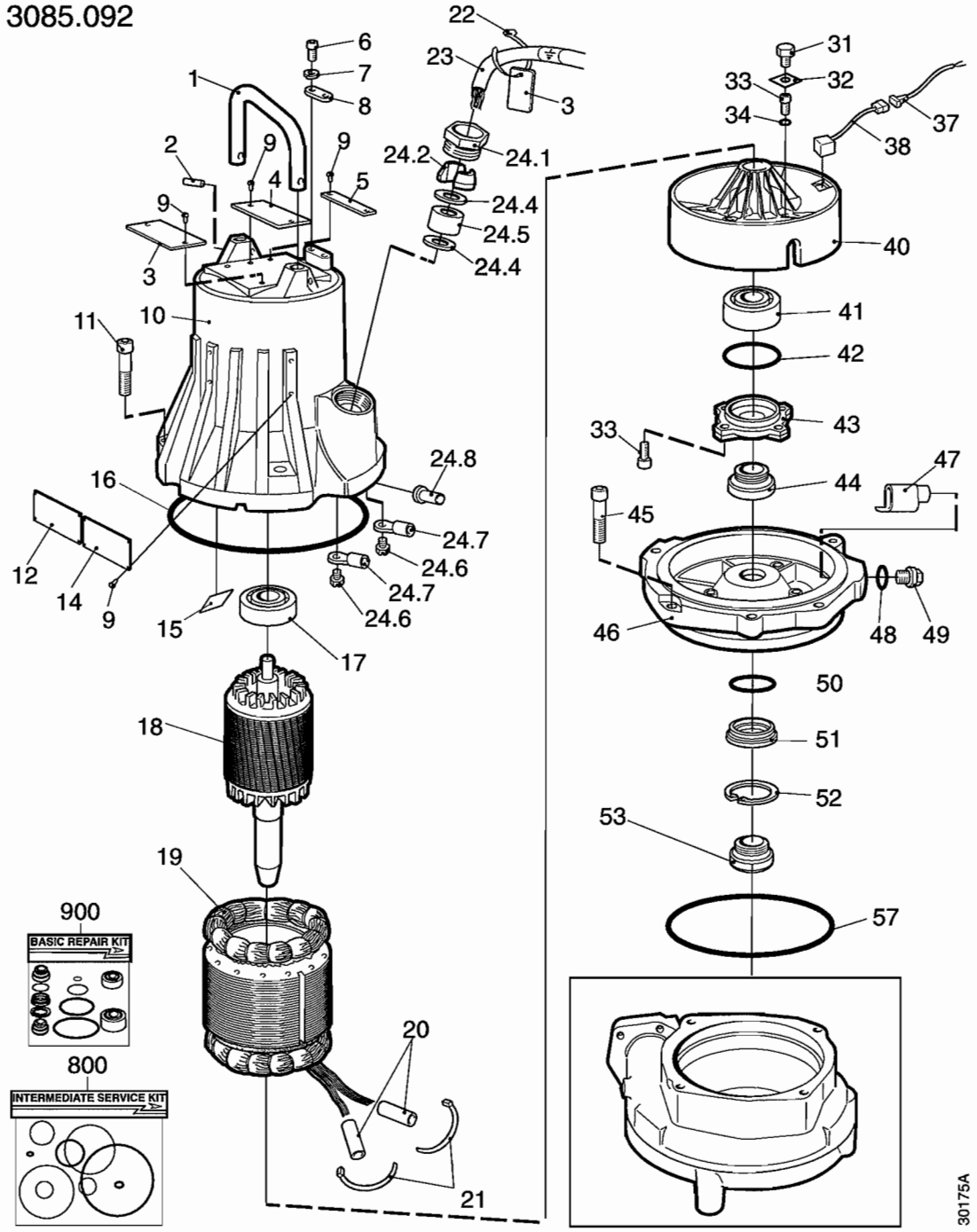
FM: Factory Mutual according to standard 3615 as:
Class I Div. I Grp C and D
Class II and III Div. I Grp E, F and G
Temperature class: T3C for ambient temperatures ≤40°C



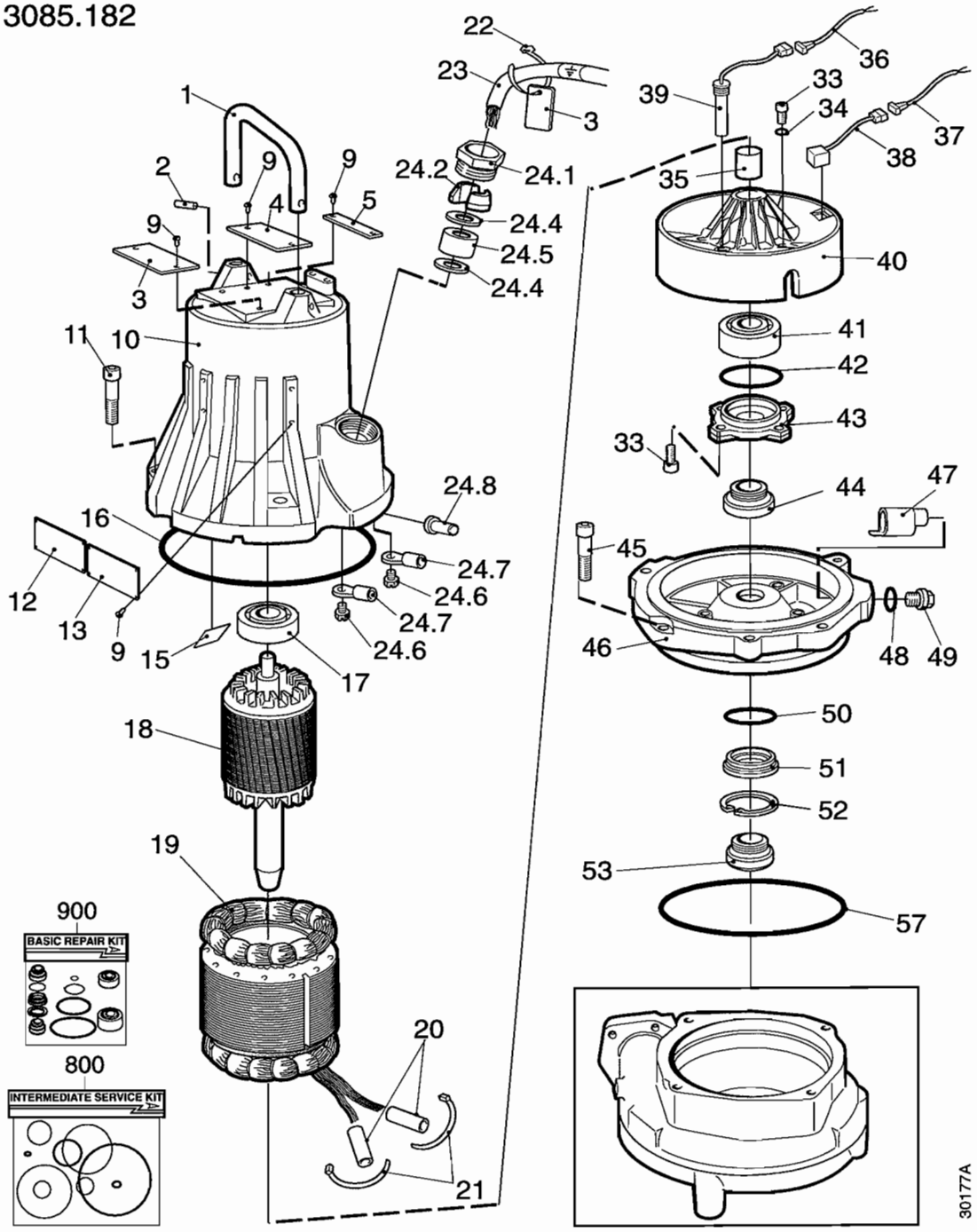
FLYGT

Exploded view

3085



3085.182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18
19
900
BASIC REPAIR KIT
800
INTERMEDIATE SERVICE KIT
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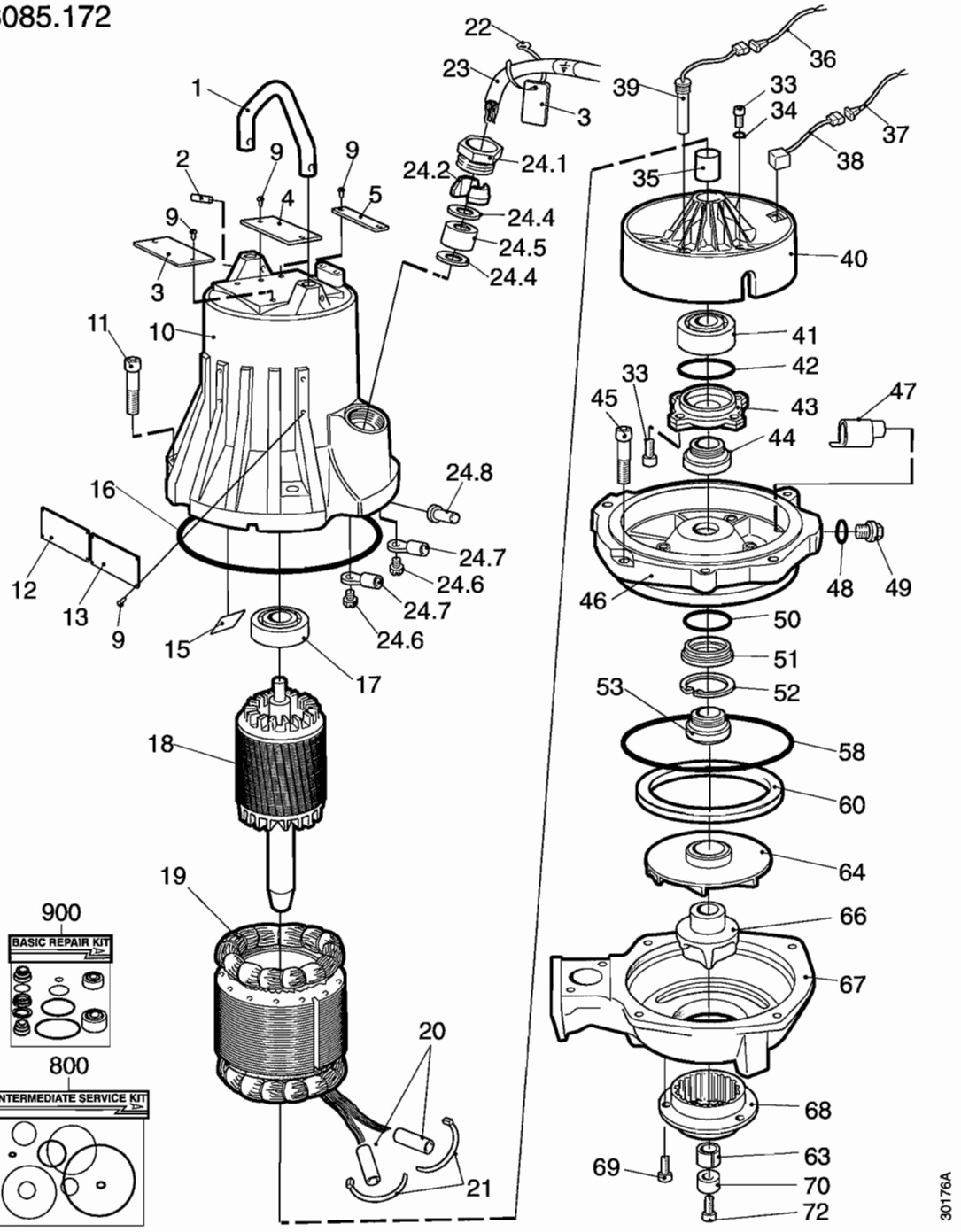
30177A

3085.172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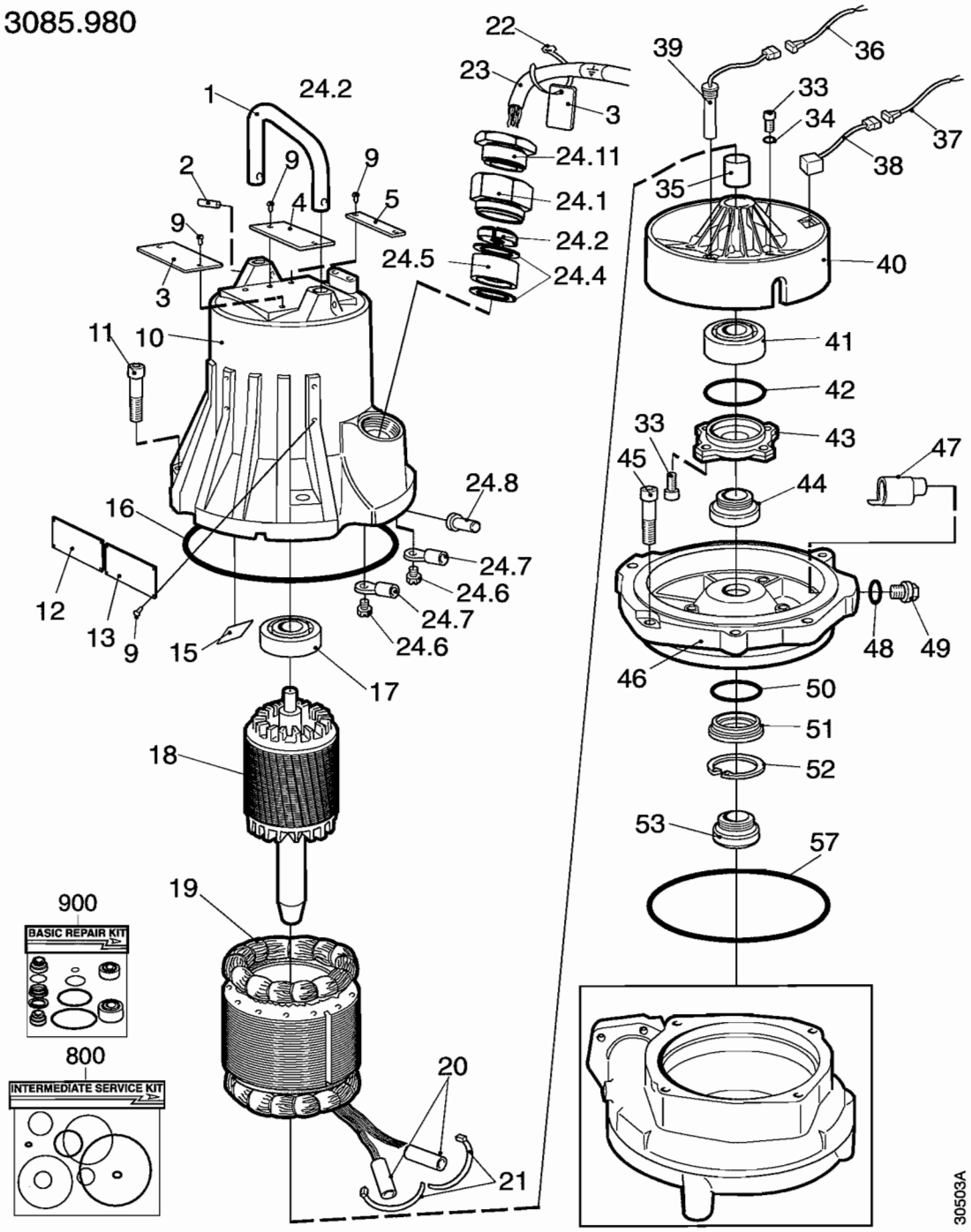
30176A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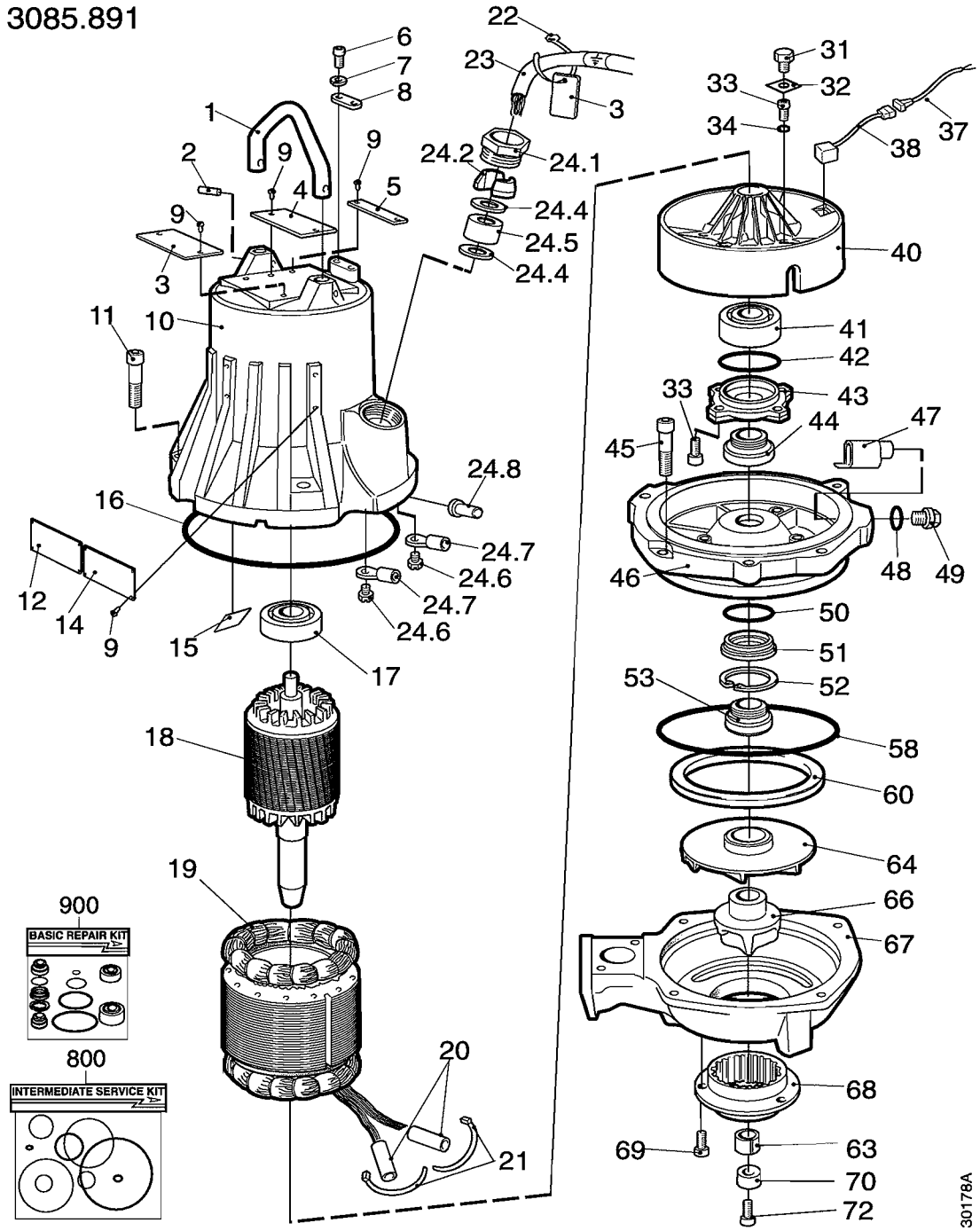
30503A


3085.891
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INTERMEDIATE SERVICE KIT
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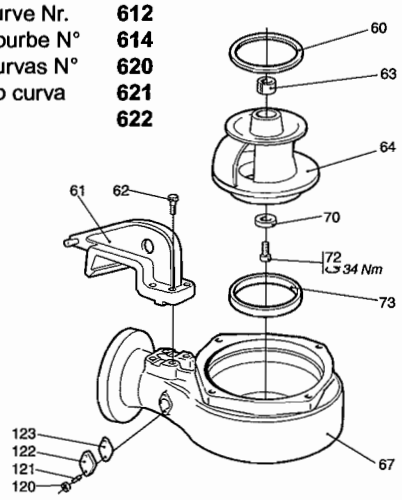
72
30178A

CP 3085 LT

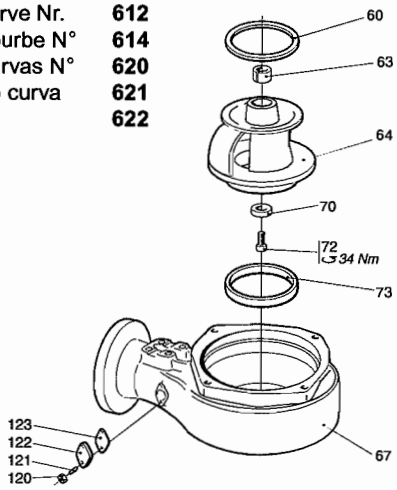
Curve No.	**412**
Kurva nr.	**414**
Kurve Nr.	**612**
Courbe N°	**614**
Curvas N°	**620**
No curva	**621**
	622



30187

C_ 3085 LT

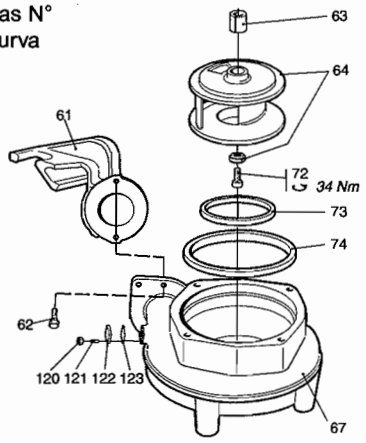
Curve No.	**412**
Kurva nr.	**414**
Kurve Nr.	**612**
Courbe N°	**614**
Curvas N°	**620**
No curva	**621**
	622



30550

CP 3085 MT

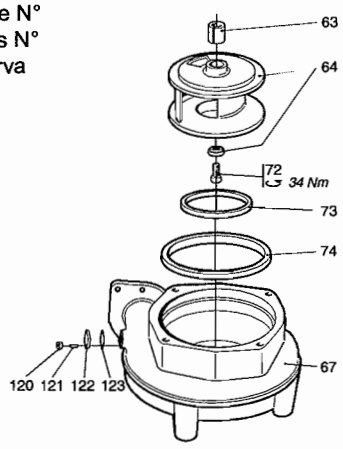
Curve No.	**438**
Kurva nr.	**440**
Kurve Nr.	
Courbe N°	
Curvas N°	
No curva	



30158

C_ 3085 MT

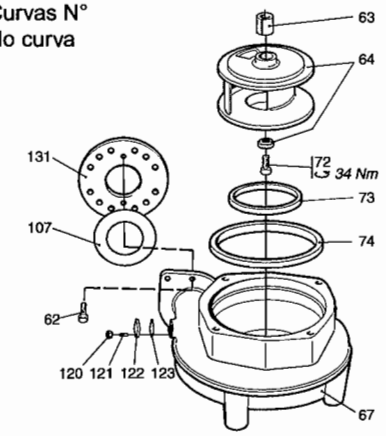
Curve No.	**438**
Kurva nr.	**440**
Kurve Nr.	
Courbe N°	
Curvas N°	
No curva	



30191A

CT 3085 MT

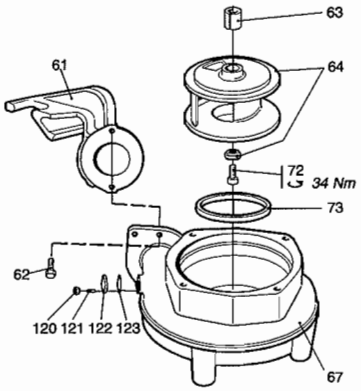
Curve No.	**438**
Kurva nr.	**440**
Kurve Nr.	
Courbe N°	
Curvas N°	
No curva	



30193A

CP 3085 MT

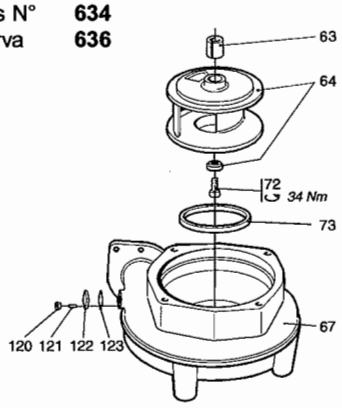
Curve No.	**432**
Kurva nr.	**434**
Kurve Nr.	**436**
Courbe N°	**632**
Curvas N°	**634**
No curva	**636**



30941

C_ 3085 MT

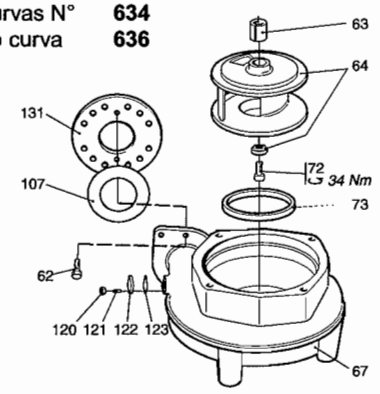
Curve No.	**432**
Kurva nr.	**434**
Kurve Nr.	**436**
Courbe N°	**632**
Curvas N°	**634**
No curva	**636**



30940

CT 3085 MT

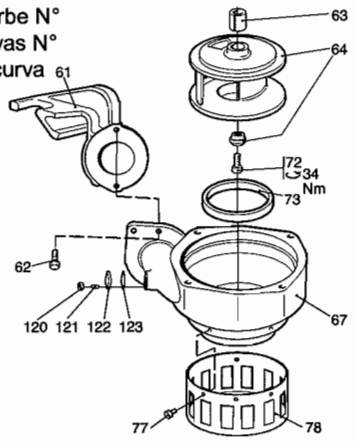
Curve No.	**432**
Kurva nr.	**434**
Kurve Nr.	**436**
Courbe N°	**632**
Curvas N°	**634**
No curva	**636**



30942

CP 3085 HT

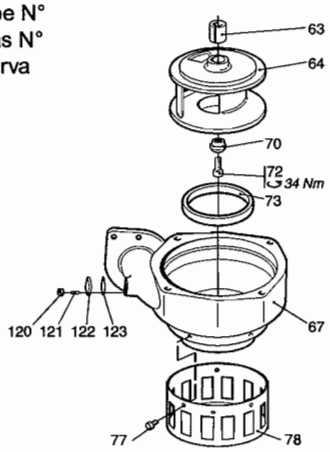
Curve No. **250**
Kurva nr. **252**
Kurve Nr.
Courbe N°
Curvas N°
No curva



30189

C_ 3085 HT

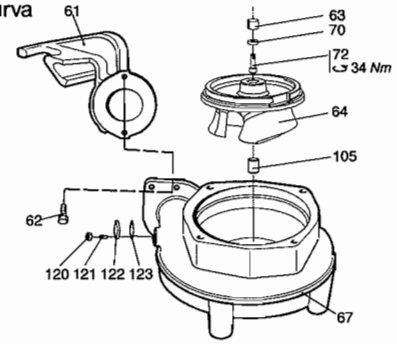
Curve No. **250**
Kurva nr. **252**
Kurve Nr.
Courbe N°
Curvas N°
No curva



30192

NP 3085 MT

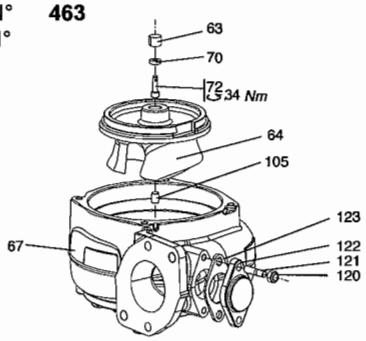
Curve No. **460**
Kurva nr. **461**
Kurve Nr. **462**
Courbe N° **463**
Curvas N°
No curva



30906

N_ 3085 MT

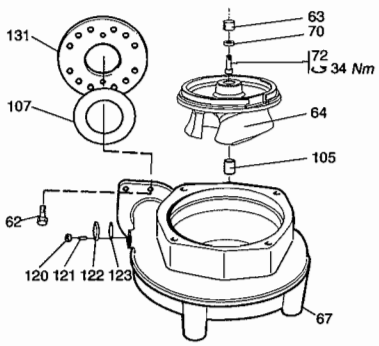
Curve No. **460**
Kurva nr. **461**
Kurve Nr. **462**
Courbe N° **463**
Curvas N°
No curva



30905

NT 3085 MT

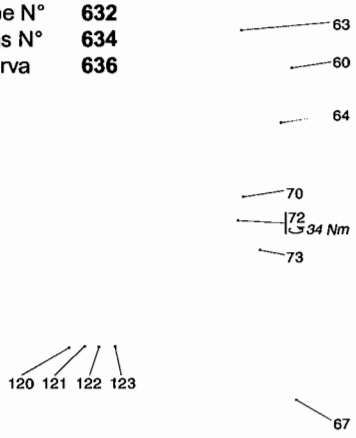
Curve No.
Kurva nr. **461**
Kurve Nr. **463**
Courbe N°
Curvas N°
No curva



30951

CF 3085 MT

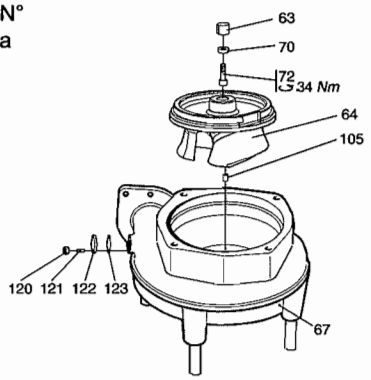
Curve No. **432**
Kurva nr. **434**
Kurve Nr. **436**
Courbe N° **632**
Curvas N° **634**
No curva **636**



30194

NF 3085 MT

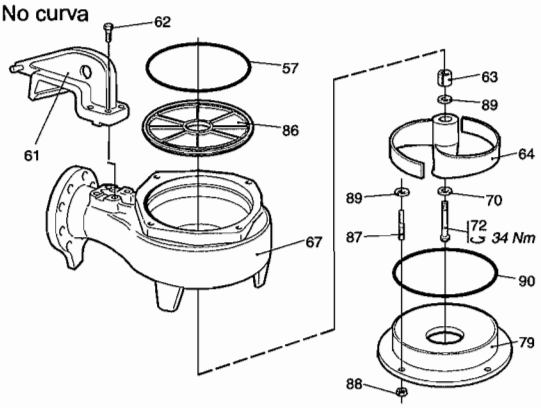
Curve No. **460**
Kurva nr. **461**
Kurve Nr. **462**
Courbe N° **463**
Curvas N°
No curva



30943

FP 3085 LT

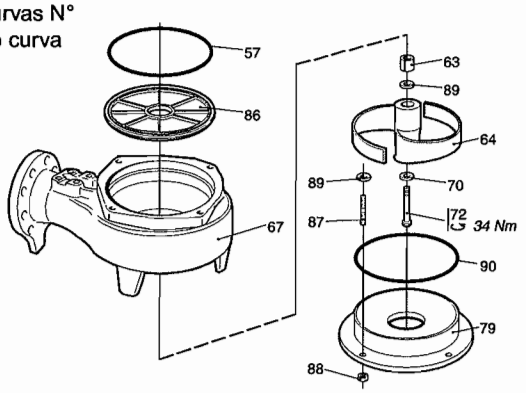
Curve No. **490**
Kurva nr. **491**
Kurve Nr. **492**
Courbe N° **493**
Curvas N°
No curva



30202

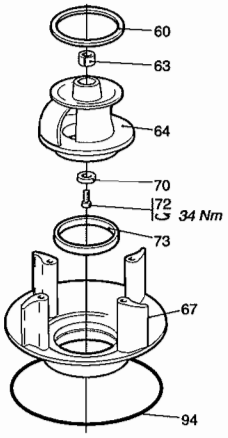
F_ 3085 LT

Curve No. **490**
Kurva nr. **491**
Kurve Nr. **492**
Courbe N° **493**
Curvas N°
No curva



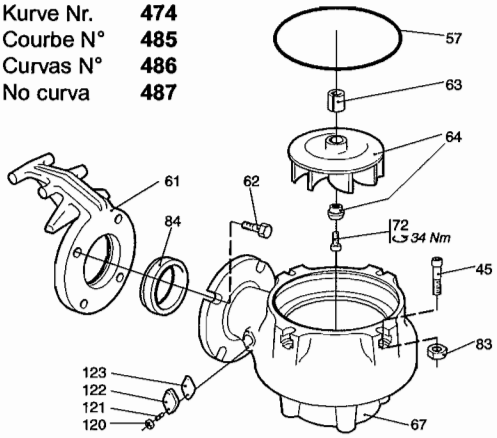
LL 3085 LT

Curve No. **412**
Kurva nr. **414**
Kurve Nr.
Courbe N°
Curvas N°
No curva



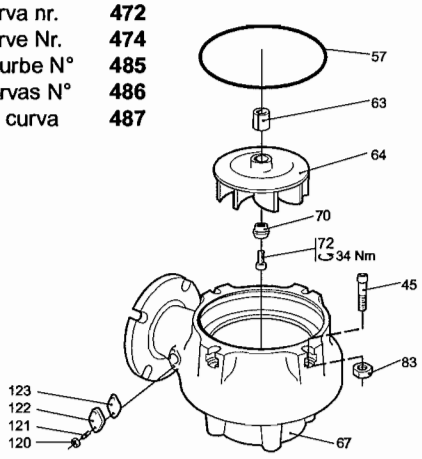
DP 3085 MT (50 Hz)

Curve No. **470**
Kurva nr. **472**
Kurve Nr. **474**
Courbe N° **485**
Curvas N° **486**
No curva **487**



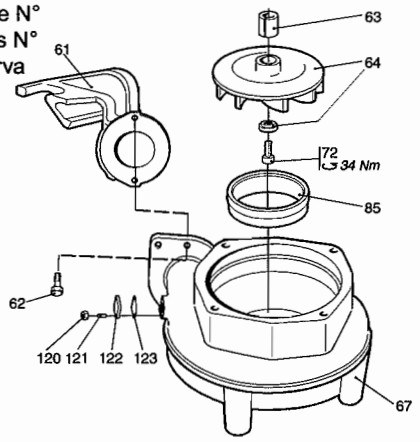
DS 3085 MT

Curve No. **470**
Kurva nr. **472**
Kurve Nr. **474**
Courbe N° **485**
Curvas N° **486**
No curva **487**



DP 3085 MT (60Hz)

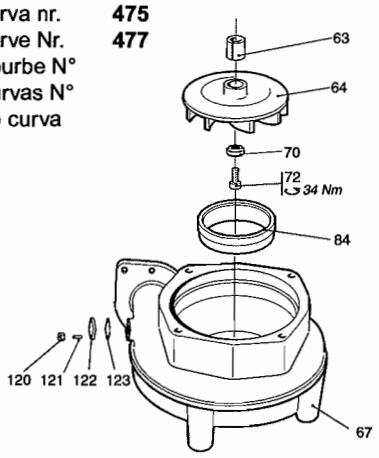
Curve No. **473**
Kurva nr. **475**
Kurve Nr. **477**
Courbe N°
Curvas N°
No curva



30196

DF 3085 MT

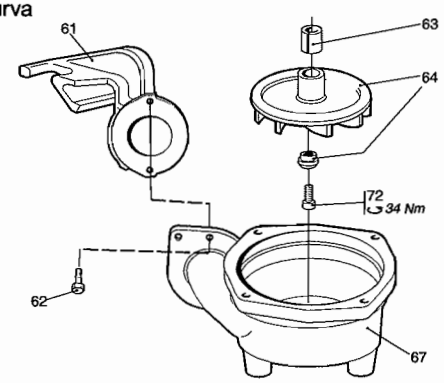
Curve No. **473**
Kurva nr. **475**
Kurve Nr. **477**
Courbe N°
Curvas N°
No curva



30200

DP 3085 HT

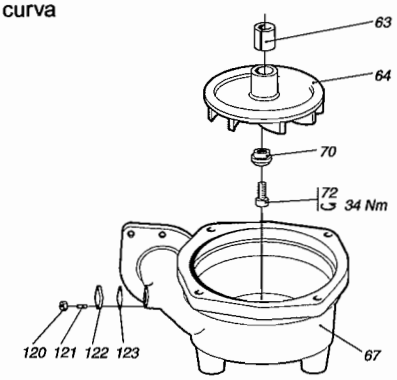
Curve No. **276**
Kurva nr. **278**
Kurve Nr. **280**
Courbe N° **282**
Curvas N° **284**
No curva



30197

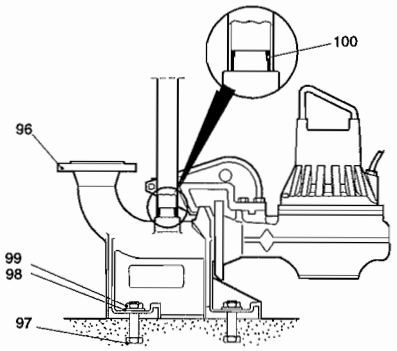
DS 3085 HT

Curve No. **276**
Kurva nr. **278**
Kurve Nr. **280**
Courbe N° **282**
Curvas N° **284**
No curva



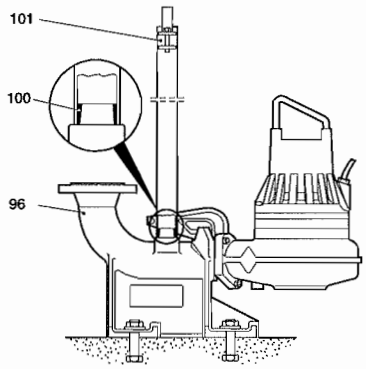
30199

CP 3085 LT



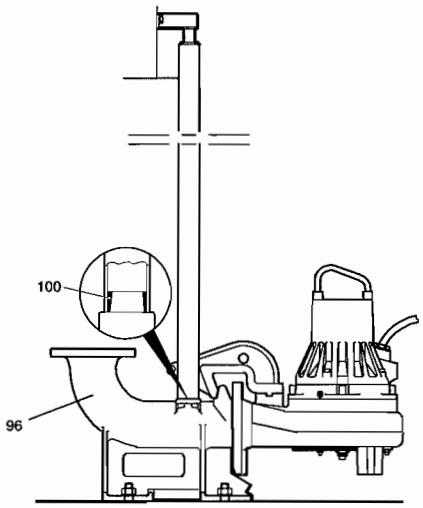
30267

CP, DP, NP 3085 MT, HT



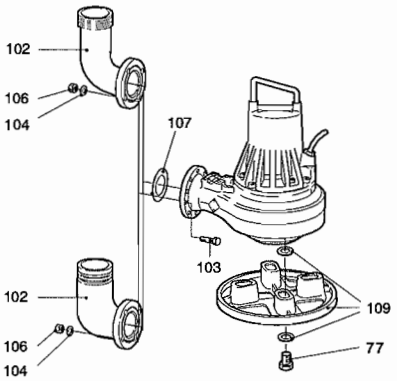
30266A

FP 3085 LT



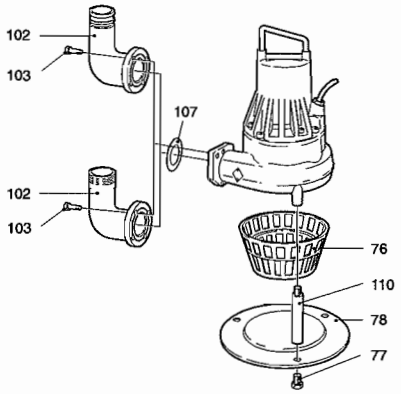
30944

CS 3085 LT



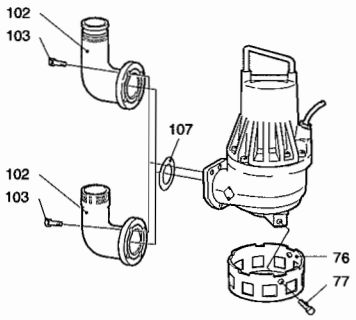
30240

CS, NS 3085 MT



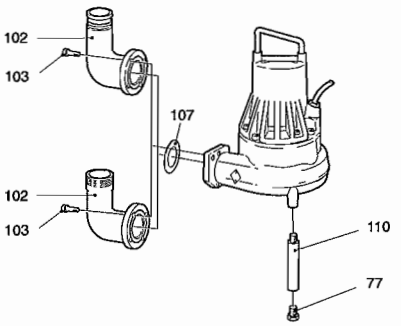
30241A

CS 3085 HT



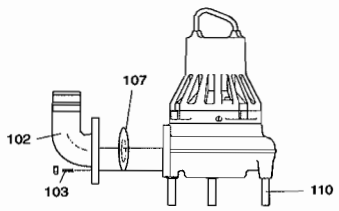
30242

CF 3085 MT



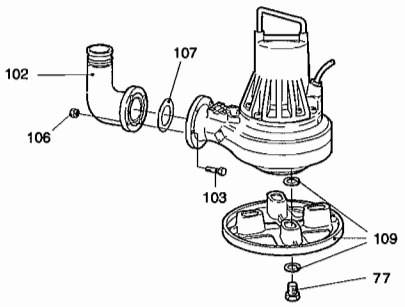
30243

DF, NF 3085 MT



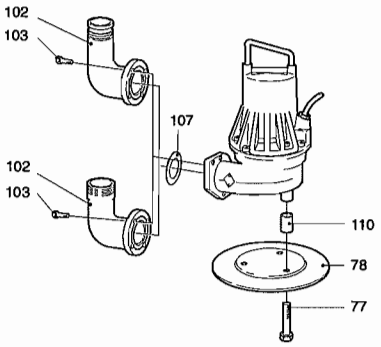
30948

DS 3085 MT



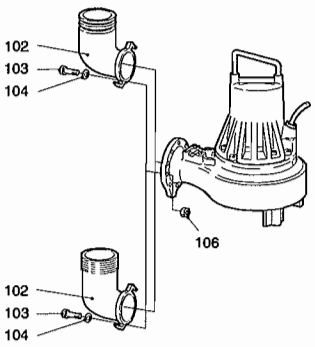
30247

DS 3085 HT



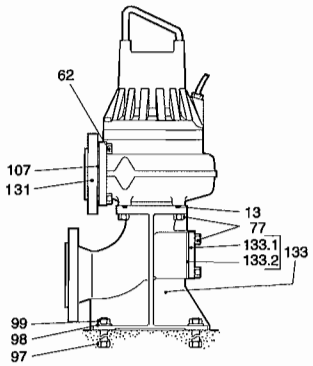
30246

FS 3085 LT



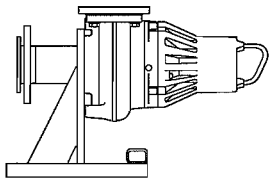
30247

CT/NT 3085



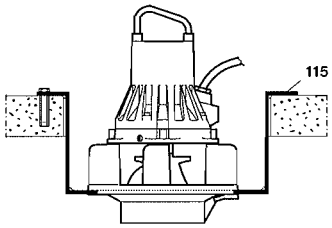
30258

CZ, NZ 3085



30921

LL 3085, type A



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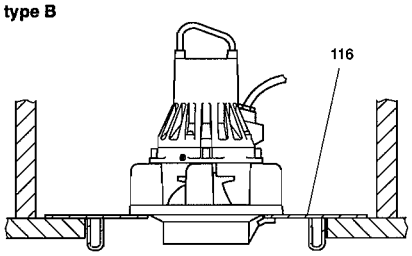
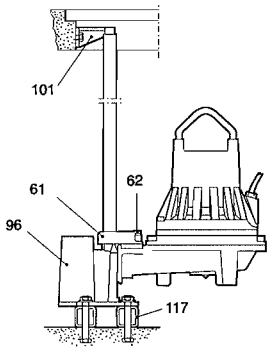


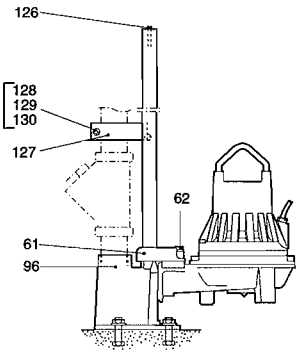
30273

MP 3085.172/891 alt 1



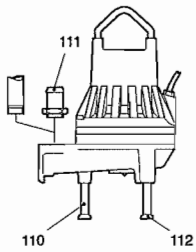
30271

MP 3085.172/891 alt 2



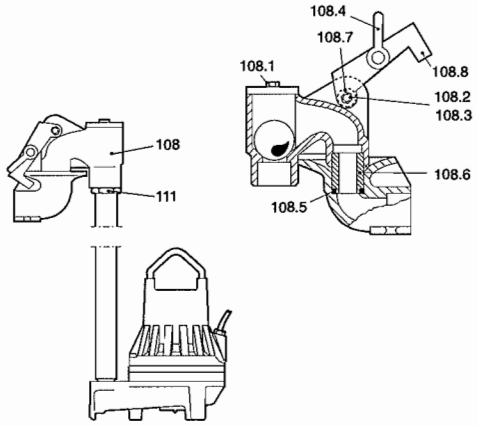
30272

MF 3085.172/891



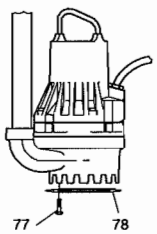
30269

MH 3085.172/891



30270

GF 3085 MT

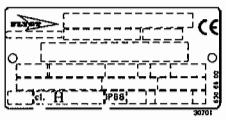


30949

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085				
			Qty / Version				
Pos.No.	Part No.	Denomination	092	182	172	891	980
1	397 80 01 397 80 02 473 23 01	LIFTING HANDLE LYFTBYGEL TRAGBUGEL ETRIER D'ELEVER ABRAZADERA DE ELEVAR MANIGLIA SOLLEVAMEN.	1 - 1	1 - 1	- - 1	- - 1	- 1 -
2	80 58 89	TENSION PIN FJÄDRANDE RÖRPINNE FEDERSTIFT GOUPILLE CLAVILJA SPINOTTO	5X24	2	2	2	2	2
3	630 68 00	DATA PLATE DATASKYLT DATENSCHILD PLAQUE SIGNALETIQUE PLACA DE CARACTERIST TARGA DATI	1	1	1	1	1
6	83 02 58	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M5X12-A4-70	2	-	-	2	-
8	279 29 00	EARTHING PLATE SKYDDSLEDAREPLATTA ERDUNGSPLATTE PLAQUE DE TERRE PLACA DE TIERRA PIASTRA DI TERRA	1	-	-	1	-
9	82 20 88 82 21 73	DRIVE SCREW DRIVSKRUV TREIBSCHRAUBE VIS FILETANTE TORNILLO VITE AUTOFILETTANTE	4X5-A2-70	8 -	8 -	8 -	8 -	- 4

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
10	556 15 01 556 15 00	STATOR HOUSING STATORHUS STATORGEHÄUSE LOGEMENT DE STATOR CARCASA DE ESTATOR ALOGGIO STATORE	1 -	- 1	- 1	1 -	- 1
11	82 00 39 83 03 06	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M8X50-A2-70	4 -	4 -	4 -	4 -	-
13	630 76 00	PLATE SKYLT SCHILD PLAQUE PLACA TARGA/PIASTRA	Warm liquid version	-	1	-	-	1
14	630 69 00 630 70 00	CERTIFICATE PLATE CERTIFIKATSKYLT ZEUGNISSCHILD PLAQUE DE CERTIFICAT PLACA DE CERTIFICADO TARGA CERTIFICATO	EN FM	1 1	- -	- -	1 1	-
15	550 21 00 550 23 00 585 07 00 585 03 00 426 69 00 550 22 00 550 24 00 615 97 00 657 79 00 667 14 00	CONNECTION PLATE KOPPLINGSSKYLT KUPPLUNGSSCHILD PLAQUE DE BRANCHEM. PLACA DE CONEXION PIASTRA DI COLLEG		- - - - 1 1 1 1 - -	1 1 1 1 1 1 1 1 1 -	1 1 - 1 1 1 1 1 - 1	- - - 1 1 1 1 1 - -	1 1 - - 1 1 1 1 1 -
16	82 79 34 82 78 37	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	200,0X3,0 FPM Warm liquid version 200,0X3,0 NBR	- 1	1 1	- 1	- 1	1 -
17	83 34 40	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLA CUSCINETTO A SFERE	6304 RS1 20X52X15	1	1	1	1	1

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085

Pos.No.	Part No.	Denomination			Qty / Version 092	182	172	891	980
18		SHAFT UNIT AXELENHET WELLENEINHEIT UNITE D'ARBRE UNIDAD DE ARBOL ALBERO ROTORE	For motor För motor Für motor	Pour moteur Para motor Per motore					
	595 91 00		15-10-4A, 15-10-6G		1	-	-	-	-
	595 91 01		15-07-4A		1	-	-	-	-
	595 92 00		15-09-2A		1	-	-	1	-
	595 92 01		15-09-2G		-	-	-	1	-
	595 98 00		15-09-2A		-	1	1	-	1
	595 98 01		15-09-2G		-	-	1	-	-
	595 98 02		15-04-2A		-	1	-	-	1
	595 99 00		15-10-4A, 15-10-6G		-	1	-	-	1
	595 99 01		15-07-4A		-	1	-	-	1
19		STATOR ESTATOR STATORE							
		1~, 50Hz, 0.85 kW, 2950r/min (15-09-2A)	—						
	404 07 76	220-240V			-	1	-	-	-
		1~, 50Hz, 1.5 kW, 1440r/min (15-10-4A)	—						
	408 40 14	220-240V			-	1	-	-	1
		1~, 50Hz, 0.95 kW, 1435r/min (15-07-4A)	—						
	408 41 14	220-240V			-	1	-	-	1
		3~, 50Hz, 0.77 kW, 2780r/min (15-04-2A)	**3~, 60Hz, 0,9 kW (1.2hp), 3380r/min (15-04-2A)**						
	434 84 29	—	380V Y/220-230V Δ		-	-	-	-	1
	434 84 31	400V Y/230Y Δ	—		-	1	-	-	1
	434 84 34	380V Y/220V Δ	440-460V Y/260V Δ		-	1	-	-	1
	434 84 38	660V Y/380V Δ	440- 460V Δ		-	-	-	-	1
	434 84 39	690V Y/400V Δ	—		-	1	-	-	1
	434 84 43	400-440V Y	480V Y		-	1	-	-	-
	434 84 51	500-550V Y	575-600V Y		-	1	-	-	1

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085

Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
19		STATOR ESTATOR STATORE						
		3~, 50Hz, 2.0kW, 1400r/min (15-10-4A)	**3~, 60Hz, 2.2kW (3.0hp),1700r/min (15-10-4A)**					
	408 40 12	—	440-460V Yser./220-230V Y //	1	1	-	-	1
	408 40 27	180-190V Y	200-220V Y	1	1	-	-	1
	408 40 29	—	380V Y/220V Δ	1	1	-	-	-
	408 40 30	—	380V Δ	1	1	-	-	-
	408 40 31	400V Y/230V Δ	—	1	1	-	-	1
	408 40 32	346-350V Y/200-208V Δ	400V YY/230-240V Δ	1	1	-	-	1
	408 40 34	380V Y/220V Δ	440-460V Y/260V Δ	1	1	-	-	1
	408 40 38	660V Y/380V Δ	440-460V Δ	1	1	-	-	-
	408 40 39	690V Y/400V Δ	—	1	1	-	-	1
	408 40 40	400V Δ	400V Δ	1	1	-	-	-
	408 40 43	400-440V Y	480V Y	1	1	-	-	-
	408 40 51	500-550V Y	575-600V Y	1	1	-	-	1
		3~, 50Hz, 1.3kW, 1400r/min (15-07-4A)	**3~, 60Hz, 1.6kW (2.2hp), 1700r/min (15-07-4A)**					
	408 41 12	—	440-460V Yser./220-230V Y//	1	1	-	-	1
	408 41 27	190-200V Y	200-220V Y	1	1	-	-	1
	408 41 30	—	380V Δ	1	1	-	-	-
	408 41 31	400V Y/230V Δ	—	1	1	-	-	1
	408 41 32	346-350V Y/200-208V Δ	400V Y/230-240V Δ	1	1	-	-	1
	408 41 34	380V Y/220V Δ	440-460V Y/260V Δ	1	1	-	-	1
	408 41 38	660V Y/380V Δ	440-460V Δ	1	1	-	-	-
	408 41 39	690V Y/400V Δ	—	1	1	-	-	1
	408 41 40	400V	400V Δ	1	1	-	-	-
	408 41 43	400-440V Y	480V Y	1	1	-	-	-
	408 41 51	500-550V Y	575-600V Y	1	1	-	-	1
		1~, 50Hz, 1.9kW, 2900r/min (15-09-2G)	**1~, 60Hz, 2.2kW (3.0hp), 3500r/min (15-09-2G)**					
	504 79 72	—	220-230V	-	-	1	1	-
	504 79 75	220-240V	—	-	-	1	1	-
		3~, 50Hz,0.9kW, 935r/min (15-10-6G)	**—**					
	539 95 01	380-400/660-690V Y		1	1	-	-	-
	539 95 03	380V Y/220V Δ		1	1	-	-	-
	539 95 05	400-440V Y		1	1	-	-	-
	539 95 39	400V Y/230V Δ		1	1	-	-	1

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085

Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
19		STATOR ESTATOR STATORE						
		3~, 50Hz, 2.4kW, 2850r/min (15-09-2A)	**3~, 60Hz, 3.0kW (4.0hp), 3450r/min (15-09-2A)**					
	408 42 12	—	440-460V Yser./220-230V Y//	1	1	1	1	1
	408 42 27	190-200V Y	200-220V Y	1	1	1	1	1
	408 42 29	—	380V Y/220-230V Δ		1	1	1	1
	408 42 30	380V Δ	—	-	1	-	-	-
	408 42 31	400V Y/230V Δ	—	1	1	1	1	1
	408 42 34	380V Y-220V Δ	440-460V Y/260V Δ	1	1	1	1	1
	408 42 38	660V Y/380V Δ	440-460V Δ	1	1	1	1	-
	408 42 39	690/400V	—	1	1	1	1	1
	408 42 40	400V Δ	400V Δ	-	1	-	-	-
	408 42 43	400-440V Y	480V Y	1	1	1	1	-
	408 42 44	415 V D	—	-	1	-	-	-
	408 42 51	500-550V Y	575-600V Y	1	1	1	1	1
20	83 65 00	INSULATING HOSE	DIAM=25 L=90	*	*	*	*	*
	94 05 91	ISOLERSLANG ISOLIERSCHLAUCH TUYAU ISOLANTE MANGUERA AISLADOR TUBO D'ISOLAMENTO	DIAM=25	-	*	-	-	*
21	83 45 59	CABLE TIE BUNTBAND SPANNBAND COLLIER DE CABLE COLLAR DE CABLE COLLARE PER CAVO	200X2,4 PA 6/6 -55+105	4	4	4	4	3
22	83 45 59	CABLE TIE BUNTBAND SPANNBAND COLLIER DE CABLE COLLAR DE CABLE COLLARE PER CAVO	200X2,4 PA 6/6 -55+105	1	1	1	1	1
23		MOTORCABLE MOTORKABEL CABLE DEL MOTOR MOTORSLADD CABLE DE MOTEUR CAVO DI POTENZA						
	94 09 37	NSSHÖU 3x2,5 + 3x2,5/3E.. (Screened), max 70°C (158°F) 18,7 - 20,0 mm		-	*	*	-	*
	94 17 22	Power cable screened 3x1,5mm², max 70°C (158°F) 13,5 -14,9 mm		-	*	-	-	*
	94 17 24	Power cable screened 6x2,5mm² +2x1.5, max 70°C (158°F) 18,1 -19,9 mm		*	-	-	-	
	94 19 75	SIH-J 4x2.5mm², max 90°C (194°F) 10 -12 mm		-	*	-	-	-
	94 20 41	SUBCAB, 4x1.5mm², max 70°C (158°F) 10.5 -11.5 mm(0.41"-0.45")		-	*	*	-	*
	94 20 42	SUBCAB, 4x2.5mm², max 70°C (158°F) 12.5 -13.5 mm (0.49"-0.53")		-	*	*	-	*
	94 20 54	SUBCAB, 7x2.5mm², max 70°C (158°F) 18 -20 mm (0.71"-0.79")		-	*	*	-	*
	94 20 59	SUBCAB, 4G2.5+2x1.5mm², max 70°C (158°F) 17 -18 mm (0.67"-0.71")		*	*	*	*	*
	94 20 61	SUBCAB, 4G1.5+2x1.5mm², max 70°C (158°F) 15.5 -16.5 mm (0.61"-0.65")		*	*	*	*	*
	94 21 02	SUBCAB, 14 AWG/7, max 70°C (158°F)18 - 20 mm (0.71"-0.79")		*	*	*	*	*
	94 21 01	SUBCAB, 14 AWG/4, max 70°C (158°F) 14.2 -15.2 mm (0.56"-0.6")		-	*	*	-	*

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085				
			Qty / Version				
Pos.No.	Part No.	Denomination	092	182	172	891	980
24.1	397 81 00	GLAND SCREW	1	1	1	1	-
	463 58 00	HYLSSKRUV VERSCHRAUBUNG ECROU DE SERRAGE TORNILLO DE CAMISA VITE DI SERRAGGIO	-	-	-	-	1
24.2	398 98 04	CLAMP	18-20mm	1	1	-	1	1
	398 98 00	KLÄMMA	10-12mm	-	1	1	-	1
	398 98 05	KLEMME	18-20mm	1	1	1	1	1
	398 98 01	CRAMPON	12-14mm	1	1	1	1	1
	398 98 02	ABRAZADERA	14-15mm	-	1	1	-	1
	398 98 03	FASCETTA PA	16-17mm	-	1	1	-	1
	398 98 06		15-16mm	1	1	1	1	1
	398 98 07		17-18mm	1	1	1	1	1
24.4	82 40 61	WASHER	24,5X35X2-A2-70 (22)-24	2	-	-	2	-
	82 40 55	BRICKA	16,5X35X2-A2-70 (14)-16	-	2	2	-	-
	82 40 57	SCHEIBE	18,5X35X2-A2-70 (16)-18	-	2	2	-	-
	82 40 59	RONDELLE	20,5X35X2-A2-70 (18)-20	-	2	2	-	-
	82 40 84	ARANDELA	14,5X35X2-A2-70 (12)-14	-	2	2	-	-
	82 41 08	RONDELLA	12,5X35X2-A2-70 (10)-12	-	2	2	-	-
	82 42 42		24,5X35X2-A2-70 (22)-24	-	-	-	-	2
24.5	84 17 90	SEAL SLEEVE	DIAM=15;L=26 for cable (10)-12	-	-	-	-	1
	84 17 91	TÄTNINGSHYLSA	DIAM=16;L=26 (12)-14	-	-	-	-	1
	84 17 92	DICHTUNGSHÜLSE	DIAM=18;L=26 (14)-16	1	-	-	1	1
	84 17 93	DOUILLE DE JOINT	DIAM=19;L=26 (16)-18	1	-	-	1	1
	84 17 94	MANGUITO DE JUNTA	DIAM=18;L=26 (18)-20	1	-	-	1	1
	84 35 32	GOMINO ENTR. CAVO	15X35X22 (14)-16	-	1	1	-	-
	84 35 33		17X35X22 TYP 2 (16)-18	-	1	1	-	-
	84 35 34		19X35X22 (18)-20	-	1	1	-	-
	84 35 59		13X35X22 TYP 2 (12)-14	-	1	1	-	-
	84 35 66		11X35X22 (10)-12	-	1	1	-	-
	84 36 39		18X35X22 TYP 2 (16)-18	-	1	1	-	-
	84 36 40		16X35X22 TYP 2 (14)-16	-	1	1	-	-
24.6	82 17 61	SCREW SKRUV SCHRAUBE VIS TORNILLO VITE TAPTITE	TAPTITE-M6X12	1	1	1	1	1
24.7	83 43 45	CABLE LUG	1,6-2,5mm²; M6	2	2	2	2	2
	83 42 96	KABELSKO	4-6mm², M6+125GR	-	1	-	-	1
	83 43 36	KABELSCHUH SABOT DE CABLE GRAPA DE CABLE CAPOCORDA	6-10mm², M6	-	1	1	-	-

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
24.8	83 44 24	CLOSED END SPLICE ÄNDSKARVHYLSA KABELENDVERBINDER RACCORDS EMBOUTS CONECTOR CONTERA CONNET PREISOLATO	2,5-6(AWG 12-10)L=17,5	8	8	8	8	8
24.11	633 11 00	GLAND SCREW HYLSSKRUV VERSCHRAUBUNG ECRUO DE SERRAGE TORNILLO DE CAMISA VITE DI SERRAGGIO		-	-	-	-	1
31	439 44 01	SCREW SKRUV SCHRAUBE VIS TORNILLO VITE		3	-	-	3	-
32	596 07 00	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA		3	-	-	3	-
33	82 17 64	SCREW SKRUV SCHRAUBE VIS TORNILLO VITE	TAPTITE-M6X20	7	7	7	7	7
34	82 50 60	LOCK WASHER LÅSBRICKA SICHERUNGSSCHEIBE RONDELLE DE BLOCAGE ARANDELA DE CIERRE RONDELLA DI BLOCCAG.	DUBO NR 301	3	3	3	3	3
35	439 42 03 439 42 04 439 42 05 439 42 06	SLEEVE HYLSA HÜLSE DOUILLE MANGUITO BUSSOLA	Shaft unit 595 99 00 Shaft unit 595 98 00 Shaft unit 595 99 01 Shaft unit 595 98 02	- - - -	1 1 1 1	- 1 - -	- - - -	1 1 1 1

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
36	504 78 06	CABLE UNIT (CLS) SLADDENHET KABELEINHEIT UNITE DE CABLE UNIDAD DE CABLE UNITA CAVO	-	1	1	-	1
36.1	83 42 42	TERMINAL KONTAKTSTIFT ANSCHLUSSSTIFT GOUPILLE DE CONTACTO PASADOR DE CONTACTO	-	2	2	-	2
36.2	83 53 40	TERMINAL DEVISE KOPPLINGSDON ANSCHLUSS VORRICHT. DISPOS. DE RACCORDEM DISPOS. DE CONEXION	-	1	1	-	1
37	504 78 07	CABLE UNIT (FLS) SLADDENHET KABELEINHEIT UNITE DE CABLE UNIDAD DE CABLE UNITA CAVO	1	1	1	1	1
38	518 89 02	LEAKAGE DETECT.UNIT FLS LÄCKAGEDETEKT.ENHET LECKAGEDETEKT.EINH. DETECT.FUITE-UNITE DETECT.GOTEO-UNIDAD UNITA' RIVEL. INFILTR	1	1	1	1	1
39	505 12 00	LEAKAGE DETECT.UNIT CLS LÄCKAGEDETEKT.ENHET LECKAGEDETEKT.EINH. DETECT.FUITE-UNITE DETECT.GOTEO-UNIDAD UNITA' RIVEL. INFILTR	-	1	1	-	1
40	594 77 01	BEARING HOLDER	1	-	-	1	-
	594 77 02	LAGERHÅLLARE (CLS)	-	1	1	-1	1
	594 77 00	LAGERHALTER SUPPORT DE ROULEMENT SUJETADOR DE COJIN. SUPP. CUSCINETTO	-	1	1	-	1
41	83 36 90	BALL BEARING 3305A C3 25X62X24,4 KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	1	1	1	1	1

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085

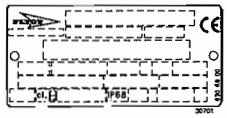
Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
42	82 80 90	O-RING	59,5X3,0 FPM Warm liquid version	-	1	-	-	1
	82 74 65	O-RING	59,5X3,0-NBR	1	1	1	1	-
		O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR						
43	594 93 00	BEARING COVER LAGERLOCK LAGERDECKEL COUVERCLE DE ROULEM TAPA DE COJINETE COPERCHIO CUSCINETTO		1	1	1	1	1
44	593 75 02	MECHANICAL SEAL, INNER	CSB-Al_2O_3	1	1	1	1	-
	593 75 03	PLANTÄTNING, INRE GLEITRINGDICHTUNG, INNER JOINT MECANIQUE, INT. JUNTA MECANICA TENUTA MECCANICA	WCCR/WCCR	-	-	-	-	1
45	82 00 71	SOCKET HEAD SCREW	M12X40-A2-70	4	4	-	-	-
	82 00 68	SEXKANTHÅLSKRUV	M12X25-A2-70	4	4	4	4	-
	83 03 45	SCHRAUBE	M12X25-A4-70	-	-	-	-	4
	83 03 48	VIS TORNILLO VITE A BRUGOLA	M12X40-A4-70	-	-	-	-	4
46	595 01 01	OIL HOUSING BOTTOM OLJEHUSBOTTEN ÖLGEHÄUSEBODEN FOND DE CART.A HUILE FONDO CAM.DE ACEITE FONDO SERBATOIO OLIO		1	1	1	1	1
47	443 49 00	SLEEVE HYLSA HÜLSE DOUILLE MANGUITO BUSSOLA		1	1	1	1	1
48	82 72 95	O-RING	19,2X3,0 FPM Warm liquid version	-	2	-	-	2
	82 73 90	O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	19,2X3,0 NBR	6	6	6	6	-

FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085				
			Qty / Version				
Pos.No.	Part No.	Denomination	092	182	172	891	980
49	428 22 01 428 22 05	INSPECTION SCREW INSPEKTIONSSKRUV INSPEKTIONSSCHRAUBE VIS D'INSPECTION TORNILLO DE INSPECT. VITE D' ISPEZIONE	2 -	2 -	2 -	2 -	- 2
50	82 79 29 82 77 97	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	53,0X4,0 FPM Warm liquid version 53,0X4,0-NBR	- 1	1 1	- 1	- 1	1 -
51	426 32 00	SEAL RING HOLDER TÄTNINGRINGSHÅLLARE DICHTUNGSRINGHALTER PORTE-ANNEAU DE JOIN PORTA-ANILLO DE JUNT SEDE ANELLO TENUTA		1	1	1	1	1
52	82 63 68	RETAINING RING SPÅRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA	SGH 65-2304/1.4122	1	1	1	1	1
53	593 75 00 593 75 03 476 27 10 476 27 08	MECHANICAL SEAL, OUTER PLANTÄTNING, YTTRE GLEITRINGDICHTUNG, ÄUSSER JOINT MECANIQUE, EXT. JUNTA MECANICA TENUTA MECCANICA	Al_2O_3 Type W WCCR Type W WCCR Type E RSiC Type E	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	- 1 1 1
57	82 78 49 82 74 95 82 71 35 82 71 70 82 75 21 82 78 27	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	221,84X3,53 NBR 219,3X5,7 NBR 174,6X6,99 FPM Warm liquid version 221,84X3,53 FPM 219,3X5,7 FPM 174,6X6,99 NBR	1 1 - - - 1	1 1 - - - 1	- - - - - -	- - - - - -	- - 1 1 1 -
58	82 74 90	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	184,3X5,7 NBR	-	-	1	1	-

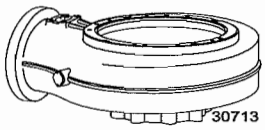
FLYGT	Motor parts Motordetaljer Motorteile	Piéces du moteur Piezas del motor Parti motore	3085

Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
60	379 79 06	WASHER	136X172X11	-	-	1	1	-
	379 79 00	BRICKA	142X172X11	1	1	-	-	1
	379 79 01	SCHEIBE	147X172X11	-	-	1	1	-
	379 79 03	RONDELLE	151X172X11	-	-	1	1	-
	379 79 05	ARANDELA RONDELLA	162X172X11	-	-	1	1	-
61	380 91 00	GUIDING CLAW	CP-LT; FP-LT	1	1	-	-	1
	398 93 00	STYRKLO	CP-MT/HT;DP-MT(60Hz)/HT	1	1	-	-	1
	404 90 01	FÜHRUNGSKLAUE	FJ	1	1	-	-	-
	414 48 00	GRIFFE DE GUIDAGE	adapter for 65 disch. conn.	1	1	-	-	-
	464 06 00	GARRA DE GUIA	MP-HT	-	-	1	1	-
	464 06 01	STAFFA SCORREVOLE	MP	-	-	1	1	-
	521 46 00		DP-MT	1	1	-	-	1
62	81 41 58	HEXAGON HEAD BOLT	M12X45-A2-70	4	4	-	-	-
	81 41 81	SEXKANTSKRUV	M16X40-A4-70	-	-	-	-	4
	82 00 72	SECHSKANTSCHRAUBE	M12X45-A2-70	-	-	2	2	-
	84 34 03	VIS A TÉTE HEXAGONAL	M16X40-A2-70	4	4	-	-	-
	81 49 09	TORNILLO DE CAB.EXAG BULLONE TESTA ESAG.	M12X45-A4-70	-	-	-	-	4
63	397 88 00	SLEEVE		1	1	1	1	-
	397 88 10	HYLSA HÜLSE DOUILLE MANGUITO BUSSOLA		-	-	-	-	1
		Pump parts **Pumpdetaljer** **Pumpenteile**	**Pièces de la pompe** **Piezas para bombas** **Parti pompa**					
64		IMPELLER PUMPHJUL LAUFRAD ROUE IMPULSOR GIRANTE	Curve No. Kurva nr. Kurve Nr. Courbe N° Curvas N° No curva					
	399 18 00	Medium head	242, 50 Hz, 1 ~ , 3 ~	-	1	-	-	1
	399 18 01	Medium head	244, 50-60 Hz, 1 ~, 3~	1	1	-	-	1
	339 69 12	Medium head	473, 60 Hz, 3 ~	1	1	-	-	1
	339 69 14	Medium head	475, 60 Hz, 1 ~, 3 ~	1	1	-	-	1
	339 69 16	Medium head	477, 60 Hz, 1 ~, 3 ~	1	1	-	-	1
	373 10 01	Low head	622, 50 Hz, 3 ~	1	1	-	-	1
	373 12 01	Low haed	620, 50 Hz, 3 ~	1	1	-	-	1
	379 33 00	Low head	414, 50-60 Hz, 614, 50 Hz	1	1	-	-	1
	379 76 00	Low head	412, 612, 50 Hz, 3 ~	1	1	-	-	1

FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa	3085

Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
64		IMPELLER PUMPHJUL LAUFRAD ROUE IMPULSOR GIRANTE	Curve No. Kurva nr. Kurve Nr. Courbe N° Curvas N° No curva					
	403 86 00	High head	276, 50 Hz, 3 ~	1	1	-	-	1
	403 86 01	High head	280, 60 Hz, 3 ~	1	1	-	-	1
	403 86 02	High head	278, 50 Hz, 3 ~	1	1	-	-	1
	403 86 03	High head	282, 60 Hz, 3 ~	1	1	-	-	1
	403 86 24	High head	284, 60 Hz, 1 ~	1	-	-	1	1
	410 33 00	Low head	490, 50 Hz, 3 ~	1	1	-	-	1
	410 33 01	Low head	492, 50 Hz, 1 ~, 3 ~	1	1	-	-	1
	410 33 02	Low head	491, 60 Hz, 3 ~	1	1	-	-	1
	410 33 03	Low head	493, 60 Hz, 1 ~, 3 ~	1	1	-	-	1
	430 07 00	Medium head	438, 50-60 Hz, 1 ~, 3 ~	1	1	-	-	1
	430 07 01	Medium head	440, 50-60 Hz, 1 ~, 3 ~	1	1	-	-	1
	431 69 01	Low head	621, 50 Hz, 3 ~	1	1	-	-	1
	444 84 00	High head	250, 50 Hz, 3 ~	-	-	1	1	-
	444 84 04	High head	254, 50 Hz, 1 ~, 3 ~	-	-	1	1	-
	444 84 08	High head	259, 50 Hz, 3 ~	-	-	1	1	-
	444 84 09	High head	253, 50 Hz, 3 ~	-	-	1	1	-
	444 84 11	High head	258, 60 Hz, 1 ~	-	-	1	1	-
	444 84 13	High head	257, 60 Hz, 1 ~	-	-	1	1	-
	444 84 14	High head	249, 50 Hz, 1 ~	-	-	1	1	-
	444 84 15	High head	252, 60 Hz, 3 ~	-	-	1	1	-
	461 78 00	Medium head	432, 632, 50 Hz, 3 ~	1	1	-	-	1
	461 80 00	Medium head	434, 634, 50 Hz, 1 ~, 3 ~, 434, 60 Hz, 3 ~	1	1	-	-	1
	461 82 00	Medium head	436, 636, 50-60 Hz, 1 ~, 3 ~	1	1	-	-	1
	492 44 00	High head	250, 50 Hz, 3 ~	1	1	-	-	1
	492 44 01	High head	252, 50-60 Hz, 3 ~	1	1	-	-	1
	521 45 00	Medium head	470, 50 Hz, 3 ~	1	1	-	-	1
	521 45 03	Medium head	472, 50 Hz, 1 ~, 3 ~	1	1	-	-	1
	521 45 06	Medium head	474, 50 Hz, 1 ~, 3 ~	1	1	-	-	1
	521 45 31	Medium head	485, 50 Hz, 3 ~	1	1	-	-	1
	521 45 32	Medium head	486, 50 Hz, 3 ~	1	1	-	-	1
	521 45 33	Medium head	487, 50 Hz, 3 ~	1	1	-	-	1
	608 00 00		460, 50 Hz, 3 ~	1	1	-	-	1
	608 00 20		461, 50 Hz, 3 ~	1	1	-	-	1
	608 00 24		462, 60 Hz, 3 ~	1	1	-	-	1
	608 00 39	N-impeller, medium head	463, 50-60 Hz, 3 ~	1	1	-	-	1
66	464 05 00	CUTTER WHEEL High head SKÄRHJUL SCHNEIDRAD ROUE DE COUPE RUEDE DE CORTE RUOTA DA TAGLIO.	249-259, 50-60 Hz, 1 ~, 3 ~	-	-	1	1	-

FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa	3085

Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
67		PUMP HOUSING PUMPHUS PUMPENGEHÄUSE CORPS DE POMPE CUERPO DE BOMBA CORPO POMPA  30713					
		4 pole / 4 pôles 4 pol / 4 polos 4 pol.					
	379 75 00	"LT" Low head version DN 100  Undrilled	1	1	-	-	1
	379 75 20	"LT" Low head version DN 100 Undrilled For flush valve / Pour vanne de brassage För omrörarventil / Para válvula de limpieza Für Rührwerkwentil / Per valvola di flussaggio	1	1	-	-	-
	379 75 01	"LT" Low head version DN 100  Drilled to SMS 342, DIN 2533, BS 4622:1970 Table 11	1	1	-	-	-
	379 75 02	"LT" Low head version DN 100  Drilled 1882 Standard	1	1	-	-	1
		6 pole / 6 pôles 6 pol / 6 polos 6 pol.					
	383 99 00	"LT" Low head version DN 100  Undrilled	1	1	-	-	1
	383 99 20	"LT" Low head version DN 100 Undrilled For flush valve / Pour vanne de brassage För omrörarventil / Para válvula de limpieza Für Rührwerkwentil / Per valvola di flussaggio	1	1	-	-	-
	383 99 01	"LT" Low head version DN 100  Drilled to SMS 342 DIN 2533 and BS 4622:1970 Table 11	1	1	-	-	-
	383 99 02	"LT" Low head version DN 100  Drilled to 1882 Standard	1	1	-	-	1

FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa	3085				
Pos.No.	**Part No.**	**Denomination**	**Qty / Version**				
			092	182	172	891	980
67	398 90 01	"MT" Medium head version DN 80  Undrilled	1	1	-	-	1
	398 90 02	"MT" Medium head version DN 80  Drilled to SMS 342, DIN 2533, BS 4622:1970 Table 11 ANSI B16.1:1967 Table 5 For CT-version, MT / Pour modèle CT, MT / För CT-utförande,MT / Para versión CT,MT / Für CT-Ausführung, MT	1	1	-	-	1
	398 90 21	"MT" Medium head version DN 80  Undrilled For flush valve / Pour vanne de brassage / För omrörarventil / Para válvula de limpieza / Für Rührwerkwentil / Per valvola di flussaggio	1	1	-	-	-
	403 83 00	"MT" Medium head version "GF" Threaded R2" With connection R2" / Med anslutning R2" / Mit Anschluss R2" / Avec connexion R2" / Con conexión R2" SMS 36 / ISO/228-1961 Throughlet / Genomlopp / Durchgang / Section de passage / Sección de paso diam. 17mm (0.68")	1	1	-	-	1
	403 87 00	"HT" High head version "D" DN 80  Undrilled	1	1	-	-	1
	408 44 00	"HT" High head version DN 80 Undrilled	1	1	-	-	1
	408 44 20	"HT" High head version DN 80  Undrilled For flush valve / Pour vanne de brassage / För omrörarventil / Para válvula de limpieza / Für Rührwerkwentil / Per valvola di flussaggio	1	1	-	-	-
	435 34 01	"LT" Low head version "FS" DN 100 Manure version  Drilled to SMS 352, DIN 2533, and BS 4266:1970 table 11	1	1	-	-	1
	435 34 05	"LT" Low head version "FS" DN 100 Manure version  Drilled to ANSI B 16.1:1967 table 5	1	1	-	-	1

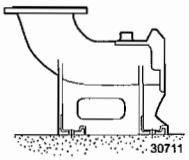
FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa	3085

Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
67	464 00 00	Vertical outlet Vertikalt utlopp Vertikaler Auslass Sortie verticale Salida vertical Mandata verticale Threaded ISO - G 1½". High head version 464 00 00+505 43 00 = 1½ - 11½ NPT Inside	-	-	1	1	-
	464 00 01	Horizantal outlet Horisontellt utlopp Horizontaler Auslass Sortie horizontale Salida horizontal Mandata orizzontale Ø 40mm. High head version For straight throughlet	-	-	1	1	-
	521 47 00	"MT" Medium head version "D" DN 82 Undrilled	1	1	-	-	1
	521 47 01	"MT" Medium head version "DS" DN 82 Undrilled	1	1	-	-	1
	521 47 20	"MT" Medium head version "D" DN 82 Undrilled Swirl type For flush valve — Pour vanne de brassage För omrörarventil — Para válvula de limpieza Für Rührwerkwentil — Per valvola di flussaggio	1	1	-	-	-
	521 47 30	"MT" Medium head version "D" DN 82 Undrilled Hardened	1	1	-	-	1
	521 47 31	"MT" Medium head version "DS" DN 82 Undrilled Hardened	1	1	-	-	1
	652 38 00	"MT" Medium head version DN 80 Undrilled Intended for N-impeller	1	1	-	-	1
	652 38 02	"MT" Medium head version DN 80 Drilled to SMS 342, DIN 2532, BS 4622:1970 Table 11 and ANSI B16.1: 1967 Table 5 Intended for N-impeller Only for NT installation	1	1	-	-	1
	652 38 20	"MT" Medium head version DN 80 Undrilled Intended for N-impeller For flush valve — Pour vanne de brassage För omrörarventil — Para válvula de limpieza Für Rührwerkwentil — Per valvola di flussaggio	1	1	-	-	1

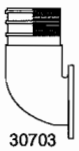
FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
67	396 72 00	DIFFUSER LEDSKENEDEL DIFFUSOR ANNEAU DIFFUSEUR DIFUSOR DIFFUSORE RIVEST.	Pump housing "CL" Lift pump version	1	1	-	-	1
68	464 04 00 464 04 02 464 04 04	CUTTING RING UNIT SKÄRRING ENHET SCHNEIDE RING EINH. ANNEAU DE COUPE UNIT ANILLO DE CORTE UNID UNITA' ANELLO ANTI INT	Intended for 250,252,254 249,253,258,259 257	- - -	- 1 -	1 1 1	1 - 1	-
69	82 00 11	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M6X12-A2-70	-	-	3	3	-
70	303 45 03 403 94 00 444 82 00 652 53 00	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	412-414, 612-614 290-293 249-250, 252-253, 254, 257-259 460-463	1 1 - 1	1 1 - 1	- - 1 -	- - 1 -	1 1 - 1
72	82 03 12 82 00 34 83 03 01	SOCKET HEAD SCR.SPEC SEXKANTHÅLSKRUV SPEC SCHRAUBE SPEZ. VIS SPEC. TORNILLO ESPEC. VITE A BRUGOLA	M8X115-A2-70 M8X25-A2-70 M8X25-A4-70	1 1 -	1 1 -	- 1 -	- 1 -	1 - 1
73	314 88 01 314 88 48 398 92 00 398 92 01 398 92 06 398 92 08 510 21 03 510 21 08	WEAR RING SLITRING VERSCHLEISSRING ANNEAU ANILLO ANELLO D'USURA	LT (L.Red Brass) LT (Stainless steel) MT (L. Red Brass) HT (L. Red Brass) MT (Stainless steel) HT (Stainless steel) LT (Rubber) MT(Rubber)	1 - 1 1 - - 1 1	1 - 1 1 - - 1 1	- - - - - - - -	- - - - - - - -	- 1 - - 1 1 - -
74	399 11 00	WASHER BRICKA SCHEIBE RONDELLE ARANDELA		1	1	-	-	1

FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa		3085				
				Qty / Version				
Pos.No.	Part No.	Denomination		092	182	172	891	980
76	384 07 00	STRAINER	CP/CS-HT	1	1	-	-	1
	398 96 00	SIL SIEB CREPINE COLADOR GRIGLIA	CS-MT/DS-MT(60Hz)	1	1	-	-	1
77	81 40 80	HEXAGON HEAD SCREW	M6x12-A2-70 GP	3	3	-	-	-
	81 41 29	SEXKANTSKRUV	M10x20-A2-70 CS/HT	3	3	-	-	-
	81 41 37	SECHSKANTSCHRAUBE	M10x55-A2-70 DS without strainer, HT	3	3	-	-	-
	81 41 52	VIS A TÉTE HEXAGONAL	M12x20-A2-70 CS/MT	3	3	-	-	-
	81 41 55	TORNILLO DE CAB.EXA	M12X30-A2-70 CT	4	4	-	-	-
	81 41 56	VITE TESTA ESAGONALE	M12X35-A2-70 DS/HT with strainer	4	4	-	-	-
	81 41 81		M16x40-A4-70 CS	-	-	-	-	4
	81 48 24		M6x12-A4-70 GF	-	-	-	-	3
	81 48 79		M10x20-A4-70 CP/HT	-	-	-	-	3
	81 48 87		M10x55-A4-70 CS	-	-	-	-	3
	81 49 02		M12x20-A4-70 CS	-	-	-	-	3
	81 49 06		M12x30-A4-70 CT	-	-	-	-	4
	81 49 07		M12x35-A4-70 CS	-	-	-	-	4
	84 34 03		M16x40 -A2-70 CS/LT	4	4	-	-	-
78	253 66 01	STRAINER BOTTOM	GF-MT	1	1	-	-	1
	398 94 01	SILBOTTEN SIEBBODEN FOND DE CREPINE FONDO DE COLADOR FONDO GRIGLIA	CS-MT/DS-MT(60Hz)	1	1	-	-	1
79	435 36 00	SUCTION COVER SUGLOCK SAUGDECKEL FOND D'ASPIRATION FONDO DE ASPIRACION DIFFUSORE INFERIORE		1	1	-	-	1
83	429 67 00	NUT		4	4	-	-	-
	429 67 01	MUTTER MUTTER ECROU TUERCA DADO		-	-	-	-	4
84	526 20 00	SEAL RING TÄTNINGSRING DICHTUNGSRING ANNEAU DE JOINT ANILLO DE JUNTA ANELLO TENUTA		1	1	-	-	1

FLYGT	Pump parts Pumpdetaljer Pumpenteile	Pièces de la pompe Piezas para bombas Parti pompa	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
85	403 85 00	INSERT RING INSATSRING EINSATZRING ANNEAU DE REDRESS. ANILLO DE ENDEREZ. ANELLO DI RIPORTO	1	1	-	-	1
86	394 39 00 410 15 00	PUMP HOUSING COVER PUMPHUSLOCK PUMPENGEHÄUSE DECKEL COUV.DE CORPS POMPA TAPA DE CUERPO BOMBA COPERCH. CORPO POMPA	290,292 291,293	1 1	1 1	-	-	1 1
87	80 94 87 80 96 98	STUD PINNSKRUV STIFTSCHRAUBE GOUJON ESPARRAGO PRIGIONIERO	8X40-A2-70 8X30-A4-70	3 -	3 -	-	-	- 3
88	82 27 27	LOCK NUT LÅSMUTTER SICHERUNGSMUTTER ECROU DE BLOCAGE TUERCA DE SEGURIDAD DADO DI BLOCCAGGIO	M8-A4-70	3	3	-	-	3
89	82 35 17 250 23 02	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	70-3/8" t = 2mm t = 0,25mm	7 27	7 27	-	-	7 27
90	82 80 83 82 74 94	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO	209,3X5,7 FPM 209,3X5,7-NBR	- 1	- 1	-	-	1 -
94	82 83 40	G-RING G-RING G-RING ANNEAU G ANILLO G ANELLO G	DIAM=325;T=16 SBR	1	1	-	-	1

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085				
			Qty / Version				
Pos.No.	Part No.	Denomination	092	182	172	891	980
		Installation **Installation** _ P **Aufstellungsart**					
96		DISCHARGE CON.STAT. TRYCKANSL. STATIONÄR DRUCKANSCHLUSS STAT. ORIFICE DE REF.STAT. ORIFICIO DE REC.STAT PIEDE ACCOPPIAMENTO 					
	83 14 62	DN 50. Threaded R 2" — MP stationary discharge connection. With straight throughlet	-	-	1	1	-
	444 68 00	DN 80 Medium / High head  Undrilled	1	1	-	-	1
	444 68 01	DN 80 Medium / High head  SMS 342, DIN 2533 1882 Standard	1	1	-	-	1
	444 68 05	DN 80 Medium / High head  ANSI B16.1:1967 Table 5	1	1	-	-	1
	444 68 07	DN 80 Medium / High head  BS 4622:1970 Table 11	1	1	-	-	1
	486 55 00	DN 50 ISO-G2" — MPH = 100mm	-	-	1	1	-
	486 55 01	2 - 11 ½ NPT — MPH = 100mm	-	-	1	1	-
	540 13 00	DN 100 Low/Medium head  Undrilled	1	1	-	-	1
	540 13 01	DN 100 Low/Medium head  SMS 342, DIN 2533 BS 4622:1970 Table 11	1	1	-	-	1
	540 13 05	DN 100 Low/Medium head  ANSI B 16. 1:1967 Table 5	1	1	-	-	1
		"Only for Top 50 and Top 65"					
	619 95 00	DN 50. Threaded R 2 " — MP stationary discharge connection. With angled throughlet	-	-	1	1	-
	619 95 01	DN 50. Threaded 2-11 1/2 NPT — MP stationary discharge connection. With angled throughlet	-	-	1	1	-
		"Only for Top 100 and Top 150"					
	619 99 10	DN 80 Medium and High head — Undrilled	1	1	-	-	1
	620 00 10	DN 80 Medium and Hig head 	1	1	-	-	1
	620 01 10	DN 100 Low and Medium head — Undrilled	1	1	-	-	1
	620 02 10	DN 100 Low and Medium head — Undrilled	1	1	-	-	1

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
97	81 39 82	HEXAGON HEAD BOLT SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÉTE HEXAGONAL TORNILLO DE CAB.EXAG BULLONE TESTA ESAG.	M8X120	4	4	-	-	-
98	82 35 26	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	20-A2-A 140	4	4	-	-	-
99	82 23 62	HEXAGON NUT SEXKANTMUTTER MUTTER ECROU TUERCA DADO ESAGONALE	M20-A2-70	4	4	-	-	-
100	255 47 00	RING RING RING ANNEAU ANILLO ANELLO		2	2	-	-	2
101	264 92 02	GUIDE HOLDER	Ø 3/4"	-	-	1	1	-
	405 77 00	GEJDFÄSTE	100x100mm (FJ)	1	1	-	-	-
	408 05 00	FÜHRUNGSHALTER	100x100mm (FJ)	1	1	-	-	-
	613 68 00	FIXATION DE GUIDE	Ø 2"	1	1	-	-	-
	613 68 04	SOPORTE DE GUIAS	Ø 2"	1	1	-	-	-
	613 68 06	SUPPORTO GUIDA COMPL.	Ø 2"	1	1	-	-	-
	613 68 07		Ø 2"	1	1	-	-	-
	669 77 00		Ø 3/4"	-	-	1	1	-
		Installation **Installation** **Aufstellungsart**	**_ S** **Installation** **Instalacion** **Installazione**					
102		DISCHARGE CONNECTION TRYCKANSLUTNING DRUCKANSCHLUSS	ORIFICE DE REFOULEM ORIFICIO DE RECALC. PIEDE ACCOPPIAMENTO					
	259 82 00	Ø 4" Low head		1	1	-	-	1
	259 84 01	Ø R4" Low head		1	1	-	-	-
	310 03 00	Ø 3" Medium head. For execution "With strainer"		1	1	-	-	1
	310 03 30	Ø 3" Medium head (Hardened)		1	1	-	-	-
	385 52 00	Ø 3 - 8 NPSM. High head		1	1	-	-	1
	385 52 01	Ø R3" High head		1	1	-	-	1

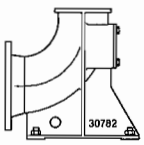

30703

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione		3085				
Pos.No.	**Part No.**	**Denomination**			**Qty / Version** 092	182	172	891	980
102	391 40 00	Ø 4". For manure version			1	1	-	-	1
	391 41 00	Ø 4 - 8 NPSM. For manure version			1	1	-	-	1
103	81 49 32	HEXAGON HEAD SCREW	M16x45-A4-70	MT	-	-	-	-	2
	81 49 35	SEXKANTSKRUV	M16x60-A4-70	MT D, DS-version	-	-	-	-	4
	81 49 36	SECHSKANTSCHRAUBE	M16x65-A4-70	MT D, DS-version	-	-	-	-	4
	81 49 58	VIS A TÉTE HEXAGONAL	M20x60-A4-70	LT	-	-	-	-	4
	84 34 04	TORNILLO DE CAB.EXAG	M16x45-A2-70	MT, HT	2	2	-	-	-
	84 34 07	BULLONE TESTA ESAG.	M16x60-A2-70	MT	4	4	-	-	-
	84 34 08		M16x65-A2-70	MT DF, DS-version	4	4	-	-	-
	84 34 11		M16x80-A2-70	FS-version	2	2	-	-	-
	84 34 30		M20x60-A2-70	LT	4	4	-	-	-
104	82 35 23	WASHER	16-A2-A 140	DF-DS-version	4	4	-	-	-
	82 35 26	BRICKA	20-A2-A 140	LT CS-version	4	4	-	-	-
	82 35 78	SCHEIBE	16-A4-A 140	MT D-version	-	-	-	-	4
	82 35 79	RONDELLE	20-A4-A 140	LT	-	-	-	-	4
	82 37 29	ARANDELA	16-200 HV-FZB	FS-version	2	2	-	-	-
	82 37 85	RONDELLA	DIN 440 16-A4	LT F-version	-	-	-	-	2
105	84 69 59	SET SCREW STOPP SKRUV GEWINDESTIFT VIS SANS TÉTE TORNILLO SIN KABESA VITE DI ARRESTO	M12x16-A2		1	1	-	-	1
106	82 23 37	HEXAGON NUT	M16-A4-70	MT D-version	-	-	-	-	4
	82 23 38	SEXKANTMUTTER	M20-A4-70	LT CS-version	-	-	-	-	4
	82 23 61	MUTTER	M16-A2-70	MT DF, DS-version	2	2	-	-	-
	82 23 62	ECROU TUERCA DADO ESAGONALE	M20-A2-70	LT CS-version	4	4	-	-	-
107	259 83 00	GASKET	LT CS-version		1	1	-	-	1
	310 05 00	PACKNING	MT CF, CS-version, HT DS-version Ø144x95		1	1	-	-	1
	310 05 01	PACKUNG JOINT JUNTA GUARNIZIONE	MT CT, NT-version Ø110x90		1	1	-	-	1
108	461 16 00	DISCHARGE CONNECTION TRYCKANSLUTNING ENH. KUPPLUNGSFUSSEINHEIT PIED D'ASSISE COMPL. CODO DE DESCARGA PIEDE ACCOPPIAMENTO	Stationary MH-Version with clack valve threaded R2"		-	-	1	1	-

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085				
			Qty / Version				
Pos.No.	Part No.	Denomination	092	182	172	891	980
108.1	81 41 32	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÉTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE ISO 4017-M10X30-A2-70	-	-	2	2	-
108.2	81 41 32	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÉTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE ISO 4017-M10X30-A2-70	-	-	1	1	-
108.3	82 23 58	HEXAGON NUT SEXKANTMUTTER MUTTER ECROU TUERCA DADO ESAGONALE ISO 4032-M10-A2-70	-	-	1	1	-
108.4	82 33 15	SCHACKLE SCHACKEL SCHÄKEL MANILLE GRILLET 1,5-24 FZ	-	-	1	1	-
108.5	82 77 47	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR 38X7-NBR	-	-	1	1	-
108.6	464 40 00	MUFF MUFF UEBERGANGSMUFFE MANCHON MANGO	-	-	1	1	-
108.7	464 41 00	BUSH BUSSNING BUCHSE DOUILLE BUJE	-	-	1	1	-
108.8	464 43 00	CLAMP KLÄMSTYCKE KLAMMER CRAMPON ABRAZADERA	-	-	1	1	-

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085				
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
109	436 94 00 436 94 01	STAND STATIV STATIV BATI BASTIDOR CAVALLETTO	Intended for DS-version "MT" Intended for CS-version "LT"	1 1	1 1	- -	- -	1 1
110	345 24 00 398 95 00	SLEEVE HYLSA HÜLSE DOUILLE MANGUITO PRIGIONIERO	Intended for DS-HT Intended for CS-MT, CF-MT, MF	3 3	3 3	- 3	- 3	3 3
111	83 92 47 505 43 00 505 43 01 83 18 28 83 18 46 83 19 34	COUPLING KOPPLING KUPPLUNG ACCOUPLEMENT ACOPLAMIENTO SEMI-GIUNTO	ISO - G1½" A - Ø 48 ISO - G1½"A - 1½ -11½ NPT ISO - G2"A - 2 - 11½ NPT DN 150 for hose 6" (Optional) Inner thread G3 "MT" (Only FD-market) DN 110 Inner thread G4 (Only FD-market)	- - - - - -	- - - 1 1 1	1 1 2 - - -	1 1 2 - - -	- - - - - -
112	534 48 00	FOOT FOT FUSS	SOCLE BASTIDOR PIEDE	-	-	3	3	-
114	499 69 00	GUIDE RING GEJDRING FÜHRUNGSRING	ANNEAU DE GUIDE ANILLO DE GUIAS ANELLO GUIDA	1	1	-	-	-
115	416 12 00	SPACING RING DISTANSRING DISTANZRING RONDELLE ANILLO ANELLO DISTANZIATORE	For LL,type A För LL, typ A Für LL, Typ A Pour LL, typ A Para LL, versión A	1	1	-	-	-
116	416 13 00	PLATE PLATTA PLATTE PLAQUE PLACA PIASTRA	For LL, type B För LL, typ B Für LL, Typ B Pour LL, typ B Para LL, versión B	1	1	-	-	-
117	82 88 42 517 55 00	BOTTOM PLATE BOTTENPLATTA GRUNDPLATTE PLAQUE DE FONDATION PLACA DE BASE PIASTRA DI BASE	Intended for version MP Intended for version MP (distance pipe)	- -	- -	1 2	1 2	- -

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085				
			Qty / Version				
Pos.No.	Part No.	Denomination	092	182	172	891	980
120	82 27 28	LOCK NUT LÅSMUTTER SICHERUNGSMUTTER ECROU DE BLOCAGE TUERCA DE SEGURIDAD DADO DI BLOCCAGGIO — M10-A4-70	2	2	-	-	-
121	80 95 07	STUD PINNSKRUV STIFTSCHRAUBE GOUJON ESPARRAGO PRIGIONIERO — 10X45-A2-70	2	2	-	-	-
122	433 56 00	COVER LOCK DECKEL COUVERCLE TAPA COPERCHIO	1	1	-	-	-
123	502 53 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE	1	1	-	-	-
126	495 27 00	CLAMP KLÄMMA KLEMME CRAMPON ABRAZADERA FASCETTA — MP-version	-	-	1	1	-
127	495 26 00	CLAMP KLÄMMA KLEMME CRAMPON ABRAZADERA FASCETTA — MP-version	-	-	1	1	-
128	81 41 14	HEXAGON HEAD BOLT SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÉTE HEXAGONAL TORNILLO DE CAB.EXAG BULLONE TESTA ESAG. — MP-version	-	-	1	1	-

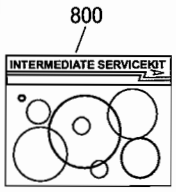
FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085				
Pos.No.	**Part No.**	**Denomination**	**Qty / Version** 092	182	172	891	980
129	82 23 57	HEXAGON NUT SEXKANTMUTTER MUTTER ECROU TUERCA DADO ESAGONALE — MP-version	-	-	1	1	-
130	82 35 16	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA — MP-version	-	-	1	1	-
		Installation **Installation** _T **Aufstellungsart** — **Installation** **Instalacion** **Installazione**					
131	543 14 00	CONVERSION PART ÖVERGÅNGSDEL ÜBERGANGSTEIL PIECE DE TRANSITION PARTE DE TRANSICION ELEMENTO CONVERSIONE —  SMS 342, DIN 2533 BS 4622:1970 table 1 ANSI BI 6.1:1967 table 5	1	1	-	-	1
132	82 74 17	O-RING — 124,3X5,7 NBR	1	1	-	-	-
	82 72 90	O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR — 124,3x5,7 FPM	-	-	-	-	1
133		SUCTION CONNECTION SUGANSLUTNING SAUGANSCHLUSS ORIFICE D'ASPIRATION ORIFICIO DE ASPIRADO CURVA D'ASPIRAZIONE — 					
	303 72 00	DN 100 (4") Medium head —  Undrilled	1	1	-	-	-
	303 72 01	DN 100 (4") Medium head —  SMS 342, DIN 2533, 1882 STD.	1	1	-	-	1
	303 72 05	DN 100 (4") Medium head — ANSI B16.1:1967 table 5	1	1	-	-	1

FLYGT	Sump components Pumpgropsdetaljer Schachteinbauteile	Equipment du puisard Equipo para pozo negro Componenti per versione	3085

Pos.No.	Part No.	Denomination			Qty / Version 092	182	172	891	980
133.1	303 76 00	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA			-	1	-	-	1
133.2	303 77 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE			-	1	-	-	1
134	554 21 00	STARTER	1.0-1.6 A, Cable 9-18 mm		-	1	-	-	-
	554 21 01	STARTAPPARAT	1.6-2.5 A, Cable 9-18 mm		-	1	-	-	-
	554 21 02	STARTER	2.4-4.0 A, Cable 9-18 mm		-	1	-	-	-
	554 21 03	DEMARREUR	4.0-6.3 A, Cable 9-18 mm		-	1	-	-	-
	554 21 04	ARRANCADOR	6.0-10.0 A, Cable 9-18 mm		-	1	-	-	-
	554 21 05	AVVIATORE	9.0-14.0 A, Cable 13-25 mm		-	1	-	-	-
	554 30 13		4.0-6.3 A, Cable 9-18 mm		-	1	-	-	-
162	93 00 77	SHRINK HOSE KRYMPSLANG SCHRUMPFSCHLAUCH TUYAU DE FRETTAGE MANGUERA DE SUNCHADO TUBO DI RIDUZIONE	(To be used with armoured cable)		-	*	-	-	*

Recommended spare parts

3085

Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
	800 	I= Intermediate Service Kit; parts for inspection and maintenance I= Intermediate Service Kit; artiklar för inspektion och underhåll I= Intermediate Service Kit; Teile für Kontrolle und Wartung I= Intermediate Service Kit; pièces pour inspection et maintenance I= Intermdeiate Service Kit; piezas para inspección y mantenimiento I= Intermediate Service Kit; parti per ispezione e mantenimento					
800	80 32 75	IS KIT 3085, 091, 092, 120,171,172, 181, 182, 890, 891 IS SATS IS SATZ JEU DE IS JUEGO DE IS KIT ANELLI OR **Consisting of;**	*	*	*	*	-
16	82 78 37	O-RING	1	1	1	1	-
34	82 50 60	LOCK WASHER	3	3	3	3	-
42	82 74 65	O-RING	1	1	1	1	-
48	82 73 90	O-RING	1	1	1	1	-
50	82 77 97	O-RING	1	1	1	1	-
58	82 74 90	O-RING	2	2	2	2	-

FLYGT	Recommended spare parts	3085					
Pos.No.	Part No.	Denomination	Qty / Version 092	182	172	891	980
	900 	**B**= Basic Repair Kit; parts for major overhaul **B**= Basic Repair Kit; artiklar för större genomgång **B**= Basic Repair Kit; Teile für Generalüberholung **B**= Basic Repair Kit; pièces pour révision complète **B**= Basic Repair Kit; piezas para revisiones importantes **B**= Basic Repair Kit; parti per revisioni complete					
900	601 89 25	BASIC REPAIR KIT	*	*	*	*	-
	601 89 26	GRUNDREPARATIONSSATS	*	*	*	*	-
	601 89 27	GRUNDREPARATURSATZ	*	*	*	*	-
	601 89 28	KIT PALIER	*	*	*	*	-
	601 89 34	JUEGO BASICO DE REP.	*	*	*	*	-
	601 89 48	KIT DI RIPARAZIONE	*	*	*	*	-
		Consisting of;					
	601 89 25						
44		593 75 02 Mechanical seal, inner Ceramic—Carbon					
53		593 75 00 Mechanical seal, outer Ceramic—Ceramic					
51		426 32 00 Seal ring holder					
800		80 32 75 IS KIT <40°C					
52		82 63 68 Retaining ring					
17		83 34 40 Upper bearing					
41		83 36 90 Lower bearing					
	601 89 26						
44		593 75 02 Mechanical seal, inner Ceramic—Carbon					
53		593 75 03 Mechanical seal, outer Tungsten Carbide—Tungsten Carbide					
51		426 32 00 Seal ring holder					
800		80 32 75 IS KIT <40°C					
52		82 63 68 Retaining ring					
17		83 34 40 Upper bearing					
41		83 36 90 Lower bearing					
	601 89 27						
44		593 75 02 Mechanical seal, inner Ceramic—Carbon					
53		476 27 10 Mechanical seal, outer Tungsten Carbide—Tungsten Carbide					
800		80 32 75 IS KIT <40°C					
52		82 63 68 Retaining ring					
17		83 34 40 Upper bearing					
41		83 36 90 Lower bearing					
	601 89 28						
44		593 75 02 Mechanical seal, inner Ceramic—Carbon					
53		476 27 08 Mechanical seal, outer Silicon Carbide—Silicon Carbide					
800		80 32 75 IS KIT <40°C					
52		82 63 68 Retaining ring					
17		83 34 40 Upper bearing					
41		83 36 90 Lower bearing					

Pos.No.	Part No.	Denomination			Qty / Version 092	182	172	891	980
900	601 89 34								
44		593 75 00	Mechanical seal, inner	Ceramic—Ceramic					
53		593 75 00	Mechanical seal, outer	Ceramic—Ceramic					
51		426 32 00	Seal ring holder						
800		80 32 75	IS KIT	<40°C					
52		82 63 68	Retaining ring						
17		83 34 40	Upper bearing						
41		83 36 90	Lower bearing						
72		82 00 34	Socket head screw						
	601 89 48								
44		593 75 03	Mechanical seal, inner	Tungsten Carbide—Tungsten Carbide					
53		593 75 03	Mechanical seal, outer	Tungsten Carbide—Tungsten Carbide					
51		426 32 00	Seal ring holder						
800		80 32 75	IS KIT	<40°C					
52		82 63 68	Retaining ring						
17		83 34 40	Upper bearing						
41		83 36 90	Lower bearing						
72		82 00 34	Socket head screw						
24.2	398 98 04	CLAMP		18-20mm	1	-	-	1	1
	398 98 00	KLÄMMA		10-12mm					
	398 98 05	KLEMME		18-20mm	-	1	1	-	1
	398 98 01	CRAMPON		12-14mm	-	1	1	-	1
	398 98 02	ABRAZADERA		14-15mm	-	1	1	-	1
	398 98 03			16-17mm	-	1	1	-	1
	398 98 06			15-16mm	1	1	1	1	1
	398 98 07			17-18mm	1	1	1	1	1
24.4	82 40 61	WASHER		24,5X35X2-A2-70	2	-	-	2	-
	82 40 55	BRICKA		16,5X35X2-A2-70	-	2	2	-	-
	82 40 57	SCHEIBE		18,5X35X2-A2-70	-	2	2	-	-
	82 40 59	RONDELLE		20,5X35X2-A2-70	-	2	2	-	-
	82 40 84	ARANDELA		14,5X35X2-A2-70	-	2	2	-	-
	82 41 08	RONDELLA		12,5X35X2-A2-70	-	2	2	-	-
	82 42 42			24,5X35X2-A2-70	-	-	-	-	2
24.5	84 17 90	SEAL SLEEVE		DIAM=15;L=26	-	-	-	-	1
	84 17 91	TÄTNINGSHYLSA		DIAM=16;L=26	-	-	-	-	1
	84 17 92	DICHTUNGSHÜLSE		DIAM=18;L=26	1	-	-	1	1
	84 17 93	DOUILLE DE JOINT		DIAM=19;L=26	1	-	-	1	1
	84 17 94	MANGUITO DE JUNTA		DIAM=18;L=26	1	-	-	1	1
	84 35 32	GOMINO ENTR. CAVO		15X35X22	-	1	1	-	-
	84 35 33			17X35X22 TYP 2	-	1	1	-	-
	84 35 34			19X35X22	-	1	1	-	-
	84 35 59			13X35X22 TYP 2	-	1	1	-	-
	84 35 66			11X35X22	-	1	1	-	-
	84 36 39			18X35X22 TYP 2	-	1	1	-	-
	84 36 40			16X35X22 TYP 2	-	1	1	-	-

Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
24.7	83 43 45	CABLE LUG	1,6-2,5mm²; M6	2	2	2	2	2
	83 42 96	KABELSKO	4-6mm², M6+125GR	-	1	-	-	1
	83 43 36	KABELSCHUH	6-10mm², M6	-	1	1	-	-
		SABOT DE CABLE						
		GRAPA DE CABLE						
		CAPOCORDA						
24.8	83 44 24	CLOSED END SPLICE	2,5-6(AWG 12-10)L=17,5	8	8	8	8	8
		ÄNDSKARVHYLSA						
		KABELENDVERBINDER						
		RACCORDS EMBOUTS						
		CONECTOR CONTERA						
		CONNET PREISOLATO						
73	314 88 01	WEAR RING	LT (L.Red Brass)	1	1	-	-	-
	314 88 48	SLITRING	LT (Stainless steel)	-	-	-	-	1
	398 92 00	VERSCHLEISSRING	MT (L. Red Brass)	1	1	-	-	-
	398 92 01	ANNEAU	HT (L. Red Brass)	1	1	-	-	-
	398 92 06	ANILLO	MT (Stainless steel)	-	-	-	-	1
	398 92 08	ANELLO D'USURA	HT (Stainless steel)	-	-	-	-	1
	510 21 03		HT (Rubber)	1	1	-	-	-
	510 21 08		MT (Rubber)	1	1	-	-	-
		Parts for Service						
	90 17 52	PARAFFIN OIL	1.0 l	*	*	*	*	*
		PARAFFINOLJA						
		PARAFFINÖL						
		HUILE DE PARAFFINE						
		ACIETE DE PARAFINA						
		OLIO DI PARAFFINA						
	90 20 61	BEARING GREASE 0.280 kg	**(Upper bearing 0.008 kg**	*	*	*	*	*
		LAGERFETT	**lower bearing 0.025 kg)**					
		LAGERFETT						
		GRAISSE A ROULEMENT						
		GRASA DE COJINETE						
		GRASSO CUSCINETTI						
	84 15 30	CARTRIDGE GUN						
		PATRONPISTOL		*	*	*	*	*
		PATRONENPISTOLE						
		PISTOLE CARTOUCHE						
		PISTOLA CARTUCHO						

Pos.No.	Part No.	Denomination		Qty / Version 092	182	172	891	980
	84 20 48	PULLER COMPL.	100SPREAD/100REACH INNER BEARING	*	*	*	*	-
	216 68 00	SPECIAL PLIER	ROT. SEAL UNIT	*	*	*	*	-
	249 92 03	IMPELLER PULLER	LT-CURVES: 620-622	*	*	-	-	-
	251 35 02	IMPELLER PULLER	G-IMPELLERS	*	*	-	-	-
	251 35 03	IMPELLER PULLER	HT-IMPELLERS	*	*	-	-	-
	303 60 00	IMPELLER PULLER	CROSS L=72-100MM MT-IMPELLERS (NOT NEVACLOG)	*	*	-	-	-
	394 69 00	STATOR PULLER	I.D.=130-170MM STATOR HANDLING	*	*	*	*	-
	398 71 00	IMPELLER PULLER UNIT CROSS	L=136MM LT-CURVES: X12, X14	*	*	-	-	-
	403 90 00	STATOR PULLER	3085,4400,4410 STATOR HANDLING	*	*	*	*	-
	426 34 00	MOUNTING SOCKET	L=110MM STAT. SEAL RING FITTING	*	*	*	*	-
	463 78 02	MOUNTING TOOL	SEAL TYPE: 397900X, 593750X	*	*	*	*	-
	466 97 01	BEARING PULLER	OUTER BEARING	*	*	*	*	-
	479 92 00	MOUNTING TOOL	SEAL TYPE: 4762702	*	*	*	*	-

892525/03

FLYGT

ENM-10

Level regulator
Niveauregler
Interrupteur à flotteur
Interruptor de nivel
Regolatore di livello
Nivåvippa

CE

Connection of level regulator for acoustic or optical alarm
Anschluß des Niveaureglers für akustische oder optische Anzeige
Connexion d'un interrupteur à niveau pour alarme acoustique ou optique
Conexión del interruptor de nivel para alarma acústica u óptica
Collegamento del regolatore di livello per allarme acustico o ottico
Anslutning av nivåvippa för akustiskt eller optiskt larm

	1	2	3
Alarm high level Signal bei Hochwasserstand Branchement pour signal au niveau supérieur Alarma para el nivel alto Allarme di massimo livello Larm högt nivå	X	X	Insulate Isolieren Isolez Aislar Isolare Isoleras
Alarm low level Signal bei Niedrigwasserstand Branchement pour signal au niveau inférieur Alarma para el nivel bajo Allarme di minimo livello Alarm lågt nivå	X	Insulate Isolieren Isolez Aislar Isolare Isoleras	X

Dashed lines show alternative wirings
Gestrichelte Linien deuten weitere Schaltungsmöglichkeiten an
Les traits en pointillés correspondent à d'autres variantes de branchement
Las líneas a trazos muestran conexiones alternativas
Le linee tratteggiate indicano collegamenti alternativi
Streckdragna linjer visar alternativa kopplingar

English

ENM-10 level regulator

The ENM-10 is a bulb-type level regulator for level regulation and control of pumps and valves.

The casing of the regulator is made of polypropylene and the cable is sheathed with a special PVC compound.

The level regulator contains a micro switch, rated 250 VAC/10 A.

Important! In many cases, local codes require that the regulator be connected to a low-voltage supply, even though it is approved for a higher voltage.

FLYGT recommends that the regulator be connected to a low-voltage supply, 48 or 24 V, and a protective transformer.

Special rules apply to installation in an explosive atmosphere. Intrinsically safe circuits are normally required (Ex i).

The ENM-10 is available in different versions for different liquid densities.

The guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or normal wear and tear.

FLYGT assumes no liability for either bodily injuries, material damages or economic losses.

Deutsch

Niveauregler ENM-10

ENM-10 ist ein Regelgerät mit festen Ein/Aus-Schaltzuständen. Es dient der Überwachung von Füllständen und der Steuerung von Pumpen und Ventilen.

Das Gerätegehäuse besteht aus Polypropylen und die Kabelummantelung aus einem speziellen PVC-Kunststoff.

Das Gerät enthält einen Miniaturschalter mit den Nenndaten 250 VAC/10 A.

Achtung! In vielen Fällen verlangen örtliche Einbauvorschriften, daß der Niveauregler an ungefährliche Kleinspannung anzuschließen ist, obwohl er für höhere Spannungen zugelassen ist.

Wir empfehlen, das Gerät an Kleinspannung, 48 oder 24 V, über Trenntransformator, anzuschließen.

Für den Einbau in explosionsgefährdete Räume gelten Sonderbestimmungen, in der Regel wird ein eigensicherer Stromkreis (Ex i) gefordert.

ENM-10 ist in verschiedenen Ausführungen für verschiedene Flüssigkeitsdichten lieferbar.

Ausgenommen von der Gewährleistung sind Schäden aufgrund mangelhafter Wartung, unvorschriftsmäßiger Installation, unsachgemäßer Reparatur oder normalem Verschleiß.

Die Haftung von FLYGT beschränkt sich auf Produktmängel und schließt jegliche weitere Haftung für Personenschäden, Sachschäden oder Vermögensschäden aus.

Français

Interrupteur à flotteur ENM-10

L'interrupteur à flotteur ENM-10 est destiné à l'asservissement de niveau et à la commande de pompes et de valves.

Son enveloppe est en polypropène et la gaine de son câble en plastique PVC spécial.

Le flotteur contient un interrupteur sensible, calibré pour 250 V AC/10 A.

Important: La réglementation locale d'installation prescrit fréquemment de relier l'interrupteur à flotteur à une basse tension même s'il est agréé pour une tension supérieure.

FLYGT recommande de brancher l'interrupteur à flotteur à une basse tension, 48 ou 24 V, et à travers un transformateur de protection.

Pour l'installation en milieu explosible existent des dispositions réglementaires particulières qui prescrivent habituellement l'emploi d'un circuit à sécurité intrinsèque (Ex i).

L'ENM-10 est livrable en différentes exécutions conçues pour diverses densités de liquide.

Cette garantie ne concerne donc pas les défauts résultant d'un manque d'entretien, d'une installation incorrecte, d'une réparation incompétente ou d'une usure normale.

FLYGT n'assume pas ailleurs aucune responsabilité en cas de dommages corporels, matériels ou autres.

Español

Interruptor de nivel ENM-10

El ENM-10 es un interruptor de nivel para el control de bombas y válvulas.

La envoltura del interruptor es de Polipropeno y el revestimiento del cable de PVC especial.

El interruptor de nivel contiene un micro-interruptor dimensionada para 250 V AC/10 A.

Nota: En muchas ocasiones, las disposiciones locales para instalaciones eléctricas exigen que el interruptor de nivel sea conectado a baja tensión, incluso cuando dicho interruptor esté aprobado para tensiones más altas.

FLYGT recomienda que el interruptor se conecte a baja tensión 24 ó 48 V, mediante un transformador de protección.

Para su instalación en un entorno explosivo se aplicarán las disposiciones oficiales vigentes, que generalmente exigen el empleo de un circuito especial de seguridad (Ex i).

El ENM-10 puede adquirirse en varias versiones para diferentes densidades de líquido.

La garantía no se refiere a desperfectos ocasionados por falta de mantenimiento, instalación errónea, reparación defectuosa o desgaste natural.

En cualquier caso FLYGT no asume ninguna responsabilidad por los daños que puedan originarse, tanto si se trata de daños personales, en el material o daños a la propiedad.

Italiano

Regolatore di livello ENM-10

L'ENM-10 è un regolatore a variazione di assetto per il controllo del livello di un liquido e per il comando di pompe e valvole.

L'involucro del regolatore di livello è in polipropilene e il cavo è rivestito con una composizione particolare di PVC.

Il regolatore di livello incorpora un deviatore sensibile di potenza nominale pari a 250 VAC/10 A.

N.B. In molti casi, le disposizioni locali prescrivono che il regolatore sia collegato a bassa tensione e anche se approvato per tensioni più alte.

La FLYGT raccomanda che il regolatore venga collegato a bassa tensione, 24 o 48 V., e tramite un trasformatore d'isolamento.

Per l'installazione in ambiente con pericolo di esplosioni vi sono disposizioni speciali. Generalmente si richiede un circuito a sicurezza intrinseca (Ex i).

L'ENM-10 è disponibile in diversi tipi, secondo il peso specifico del liquido nel quale è impiegato.

La garanzia non copre guasti causati da insufficiente manutenzione, errata installazione, eventuali lavori di riparazione mal eseguiti o normale usura.

La FLYGT non si assume alcuna responsabilità per eventuali danni a persone e/o cose o per perdite economiche.

Svenska

ENM-10 nivåvippa

ENM-10 är en vippa för nivåreglering, styrning av pumpar och ventiler.

Nivåvippans hölje består av polypropen och sladdens hölje är av speciellt PVC-material.

Nivåvippan innehåller en mikrobrytare med märkdata 250 VAC, 10 A.

OBS! I många fall kräver lokala installationsföreskrifter att vippan ansluts till klenspänning, även om vippan är godkänd för en högre spänning.

FLYGT rekommenderar att vippan ansluts till klenspänning. I Sverige gäller generellt att ENM-10 endast får anslutas till max 24 V installationsspänning samt skyddstransformator.

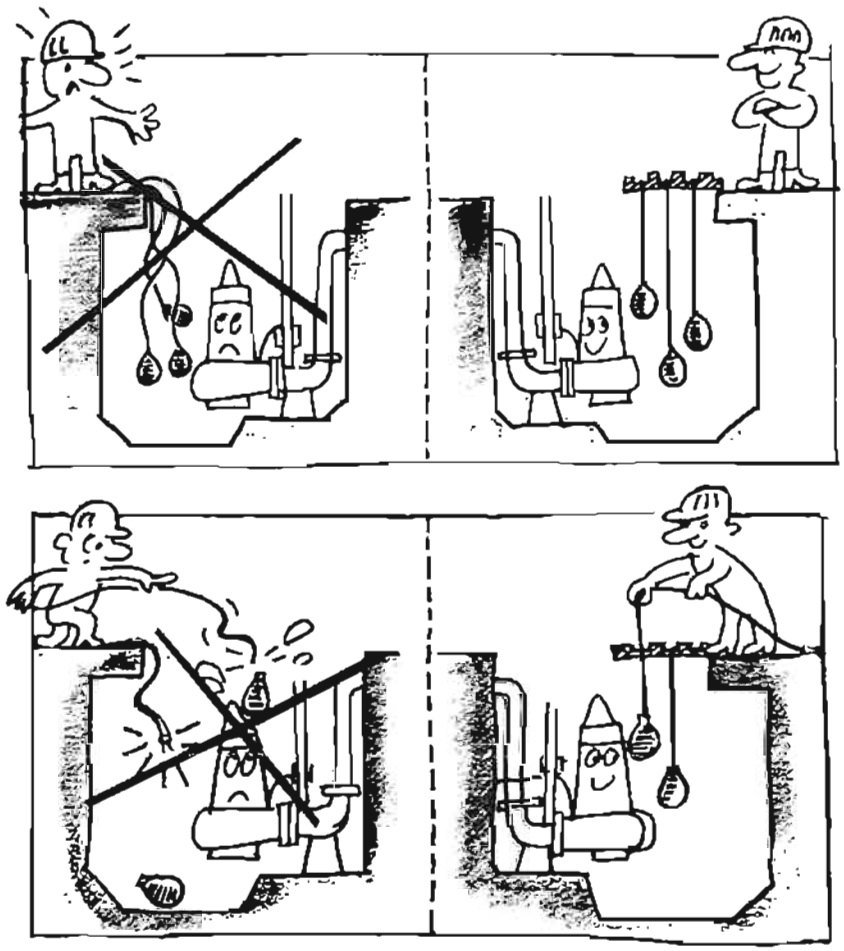
För installation i explosiv miljö gäller särskilda bestämmelser, vanligen krävs egensäker krets (EX i).

ENM-10 finns i olika utföranden för olika vätskedensiteter.

FLYGTS ansvar avser inte fel förorsakade av bristande underhåll, felaktig installation eller normal förslitning (utmattning).

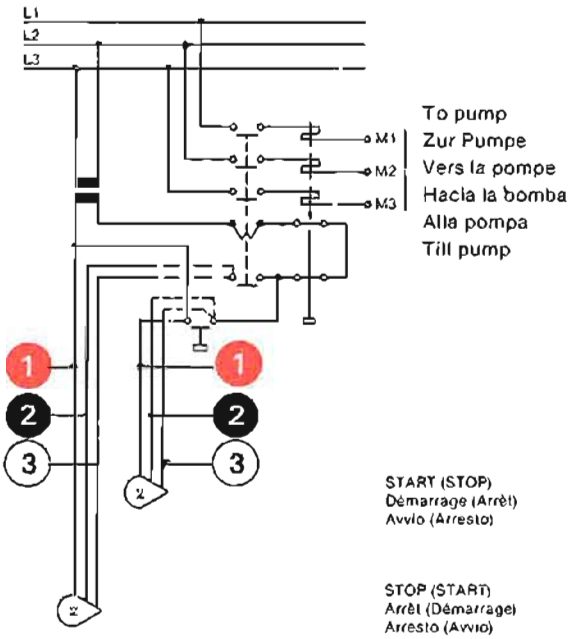
Tillverkaren påtar sig inget ansvar för skador vare sig det är personskada, sakskada eller förmögenhetsskada.

Version Ausführung Version Versión Versione Version	Density Dichte Densité Densidad Densitá Densitet	Cable Kabel Câble Cable Cavo Kabel	
582 88 00	0.65 - 0.80	20m PVC	
582 88 01	0.80 - 0.95	20m PVC	
582 88 02	0.95 - 1.10	6m PVC	
582 88 03	0.95 - 1.10	13m PVC	
582 88 04	0.95 - 1.10	20m PVC	
582 88 05	1.05 - 1.20	20m PVC	
582 88 06	1.20 - 1.30	20m PVC	
582 88 07	1.30 - 1.40	20m PVC	
582 88 08	1.40 - 1.50	20m PVC	
582 88 18	0.65 - 0.80	20m PVC	
582 88 19	0.80 - 0.95	20m PVC	
582 88 20	0.95 - 1.10	6m PVC	
582 88 21	0.95 - 1.10	13m PVC	
582 88 22	0.95 - 1.10	20m PVC	
582 88 23	1.05 - 1.20	20m PVC	
582 88 24	1.20 - 1.30	20m PVC	
582 88 25	1.30 - 1.40	20m PVC	
582 88 26	1.40 - 1.50	20m PVC	
582 88 27	0.65 - 0.80	20m PVC	For USA
582 88 28	0.80 - 0.95	20m PVC	For USA
582 88 29	0.95 - 1.10	6m PVC	For USA
582 88 30	0.95 - 1.10	13m PVC	For USA
582 88 31	0.95 - 1.10	20m PVC	For USA
582 88 32	1.05 - 1.20	20m PVC	For USA
582 88 33	1.20 - 1.30	20m PVC	For USA
582 88 34	1.30 - 1.40	20m PVC	For USA
582 88 35	1.40 - 1.50	20m PVC	For USA
582 88 61	0.65 - 0.80	20m Chloroprene	
582 88 62	0.80 - 0.95	20m Chloroprene	
582 88 63	0.95 - 1.10	6m Chloroprene	
582 88 64	0.95 - 1.10	13m Chloroprene	
582 88 65	0.95 - 1.10	20m Chloroprene	
582 88 66	1.05 - 1.20	20m Chloroprene	
582 88 67	1.20 - 1.30	20m Chloroprene	
582 88 68	1.30 - 1.40	20m Chloroprene	
582 88 69	1.40 - 1.50	20m Chloroprene	
582 88 70	0.65 - 0.80	20m Chloroprene	
582 88 71	0.80 - 0.95	20m Chloroprene	
582 88 72	0.95 - 1.10	6m Chloroprene	
582 88 73	0.95 - 1.10	13m Chloroprene	
582 88 74	0.95 - 1.10	20m Chloroprene	
582 88 75	1.05 - 1.20	20m Chloroprene	
582 88 76	1.20 - 1.30	20m Chloroprene	
582 88 77	1.30 - 1.40	20m Chloroprene	
582 88 78	1.40 - 1.50	20m Chloroprene	

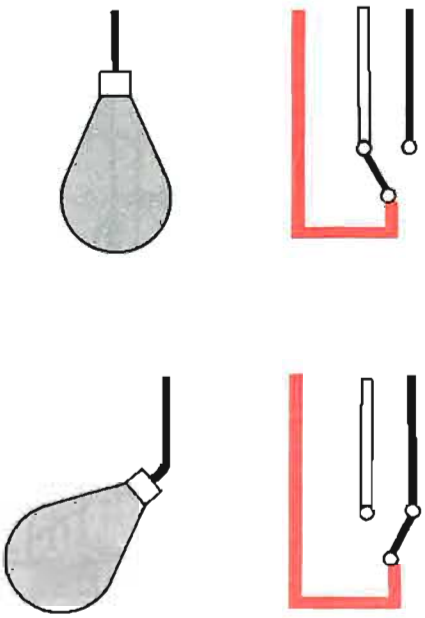


Wiring table for level regulators
Anschlußtabelle für Niveauregler
Tableau de branchement pour interrupteurs à flotteur
Tabla de conexión para interruptores de nivel
Schema di collegamento per regolatori di livello
Kopplingstabell för nivåvippor

	1	2	3
Wired for emptying of pump sump Schaltung für das Entleeren eines Sammelbehälters Branchement pour vidange de puisard Conectado para vaciado de pozo Collegato per lo svuotamento del pozzo Kopplad för tömning av pumpgrop	X	X	Insulate Isolieren Isolez Aislar Isolare Isoleras
Wired for filling of tank Schaltung für Behälterfüllung Branchement pour remplissage de réservoir Conectado para llenado de depósito Collegato per il riempimento del pozzo Kopplad för fyllning av tank	X	Insulate Isolieren Isolez Aislar Isolare Isoleras	X



Dashed lines show alternative wirings
Gestrichelte Linien deuten weitere Schaltungsmöglichkeiten an
Les traits en pointillés correspondent à d'autres variantes de branchement
Las líneas a trazos muestran conexiones alternativas
Le linee tratteggiate indicano collegamenti alternativi
Streckdragna linjer visar alternativa kopplingar



Depth of immersion: max. 20 m (65 ft).
Profondeur d'Immersion: max. 20 m (65 ft).
Eintauchtiefe: max 20 m.
Profundidad de inmersión: máx. 20 m.
Profondità d'Immersione: massimo 20 m.
Nedsänkningsdjup: max 20 m.

Printed in Sweden KT 210191

-Flygt Submersible Pump Controls Manual

Franklin Cleaners
Control Panel

Pumping Services, Inc.
368 Lincoln Blvd.
Middlesex, NJ 08846
Tel: (732) 469-4540
Fax: (732) 469-5912

A. Control Panel Specifications
B. Operation Instructions
C. Drawings
D. Component Specifications

6/16/2003

Control Panel Specifications

FLYGT

An **ITT Industries** company

ENGINEERING SUBMITTALS

FILE	
JOB NAME-	FRANKLIN CLEANERS
QUOTE NO.-	55875AC Rev: A
DATE-	3/14/2003
CUSTOMER	PUMPING SERVICES – DALE PARKHURST

ELECTRICAL SERVICE	
VOLTAGE -	208
PHASE -	3
WIRES -	4

CONTROL SYSTEM	
TYPE OF CONTROL PANEL -	DUPLEX STATION
SENSING DEVICE -	FLOATS
NUMBER OF MOTORS -	2
MOTOR H.P.-	3HP (10 FLA)
ENCLOSURE:	
MATERIAL -	STEEL
NEMA RATING -	12
SIZE -	36" X 30" X 10"
MODIFICATIONS -	LEGENDS W/ SCREWS – UL 508 913 SEL - ETL
MOUNTING STYLE -	WALL MOUNT

PRODUCTION REQUIREMENT
[ ] APPROVAL WAIVED
[ ] APPROVED AS SUBMITTED
[ ] DRAWINGS APPROVED AS NOTED, "PROVIDE CLEAR AND PRECISE COMMENTS"

APPROVAL SIGNATURE:_____

UL approval check list

✓ make sure fuses are proper size

✓ label all fuses

✓ isolate neutral

____ check the following components for ul approval:

flasher

alarm light

heater (hoffman or strip heater)

✓ all wire must be 90 deg at least

✓ make sure the phase monitor is fused

____ must have an overload chart

✓ fill out the pump data sheet includes voltage, horse power, fls, and total fla

____ ground fault protection on the secondary of the transformer when non ul components are in control circuit of panel

____ attach a non ul component list sheet when needed

✓ mark all ground lugs with ground label

✓ mark terminal block with torque requirement label

____ mark out 4, 4x if a hole is made in the enclosure

✓ intrinsically safe markings

install grounded barrier

mark terminal strip

✓ SEL on panels with Main or Main and Emergency

____ Article 702 on panels with Main and Emergency

✓ SEL drawing 60, 100, 150, 200 (other) 40

UL NUMBER BD-050158

PANEL SERIAL NUMBER 03-0439

ETL approval check list

- ✓ make sure fuses are proper size
- ✓ label all fuses
- ✓ isolate neutral
- ____ check the following components for ETL approval:
  - flasher
  - alarm light
  - heater (hoffman or strip heater)
- ✓ all wire must be 90 deg at least
- ✓ make sure the phase monitor is fused
- ____ must have an overload chart
- ✓ fill out the pump data sheet includes voltage, horse power, fls, and total fla
- ✓ mark all ground lugs with ground label
- ✓ mark terminal block with torque requirement label
- ____ mark out 4, 4x if a hole is made in the enclosure
- ✓ intrinsically safe markings
  - install grounded barrier
  - mark terminal strip
- ✓ SEL on panels with Main or Main and Emergency
- ____ Article 702 on panels with Main and Emergency
- ✓ SEL drawing 60, 100, 150, 200 (other) 40

PANEL SERIAL NUMBER 03-0439

PANEL QUOTE NUMBER 55875AC

Operation Instructions

OPERATIONS MANUAL

GENERAL:

This control system will operate two (2) submersible sewage pumps and provides for automatic alternation of pumps to equalize run time. The controls operate with three (3) float regulators adjusted to predetermined levels within the wet well. Aluminum dead front with breaker knockouts is provided for safety and allows for check operation of system.

BREAKERS:

The circuit breakers are located in the upper right hand portion of the enclosure and include: (1) main circuit breaker (MCB); (2) pump motor breakers (MB); (3) transformer circuit breaker (TCB); and (4) control circuit breaker (CCB).

Incoming power 208 VAC, 3 phase, 4 wire from the local utility is applied to the main circuit breaker. The power from the MCB is distributed to the other circuit breakers. MB1 and MB2 control power to pumps 1 and 2 respectively. The TCB controls the power to the control power transformer (CPT), which control the control voltage. The CCB controls power to the control circuits.

STARTERS:

The starters are located in the lower right hand portion of the enclosure and contain the necessary control wiring to actuate the starter coils on demand from the controls. The starters contain a melting allow overload heater on each power leg rated at the full load amp draw of the pumps. Excessive amp draw by the pumps will open the overload relay contacts and shut down the pump. The manual reset handle located on the overload relay must be reset before the pumps will restart.

NOTE: If reset is required, the amp draw of the pump should be checked.

CONTROLS:

The controls consist of a 120 VAC intrinsically safe control system for safety reasons. The relays control sequencing and voltage application to the pump alternator (PAA), lights and alarm functions.

The output voltage of the intrinsically safe relays is applied to the float switches directly and consists of a DC voltage level. When the float switch tilts, the contact closure signals the ISR to turn on and feed a 120 VAC signal to the operating relay coil.

OPERATING SEQUENCE

(a) Low level operation:

When the low level float switch [FR1] tilts, it removes the voltage from the pump call for in hand and automatic. R1 will energize for dry contact remote alarm and activate R2 for a common alarm.

(b) Lead Pump Operation:

When the level in the wet well rises, tilts float regulator (FR2), ISR2 relay is activated for a holding circuit for the lead pump call. ISR2 controls the off level and sets the shut off level for the lead pump.

As the level rises in the wet well, float regulator (FR3) tilts. ISR3 is activated which supplies a voltage to TD1 and through contacts 3-1, to the manual and automatic alternator through the HOA switches for starting of the lead pump. When the motor starter is activated, a run light is illuminated and the elapsed time starts recording signifying the motor is on. The lock in circuit to the off float switch is through relay TD1 contacts 6-8. The lead pump will operate until the off float switch opens.

(c) Alarm Operation:

The following alarm conditions will be identified by alarm indications.

1. Low level alarm. [Pilot Light]
2. Pump 1 fail. [Pilot Light]
3. Pump 2 fail. [Pilot Light]
4. High Pressure. [Pilot Light]

(d) Alternator Operation:

The automatic alternator operates on de-energization to prevent contact arcing and momentary starting of pumps. The alternator sequences with the OFF float regulator (FR2). The manual alternator switch lead-auto-lag switch mounted on the dead front determines the sequencing of the pumps. The lead-lag selector switch must be in the left (auto) position for normal operation, whenever a pump becomes inoperative, (say pump # 1) the selector switch may be placed in the # 2 position so that pump 2 is always the lead pump.

To replace a pump, place the alternator switch in the lead pump position of the pump to stay active. Turn the defective pump motor breaker and the HOA switch off position. The pump may now be removed.

(e) Pump Fail:

If a pump is called and does not start, TD2 or TD3 will time out. TD2 will activate R3 and pump 1 fail pilot light. Once activated R3 will latch through R3 contact [3-1] to a manual reset push button. TD3 will activate R4 and pump 2 fail pilot light. Once activated R4 will latch through R4 contact [3-1] to a manual reset push button.

Remote System:

The remote signals will be activated in the case of a failure as indicated above. The signals are provided at terminal strip "A".

The following conditions will be sent out as dry contacts.

1. Phase fail
2. Pump 1 Fail
3. Pump 2 Fail
4. High Pressure
5. Low Level
6. Overtemp/Moisture 1
7. Overtemp/Moisture 2
8. Common Alarm
9. Pump Run

MINI-CAS II Operation:

Each pump is supplied with a moisture-thermal controller that will provide an indication of the motor status. In the event of a pump failure, a remote indication is supplied through relays R5 and R6.

MAINTENANCE:

To assure watertight integrity, the hold-down "dogs" on the cabinet should be secure at all times. A mild protective spray, such as CRC 226, should be used bi-monthly on the outer door gasket.

All conduit openings should be sealed to preclude intrusion of gases from the wet well.

NORMAL CONDITIONS OF COMPONENTS:

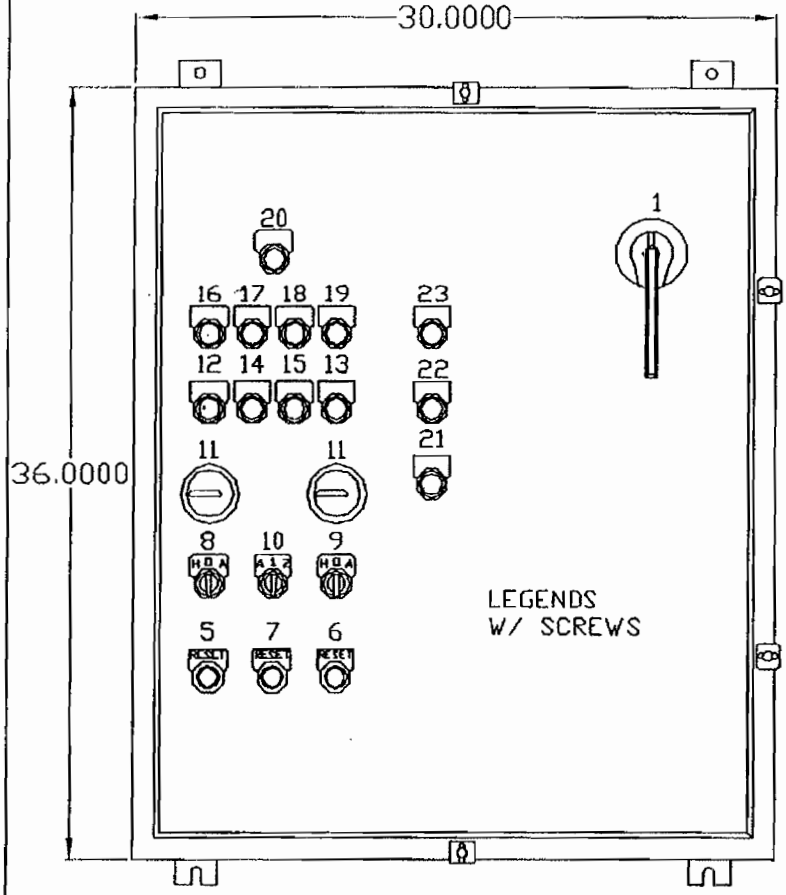
1. Intrinsically safe relays - When the LED is on, power is applied to the unit.

2. Relays - The indicator lights illuminate when the relay is activated.

MALFUNCTION INDICATION POSSIBLE CAUSES

1. Pump(s) will not run. (hand position)	1A. Loss of incoming power. B. Motor breakers in off position. C. HOA in off position. D. CCB in off position. E. MS OL's tripped. F. Defective ISR1. G. Defective F1, F2. H. Defective motor starter. I. Motor over temp. TTS open J. MINI-CAS FUS II dropped out.
2. Pump(s) will not run. (auto position)	2A. All of above. B. Defective ISR3. C. Defective FR3. D. Defective manual alternator. E. Defective CCT.
3. Alternator will not alternate.	3A. Defective FR2. B. Defective alternator C. Defective ISR2. D. Manual alternator switch in wrong position.

Drawings



1 - MAIN BREAKER
5 - MINICAS 1 RESET
6 - MINICAS 2 RESET
7 - PUMP FAIL RESET
8 - PUMP 1 HAND-OFF-AUTO
9 - PUMP 2 HAND-OFF-AUTO
10 - ALTERNATION SELECTOR SWITCH
11 - ELAPSE TIME METER
12 - RL1 PUMP 1 RUN
13 - RL2 PUMP 2 RUN
14 - PL5 PUMP 1 FAIL
15 - PL6 PUMP 2 FAIL
16 - PL7 OVERTEMP 1
17 - PL8 MOISTURE 1
18 - PL10 MOISTURE 2
19 - PL9 OVERTEMP 2
20 - PL11 HIGH PRESSURE
21 - PL1 LOW LEVEL
22 - PL2 OFF LEVEL
23 - PL3 ON LEVEL

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

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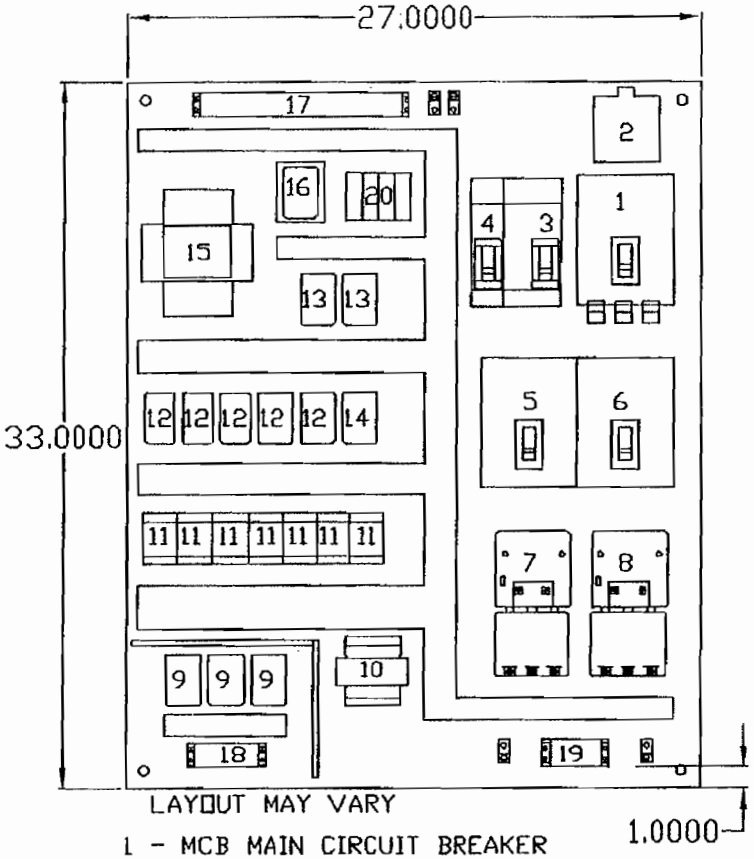
TRUMBULL, CT 06611



LAYOUT MAY VARY

1 - MCB MAIN CIRCUIT BREAKER
2 - LA LIGHTNING ARRESTOR
3 - TCB TRANSFORMER CIRCUIT BREAKER
4 - CCB CONTROL CIRCUIT BREAKER
5 - MB1 MOTOR BREAKER 1
6 - MB2 MOTOR BREAKER 2
7 - MS1 MOTOR STARTER 1
8 - MS2 MOTOR STARTER 2
9 - ISR1 THROUGH ISR3 INTRINSICALLY SAFE RELAY
10 - CCT CONTROL CIRCUIT TRANSFORMER
11 - R1 THROUGH R8 CONTROL RELAY
12 - TD1 THROUGH TD6 TIME DELAY
13 - MC1&2 MINICAS
14 - ALT ALTERNATOR
15 - CPT CONTROL POWER TRANSFORMER
16 - PM PHASE MONITOR
17 - TSA TERMINAL STRIP A
18 - TSB TERMINAL STRIP B
19 - TSC TERMINAL STRIP C
20 - F FUSE BLOCK

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

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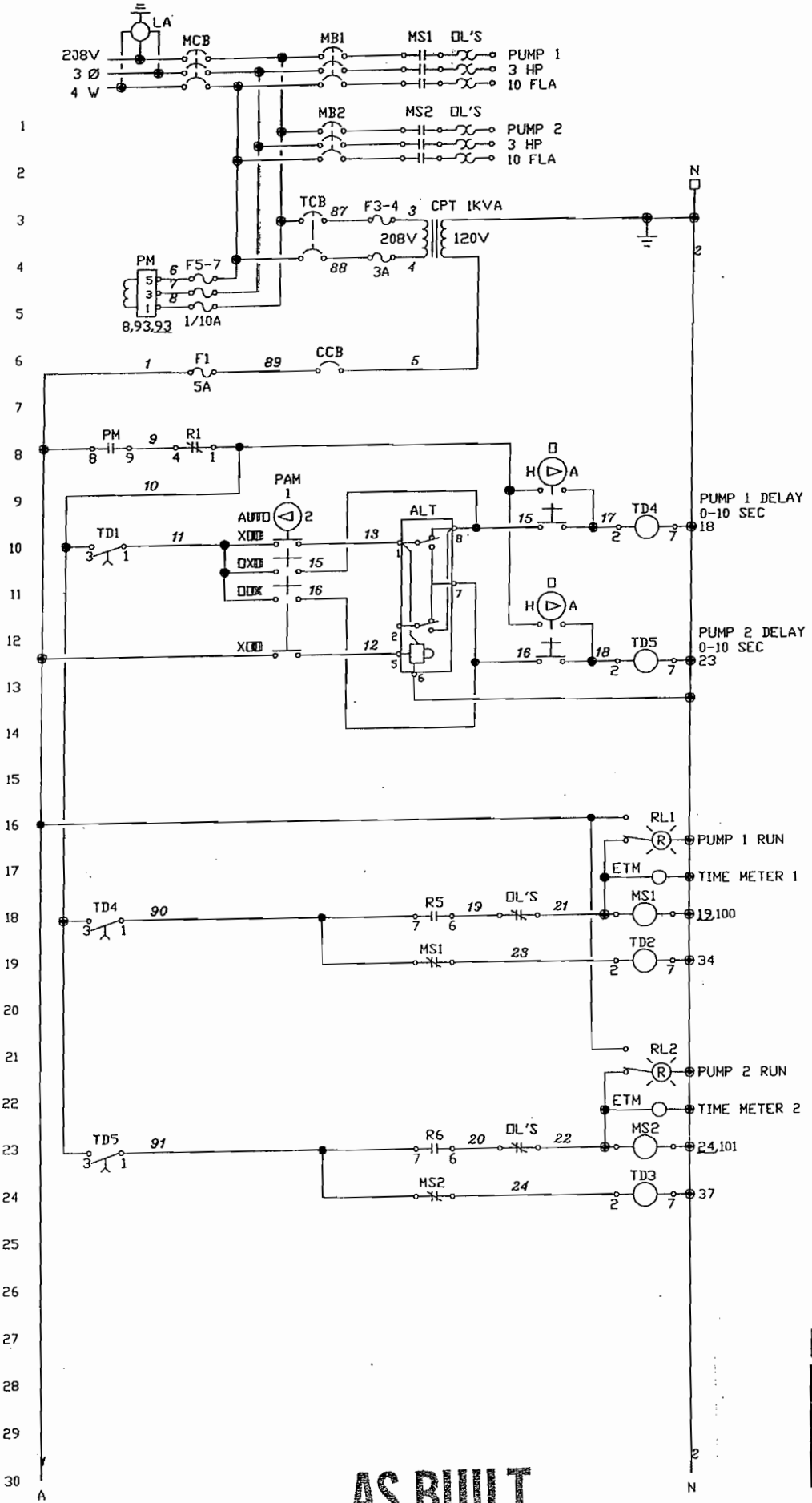
TRUMBULL, CT 06611



FRANKLIN CLEANERS

QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

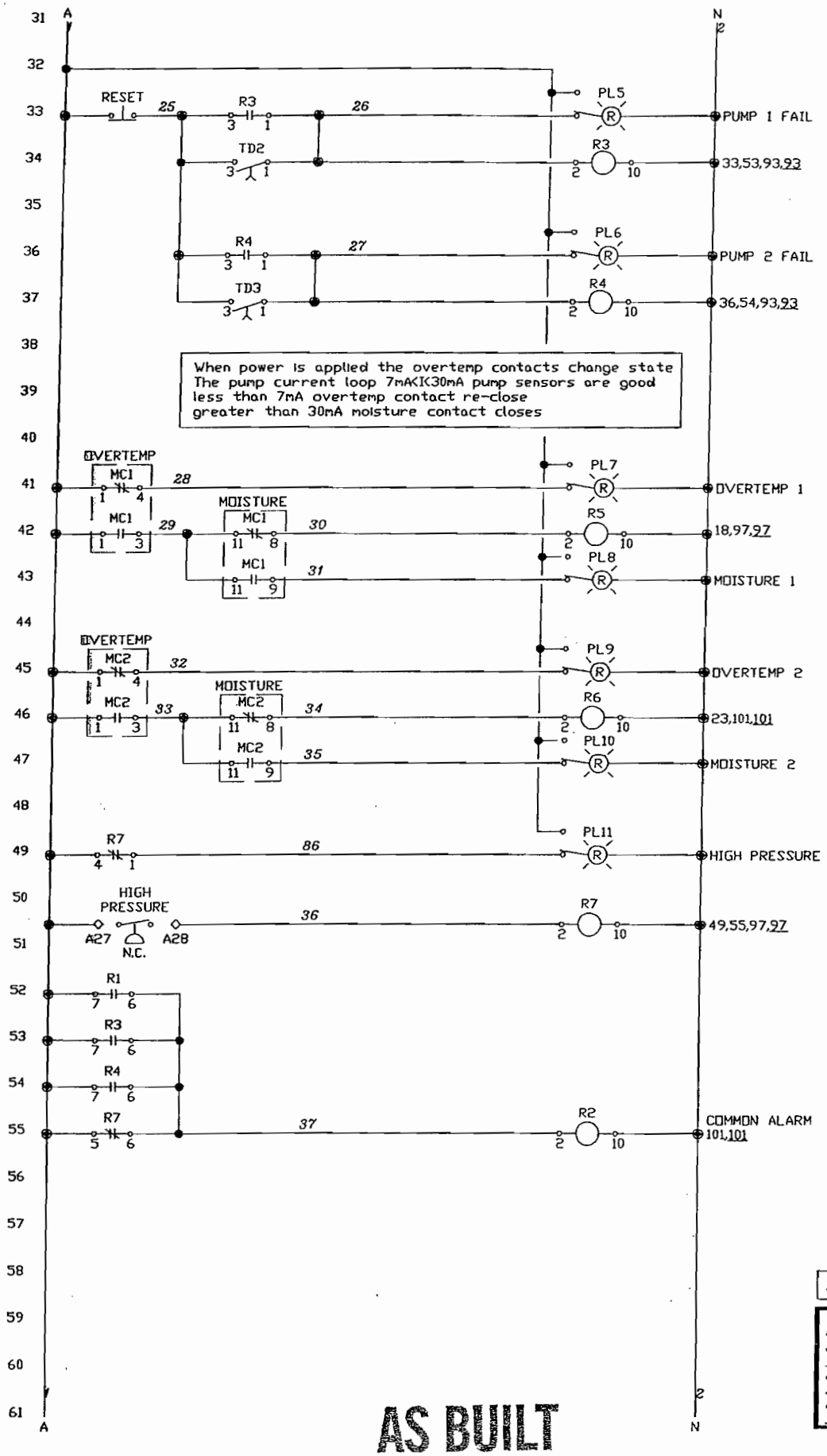
ITT-FLYGT CORP.
TRUMBULL, CT 06611

ITT-FLYGT

ETL LISTED

UL LISTED
508 STANDARD
SERIAL NO.

SERVICE ENT
HAZ LOCATION
SERIAL NO.



AS BUILT

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

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ITT—FLYGT

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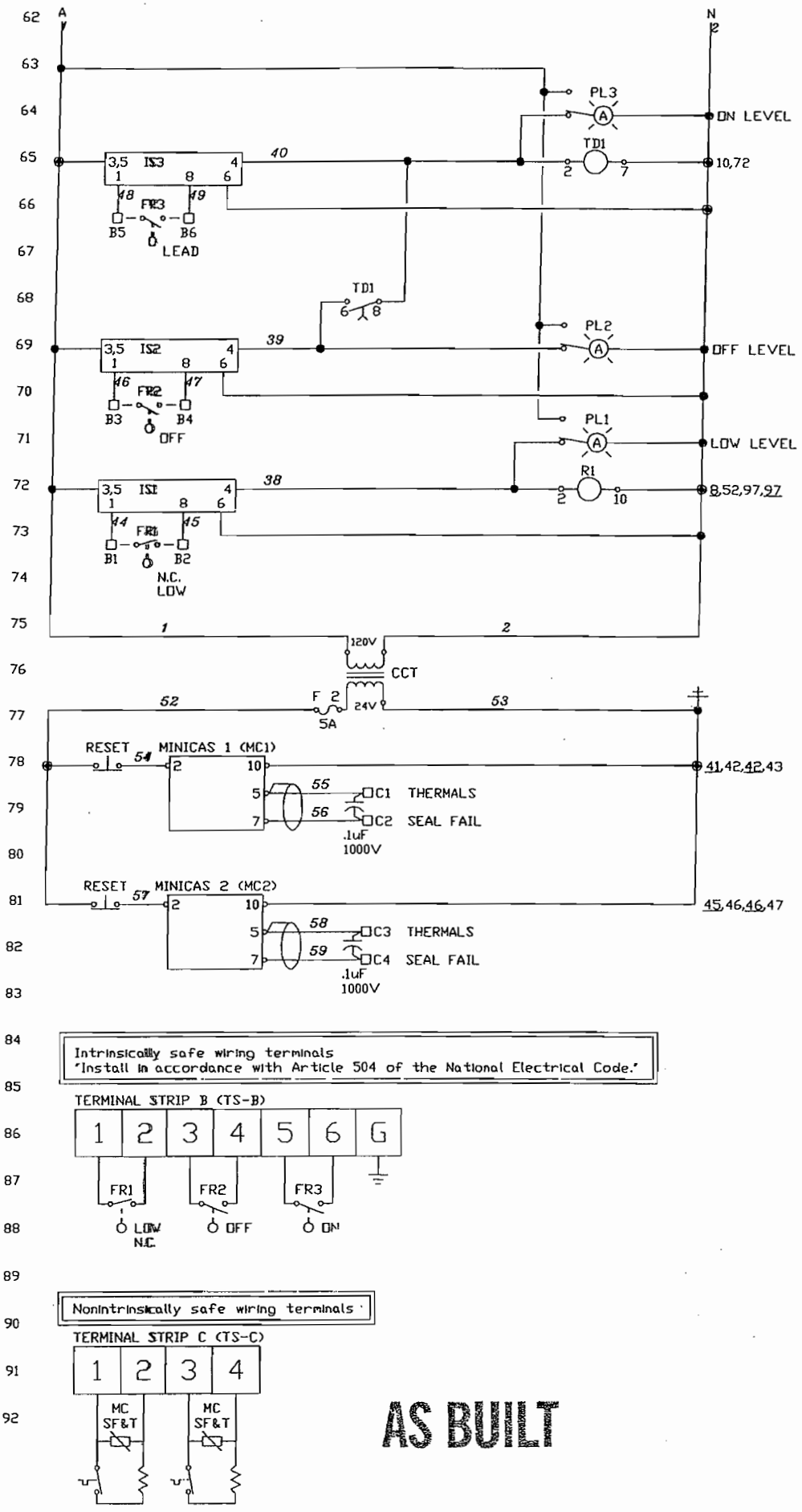
SERIAL NO.



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QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

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ITT-FLYGT

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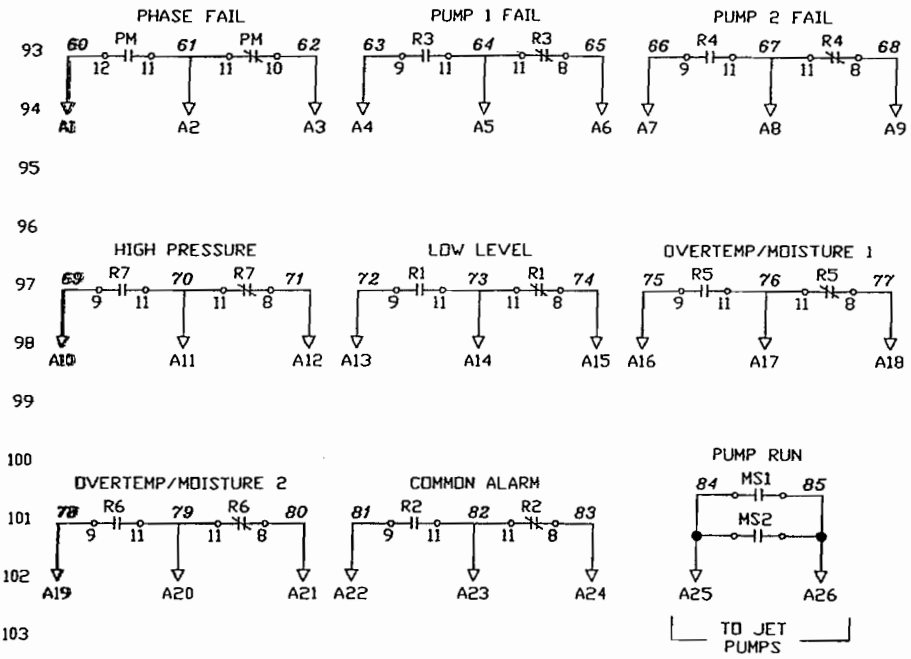
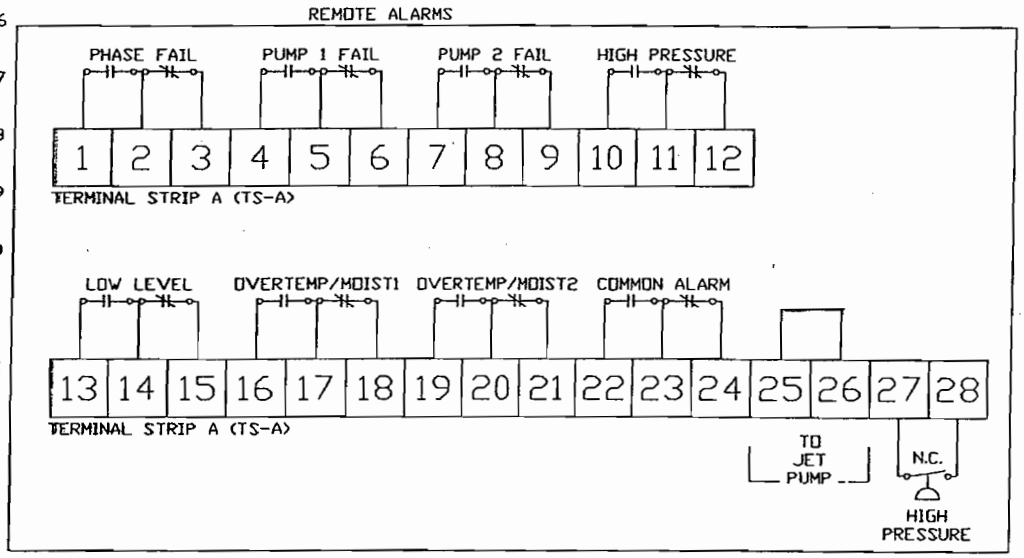
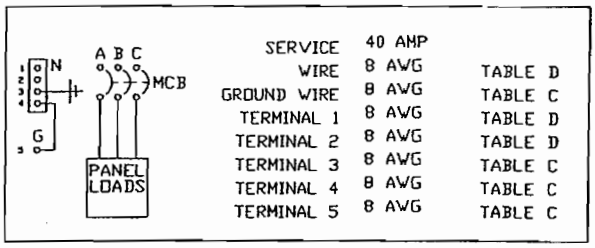
SERIAL NO.



LAST WIRE #91

Dry contacts leaving panel powered by other source





SERVICE	40 AMP	
WIRE	8 AWG	TABLE D
GROUND WIRE	8 AWG	TABLE C
TERMINAL 1	8 AWG	TABLE D
TERMINAL 2	8 AWG	TABLE D
TERMINAL 3	8 AWG	TABLE C
TERMINAL 4	8 AWG	TABLE C
TERMINAL 5	8 AWG	TABLE C

CUSTOMER	PUMPING SERVICES			
JOB NAME	FRANKLIN CLEANERS			
VOLTAGE	208	PHASE 3		HZ 60
H.P.	#1 3	#2 3	#3 X	#4 X
F.L.A.	10A	10A	X	X
TOTAL F.L.A.	25A			
SERIAL #	03-0439		DATE: 4/24/2003	

ETL LISTED

UL LISTED
508 STANDARD
SERIAL NO.

SERVICE ENT
HAZ LOCATION
SERIAL NO.

AS BUILT

FRANKLIN CLEANERS			
QUOTE NO.	DATE	DRAWN BY	REVISION
55875AC	3.11.03	MED	A

ITT-FLYGT

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TRUMBULL, CT 06611

FLYGT

An **ITT Industries** company

AS BUILT

BILL OF MATERIAL | BY: MED

QUOTE NO.	**55875AC**	**Date:4/25/2003**	**Rev: A**
JOB NAME	**FRANKLIN CLEANERS**	**03-0439**	
CUSTOMER	**PUMPING SERVICES**	**Po#**	

QTY	LEGEND	DESCRIPTION	MFG.	PART #	Check Off
1		ENCLOSURE	HOFFMAN	A-363010LPX	[✓]
1		SUB PANEL	HOFFMAN	A-36P30	[✓]
1	N	ISOLATED NEUTRAL BLOCK	SQD	SN12125	[✓]
2	G	GROUND BUSS	SQD	PK7GTA	[✓]
1	MCB	MAIN CIRCUIT BREAKER	SQD	FAL32040	[✓]
1	OP M	OPERATOR MECHANISM (FAL)	SQD	9421-LN3	[✓]
1		MULTI-LUG KITS (6-#14-#6)	SQD	PDC6FA6	[✓]
2	**MB**	**MOTOR BREAKER**	**SQD**	**FAL36015-13M**	[✓]
1	CCB	CONTROL BREAKER	SQD	FAL14015	[✓]
1	TCB	TRANSFORMER CIRCUIT BREAKER	SQD	FAL24030	[✓]
2	MS	MOTOR STARTER (SIZE 1)	SQD	8536-SCO3V02S B	[✓]
6	OL	OVERLOAD HEATERS	SQD	AR15.4	[✓]
1	CPT	CONTROL POWER TRANSFORMER	SQD	9070-T1000D3	[✓]
1	CCT	CONTROL TRANSFORMER	SQD	9070-T75D23S12	[✓]
2	TS	TERMINAL STRIP	MARATHON	SERIES 200	[✓]
1	TS	TERMINAL STRIP	MARATHON	SERIES 300	[✓]
2	* F	FUSE	LITTELFUSE	BLF –5 /250V	[✓]
2	* F	FUSE (TIME DELAY AC-DC)	LITTELFUSE	KLDR –3 /600V	[✓]
3	* F	FUSE (FAST ACT AC - DC)	LITTELFUSE	KLK-1/10 /600V	[✓]
6		FUSE HOLDER	LITTELFUSE	L60030M1PQ	[✓]
2	HOA	HAND-OFF-AUTO SELECTOR	SQD	9001SKS43B	[✓]
2		(NO, NC) CONTACT	SQD	9001-KA1	[✓]
1	PAM	PUMP ALTERNATOR MANUAL	SQD	9001SKS46B	[✓]
1		(NO, NC) CONTACT	SQD	9001-KA1	[✓]
2		(NC) CONTACT	SQD	9001-KA3	[✓]
2	RL	RUN LIGHT	SQD	9001SKT1	[✓]
10	PL	PILOT LIGHT	SQD	9001SKT1	[✓]
2	ETM	ELAPSED TIME METER	REDINGTON	710-0016	[✓]
3	P/B	PUSH BUTTON	SQD	9001-SKR1U	[✓]
3		(NC) CONTACT	SQD	9001-KA3	[✓]
7	R	CONTROL RELAY (120VAC)	POTTER B.	KRPA14AN-120	[✓]
3		8 PIN SOCKET (ISR)	OMRON	PF083A	[✓]
6		8 PIN SOCKET	IDEC	SR2P-06	[✓]
9		11 PIN SOCKET	IDEC	SR3P-05	[✓]
1		12 PIN SOCKET	CUSTOM CONN	SD12	[✓]
1	ALT	AUTO ALTERNATOR (13SP)	FLYGT	14-40 31 86	[✓]

Component Specifications

3	ISR	INTRINSICALLY SAFE RELAY (120V)	FLYGT	14-40 32 22	[✓]
1	PM	PHASE MONITOR (230V 12 PIN)	FLYGT	14-40 32 12	[✓]
2	MC	MINI-CAS (ADD .1Uf 1000V CAPACITOR TO MINI-CAS PINS 5-7)	FLYGT	14-40 71 13	[✓]
1	LA	LIGHTNING ARRESTOR	SQD	6671 SDSA3650	[✓]
5	**TD**	**TIME DELAY**	**SQD**	**9050-JCK60V20**	[✓]
1	VC	VAPOR CAPSULE	ZERUST	VCC-1	[✓]

NOTES: *** OR EQUAL**

PACKING LIST

Quote#:55875AC	**Date: 4/25/2003**	**Rev: A**

SPARE PARTS

QTY	LEGEND	DESCRIPTION	MFG	PART #	
1	**CPT**	**CONTROL POWER TRANSFORMER**	**SQD**	**9070-T1000D3**	[✓]
1	**CCT**	**CONTROL TRANSFORMER**	**SQD**	**9070-T75D23S12**	[✓]
3	**R**	**CONTROL RELAY (120VAC)**	**POTTER B.**	**KRPA14AN-120**	[✓]
3	**TD**	**TIME DELAY**	**SQD**	**9050-JCK60V20**	[✓]
12	*F	FUSE	LITTELFUSE	BLF –5 /250V	[✓]
12	*F	FUSE (FAST ACT AC - DC)	LITTELFUSE	KLK-1/10 /600V	[✓]
12	*F	FUSE (TIME DELAY AC-DC)	LITTELFUSE	KLDR –3 /600V	[✓]
16	**PL**	**PUSH-TO-TEST PILOT LIGHTS**	**SQD**	**9001SKT1**	[✓]

AS BUILT

SHOP CHECK SHEET

Quote#:55875AC	Date: 4/25/2003	Rev: A

P.O.#				Ship Date	4/25/2003		
H.P.'s	3	# PUMPS	2	VOLTAGE	208V	PHASE	3
		DRIPSHIELD	NO	SERIAL #	03-0439		
DEADFRONT	N/A	ENCLOSURE TYPE	12/3R	MATL.	STEEL		

SPECIAL INSTRUCTIONS	Check OFF
STAINLESS SCREWS IN DOOR LEGENDS	[✓]
INTRINSICALLY SAFE DEVICES HAVE ALUMINUM BARRIER	[✓]
REMOTE PRESSURE SWITCH NOT INCLUDED	[✓]
CORROSION INHIBITOR	[✓]

Wire Numbers – Type _____	[✓]
Legends and Legend Sheet	[✓]
Ground Lugs	[✓]
Overload Heater Chart	[✓]
Pump Data Sheet	[✓]
Drawings on Door	[✓]
Picture of Panel	[✓]

ETL LABEL	[✓]
UL Serial No. **BD050158**	[✓]
Service Entrance	[✓]
UL Hazardous Locations **BD395290**	[✓]

Spare Parts

AS BUILT

[ ] In Panel See Packing List [ ]

[ ] In Separate Box See Packing List [ ]

Wired by: subpanel B.S._____ door/deadfront J.N._____

Tester T.W._____

Inspector J.N. _____

Comments Entire packing list shipped seperate in boxes as marked.

-Air Stripper
-W.E. Anderson Model L6 Float Switch

TROUBLE SHOOTING

Trouble Shooting Operational Notes

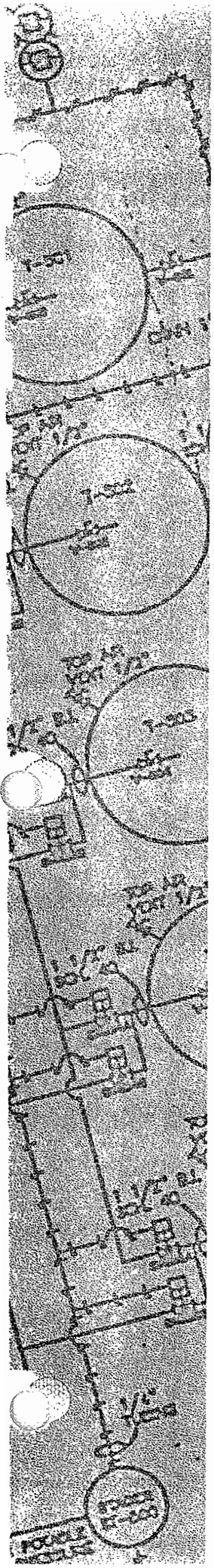
A. Any switch in the "HAND" position will operate the corresponding circuit under any alarm condition, except for a motor temperature fault or a circuit overload. The "HAND" position is for diagnostics or to clear alarms. The system should never be left unattended while any switch is in the "HAND" position.

B. To reset an alarm, switch all Hand-Off-Auto (HOA's) switches to the "OFF" position. Then the press the "RESET" button. If the panel will not reset, then an alarm condition still exists.

C. Upon powering the panel, alarm lights will be lit. The panel must be reset every time power is disconnected.

D. This system includes run hour meters for each major motor.

System	Problem	Possible cause	Solution
STAT	Water in air discharge line	Water flow rate too high	Verify water flow rate conditions and adjust flow rate accordingly
		Air flow rate too high	Verify airflow rate conditions and adjust flow rate accordingly.
		Foaming	Contact CARBONAIR for a foaming test kit.
	High Pressure Drop Pressure in the unit exceeds the recommended maximum (9" H_2O per tray).	Water flow rate too high	Verify water flow rate conditions and adjust flow rate accordingly
		Air flow rate too high	Verify airflow rate conditions and adjust flow rate accordingly.
		Excessive effluent pressure	Verify operating condition. Ensure that there is not excessive backpressure on the unit, (i.e. reduced pipe sizes, fouled Carbon bed, or fouled CATOX.)
		Trays fouled	Inspect and clean trays
	Leaky Gaskets	Pressure drop too high	See "STAT-High Pressure Drop" section
		Damaged gaskets	Replace leaky gasket



STAT® Series
Low Profile Air Strippers

Carbonair's exclusive STAT series represents the best choice in low profile air strippers, combining high performance, flexibility and design simplicity. Carbonair's STAT units are available with a number of tray configurations, blowers and controls, and can achieve a removal efficiency of up to 99.99% for a long list of volatile organic compounds.

Construction Materials

Air Stripper
304 series stainless steel.

Gaskets
Gasoline-resistant neoprene.

Demister
Polypropylene material capable of removing 99.5% of the droplets 10 microns or larger; 95% of the droplets 5-10 microns in size.

Design

Flanged Inlet and Outlet
Flanged (150 pound) inlet and outlet configuration to maximize the integrity of piping connections.

Anti-bypass Valve*
Eliminates need for priming prior to system start-up.

Flapper Valve (Gravity units)*
Prevents air from bypassing the sieve trays through the effluent discharge during start-up.

Downcomer
Weir type square downcomer flow distribution system ensures uniform water distribution over the trays. Minimizes back pressure and head losses.

Sieve Trays
STAT 15, 30, 80: 10.25" high. Minimum water height of 4".
STAT 180, 400, 720: 12.25" high. Minimum water height of 4".

Tray Alignment Guides
Permanently installed for proper tray alignment.

Tray Fastening
Stainless steel over-center latching clips.

Collection Sump
Minimizes pump cycling and maintains sufficient turbulence.

Regenerative Blower
Direct coupled regenerative blower maintains high air pressure at low flow rates.

Accessories

Pump-out
Incorporates float switches in an externally-mounted clear PVC sight glass.

Pressure Gauge
Installed on sight glass.

Low Pressure Switch
Mounted in blower discharge piping.

Options

- Water temperature and flow monitoring.
- Air temperature and flow monitoring.
- Explosion-proof controls.
- Enclosures and trailers.
- Off-gas carbon filtration.
- Custom control panel.
- Humidity control.
- Discharge pump.
- Carbon polish.
- Well control.
- Pump-down.
- Sample taps.

*U.S. Patent Numbers 5,478,507 and 5,378,267.

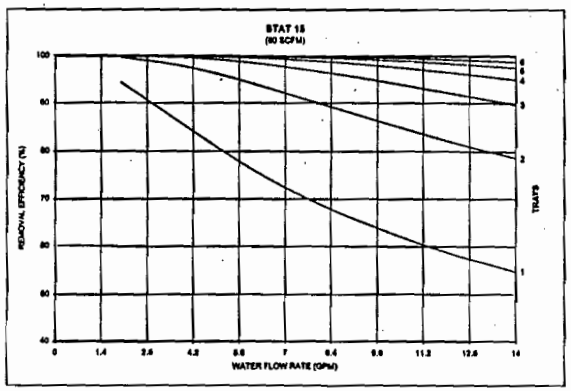
CARBONAIR®
ENVIRONMENTAL SYSTEMS
2731 Nevada Avenue North
New Hope, MN 55427-2806
800-526-4999 *Toll-free*
763-544-2154 *Voice*
763-544-2151 *Fax*
www.Carbonair.com

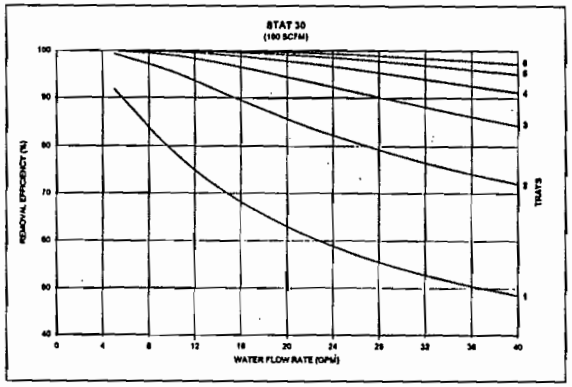
Specifications

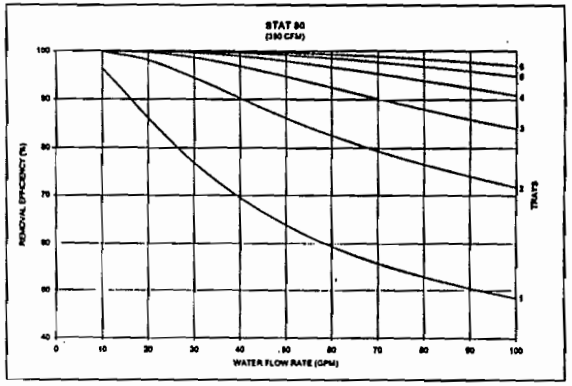
Model	STAT 15	STAT 30	STAT 80	STAT 180	STAT 400	STAT 720
Tray dimensions (LxWxH; inches)	24x9x10	36x12x10	48x24x10	72x36x12	120x48x12	144x72x12
Sump holding capacity (gallons)	13	30	70	250	560	1000
Maximum height (inches)*	93	96	97	120	122	130
Liquid flow (gpm)	0.5-12	1-35	5-80	10-200	20-400	40-1000
Minimum air flow (cfm)	60	100	300	650	1800	3000
Maximum air flow (cfm)	80	150	350	900	2100	4000

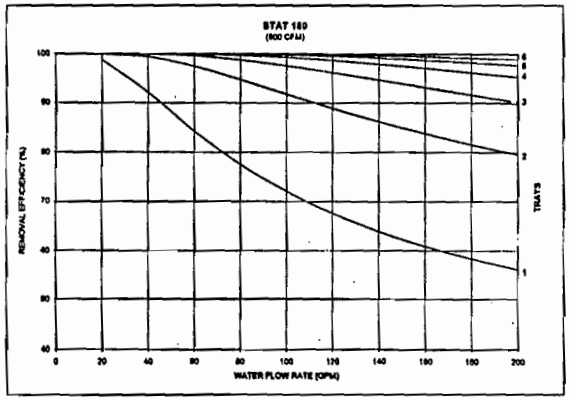
**Six-tray STAT without skid*

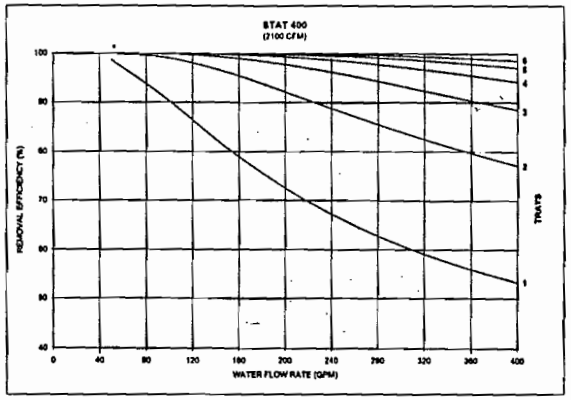
Benzene removal efficiency at 55° F predicted by computer modeling.

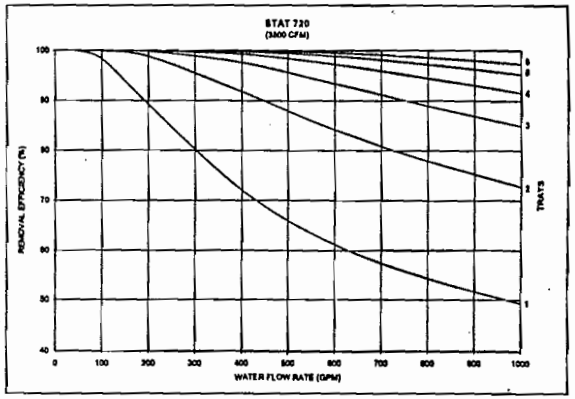


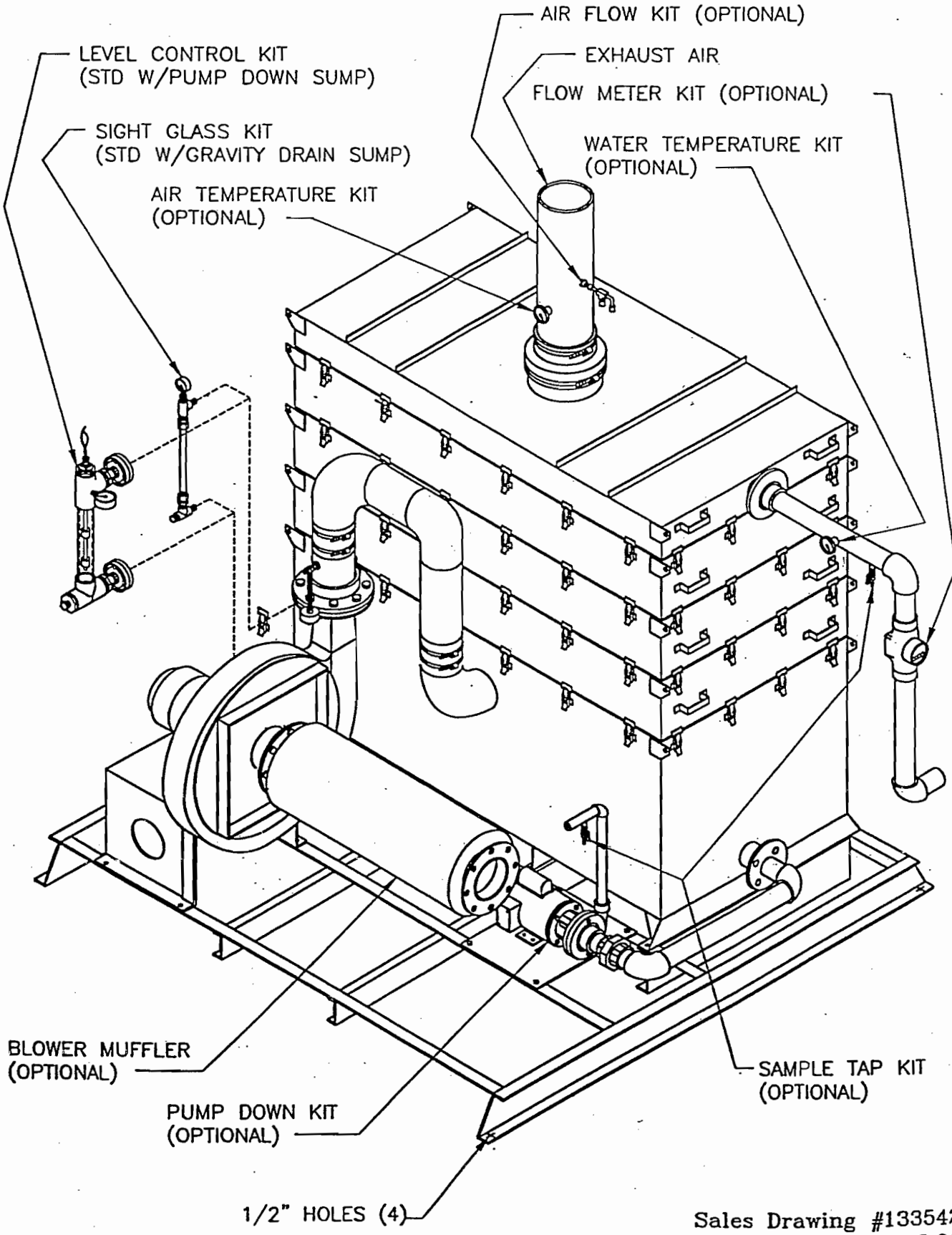






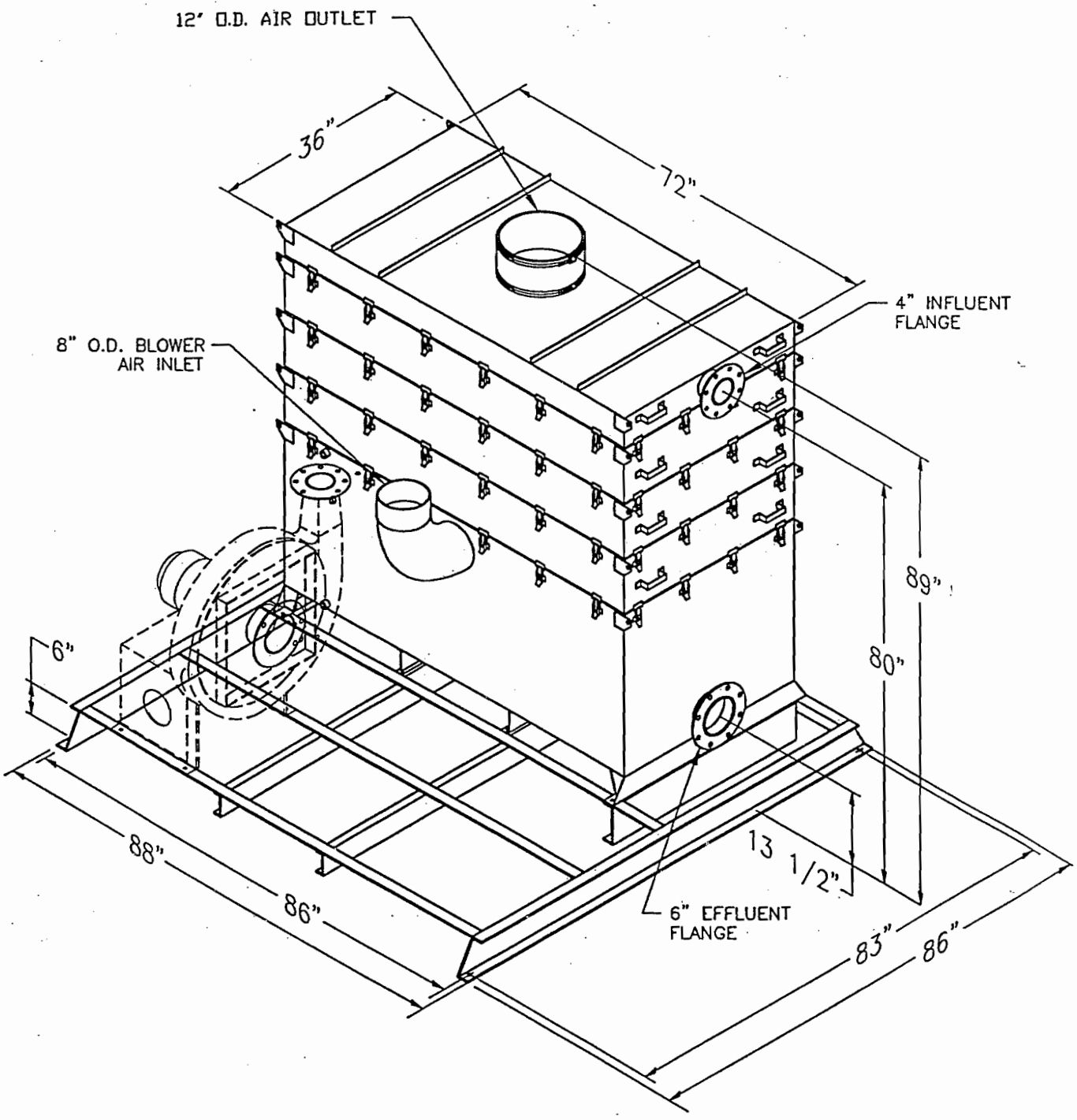






Sales Drawing #133542
96.12.06

STAT 180 For Gravity Drain – Architectural View



NOTE: Adjust overall height by 12 1/4" for each aeration tray added or deleted. Influent flange on the same side as effluent with odd number of trays.

NOTE: Drawing shown with three (3) trays only.

Sales Drawing #133583
6/30/98

CARBONAIR®
ENVIRONMENTAL SYSTEMS

Operation & Maintenance Manual

Carbonair Model STAT-180 Low Profile Air Stripper

CONTENTS

1.0 SAFETY PRECAUTIONS

Failure to observe these precautions could result in serious bodily injury and/ or property damage.

- Be sure to read and understand this O & M manual before beginning operation. If you have any questions, please call Carbonair Environmental Systems, Inc. at (800) 526-4999.
- Be sure all electrical disconnects are **"OFF"** and locked out before servicing.
- Always wear gloves, eye protection & protective clothing when working with the equipment.
- Be sure the STAT is properly vented, has adequate air supply and the ducting between blower and STAT is fastened securely.
- The introduction of free-product into the STAT-180 is not recommended because it will adversely affect any nonmetallic materials and system performance.
- Be sure to take proper precautions when lifting STAT trays.

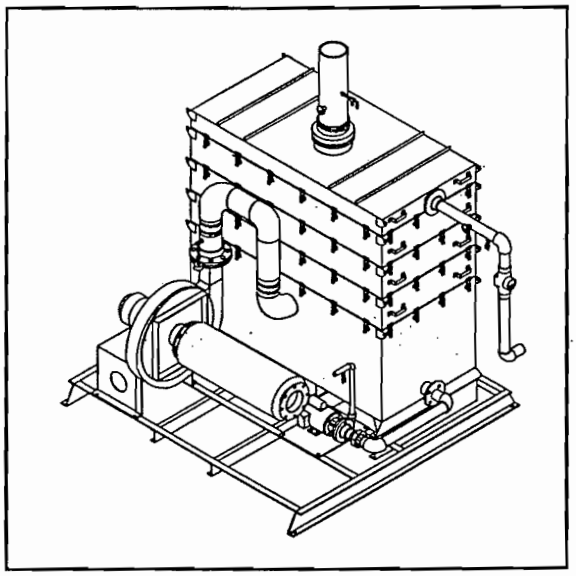


Figure No. 1 - Typical STAT Unit

2.0 EQUIPMENT DESCRIPTION

The STAT-180 is a low profile stainless steel air stripper with a modular design capable of accommodating from 1 to 6 aeration trays. The design allows the trays to be easily removed, cleaned and replaced with minimal downtime. The following table summarizes the specifications for the typical STAT-30 low profile air stripper.

#	Design Parameter	Specification
1	Tray Length	72 inches
2	Tray width	36 inches
3	Height/Stage	10 inches
4	Overall Sump Height	24 inches
5	Demister Height	8 1/2 inches
6	Maximum Height	92 1/2 inches (6 trays)
7	Water flow	10 - 200 gpm
8	Water Inlet	4 inch
9	Water Outlet	6-inch Gravity Drain 3-inch Pump Down
10	Air Flow	650 & 700 cfm
11	Air Inlet	8 inch
12	Air Outlet	12 inch

Table No. 1 - STAT-180 Specifications

Be sure to refer to Section 12 at the end of this manual for specific operating parameters and dimensions.

The STAT-180 is equipped with the following standard system components:

- ✓ Gravity Drain Sump
  - Sight Glass
  - High Level Switch
- ✓ Aeration Trays
- ✓ Demister
- ✓ Blower
- ✓ Air Bleed Valve
- ✓ Low Pressure Switch

The STAT-180 can also be configured with the following optional components:

- ✓ Air Temperature Kit
- ✓ Air Flow Kit
- ✓ Water Flow Meter Kit
- ✓ Water Temperature Kit
- ✓ Sample Tap Kit
- ✓ Pump-Down Kit
- ✓ Pump-Down Collection Sump
  - Level Control Kit
  - Low, High, High-High Level Switches
- ✓ Blower Muffler Kit

3.0 PROCESS DESCRIPTION

Carbonair's STAT-180 air stripper is a sieve tray aeration unit and does not contain packing media.

In this technology the water and air are contacted in step-wise fashion through multiple trays. The water enters near the top and flows horizontally across each tray and through a downcomer to the tray below. A pressure blower provides air for the aerating process. The air enters the bottom of the unit and is forced through openings in the trays, bubbling through the water to form "an air/water froth", which provides extreme turbulence and excellent volatilization. The overall effect is a multiple counter-current contact of water and air, with each tray having a cross-flow of water opposing a vertical flow of air.

4.0 INSTALLATION

Be sure to carefully read all of the instructions before beginning the installation of the STAT-180 low profile air stripper.

4.1 Inspection

Upon receipt of the STAT unit, and before the unit is removed from the truck, be sure to inspect the system for damage to the shell, all the fittings, the inlet/outlet ports and other equipment. Structural damage to these items could

compromise the integrity of the system. **DO NOT** operate the unit if it has been damaged since this could result in damage to other equipment or personal injury. If the STAT-180 low profile air stripper sustains damage during transit, notify the carrier and call Carbonair immediately at (800) 526-4999.

- *If not notified immediately, Carbonair cannot warranty any shipping damage.*

4.2 Loading & Unloading

The STAT-180 should be unloaded and placed by an appropriately sized forklift or pallet jack operated by an experienced operator. A STAT-180 unit with one tray weighs approximately 400 lbs. and with 6 trays weighs approximately 900 lbs. – excluding external piping .

The STAT-180 must be placed on a level concrete pad designed to handle the full operating load of the unit . The STAT base should be bolted to the concrete pad prior to initiating operation.

Be sure to follow proper safety procedures when loading and unloading the STAT unit.

4.3 Connections

Assemble and mount all of the external piping, valves, and instrumentation after the STAT is in place. Make sure that the piping is adequately supported so that excessive load or torque is not placed on the unit fittings.

4.3.1 Mechanical Connections

1. Locate and anchor the STAT unit in an area which allows access to all sides of the unit. Shim as needed to make sure STAT unit is level.

2. Attach exhaust stack (or off gas downcomer if required). Avoid unnecessary restrictions in off-gas ducting. Ducting should be sized for minimal friction loss according to the STAT design air flow rate. When in doubt, ducting should match the size of the STAT air discharge.

3. Connect the influent water piping to the influent flange or coupling. We recommend installing a sampling tap (sample tap kit, part No. 128320) in the influent piping and discharge piping. All interconnection piping should be self-supporting.

4. Connect the drain piping and install pump-down kit if supplied.

   For gravity drainage, connect the effluent water discharge piping to the discharge flange or coupling. Discharge piping should be the same diameter as the effluent flange or coupling on the STAT unit, or larger. (See Table No. 2)

DRAIN DIAMETER (INCHES)	SLOPE PER FOOT		
	1/8 INCH	1/4 INCH	1/2 INCH
2	16 gpm	21 gpm	26 gpm
2 1/2	18 gpm	24 gpm	31 gpm
3	36 gpm	42 gpm	50 gpm
4	180 gpm	216 gpm	250 gpm
5	390 gpm	480 gpm	575 gpm
6	700 gpm	840 gpm	1,000 gpm

Table No. 2 - Minimum Pipe Size for Gravity Drain

IMPORTANT: ***STAT gravity discharge lines require a vacuum relief system. This will prevent any type of vacuum on the float valve on the interior of the STAT. Do not attempt to pump out a STAT sump intended for gravity drain. A simple vacuum relief system is a tee inserted in the discharge piping with a vertical pipe open to the atmosphere. The tee should be installed as close as possible to the STAT discharge connection.***

5. If no skid base is provided, locate and anchor the blower anywhere near the STAT air inlet tube, as long as the ducting will reach from the blower discharge to the STAT inlet tube. Mount the blower off the floor, if possible.

4.3.2 Electrical Connections

Make the following electrical connections, observing codes or restrictions (such as explosion-proof wiring) at your installation site:

1. Connect sump high level switch to control panel (if not already wired). The sump high level switch is located near the top of the sump sidewall. The switch is normally open until sump flooding occurs.

2. Connect blower low pressure switch to controls (if not already wired). The blower low pressure switch is located either on the blower outlet pipe or in the control panel. The blower low pressure switch has the following connections:

   ✓ Common
   ✓ Normally Open (closes on blower pressure)
   ✓ Normally Closed (opens on blower pressure)

3. For pump-down systems, a level control kit is provided in the sump sidewall (see options, page 14). This control must also be wired (if not wired already) in order to control the discharge pump. The switch options are:

✓	Top (Red-Yellow) (HiHi)	System Shutdown
✓	Middle (White) (Hi)	Pump On
✓	Bottom (Black) (Lo)	Pump Off

   The top switch is normally closed when the sump is empty. The middle and bottom switches are normally open when the sump is empty.

5.0 START-UP

Upon completion of the system installation, checkout and start-up of the unit can be initiated.

Operating conditions specific to your STAT unit should be recorded in Section 12.0 during startup and initial operation. this information will then be available for future reference should questions arise.

Before starting the unit, check the following:

1. Verify that the blower low pressure switch is calibrated before start-up. If blower low pressure switch does not operate as described in section 4.3.2, see the manufacturer's data sheet supplied to adjust the set point of the switch.

2. Bump the blower motor and verify proper rotation direction.

3. If a transfer pump is supplied, bump the transfer pump motor and verify proper rotation direction.

After the unit is checked-out, start up can be initiated to test system function prior to continuous operation. Whenever possible, it is advisable to use clean, fresh water for system start-up. This will eliminate possible discharge of contaminants if mechanical adjustments are required.

1. Verify that all the valves are positioned properly.

2. Start the STAT blower.

It is important to start the blower first to ensure that contaminated water is treated immediately upon entering the STAT unit.

Note: ***Because the STAT-180 uses a regenerative type blower, the motor in-rush current draw is unaffected by start-up under a NO LOAD condition.***

3. Start the flow of clean water to the unit.

   Stripping starts immediately as the downcomer blocking valve forces air into the processing area of each tray, preventing air from passing upward through the water downcomer.

   After flow is initiated, water enters the top of the unit at the demisting section and is directed into the top tray. The water flows over the weir and across each successive tray in a serpentine pattern.

   If the STAT unit is not equipped with a transfer pump, the water accumulates in the sump section and then gravity drains to the discharge point through the mechanical float valve. The mechanical float valve prevents pressurized air from escaping through the effluent connection.

If the STAT unit is set up for pump-out operation, a mechanical float valve is not used.

4. Immediately start the transfer pump (if supplied) to remove the treated water from the STAT sump.

5. Check the system for leaks at the seams. (Leaks are more likely to occur at corners and on the lower trays.)

6. Check system pressures and equipment temperatures. Verify that the operating parameters are within equipment design specifications.
   *Sump pressure should never exceed 45" w.c. under normal conditions.

7. Measure the water and air flows through the unit.

8. Check the pressure drop across the trays and compare with the pressure drop chart in Section 10. Verify that the pressure drop is within system design guidelines.

9. Adjust air flows to minimum design airflow. You may adjust air flow higher to optimize system performance.

Air Flow Adjustment and Measurement

You must have a means of measuring air flow to correctly operate your STAT unit. Carbonair can provide you with an air flow kit (Part No. 159841) composed of a flow element, a magnehelic gauge that when installed, provide a means of measuring the air flow through the system.

This STAT unit is designed to operate at the minimum air flow rate specified in section 12.0 of this manual. **The blower air flow rate is not preset at the factory.** Varying field conditions and the sensitivity of air bleed valve require that the valve be set to field conditions. Improper adjustment of the valve can lead to excessive water carry over in the exhaust stream as well as a lowered stripping efficiency.

To adjust the STAT operating air flow rate, first turn on the STAT blower and begin to introduce water into the system at the design flow rate. (Note: You must have a means of measuring the water flow rate (flow meter) on the influent line, down stream of any pumps). Once the system is accepting water at the operating flow rate note the measured air flow rate using the air flow kit. If the measured air flow rate is above or below the design air flow rate listed in Section 12.0, you must adjust the air flow using the air bleed valve on the blower exhaust. Turning the valve clockwise will close the valve and increase the air flow through the STAT. Turning the valve counter clockwise will open the valve and decrease the air flow through the STAT.

Note: **You must periodically check and adjust the air flow during the operation of the system. Conditions may change (like increase or decrease in water flow rates, addition of down stream air treatment technologies or fouling of the air stripper) that will increase or decrease back pressure in the blower and cause the air flow rate to deviate from the design flow rate.**

6.0 OPERATION

When the STAT is operating within its parameters, a base line pressure drop should be established. This can be monitored during operation for maintenance purposes. Your STAT system should be supplied with the proper blower for overcoming the total pressure drop through the system. If adding gas phase carbon adsorption to the off-gas of a STAT unit previously operated with atmosphere discharge, contact Carbonair to determine if the current blower/ducting configuration will be adequate.

Once the system has been tested with fresh water, proceed with treating contaminated water. (Maximum pressure – 50" w.c.)

7.0 TROUBLE SHOOTING

There are a few situations that may arise while operating the STAT-180 which can adversely effect the performance of the unit and/or result in abnormally high maintenance costs. If these situations cannot be resolved using the following trouble shooting guide, contact Carbonair at (800) 526-4999 for additional help.

1. **Situation:**
   Excessive condensate or foam is noted leaving the exhaust of the STAT.

Probable Cause:
There are two main items that can cause water carry over into the exhaust:

a. Air flow rate that is in excess of the rated air flow of unit.

b. Surfactants in the water such as soaps, detergents and other organic compounds that may cause a stable bubble froth to form and accumulate in the unit.

Solution:

a. Measure the air/water flows and compare with the design water and air flow rate of the system. If air flow is excessive, the flow should be adjusted to design conditions.

b. It may be necessary to add a defoaming agent to influent water of the STAT. This agent will prevent stable bubble formation and allow the STAT to operate properly. Additional information is found in Fact Sheet #8. Contact Carbonair at (800) 526-4999 for information on defoaming agents.

2. **Situation:**
The pressure drop across the trays is higher at initial start-up than it should be, according to the pressure drop chart in Section 10.

Probable Cause:
If this occurs, the flow of air through the tray holes is restricted. The most common causes for this pressure drop build up are:

a. Sediment/solids in the water stream have clogged the holes in the aeration trays.

At initial start-up, sometimes there can be an excessive amount of solids introduced into the system from the well(s). Eventually, these solids are removed from the well(s) and cleaner ground water is produced.

b. The flow of air through the STAT unit is greater than the system design specifications.

c. The flow of water through the STAT unit is greater than the system design specifications.

Solution:

a. Measure the air/water flows and check the pressure drop curve to determine the design pressure drop and compare with the actual pressure drop.

b. If the flows are in excess of design specifications, adjust flow accordingly.

c. If process flow adjustments have no effect, clean out the STAT unit and develop the well(s) further before introducing flow to the STAT unit.

3. **Situation:**
Deteriorating treatment performance.

Probable Cause:
Treatment performance can deteriorate for a number of reasons including:

a. Inadequate air/water ratio resulting in poor volatilization of organic components.

b. Influent contaminant concentrations higher than initial design parameters.

c. Influent contaminant components different than initial design parameters.

d. Aeration trays have become fouled.

Solutions:

a. Verify that the system flows are within the design specifications.

b. Verify that the air/water ratio is within design specifications.

c. Clean the STAT trays.

d. Conduct influent analyses to verify initial design parameters - components and concentrations.

e. Call Carbonair for assistance if operating parameters

have changed - system modifications may be necessary.

4. **Situation:**
The STAT sump high level alarm frequently trips due to high sump level conditions.

Probable Cause:
If the sump high level alarm trips, it means that the water is not being removed as quickly as it is accumulating in the sump. This could occur for the following reasons:

a. The transfer pump has failed.

b. The influent water flow rate exceeds the effluent drainage or pumping capacity.

Solutions:

a. Verify that the transfer pump is operating properly.

b. Measure the influent flow rate and check the effluent drainage design to determine if the influent flow rate exceeds the effluent drainage system capacity.

Read all installation instructions before beginning disassembly. Contact Carbonair for replacement parts.

c. If the flow rate is within design specifications, clean the effluent piping to clear any blockages.

8.0 MAINTENANCE

There are several maintenance tasks which must be performed periodically to ensure continued, trouble free operation. These tasks are discussed in subsequent sections.

8.1 Disassembly/Cleaning

1. Prior to disassembly of unit, turn off influent pump and allow blower to operate for a few minutes.

This will allow contaminated water within aeration plates to be treated as the unit drains.

2. When effluent flow has completely stopped, turn off blower and turn main power disconnects to the off position and lock them out.

Be sure that STAT is completely drained by removing plug at the bottom of the sight glass.

3. Disconnect and remove air discharge stack or ducting from top of unit.

This procedure may not be necessary if space permits removal of the demister section with stack attached.

4. Disconnect the influent piping. Make sure loose influent piping is adequately supported.

5. Starting with the demister section, unfasten the lever-lock clips and lift off the demister section.

6. Before and during disassembly, it is important to note the placement of the aeration trays. Taking time to familiarize yourself with the STAT unit will make reassembly faster and easier.

7. Alignment of buttons on trays, sump and demister should be noted. Proper assembly of STAT requires alignment of buttons shown in Figure No. 2.

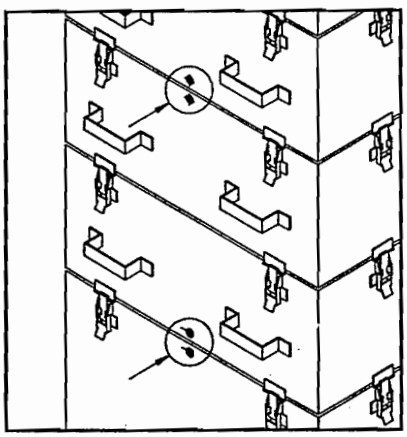


Figure No. 2
Proper Alignment of STAT Buttons

8. The unit must always be disassembled piece by piece from the top down. It is recommended that removed pieces be set on wooden supports, such as a pallet, to avoid damage to the gasket sealing surfaces and clips.

9. Each section must be raised a few inches prior to moving piece horizontally.

10. Paying special attention to the placement of each aeration tray, remove each tray until only the sump section remains. Again, make note of proper alignment of buttons.

11. Once all aeration trays are removed, check the integrity of the gasket material.

12. Any fouling buildup on the trays may be cleaned using a pressure washer or may be scraped out. Use caution not to damage the flapper valve or gasket material when cleaning. Holes smaller than 3/16" indicate fouling.

13. When cleaning the demister section and aeration trays, be careful not to damage gaskets. The mist eliminator pad may have to be cleaned with water pressure or muriatic acid. If this is unsuccessful, the pad must be replaced. Fouling in the demister can cause excessive back pressure of the system.

14. The sump section should be cleaned in the same manner. Check the float valve gravity flow system n the sump section (if supplied) for plugging and material deterioration.

    Check each tray downcomer valve for scale and bacteria build-up. Clean if necessary.

15. Prior to reassembly, make sure the areas that mate with the gasket material are clean and free of foreign matter.

8.2 Reassembly

1. To reassemble the unit, follow the disassembly instruction in reverse order. A light coating of silicone grease on the gasket surface before reassembly will act as an inert gasket sealant and lubricant. DO NOT use any other material for gasket sealant, as it may affect the operation of the STAT unit. If silicone grease or replacement gasket material is not available, contact Carbonair for supplies. Keep in mind that each piece MUST be put back in the same position and orientation as before disassembly. Improper assembly could cause malfunction or damage to the STAT unit. Refer to Figure No. 2 for button alignment.

2. Connect all inlet and outlet piping, discharge stacks, etc., prior to restarting unit.

3. Whenever possible, use clean, fresh water for system testing after reassembly. Start the blower first. Once blower is operating, start influent pump(s) or water flow.

4. After starting the influent pump(s), check for leaks throughout the system.

Refer to Section 5.0 Startup, page 4.

8.3 Gasket Replacement

Safety Precautions

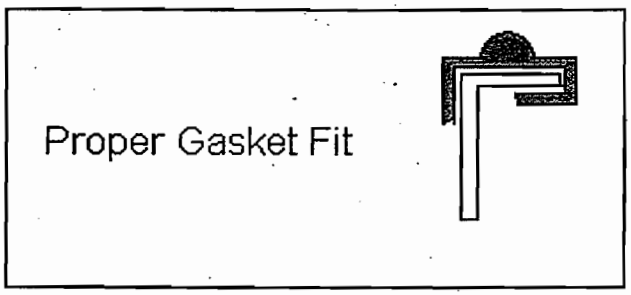
- Be sure to read and understand this O & M manual before beginning gasket maintenance. If you have any questions, please call Carbonair Environmental Systems, Inc. at (800) 526-4900.
- Always wear gloves, eye protection and protective clothing when working with the equipment.
- Be sure all mechanical inlets are blocked off and locked out before disassembly.
- Be sure all electrical disconnects are "**OFF**" and locked out before servicing.

Replacement Procedure

1. Disassemble STAT (see Section 8.1 of this STAT Operations & Maintenance Manual).

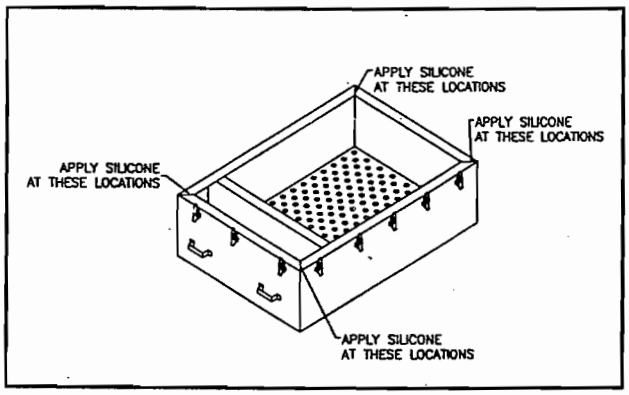
2. Remove the old gasket and adhesive. A sharp putty knife can be used to scrape off any fragments not easily removed. Any old adhesive and silicone can be removed using mineral spirits and then hot water and soap. Tray surfaces must be clean before the new gasket is placed on the tray.

3. When the tray is clean, install the new gasket, beginning at one corner and working around to all sides of the tray. You may need to trim some areas to avoid clips or lifting lugs.



Note: On the larger model STATs (180's and up), the gasket may start to pull itself off before the entire gasket is in place. If this happens, try to fasten the corners in place as you go around. A small dab of Super Glue, clothespins, or tape may be used every two feet to hold the gasket in place on the tray. Once the entire gasket is in place, the pins or tape can be removed and the gasket should remain in place on its own.

4. Apply a thin layer of silicone grease to the corners of the gasket and the corners of the tray under the gasket. This helps to create a better seal between the gasket and the tray above.



5. Reassemble STAT (See Section 8.2 of this STAT Operations & Maintenance Manual).

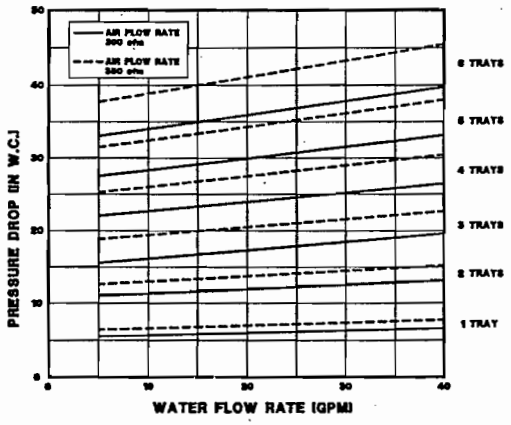
6. Begin operation of STAT with clean water and check the system for leaks.

9.0 SPARE PARTS

When ordering spare parts, refer to the drawings at the end of this manual. Be sure to provide the unit model number and the complete description of the part.

10.0 PRESSURE DROP CHART

The following pressure drop chart shows the estimated pressure drop in inches of water at different liquid flow rates through the STAT-180 with 1,2,3,4,5 and 6 aeration tray configurations. These curves apply to STAT units with clean aeration trays.



11.0 DRAWINGS

Assembly drawings have been included on pages 10 and 12 to simplify the part identification and ordering process. A parts list is included along with corresponding order number.

Figure No. 7

STAT-180 Low Profile Air Stripper - Assembly Drawing No. 1

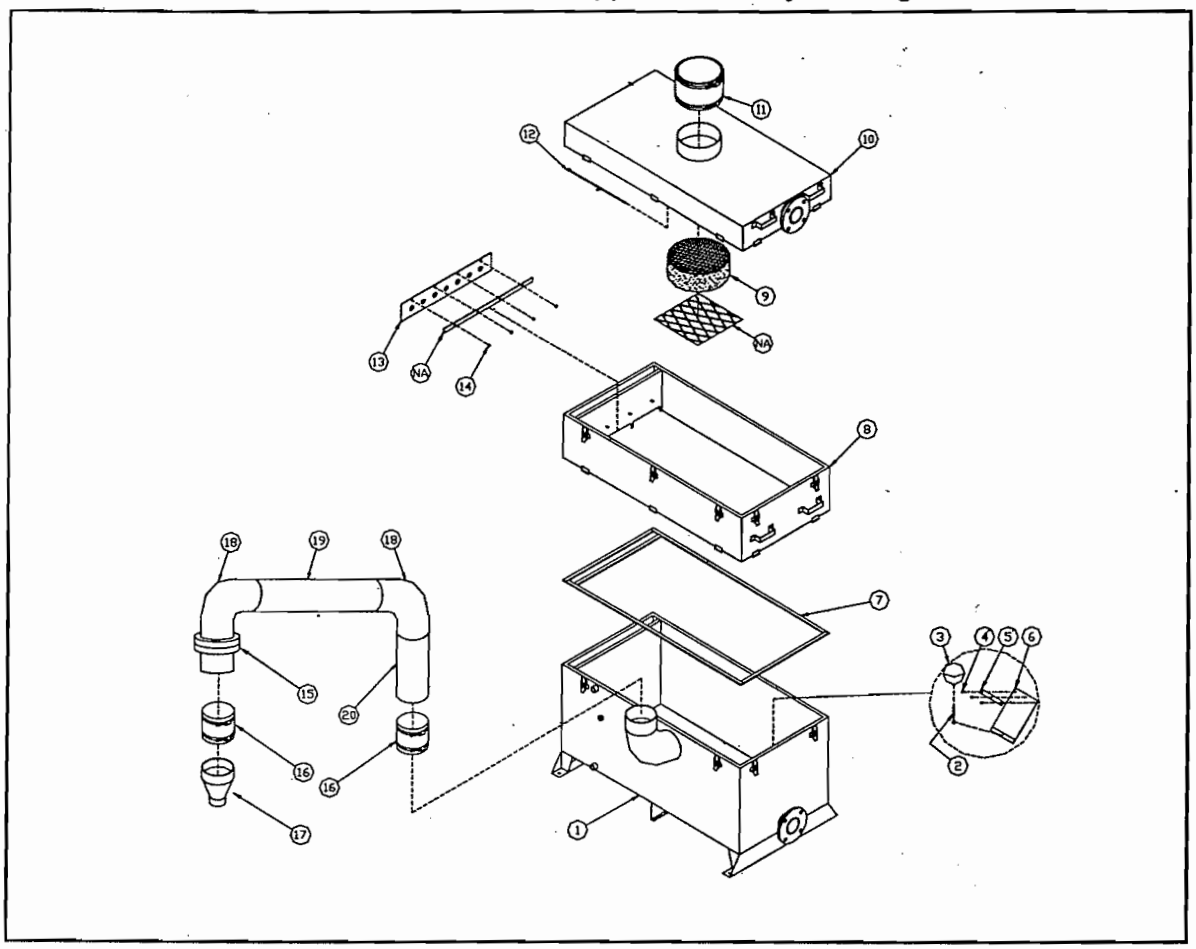


Table No. 4

STAT-180 Low Profile Air Stripper - Parts List

INDEX #	PART DESCRIPTION	INDEX #	PART DESCRIPTION
1	Sump	10	Demister
2	Float Rod	11	Flex Coupling
3	Float Ball	12	Plastic Tie Cable
4	Stainless Steel Screw	13	Downcomer Valve
5	Valve Drain Plate	14	Hex Lock Nut
6	Flapper Valve	15	Duct Hose
7	Silicon Gasket Strip	16	Hose Clamp
8	Aeration Tray	17	Transition Duct
9	Demisting Material		

Figure No. 8
STAT-30 Low Profile Air Stripper - Assembly Drawing No. 2

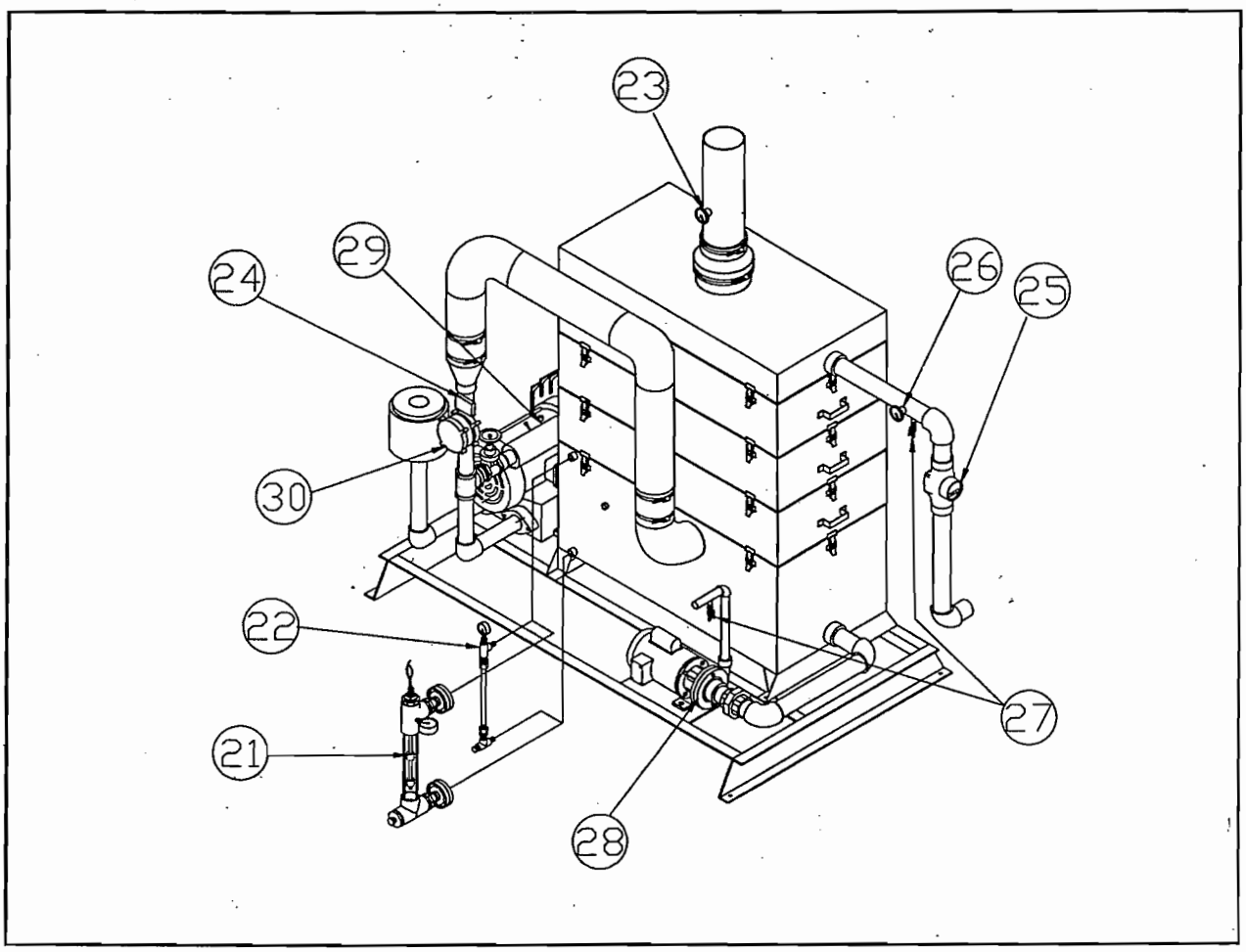


Table No. 5
STAT-180 Low Profile air Stripper - Parts List

#	Part Description	#	Part Description
21	Level Control Kit	26	Water Temp Kit
22	Sight Glass Kit	27	Sample Tap Kit
23	Air Temp Kit	28	Pump- Down Kit 3 - Phase TEFC
24	Air Flow Meter	29	Blower Muffler Kit Regenerative 1"
25	Water Flow Meter Kit	30	Low Pressure Switch

12.0 SPECIFIC OPERATING PARAMETERS

Job _____

Recommend Air Stripper _____

Serial Number _____

Cross-sectional Dimensions _____

Number of Plates _____

Design Liquid Flow Rate _____

Critical Compound _____

Average Concentration _____

Effluent Concentration Requirement _____

Air-to-Water Ratio _____

Control Panel Yes_____ No_____ Rating: _____

Water Discharge	Gravity	_____	Pump Out	_____
Air Discharge	Atmosphere	_____	Post Treatment	_____
Blower Motor	HP	_____	Phase	_____
	Volts	_____	Rating	_____
Level Switch(es)	Standard	_____	Explosion-Proof	_____
Pressure Switch	Standard	_____	Panel	_____

Optional Features Included:

Air Temperature Kit	☐	Sample Tap Kit	☐
Air Flow Kit	☐	Pump-Down Kit	☐
Water Flow Meter Kit	☐	Blower Kit	☐
Water Temperature Kit	☐		

Notes

_____

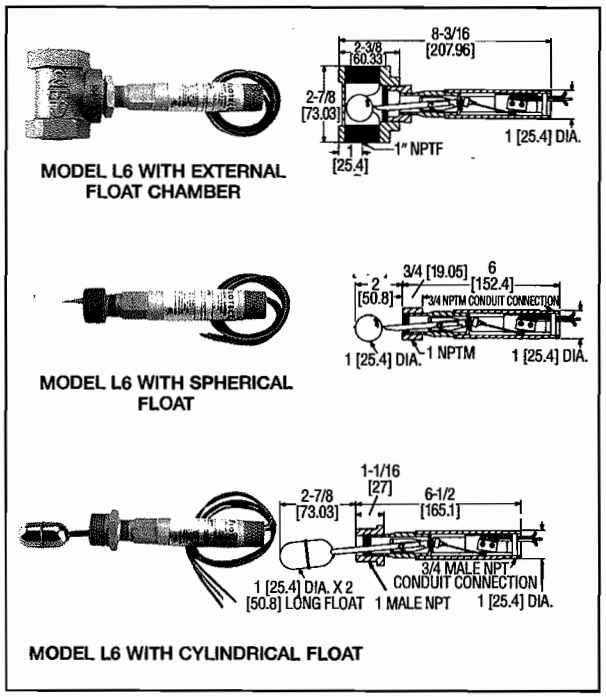
_____

_____

Notes

Series L6 FLOTECT® Liquid Level Switch

Easy in-wall or external installation, up to 2000 psig (138 bar).



SPECIFICATIONS

Service: Liquids compatible with wetted materials.
Wetted Materials:
Float: Solid polypropylene or 304 SS.
Lower Body: Brass or 303 SS.
Magnet: Ceramic.
External Float Chamber (Tee): Matches lower body choice of brass or 303 SS.
Other: Lever Arm, Spring, Pin, etc.: 301 SS.

Temperature Limit: 220°F (105°C) standard, MT high temperature option 400°F (205°C) [MT option not UL, CSA, or CENELEC].
Pressure Limits: See chart below.

Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups A, B, C and D; Class II, Groups E, F, and G. (Group A on stainless steel body models only). CENELEC EExd IIC T6 (T amb=75°C).

Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL models: 5A @ 125/250 VAC. CSA and CENELEC models: 5A @ 125/250 VAC; 5A res., 3A ind. @ 30 VDC. MV option: .1A @ 125 VAC. MT option: 5A @125/250 VAC. [MT option not UL, CSA or CENELEC].

Electrical Connections: UL models: 18 AWG, 18" (460 mm) long. CENELEC/CSA models: terminal block.
Upper Body: Brass or 303 SS.

Conduit Connection: 3/4" NPT male standard, 3/4" NPT female on junction box models.

Process Connection: 1" NPT male on models without external float chamber, 1" NPT female on models with external float chamber.
Mounting Orientation: Horizontal with index arrow pointing down.
Weight: Approximately 1 lb (.5 kg) without external float chamber, 1.75 lb (.8 kg) with external floatt chamber.
Specific Gravity: See chart below.

STOCKED MODELS

Model No.	Body	Installation	Float Material	Max. Pressure psig(bar)	Min. Sp. Gr.
L6EPB-B-S-3-O	Brass	Side Wall Mounting	Solid Polypropylene	1000 (69)	0.9
L6EPB-B-S-3-A	Brass	Side Wall Mounting	Stainless Steel, Cylindrical	200 (13.8)	0.5
L6EPB-B-S-3-C	Brass	Side Wall Mounting	Stainless Steel, Spherical	350 (24.1)	0.7
L6EPB-B-S-3-B	Brass	With External Float Chamber	Solid Polypropylene	250 (17.2)	0.9
L6EPB-B-S-3-H	Brass	With External Float Chamber	Stainless Steel, Spherical	250 (17.2)	0.7
L6EPB-S-S-3-O	Stainless Steel	Side Wall Mounting	Solid Polypropylene	2000 (138)	0.9
L6EPB-S-S-3-A	Stainless Steel	Side Wall Mounting	Stainless Steel, Cylindrical	200 (13.8)	0.5
L6EPB-S-S-3-C	Stainless Steel	Side Wall Mounting	Stainless Steel, Spherical	350 (24.1)	0.7
L6EPB-S-S-3-S	Stainless Steel	With External Float Chamber	Solid Polypropylene	2000 (138)	0.9
L6EPB-S-S-3-L	Stainless Steel	With External Float Chamber	Stainless Steel, Spherical	350 (24.1)	0.7

Surprisingly compact, the Flotect L6 is designed and built for years of trouble-free service in a wide variety of process liquid level applications. Operation is simple and dependable with no mechanical linkage as the level switch is magnetically actuated. The float lever pivoted within the body moves when the process liquid displaces the float. A magnet on the opposite end of the float lever controls a second magnet on the switch actuating lever located in the switch housing.

FEATURES

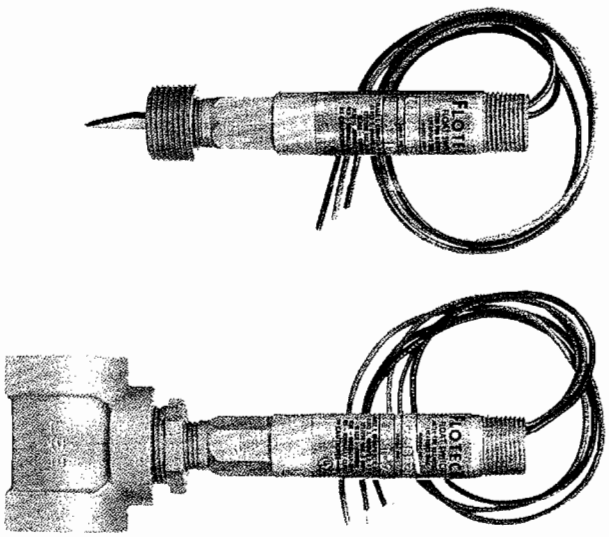
- Leak proof lower body machined from bar stock
- Choice of models for direct side wall mounting or mounted in a tee to act as an external float chamber
- Weatherproof
- Explosion-proof (listings included in specifications)
- Electrical assembly can be easily replaced without removing the unit from the installation so that the process does not have to be shut down
- Sensitive to level changes of less than 1/2" (12 mm)

Options:

Gold Plated Contacts option for dry circuits,add suffix **-MV** (see electrical rating in specifications).....
High Temperature option rated 400°F (204°C), add suffix **-MT** (see electrical rating in specifications, no listings or approvals, only available on models with stainless steel floats).....
CSA/CENELEC approved construction, includes junction box, add suffix **-CN** (CENELEC on models with stainless steel floats only).....
Junction Box, weatherproof and explosion-proof, add suffix **-JCT**.....**DPDT contacts,** change seventh character in model number to "D". Example: L6EPB-B-D-3-O .....
303 Stainless Steel Upper Body, change fifth character in model number to "S". Example: L6EPS-S-S-3-S.....

FLOTECT™ MODEL L-6 FLOAT SWITCH

Installation and Operating Instructions



Explosion-Proof; U.L. and C.S.A. Listed -
Class I, Groups *A, B, C & D
Class II, Groups E, F & G
CENELEC: EExd IIC T6 (T amb=75°C)
*(Group A, stainless steel body only)

PHYSICAL DATA

Temperature Limit: 220°F (105°C) maximum
Maximum Pressure: See chart below
Switches: One or two SPDT snap switches
Electrical Rating: U.L.: 5A @ 125/250 VAC.
C.S.A. and CENELEC: 5A @ 125/250 VAC, 5A resistive, 3A inductive @ 30 VDC.
Optional ratings: MV option—Gold contacts for dry circuits. Rated 0.1A @ 125 VAC MT option: 400°F (205°C) 5A @ 125/250 VAC (not listed).
Wiring Connections: 3-18" (460mm) wire leads, 18 ga.
CENELEC models only: push-in type terminal blocks
Black = common, blue = N.O., red = N.C.
Minimum Specific Gravity:
Polypropylene float - 0.9
Round SS float - 0.7
Cylindrical SS float - 0.5
Switch Body: Brass 3/4" NPT conduit connection.
For SS switch body, change model no. to L6EPS.
Piping/Mounting Connection: 1" NPT
Installation: Horizontal, index arrow pointing down.
Weight: 1 lb. (.5 KG); w/external chamber 1-3/4 lb. (.8 KG)

WETTED MATERIALS CHART

Model	Brass	Bronze	Ceramic	Polypropylene	301SS	303SS	304SS
B-S-3-A	X		X		X		X
B-S-3-B	X	X	X	X	X		
B-S-3-C	X		X		X		X
B-S-3-H	X	X	X		X		X
B-S-3-O	X		X	X	X		
S-S-3-A			X	X	X		X
S-S-3-C			X		X	X	X
S-S-3-L			X		X	X	X
S-S-3-O			X	X	X	X	
S-S-3-S			X	X	X	X	

MAXIMUM PRESSURE CHART

Model Number	Float	Pressure Rating PSIG (KG/CM²)
L6EPB-B-S-3-A	Cylindrical SS	200 (14)
L6EPB-B-S-3-B	Polypropylene	250 (18)
L6EPB-B-S-3-C	Round SS	350 (25)
L6EPB-B-S-3-H	Round SS	250 (18)
L6EPB-B-S-3-O	Polypropylene	1000 (70)
L6EPB-S-S-3-A	Cylindrical SS	200 (14)
L6EPB-S-S-3-C	Round SS	350 (25)
L6EPB-S-S-3-L	Round SS	350 (25)
L6EPB-S-S-3-O	Polypropylene	2000 (140)
L6EPB-S-S-3-S	Polypropylene	2000 (140)

INSTALLATION:

Unpack switch and remove any packing material found inside lower housing or float chamber.

Switch must be installed with body in a horizontal plane and arrow on side pointing down.

If switch has an external float chamber (tee), connect it to vertical sections of 1" NPT pipe installed outside vessel walls at appropriate levels. If unit has no external float chamber, it must be mounted in a 1" NPT half coupling welded to the vessel wall. The coupling must extend through the wall.

Inspect and clean wetted parts at regular intervals.

ELECTRICAL CONNECTIONS:

Connect wire leads in accordance with local electrical codes and switch action required. N.O. contacts will close and N.C. contacts will open when liquid level causes float to rise. They will return to "normal" condition on decreasing liquid level. Black = common, Blue = N.O. and Red = N.C.

For units supplied with both internal and external grounds, the ground screw inside the housing must be used to ground the control. The external ground screw is for supplementary bonding when allowed or required by local code. Some CSA listed models are furnished with a separate green ground wire. Such units must be equipped with a junction box, not supplied but available on special order.

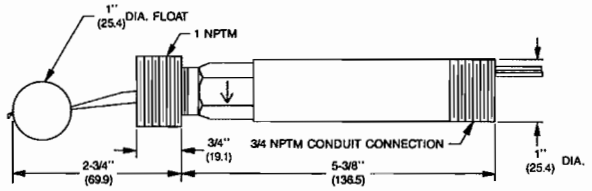
CENELEC certified models include a junction box. Cable should enter enclosure through an approved EX cable gland, not supplied. Push stripped and tinned leads into appropriate openings in terminal block(s). To connect fine stranded leads or to remove any wire, depress spring release with small screwdriver first.

All wiring, conduit and enclosures must meet applicable codes for hazardous areas. Conduits and enclosures must be properly sealed. For outdoor or other locations where temperatures vary widely, precautions should be taken to prevent condensation inside switch or enclosure. Electrical components must be kept dry at all times. **CAUTION:** To prevent ignition of hazardous atmospheres, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in use.

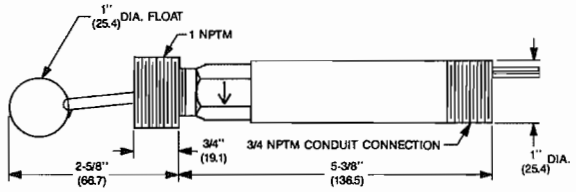
Dimensions on reverse

W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC.
P.O. BOX 358 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/879-8000
Fax 219/872-9057

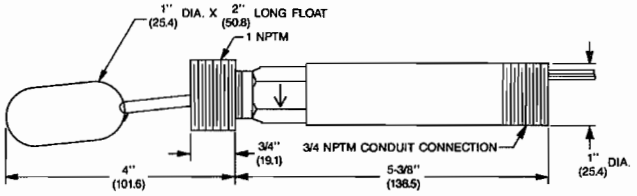
FLOTECT™ MODEL L-6 FLOAT SWITCH — DIMENSION DRAWINGS



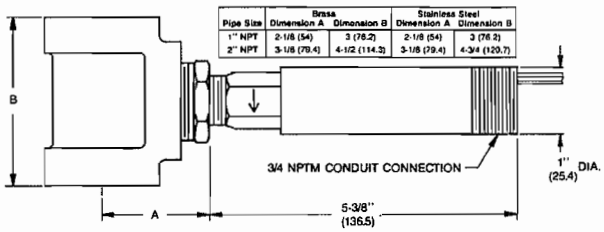
Polypropylene Float



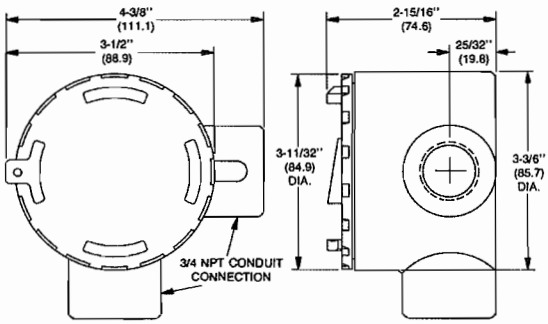
Round Stainless Steel Float



Cylindrical Stainless Steel Float



With External Float Chamber (Tee)



CSA, CENELEC Conduit Enclosure

Limited Warranty: The Seller warrants all Dwyer instruments and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's opinion provided the instruments have been returned, transportation prepaid, within one year from the date of purchase. All technical advice, recommendations and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory or the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.

THIS EXPRESS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER REPRESENTATIONS MADE BY ADVERTISEMENTS OR BY AGENTS AND ALL OTHER WARRANTIES, BOTH EXPRESS AND IMPLIED. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE FOR GOODS COVERED HEREUNDER.

Buyers Remedies: THE BUYER'S EXCLUSIVE AND SOLE REMEDY ON ACCOUNT OF OR IN RESPECT TO THE FURNISHING OF NONCONFORMING OR DEFECTIVE MATERIAL SHALL BE TO SECURE REPLACEMENT THEREOF AS AFORESAID. THE SELLER SHALL NOT IN ANY EVENT BE LIABLE FOR THE COST OF ANY LABOR EXPENDED ON ANY SUCH MATERIAL OR FOR ANY SPECIAL, DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES TO ANYONE BY REASON OF THE FACT THAT IT SHALL HAVE BEEN NON-CONFORMING OR DEFECTIVE.

W.E. ANDERSON DIV. DWYER INSTRUMENTS, INC.
P.O. Box 358
Michigan City, IN 46360
Phone: 219/879-8000
Fax: 219/872-9057

FR 82-440726-00
Printed in U.S.A. 10/93

-New York Blower IM-140
-Dwyer Series 1800 Low Differential Pressure Switches
-W.E. Andersen V4 Flotect Flow Switch
-Mercoid CS Series Low Cost Diaphragm Pressure Switches

The New York Blower Company

Fan-to-Size
Fan Selection Data

Project:	
Location:	
Contact:	

Fan Design

Product:	Pressure Blower	Arrangement:	1
Size/Model:	2506	Drive type:	Belt
Wheel Type:	Steel		
Wheel Material:	Mild Steel		
Wheel Width:	100.0 %	Wheel Diameter:	100.0 %

Operating Conditions

Volume Flow Rate:	740 CFM	Fan Speed:	3753 rpm
Fan Static Pressure:	50.0 in wg	Fan Input Power:	12.4 bhp
Outlet Velocity:	3700 ft/min	VP/SP ratio:	0.015
Altitude (above mean sea level):	0 ft	Operating Temperature:	70 Deg F
Operating Inlet Airstream Density:	0.0658 lb/ft3		
Static Efficiency:	46.83%	Mechanical Efficiency:	47.53%
Maximum Operating Temperature:	70 Deg F	Maximum Safe Operating Speed:	3800 rpm

Sound Power Level Ratings Levels expressed in dB (power levels reference 10^{-12} watts)

Center Frequency (Hz):	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Octave Bands:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Overall**
Total Fan Power Levels*:	97.6	103.5	108.7	110.4	103.1	96.9	91.6	86.6	113.8
Inlet Power Levels**:	94.6	100.5	105.7	107.4	100.1	93.9	88.6	83.6	110.8
Outlet Power Levels**:	94.6	100.5	105.7	107.4	100.1	93.9	88.6	83.6	110.8

*As corrected for point of operation (location on fan curve)
**Unsilenced Inlet and Outlet power ratings are 3 dB lower than total fan power levels under the assumption that "half" of the sound power can be attributed to each opening. Silenced power ratings include this 3 dB reduction as well as the silencer attenuation.

Estimated Sound Pressure Levels Expressed in dB (pressure levels reference $2x10^{-7}$ microbar)

Directivity/Reflection Factor (Q) is 2, hemispherical radiation; Distance is 3 ft.; A-weighting is in use.

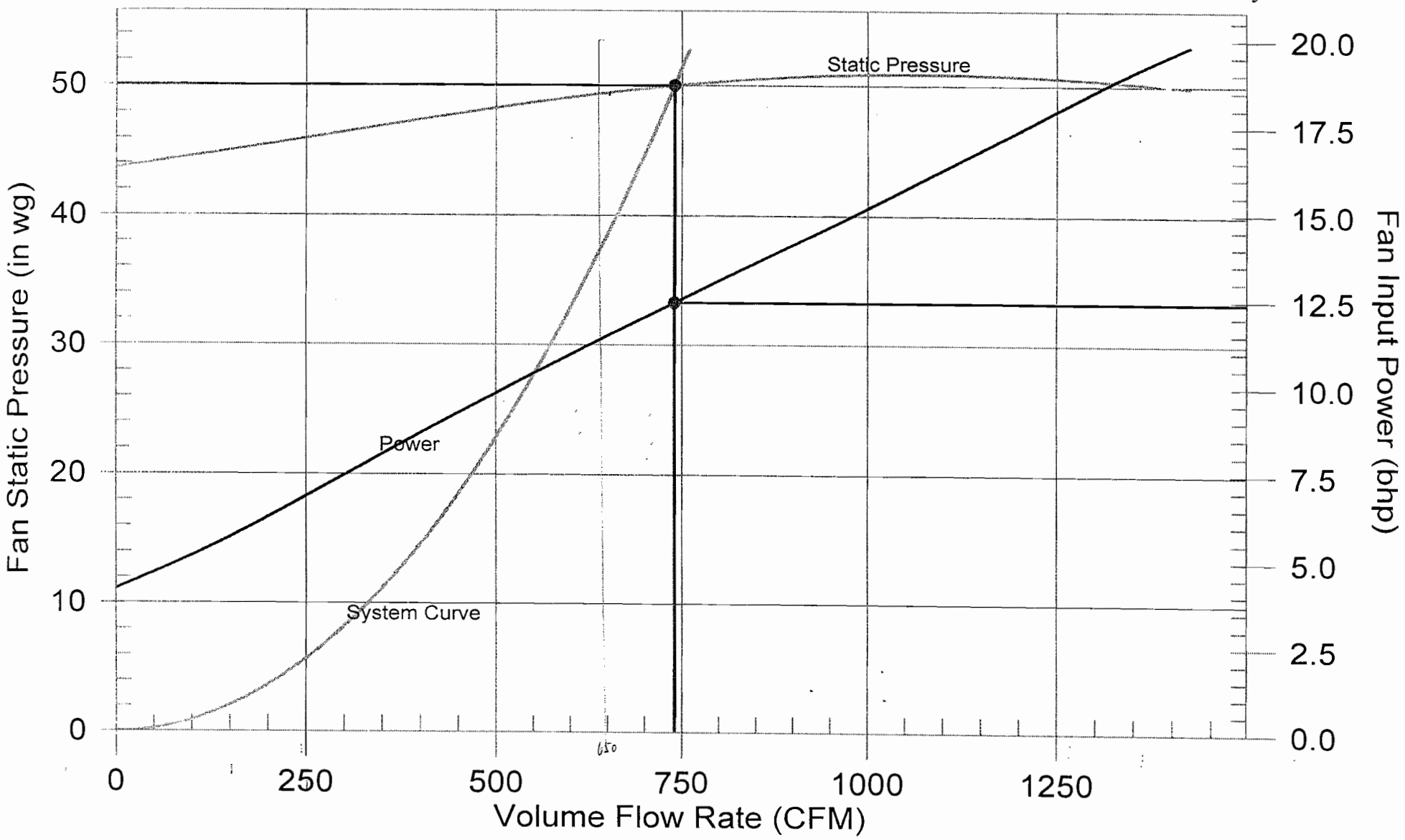
The estimated sound pressure level outside the fan due to an open inlet OR outlet is 99.7 dBA at 3.0 feet. The estimated sound pressure level outside the fan when BOTH inlet and outlet are ducted is 87.0 dBA at 3.0 feet (Housing Radiated Noise).

The New York Blower Company

Fan-to-Size
Volume Flow Rate: 740 CFM
Fan Static Press.: 50.0 in wg
Speed: 3753 rpm
Power: 12.4 bhp

Pressure Blower
2506 Steel
Arr.: 1

Temp.: 70 Deg F
Altitude: 0 ft
Density: 0.0658 lb/ft3
Outlet Velocity: 3700 ft/min



nyb | The New York Blower Company®

REVISED ACKNOWLEDGEMENT (REVISIONS SHOWN IN BOLD)

CARBONAIR ENVIROMENTAL P.O. 30686

Date: Jan. 24, 2003
nyb File Number: X04835A
Office Reference: NYB-03-127

THANK YOU FOR YOUR ORDER

Sold To:	Ship To:
CARBONAIR ENVIROMENTAL 2731 NEVADA AVE N NEW HOPE, MN 55427-2864	CARBONAIR ENVIROMENTAL 2731 NEVADA AVE N NEW HOPE, MN 55427

Ship Via: GROUND FRT

Freight Terms: Prepaid And Add

Drawings: 1, Curves: 1, Maint. Manuals: 1

Fan Group 1

Final Customer: CARBONAIR ENVIROMENTAL PO# 30686

CAPACITIES	CFM	SP	RPM	BHP	DEG	DENS	ALT
STD	740	57.000	3753	14.20	70	.07500	
OPER	740	50.000	3753	12.40	70	.06580	

1 CW TH, SIZE 2506S PRESSURE BLOWER, STEEL-WHL, ARR-1, MTR POS Z FLANGED INLET 08" FLANGED OUTLET 06"
1 20 HP, 3600 RPM, 3-60-200 V., Premium EFF., TEFC ENCL., FRAME 256T, F INSULATION, MFG: Baldor, MFG PART: EM4106T-8, Per SPA# SX01459BP MOTOR AND MOUNTING BY NYB
1 MOTOR MOUNTING CHARGE
1 TO-SCALE COMPOSITE DRAWING
1 CONSTANT V-BELT DRIVE 1.50 SF
1 BELT GUARD
1 SHAFT & BEARING GUARD
1 DAMPER, OUTLET, SINGLE VANE INTEGRAL CONTROL ARM LOCATED ON INLET SIDE
1 UNITARY BASE
MUST BE SAME OVERALL UNITARY BASE DIMENSIONS AS BI #1580
1 GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON ALL SURFACES COAT ALL SURFACES OF FAN USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07
1 GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON BELT GUARD COAT BELT GUARD USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07
1 GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON SHAFT & BEARING GUARD COAT SHAFT & BEARING GUARD USING TNEMEC #66-1211 RED PRIMER OVER A

Fan Group 1 Continued

SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07
1 GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON UNITARY BASE COAT UNITARY BASE USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07

The New York Blower Company

Date:	1/29/2003		
File:	X04835	Control:	100
Sequence:	1	Chg Order:	A
Revision:		Processor:	KAB

Customer: **CARBONAIR ENVIROMENTAL**

Purchase Order: 30686 **Office Reference:** NYB-03-127
Tagging:

FAN INFORMATION

Quantity:	1
Product Line:	Pressure Blower
Size:	2506S
Class/Wheel Type:	0 / Steel
Rotation:	CW
Arrangement:	1
Discharge:	TH
Motor Position:	Z
Motor By:	NYB
Mounting By:	NYB
Bearing Mfg. & Model:	BRG 1-11 22400 - S2000 (or equal) / BRG 1-11 P-327 LINKBELT (or equal)

Total fan wt. With accessories: 882 lbs

DRIVE INFORMATION

QTY	DESCRIPTION	PART NUMBER	
1	Motor Sheave	3P3V60	
1	Motor Bushing	P1 X1-5/8	99-0148
1	Fan Sheave	3P3V56	
1	Fan Bushing	P1 X1-11/16	99-0119
3	Belt	3VX850	
	Belt Centers:	33.39	in

SF: 2.09
Belt Tens: 2.98 lb to defl belt 0.52 in

FAN PERFORMANCE DATA

Capacity	CFM	SP	RPM	BHP	TEMP	DENS	ALT	MAX SS
STANDARD	740	57	3753	14.2	70	0.075	0	3800
OPERATING	740	50	3753	12.4	70	0.0658	0	3800
FUTURE								
TEST								

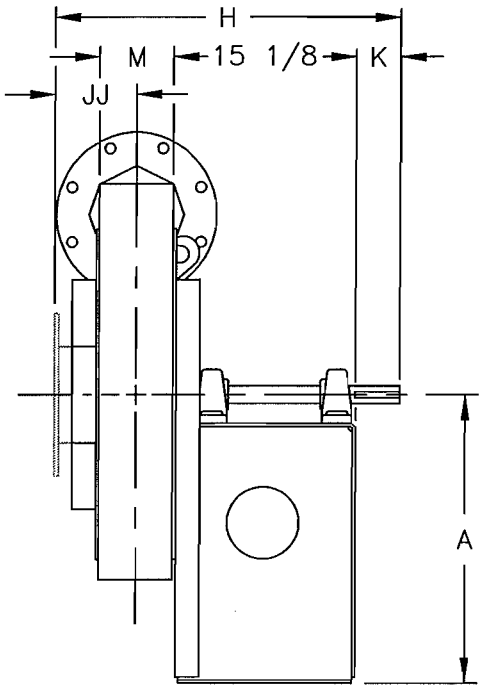
SALES MEMO INFORMATION

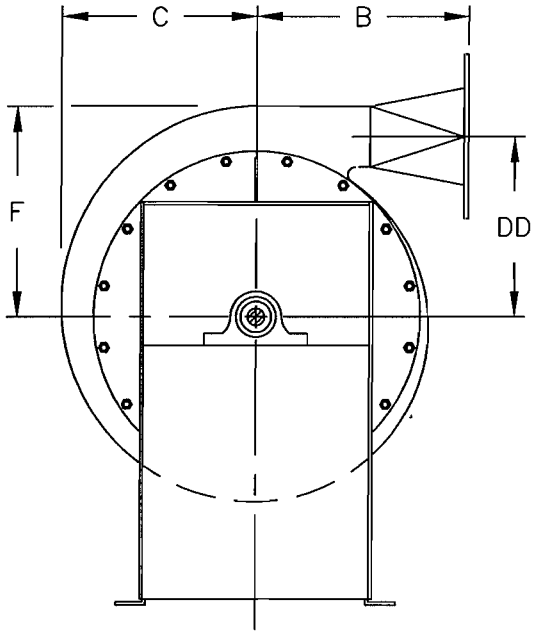
QTY	DESCRIPTION	Drawing#
1	CW TH, SIZE 2506S PRESSURE BLOWER, STEEL-WHL, ARR-1, MTR POS Z FLANGED INLET 08" FLANGED OUTLET 06"	X04835-100-02
1	20 HP, 3600 RPM, 3-60-200 V., PREMIUM EFF., TEFC ENCL., FRAME 256T, F INSULATION, MFG: BALDOR, MFG PART: EM4106T-8, PER SPA# SX01459BP MOTOR AND MOUNTING BY NYB	
1	MOTOR MOUNTING CHARGE	
1	TO-SCALE COMPOSITE DRAWING	
1	CONSTANT V-BELT DRIVE 1.50 SF	
1	BELT GUARD	X04835-101-03

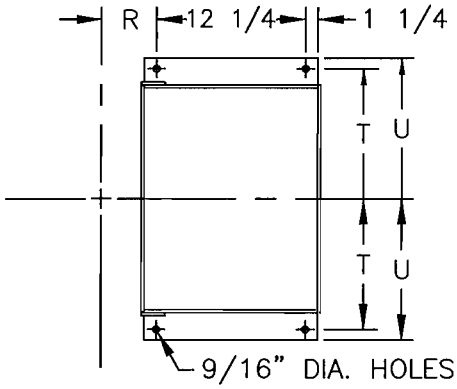
QTY	DESCRIPTION	Drawing#
1	SHAFT & BEARING GUARD	
1	DAMPER, OUTLET, SINGLE VANE INTEGRAL CONTROL ARM LOCATED ON INLET SIDE	X04835-100-04
1	UNITARY BASE MUST BE SAME OVERALL UNITARY BASE DIMENSIONS AS BI #1580	X04835-103-05
1	GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON ALL SURFACES COAT ALL SURFACES OF FAN USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07	
1	GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON BELT GUARD COAT BELT GUARD USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07	
1	GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON SHAFT & BEARING GUARD COAT SHAFT & BEARING GUARD USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07	
1	GROUP 1 COATINGS, SPECIAL COATING (SANDBLAST), CC7Y, ON UNITARY BASE COAT UNITARY BASE USING TNEMEC #66-1211 RED PRIMER OVER A SP#6 BLAST, SYSTEM DFT TO BE 3-5 MILS PER SPA X116-SB-07	

CARBONAIR ENVIROMENTAL

PURCHASE ORDER: 30686







INLET AND OUTLET FLANGES ARE 3/8" THICK MATERIAL.

PRESSURE BLOWERS ARE ROTATABLE IN THE FIELD BY 22 1/2° INCREMENTS.

FURNISHED WITH FLANGED INLET AND OUTLET WHICH FITS ANSI 150 PIPE FLANGES.

MAXIMUM TEMPERATURE :
200°F (93°C) – ALUMINUM WHEEL
300°F (149°C) – STEEL WHEEL

ITEM	DIMENSIONS	
	in	mm
A	26 5/8	676
B	19	483
C	19 7/16	494
DD	17 5/8	448
F	20 5/8	524
H	29 5/8	752
JJ	7	178
K	5	127
M	5	127
R	3 7/8	98
T	10 7/8	276
U	11 3/4	298
SHAFT DIA.	1 11/16	–
KEYWAY	3/8	–

FLANGED OUTLET	DIMENSIONS	
	in	mm
I.D.	6	152
B.C.	9 1/2	241
O.D.	11	279
NO. HOLES	8	–
DIA. HOLES	7/8	22

FLANGED INLET	DIMENSIONS	
	in	mm
I.D.	8	203
B.C.	11 3/4	298
O.D.	13 1/2	343
NO. HOLES	8	–
DIA. HOLES	7/8	22

TOLERANCE: ±1/8" (±3mm)

nyb The New York Blower Company

7660 Quincy Street, Willowbrook, IL 60521

Pressure Blower A1

SIZE: 2506S CW TH

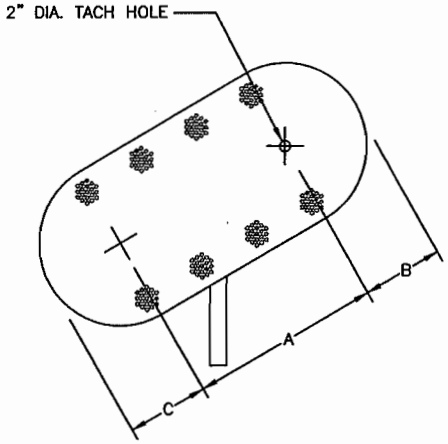
Date 01-29-03 Certified KAB

Drawing No. X04835-100-2 Rev. ___

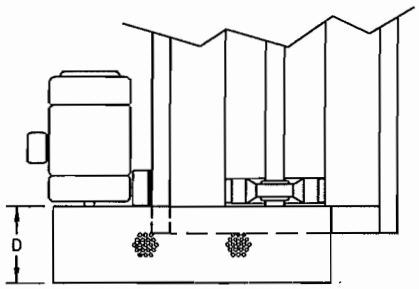
CARBONAIR ENVIROMENTAL

PURCHASE ORDER: 30686

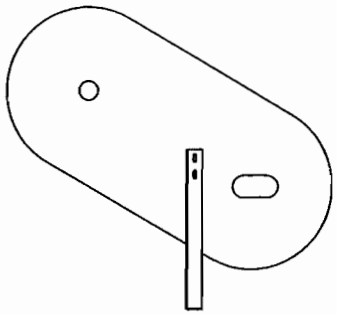
FRONT VIEW

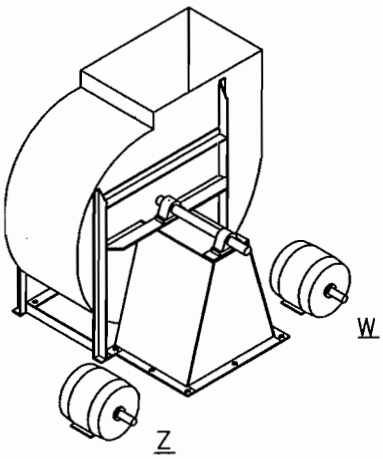


TOP VIEW



BACK VIEW





AMCA STANDARD MOTOR POSITIONS

MOTOR POSITIONS ARE DETERMINED BY VIEWING FAN FROM DRIVE SIDE, AND SELECTING W OR Z.

CONSTRUCTION FEATURES

1. BELT GUARD SHOWN HAS SOLID BACK AND SIDES EXCEPT FOR SHAFT OPENINGS
2. FRONT COVER IS REMOVABLE WITH SELF-TAPPING SCREWS

DIMENSIONS

ITEM	DIMENSIONS	
	in	mm
A	33 3/8	848
B	5 5/8	143
C	5 5/8	143
D	7	178

TOLERANCE: ±1/8" (±3mm)

nyb The New York Blower Company

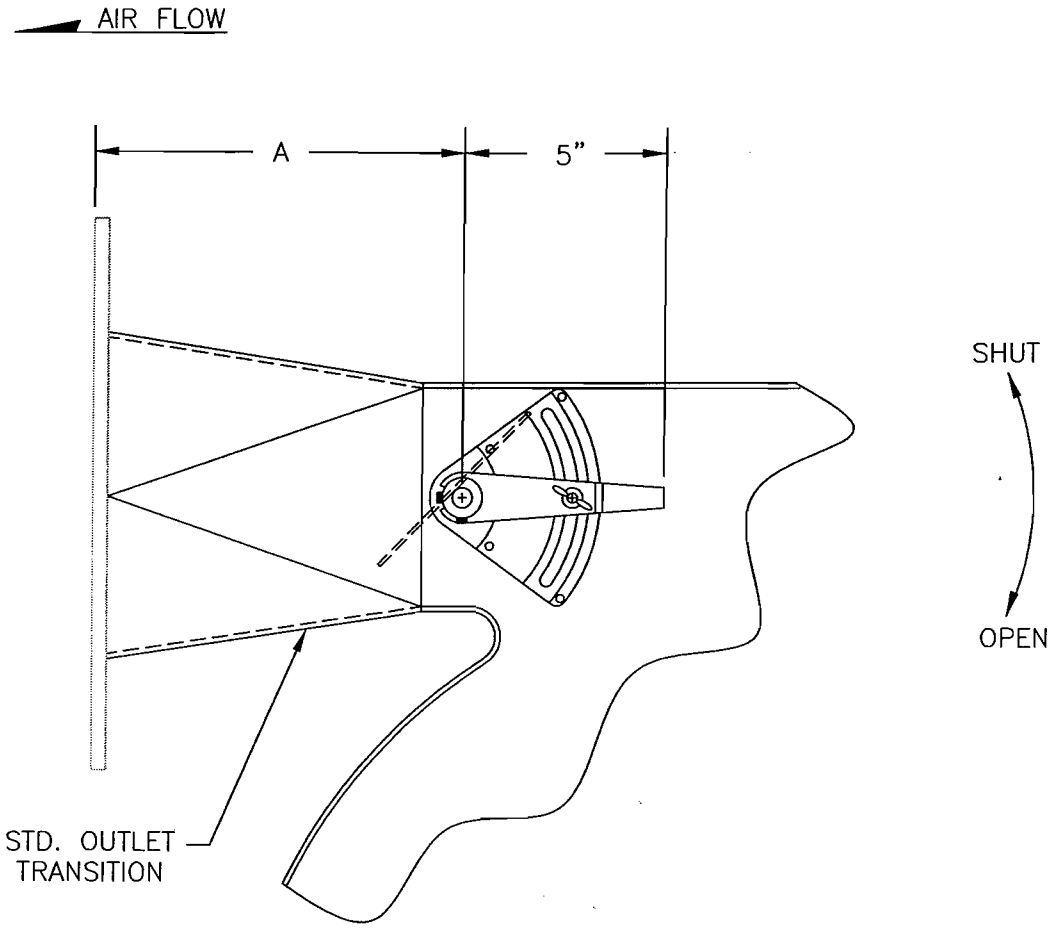
7660 Quincy Street, Willowbrook, IL 60521

Pressure Blower 2506 Steel Belt Guard

Date 01-29-03 Certified KAB

Drawing No. X04835-101-3 Rev.

PURCHASE ORDER: 30686



CW FAN SHOWN VIEWED FROM INLET SIDE

DAMPER IS A SINGLE VANE TYPE.

DAMPER OPERATES CW TO OPEN.

ITEM	DIMENSIONS	
	in	mm
OUTLET DIA.	6	–
A	9 5/8	244

TOLERANCE: ±1/8" (±3mm)

The New York Blower Company

7660 Quincy Street, Willowbrook, IL 60521

INTEGRAL OUTLET DAMPER

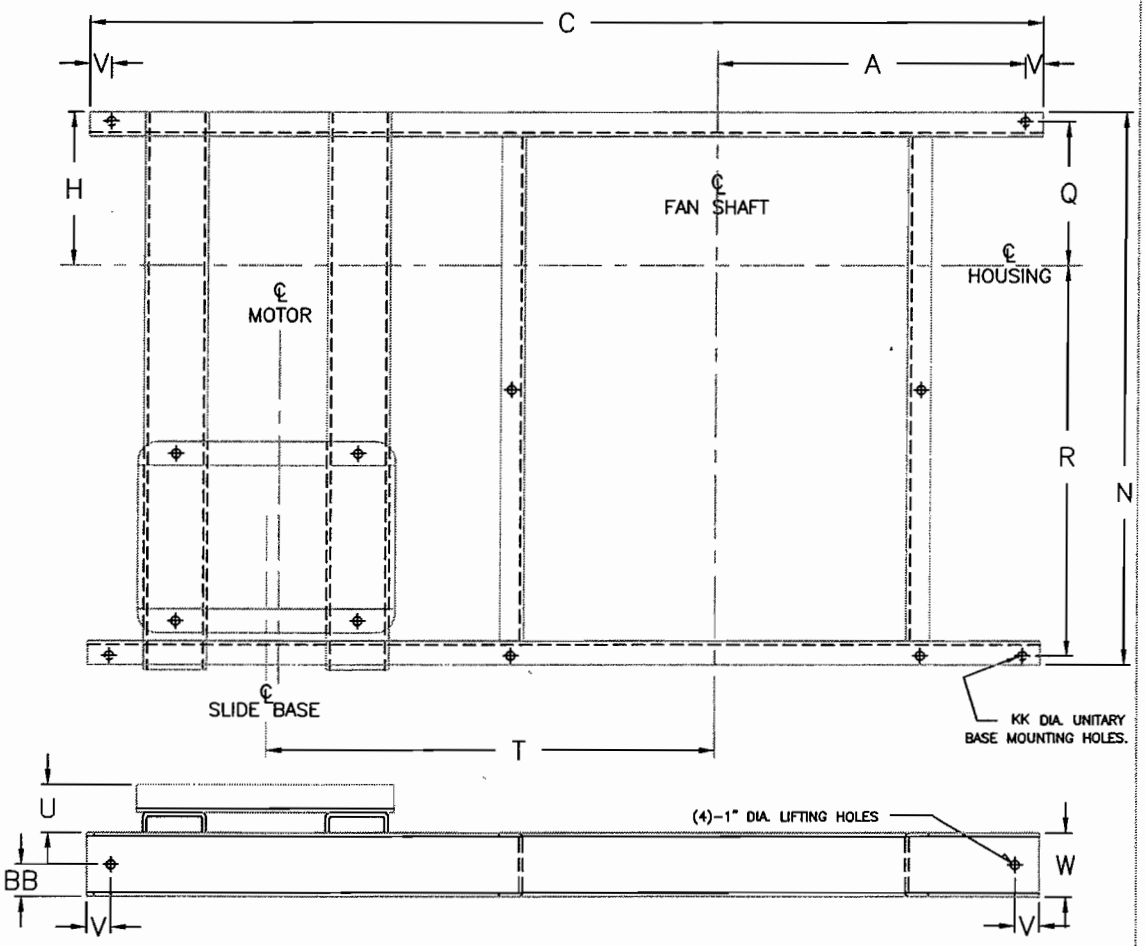
SIZE: 2506S

Date 01-29-03 Certified KAB

Drawing No. X04835-100-4 Rev.

CARBONAIR ENVIROMENTAL

PURCHASE ORDER: 30686



ITEM	DIMENSIONS	
	in	mm
A	13 3/4	349
C	57 3/8	1457
H	4 3/4	121
Q	3 7/8	98
N	21 3/4	552
R	16 1/8	410
T	29 3/4	756
U	3 7/8	98
V	1 1/2	38
W	4	102
BB	2	51
KK	(4) – 9/16	–

Approx. Weight: 112 lbs (Includes slide base weight.)

nyb The New York Blower Company

7660 Quincy Street, Willowbrook, IL 60521

Unitary Base – Position Z

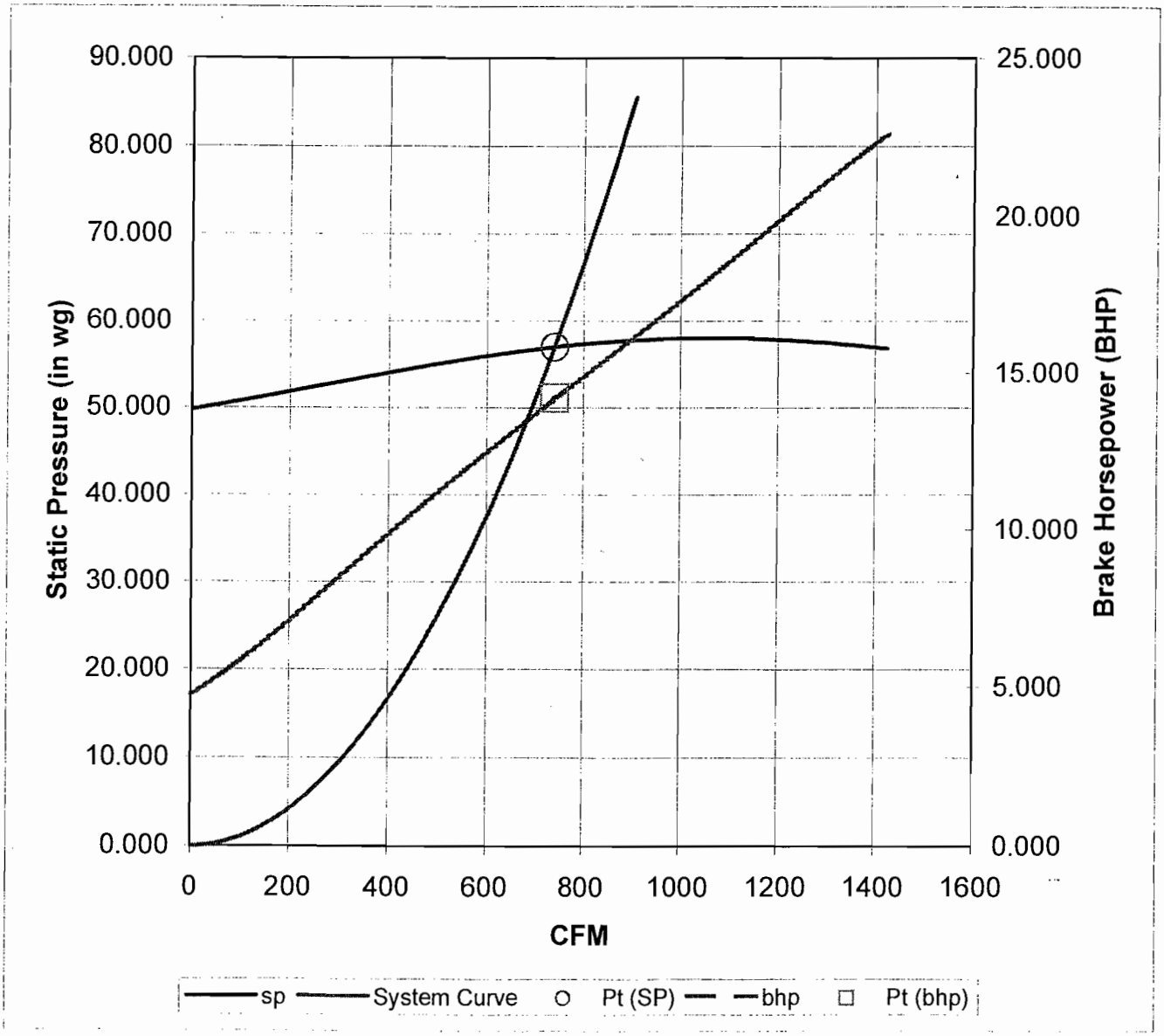
SIZE: 2506S

Date 01–29–03 Certified KAB

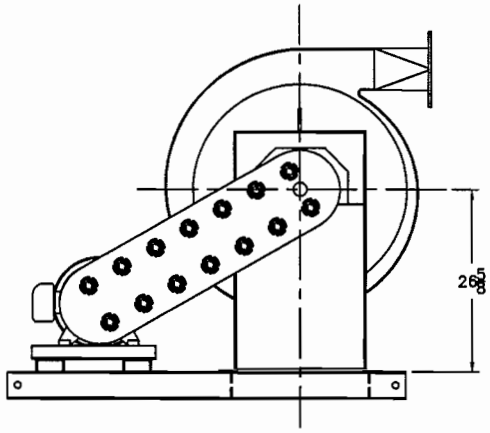
Drawing No. X04835–103–5 Rev. ___

Performance Curve

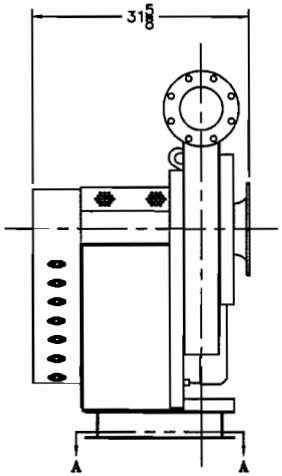
Date:	29-Jan-03	File:	**X04835-100**	**KAB**
Performance		Cust. No.:	*30686*	
Options:		Customer:	*CARBONAIR ENVIROMENTAL*	
Outlet Damper		Product Line:	*Pressure Blower*	
		Size:	*2506S*	
		Capacity:	*Standard*	
		CFM:	*740*	
		SP:	*57*	
		RPM:	*3753*	
		BHP:	*14.2*	
Temperature:	*70*	Density:	*0.075*	
Altitude:	*N/A*	Max Safe Speed:	*3800*	



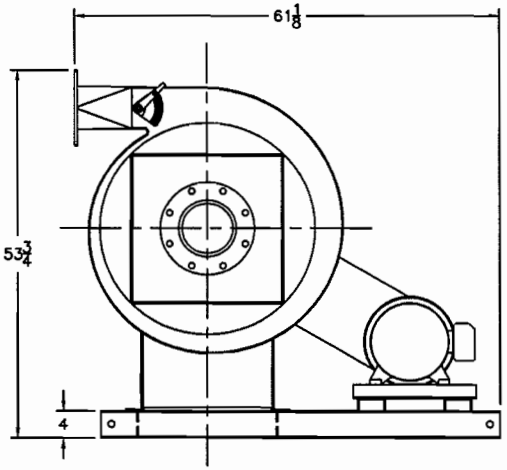
REVISIONS			
SYM.	DATE	SIG.	DESCRIPTION
-	-	-	-



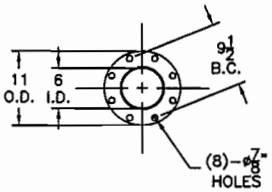
DRIVE SIDE VIEW



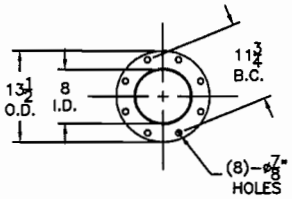
RIGHT SIDE VIEW



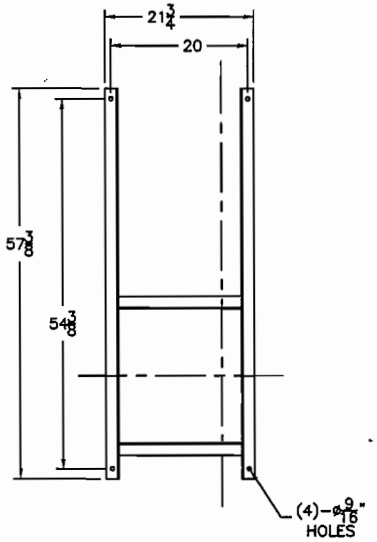
INLET SIDE VIEW



FLANGED OUTLET DETAIL



FLANGED INLET DETAIL



SECTION A-A

CUSTOMER CARBONAIR ENVIRONMENTAL
CUSTOMER'S NO. 30686
FILE NO. X04835-100 DATE: 1-30-03
TAGGING

COMPOSITE DRAWING
2506S PRESSSURE BLOWER
CW TH
ARR. 1

DRAWN KAB APPROVED
SCALE PS DATE 1-30-03

The New York Blower Company
7660 Quincy Street
Willowbrook, IL 60521

DRAWING NUMBER
3CD3876

TROUBLE SHOOTING

Trouble Shooting Operational Notes

A. Any switch in the "HAND" position will operate the corresponding circuit under any alarm condition, except for a motor temperature fault or a circuit overload. The "HAND" position is for diagnostics or to clear alarms. The system should never be left unattended while any switch is in the "HAND" position.

B. To reset an alarm, switch all Hand-Off-Auto (HOA's) switches to the "OFF" position. Then the press the "RESET" button. If the panel will not reset, then an alarm condition still exists.

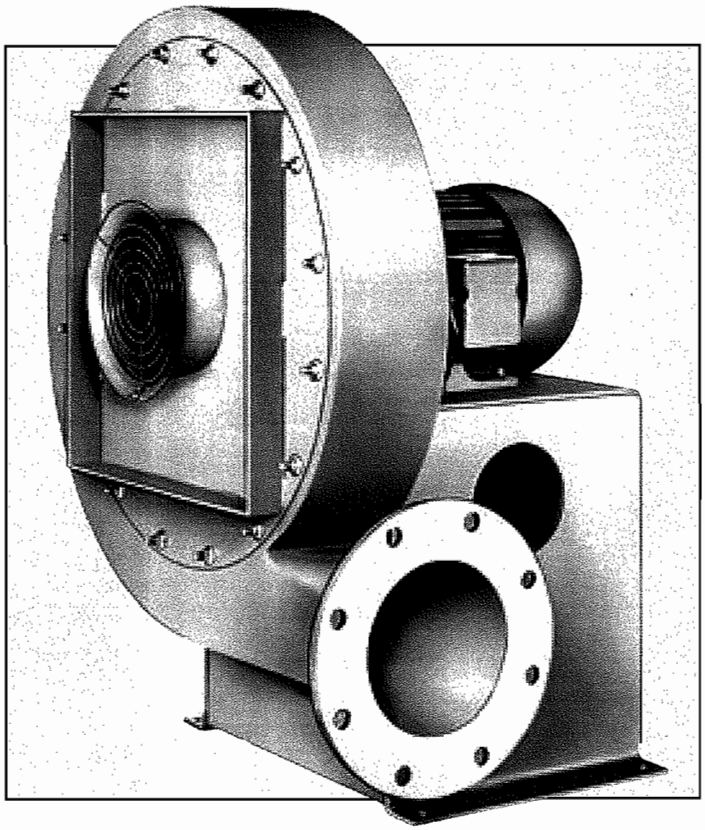
C. Upon powering the panel, alarm lights will be lit. The panel must be reset every time power is disconnected.

D. This system includes run hour meters for each major motor.

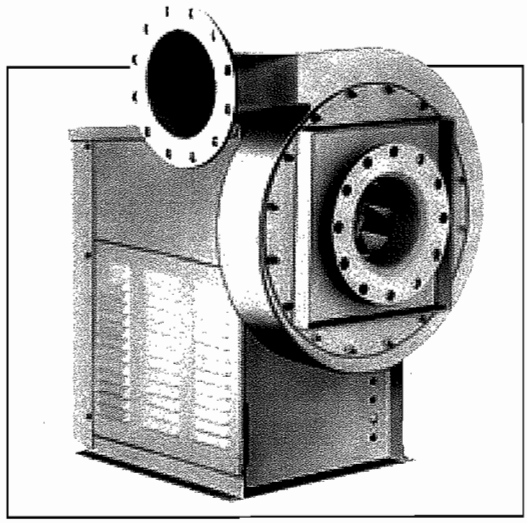
System	Problem	Possible cause	Solution
STAT Blower	Blower will run in "HAND" but not in "AUTO"	Alarm condition	Clear any alarm condition and reset the control panel. See Attachment 10 alarm interlocks.
	Blower will not run in the "HAND" position	Tripped circuit protector	Open the inner door and reset the circuit protector. A tripped circuit protect can be an indication of a problem. Inspect the system thoroughly and check the operating conditions.
		Motor temperature switch is inoperative	Check to see that the motor temperature switch has been wired, or that there is a jumper, if a switch is not present.
		Faulty Blower	Refer to manual or contact CARBONAIR for help in diagnosing faulty blower.
	Blower runs at a reduced performance	Incorrect blower rotation	Verify and change rotation
		Inlet filter fouled	Clean or replace inlet filter
		Excessive effluent pressure	See "STAT-High Pressure Drop" section
	Positive pressure instead of negative pressure at SVE inlet	Incorrect blower rotation	Verify and change rotation
	Blower runs at a reduced performance	Inlet filter fouled	Clean or replace inlet filter
		Excessive effluent pressure	Verify operating condition. Ensure that there is not excessive backpressure on the unit, (i.e. reduced pipe sizes, fouled Carbon bed, or fouled CATOX.)
		Moisture separator relief valve set to low	Refer to manual or contact CARBONAIR for help in adjusting relief valve
		Sheaves incorrectly installed	Verify that the sheaves are installed in their appropriate location. If they are incorrect, switch sheaves.
	Excessive Amp Draw	Excessive influent vacuum	Reduce inlet vacuum
		Excessive effluent pressure	Verify operating condition. Ensure that there is not excessive backpressure on the unit, (i.e. reduced pipe sizes, fouled Carbon bed, water in the after cooler, or fouled CATOX.)
		Sheaves incorrectly installed	Verify that the sheaves are installed in their appropriate location. If they are incorrect, switch sheaves.
		Obstruction in blower	Inspect blower for signs of wear on the lodes, or obstructions. Be sure blower motor power is tagged and locked out before inspecting blower.
		Blower damaged	Refer to manual or contact CARBONAIR for help in diagnosing faulty blower

BULLETIN 451
JANUARY, 2001

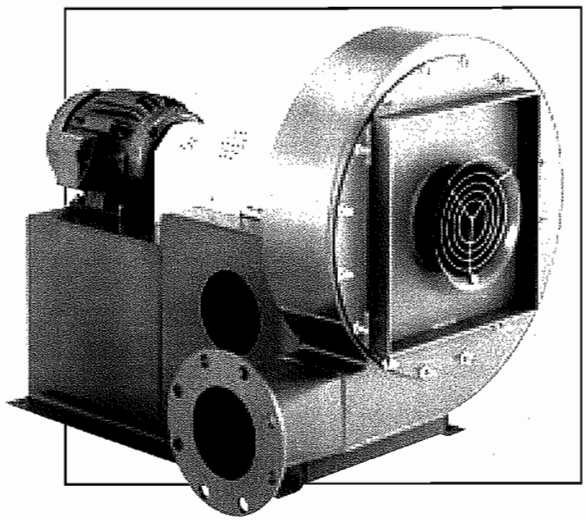
PRESSURE BLOWERS



ARRANGEMENT 4



ARRANGEMENT 10



ARRANGEMENT 8

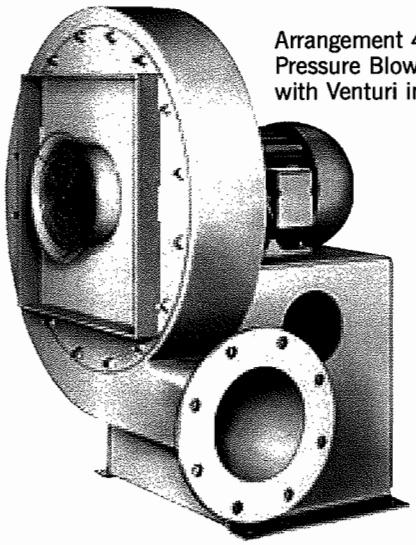
- Static pressures to 58"WG
- Capacities to 5200 CFM
- Temperatures to 600°F.

ISO 9001 Certified

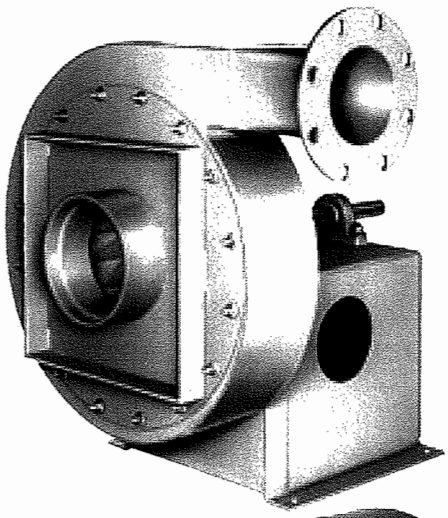
nyb | The New York Blower Company®

7660 QUINCY STREET–WILLOWBROOK, ILLINOIS 60527-5530
TEL: [630] 794-5700 • FAX: [630] 794-5776 • WEB: http://www.nyb.com • E-MAIL: nyb@nyb.com

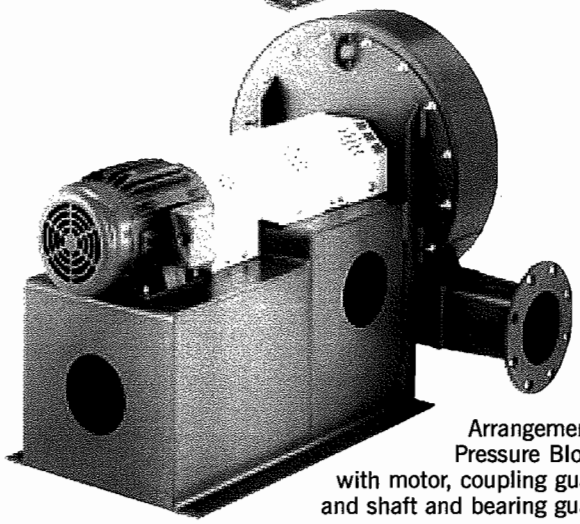
For greater pressures and capacities:
see Type HP Pressure Blowers



Arrangement 4
Pressure Blower
with Venturi inlet.



Arrangement 1
Pressure Blower
with plain pipe
inlet.



Arrangement 8
Pressure Blower
with motor, coupling guard,
and shaft and bearing guard.

The New York Blower Company certifies that the Pressure Blowers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

PRESSURE BLOWERS ...for process systems

DESIGN FEATURES

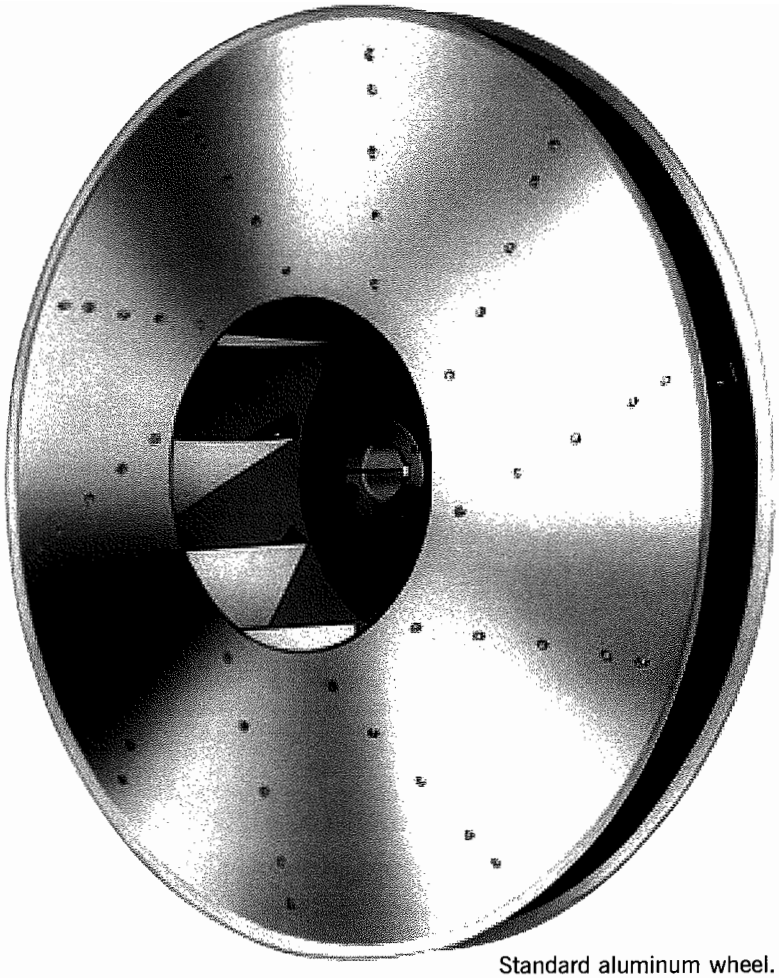
- Pressures to 58"WG.
- Capacities to 5200 CFM.
- Stable performance . . . the pressure curve remains stable from wide-open to closed-off . . . fan instability, or pulsation, is eliminated even when "turn-down" approaches zero flow.
- Efficiency . . . advanced wheel and aerodynamic housing design combine for air-handling efficiency superior to conventional radial-wheel designs.
- Wide performance range . . . choice of 13 wheel diameters and five outlet sizes enable efficient fan selection across a broad range of volumes and pressures.
- Choice of arrangements . . . direct-drive and belt-drive.
- Wide application range . . . designed for continuous operation in combustion, cooling, conveying, drying, and various process systems.

CONSTRUCTION FEATURES

- All-welded steel housings . . . heavy-gauge housings are rigidly braced to prevent "flexing" at high pressures.
- Flanges . . . continuously welded flanges match ANSI Class 125/150 hole pattern.
- Balance . . . all wheels are precision-balanced prior to assembly . . . fans with motors and drives mounted by **nyb** are final-balanced at the specified running speed.
- Shafting . . . straightened to close tolerance to minimize "run-out" and ensure smooth operation.
- Inlet configuration . . . a choice of three inlet types allows units to be tailored to specific application requirements.
- Lifting eyes . . . standard on all units for ease of handling and installation.
- Finish . . . medium-green industrial coating.

STANDARD ALUMINUM WHEEL

The unique Pressure Blower wheel is designed to provide efficient performance and reduced sound levels . . . the dual-taper design concept yields typical efficiencies up to 10 percentage points greater than conventional straight radial wheels. Riveted high-strength aluminum alloy blades and side plates minimize overhung wheel weight and starting inertia. Ductile-iron, taper-lock hubs make wheels easily removable. Welded steel and stainless steel wheels are also available . . . see page 5.

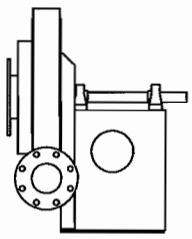


Standard aluminum wheel.

ARRANGEMENTS

PRESSURE BLOWERS

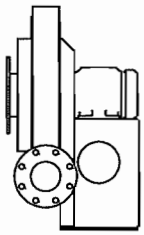
ARRANGEMENT 1



Recommended for belt-driven applications only. Wheel is mounted on shaft mounted in heavy-duty bearings.

Max. airstream temperature:
200°F.–aluminum wheel.
300°F.–steel wheel.
600°F.–heat fan.

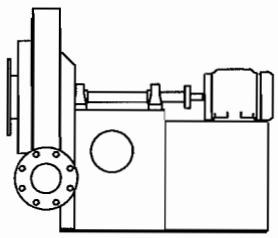
ARRANGEMENT 4



A compact direct-drive unit with a minimum number of moving parts for ease of maintenance. Wheel is mounted directly on motor shaft.

Max. airstream temperature:
180°F.

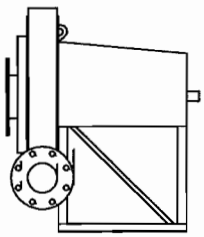
ARRANGEMENT 8



Direct-drive arrangement similar to Arrangement 1, but with integral motor pedestal . . . fan shaft is connected to the motor shaft with a flexible coupling.

Max. airstream temperature:
200°F.–aluminum wheel.
300°F.–steel wheel.
600°F.–heat fan.

ARRANGEMENT 10

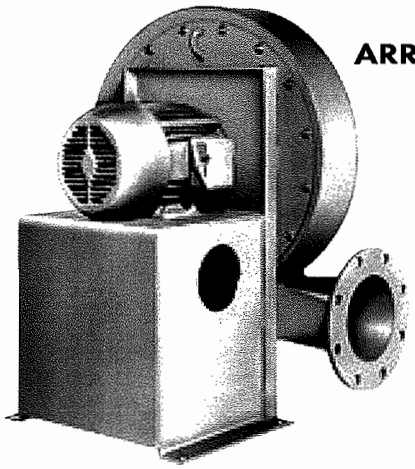


Enclosed belt-drive arrangement. Ideal for outdoor applications. Wheel mounted on shaft mounted in heavy-duty bearings.

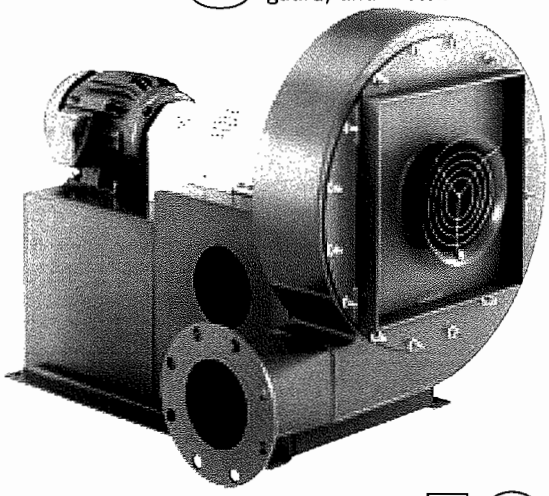
Max. airstream temperature:
200°F.–aluminum wheel.
300°F.–steel wheel.
600°F.–heat fan.

ACCESSORIES MODIFICATIONS

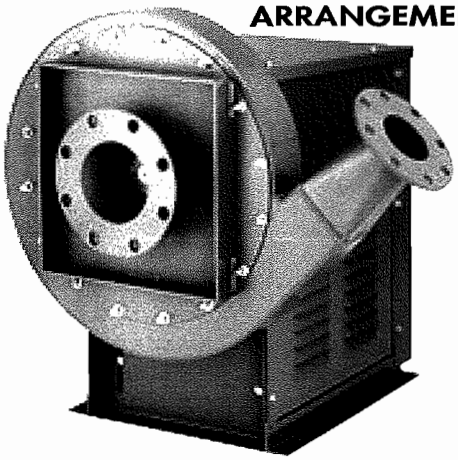
ARRANGEMENT 4



ARRANGEMENT 8 with Venturi inlet, shaft and bearing guard, coupling guard, and motor.



ARRANGEMENT 10 with flanged inlet and optional weather cover/belt guard.



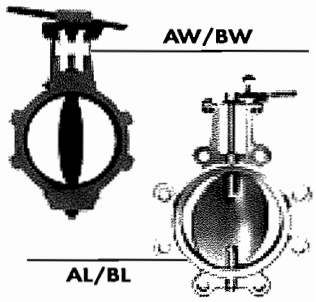
- **COMPANION FLANGES**
  Designed to fit flush with fan inlet and outlet flanges, provided with a matching hole pattern.

- **DRAINS**
  Tank flange is welded to the lowest point of the housing scroll . . . female pipe thread . . . includes plug.

- **INLET FILTER**
  Filters use oil-wetted or dry element. High-efficiency filter is flange-mounted. Furnished standard with outboard support bracket and available with or without protective hood.

- **SILENCERS**
  Available to match standard inlet or outlet flange sizes. Heavy-welded construction filled with high-density, acoustical absorption material.

- **OUTLET DAMPERS**
  Available as either an integral outlet design for fixed damper control or a separate wafer design for variable-flow applications [shown]. Wafer damper is available with optional actuator and positioner.



- **SHAFT SEALS**
  Ceramic-felt shaft seals consist of compressed ceramic felt elements. Lubricated lip seals [Buna, Teflon®, and Viton®] and gas-purgeable mechanical seals are also available. See your **nyb** representative for availability.
  [Teflon and Viton are registered trademarks of DuPont and DuPont Dow Elastomers, respectively.]

- **ACCESS DOOR**
  Gasketed, flush bolted door opens to provide access to wheel.

- **HEAT-FAN CONSTRUCTION**
  Available on Arrangements 1, 8, and 10 steel wheel Pressure Blowers up to 600°F. Modifications include shaft cooler and shaft-cooler guard, and high-temperature paint above 500°F.

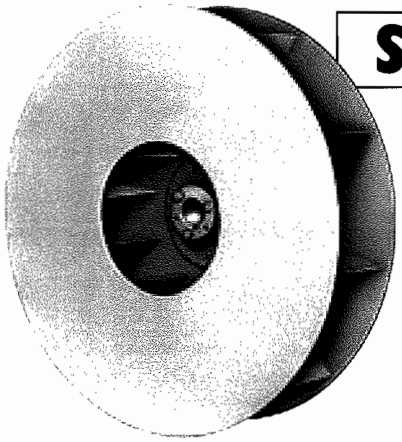
- **LL-1 LOW LEAKAGE CONSTRUCTION**
  Special construction to minimize leakage includes lip-type shaft seal, non-rotatable housing with solid drive side, double studs, and neoprene gasketing. Max. temperature 200°F. due to gasketing limitations. Not available with heat-fan construction.

- **SPECIAL ALLOY CONSTRUCTION**
  Airstream components can be constructed of a wide range of alternate alloys for corrosive applications.

- **UNITARY BASE**
  Arrangement 1 fan, motor, and guards can be mounted and shipped on a rugged, structural-steel base. Factory-assembled and run-tested prior to shipment.

PERFORMANCE

STEEL WHEELS



Typical steel wheel.

Welded steel or stainless-steel wheel construction is available in straight radial design. AMCA Certified Ratings Seal applies to Pressure Blowers with aluminum wheel design only. Air volume and pressure capabilities are the same as the dual-taper aluminum wheel . . . brake horsepower requirements must be increased by the factors in Chart I.

CHART I
STEEL WHEEL HORSEPOWER CORRECTIONS

Outlet size	Wheel size	BHP correction factors*
04	14 to 22	1.15
06	14 to 18 19 to 26	1.06 1.15
08	15 to 22 23 to 26	1.06 1.15
10	19 to 26	1.06
12	23 to 26	1.06

*Some fan and motor combinations with steel wheels may be restricted due to starting torque requirements. Consult **nyb**.

18" Pressure Blower with 04 outlet to handle 400 CFM at 23½"SP at .075 lbs./ft.³ density. Aluminum wheels require 2.6 BHP as shown on page 6. Steel or stainless-steel wheels require [1.15 x 2.6] 3.0 BHP.

MAXIMUM SAFE SPEED

CHART II
MAXIMUM SAFE SPEEDS [RPM]†

Wheel diameter	Aluminum wheel	Steel wheel	
	All Arr.	Arr. 1, 4, 8	Arr. 10
14	4000	4000	4000
15	4000	4000	4000
16	4000	4000	4000
17	4000	4000	4000
18	4000	4000	4000
19	3900	3900	2992
20	3900	3900	2918
21	3900	3900	2851
22	3900	3900	2787
23	3800	3800	3178
24	3800	3800	3121
25	3800	3800	3068
26	3800	3800	3017

† derate for temperature not required.

CORRECTION FACTORS

Performance is based on actual cubic feet per minute [ACFM] at the blower inlet at standard density [.075 lbs./ft.³] and static pressure at the blower outlet. Static pressure capabilities are shown in inches water gauge ["WG].

Air density corrections are necessary for proper selection when air density varies from the standard .075 lbs./ft.³ at 70°F. at sea level. This also occurs when negative static pressure exists [rarefication] on the inlet side of the fan. Multiply the required static pressure at conditions by the appropriate factors in Charts III, IV, and V to obtain corrected pressure for blower selection. Pressure and BHP will be reduced at conditions by the inverse of these factors. Multiply one factor by the other if temperature, altitude, and rarefication are non-standard. For example: If the installation is located at an altitude of 4000 feet, the gas temperature is 300°F., and the inlet pressure is –40"WG, the correction factor is 1.84 [1.16 x 1.43 x 1.11].

CHART III
ALTITUDE [ft.] CORRECTIONS

Alt.	Factor
0	1.00
500	1.02
1000	1.04
1500	1.06
2000	1.08
2500	1.10
3000	1.12
3500	1.14
4000	1.16
4500	1.18
5000	1.20
6000	1.25
7000	1.30
8000	1.35
9000	1.40
10000	1.45

CHART IV
TEMPERATURE CORRECTIONS

Temp. °F.	Factor
0	.87
20	.91
40	.94
60	.98
70	1.00
80	1.02
100	1.06
120	1.09
140	1.13
160	1.17
180	1.21
200	1.25
300	1.43
400	1.62
500	1.81
600	2.00

CHART V
RAREFICATION CORRECTIONS

Neg. inlet pressure "WG	Factor
15	1.04
20	1.05
25	1.07
30	1.08
35	1.09
40	1.11
45	1.12
50	1.14
55	1.16
60	1.17
65	1.19
70	1.21
75	1.23
85	1.26

SAFETY EQUIPMENT

Belt guards, inlet and outlet guards, shaft and bearing guards, and coupling guards are available from The New York Blower Company. Contact your **nyb** representative for further information.

NOTE: Safe operation of air-moving equipment is dependent on proper installation and maintenance including selection and use of appropriate safety accessories for the specific installation. The system designer must consider providing guards for all exposed moving parts as well as protection from access to high-velocity airstreams. Improper application, installation, maintenance or safety-guard selection can create danger to life and limb of personnel. Users and/or installers should read "Recommended Safety Practices For Air Moving Devices" as published by the Air Movement and Control Association International, 30 West University Drive, Arlington Heights, Illinois 60004, which is included with the packing slips for all shipments from **nyb** and available on request.

Using Performance Curves

Performance is shown according to outlet sizes for quick reference to duct diameter and velocity. Brake horsepower increments are identified on each curve. Recommended standard blower size and motor combinations are based on the most efficient area of operation and are indicated by the arrows. Nonstandard combinations are generally available, but are usually less efficient than the standard combinations.

SIZING NOMENCLATURE

7-digit model number designates the wheel diameter, outlet size, wheel type, and nominal motor horsepower.

Note: the last two digits showing motor horsepower are not required for Arrangement 1 Pressure Blowers.

EXAMPLE

21 — Wheel diameter

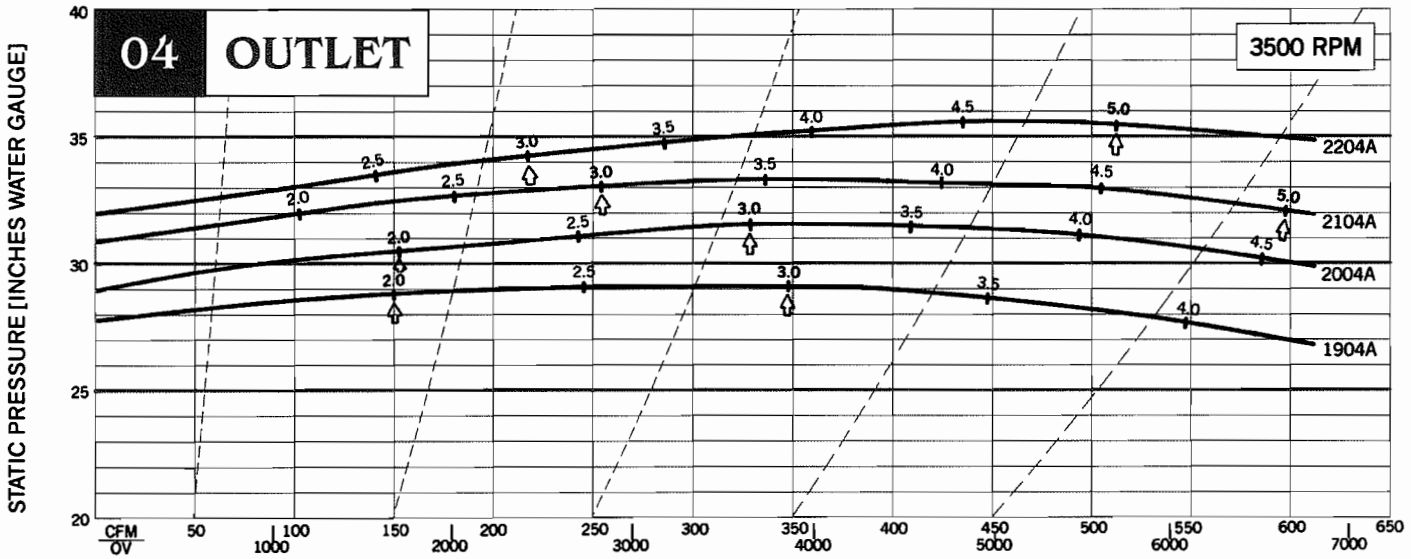
06 — Outlet size [inches]

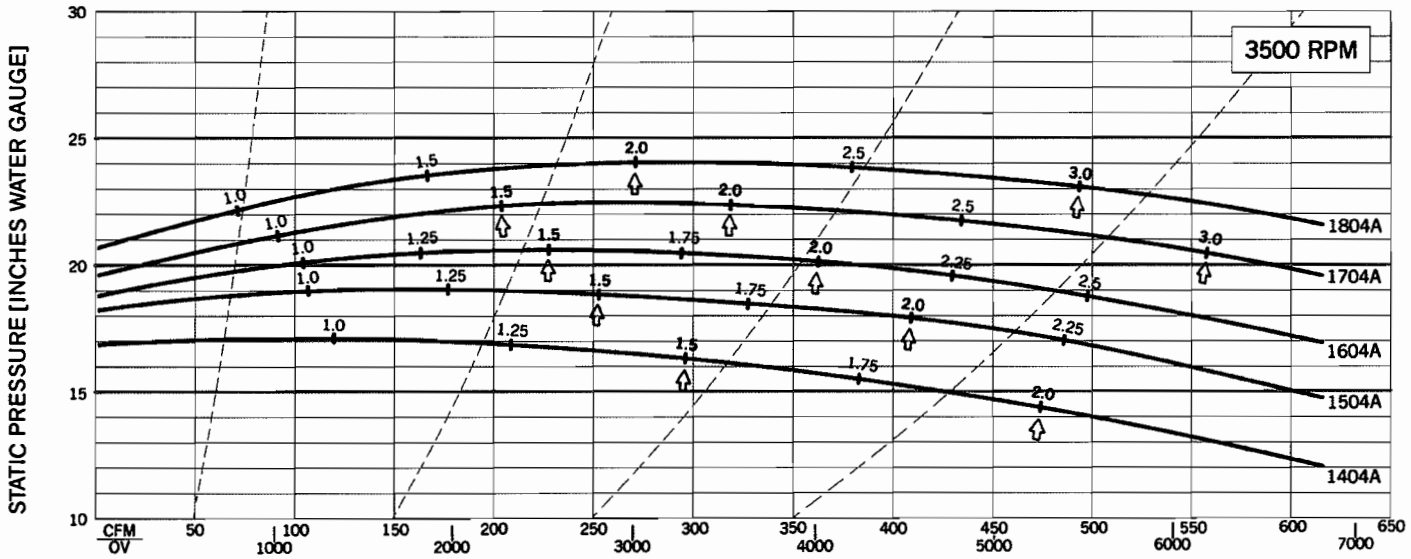
A — Wheel type: A = aluminum; S = steel/stainless steel

7½ — Nominal horsepower

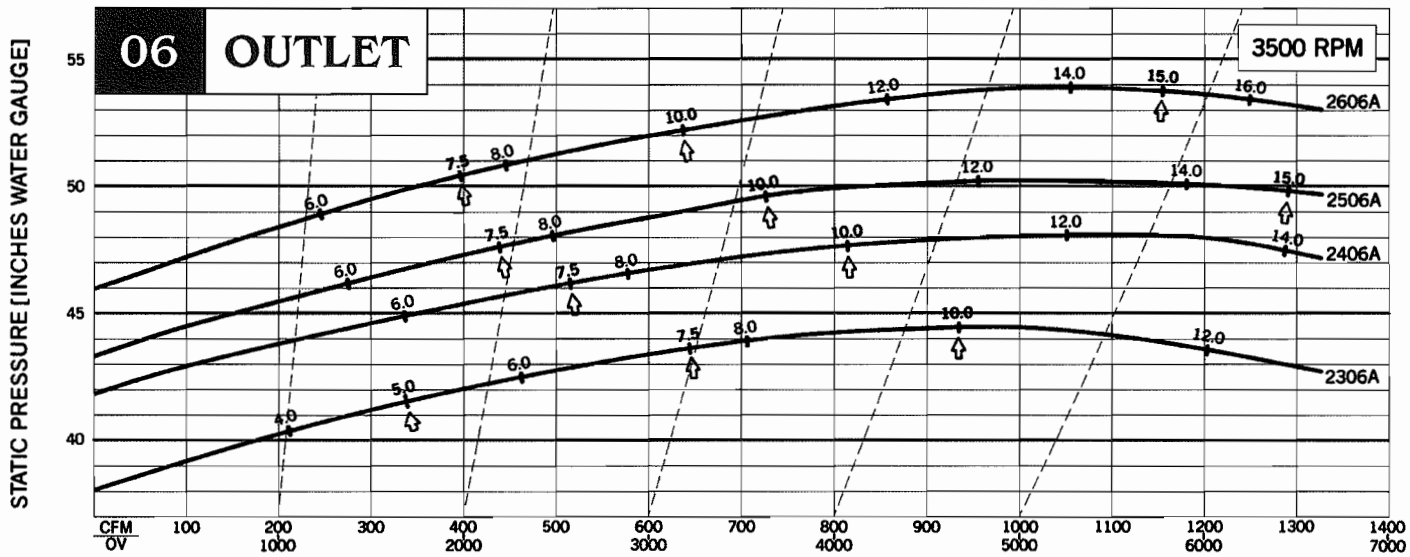
PROCEDURE	STEPS	EXAMPLE
Determine the appropriate outlet size.	1	The 06 outlet is selected for 800 CFM at 32"SP.
Plot the CFM and SP [standard] and follow a projected system line up to the pressure curve that meets or slightly exceeds the required performance.	2	A Size 2106A will provide 820 CFM at 33.6"SP.
Determine the BHP required for the point of operation . . . see page 4 for steel or stainless-steel wheel factors.	3	2106A requires 6.3 BHP. 2106S requires 7.2 BHP [6.3 x 1.15].
Read to the right to select motor horsepower.	4	A 7½ HP motor will cover both wheel types.

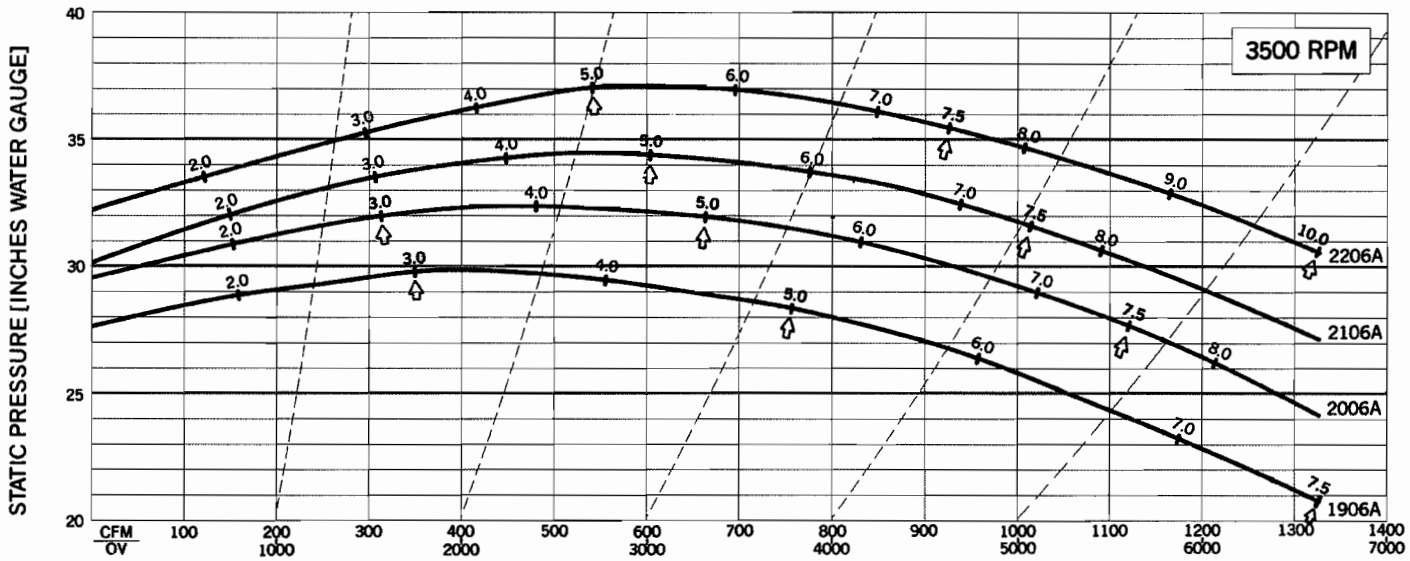
Note: The horsepower coverage of a given motor will increase 15% when a 1.15 service factor motor is utilized.

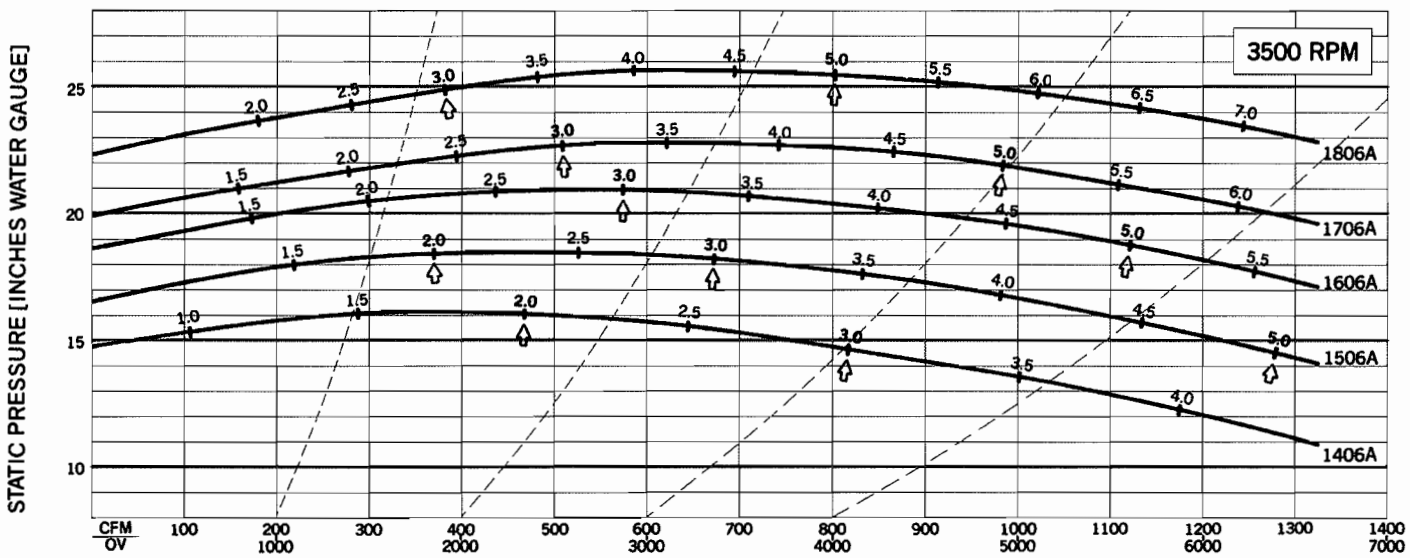




Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses. Performance ratings do not include the effects of appurtenances in airstream.







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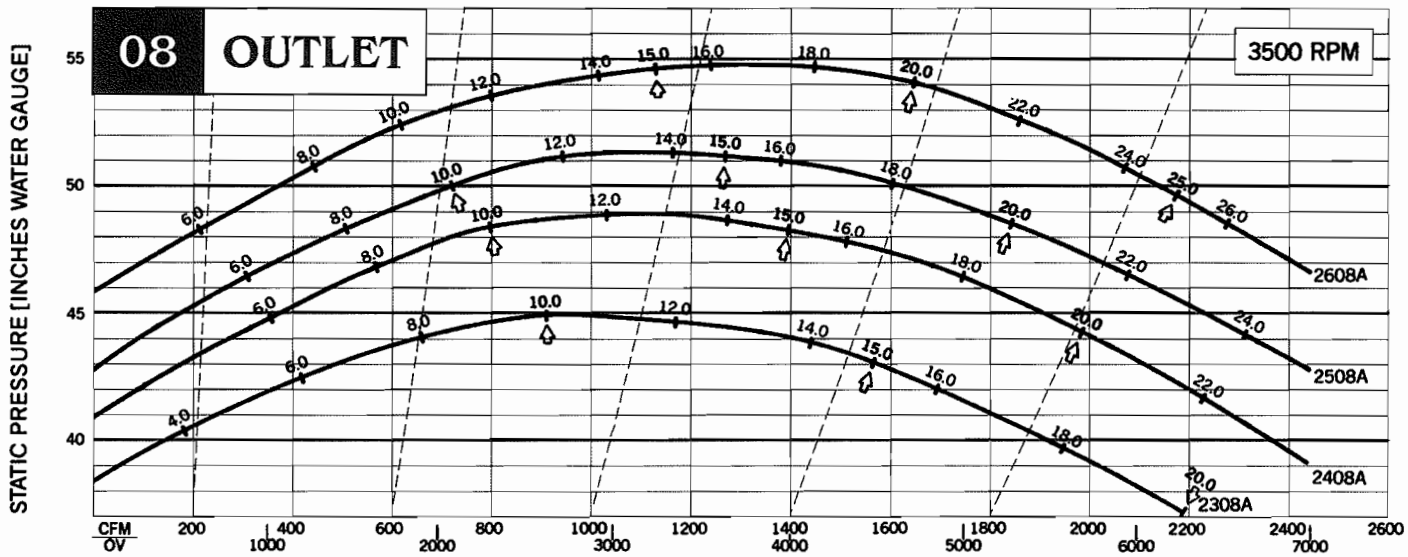

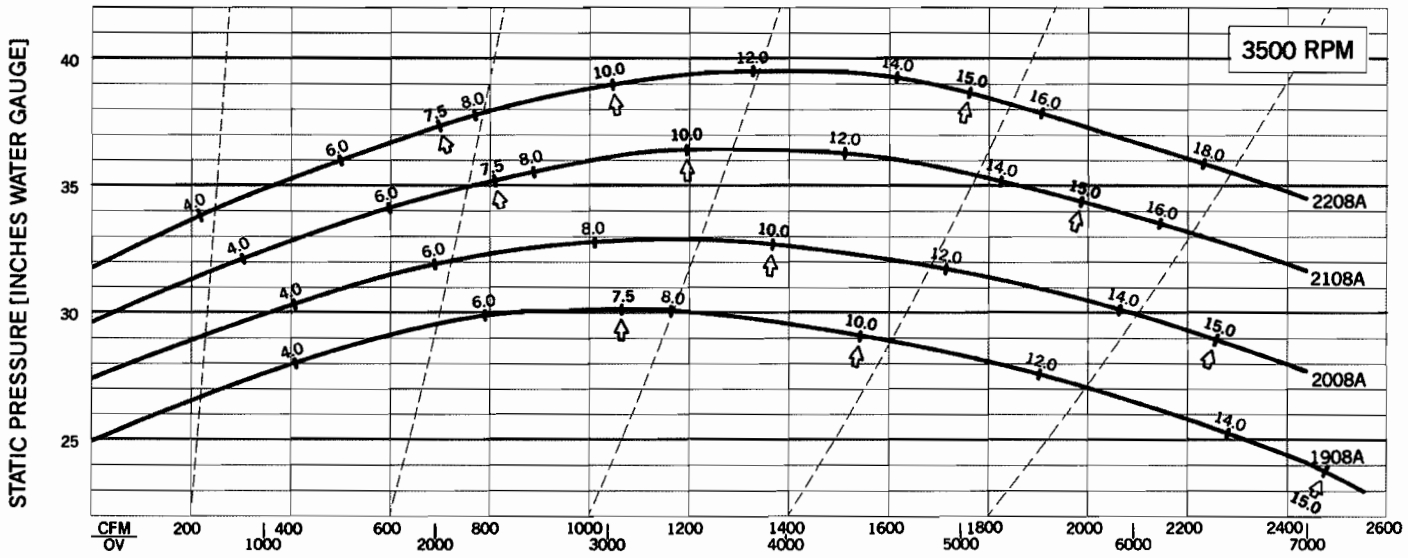

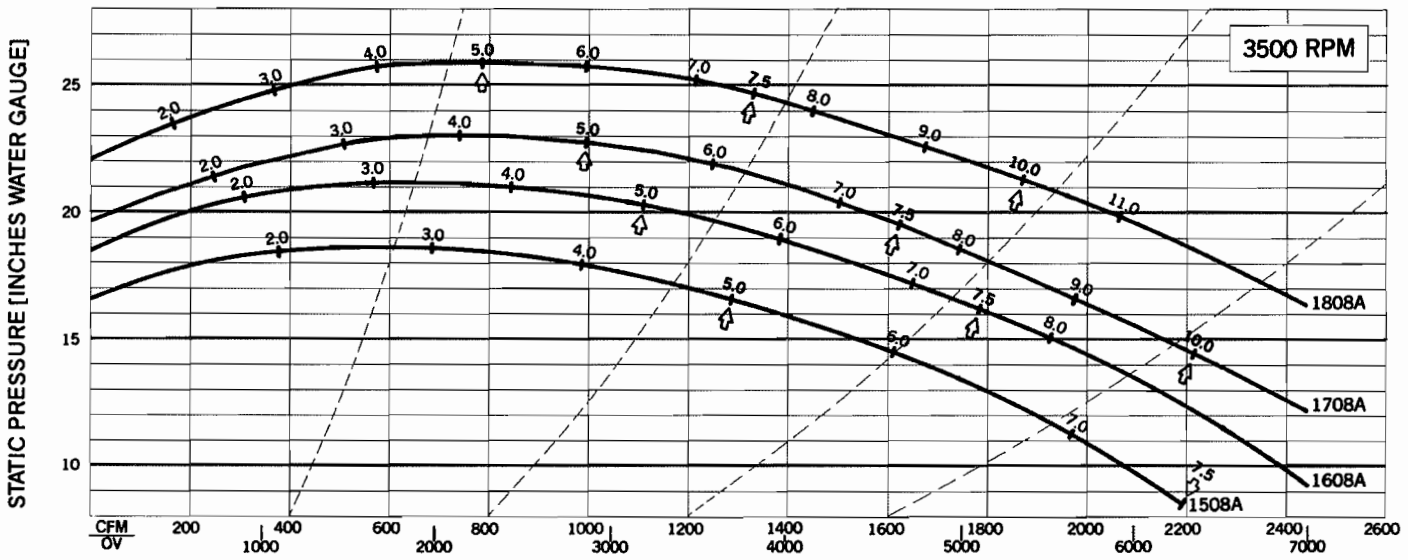

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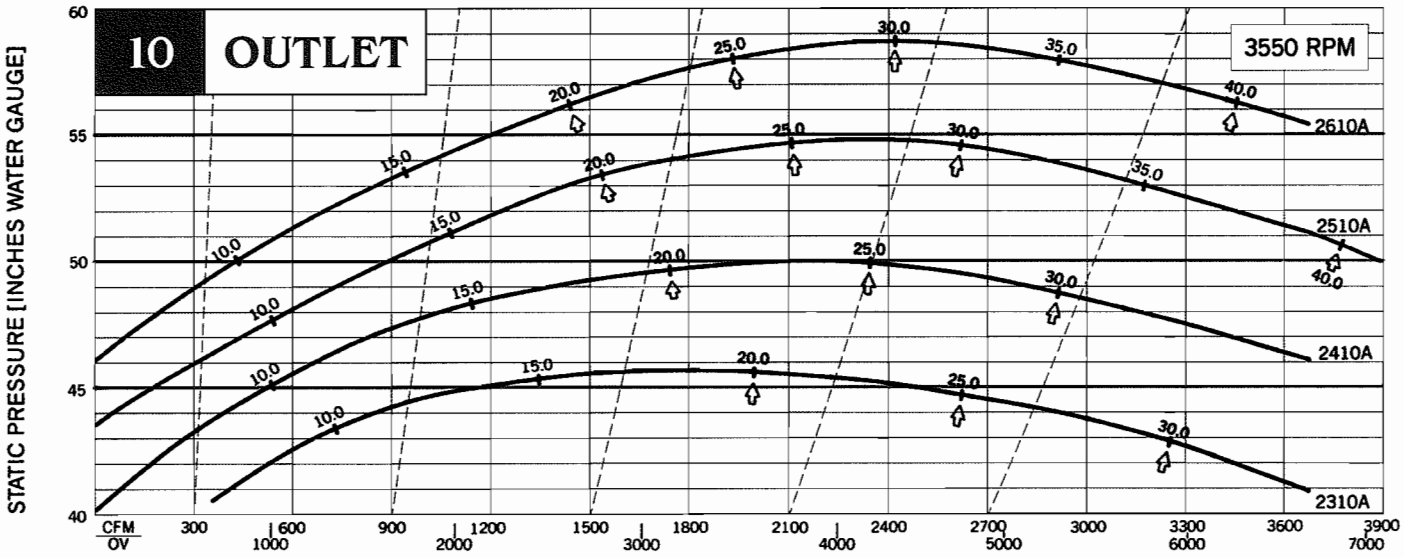
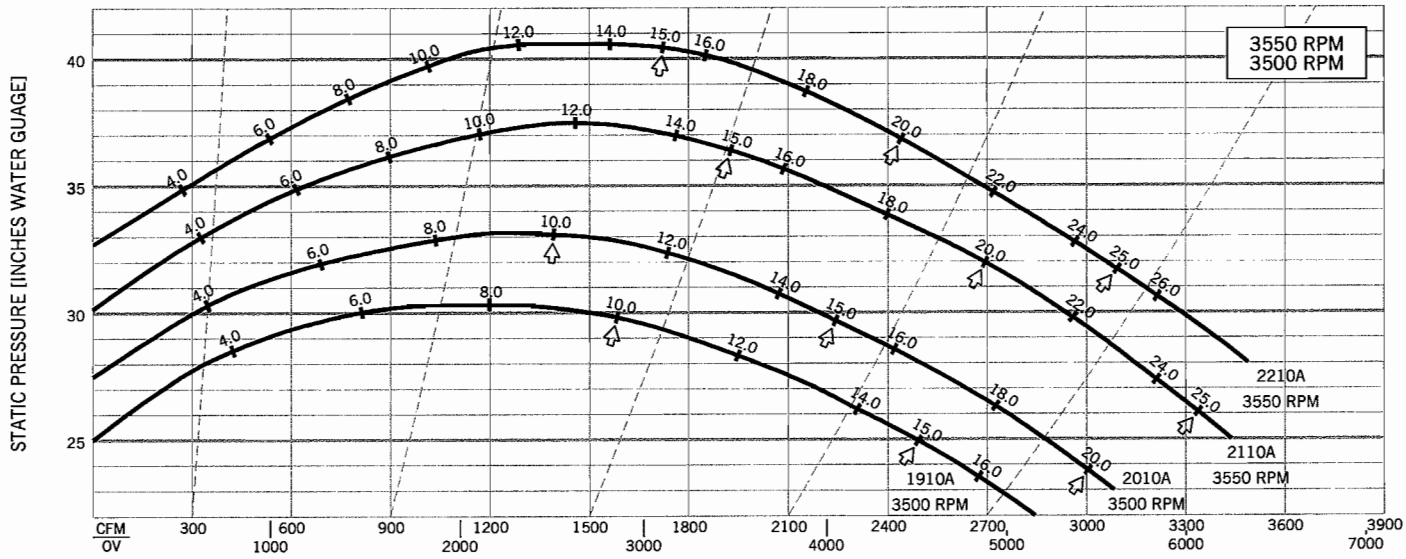
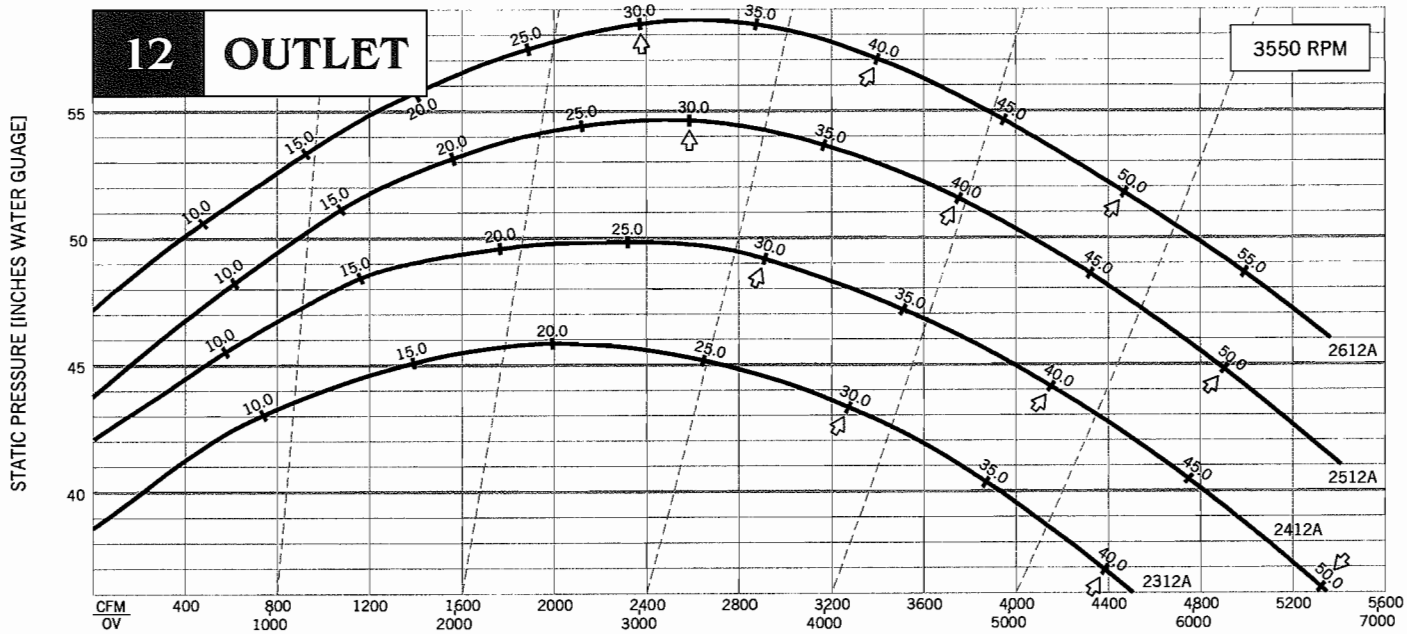






Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses. Performance ratings do not include the effects of appurtenances in airstream.

DIMENSIONS [INCHES]

Dimensions not to be used for construction unless certified.

Wheel dia.	A		C	D	F	G	K	N	S	T			U		V	W	Arr. 10 motor lim.		
	Arr. 8	Arr. 10					Arr. 10	Arr. 10	Arr. 10	Arr. 4	Arr. 8	Arr. 10	Arr. 4	Arr. 8	Arr. 10	Arr. 10	ODP	TEFC	C-NW
14-18	19½	21	13⅜	11¾	14⅜	12¾	3½	22	17⅜	8⅞	9⅛	9⅜	9¾	10	8¼	10¼	215T	215T	16⅝
19-22	23⅜	27⅝	16½	14⅞	17½	15½	4½	26	19⅞	10⅞	10⅞	12¼	11¾	11¾	11	13	256T	254T	18⅝
23-26	26⅝	27⅝	19½	17⅝	20⅝	18¼	4½	26	19⅞	10⅞	10⅞	12¼	11¾	11¾	11	13	256T	254T	18⅝

Wheel dia.	Outlet size	Inlet flange	Motor frame Arr. 4, 8	A Arr. 4	B	H Arrangement 4	H Arrangement 8	H Arrangement 10	JJ	K Arr. 8	L	M	NN Arr. 8	R Arr. 4, 8	R Arr. 10	S Arr. 4	S Arr. 8	Fan weight* Arrangement 4	Fan weight* Arrangement 8	Fan weight* Arrangement 10
14-18	04	6	143-145	17¾	18¼	19	39½	31⅛	5⅝	3⅜	6⅝	3⅜	31⅞	3⅜	4⅜	8⅝	15	145	295	205
			182-184	19		24½	41⅞						33⅜			14⅛	16½	165		
19-22			143-145	23	17¾	25	39⅞	36⅛	6⅛				31⅞		5⅛	14⅛	15	230	395	305
			182-184	24			42½						33⅜				16½			
14-18	06	8	143-145	17¾	18¼	21⅜	41⅞	33½	6¾	3⅜	8⅝	6¼	33	4½	5½	8⅝	15	165	315	210
			182-184	19		26⅞	44⅜						34½			14⅛	16½	185		
			213-215	19¾			47½			2⅞			36¾				18¾	190	320	
19-22		6	143-145	23	17¾	25	39⅞	36⅛	6⅛	3⅜	6⅝	3⅜	31⅞	3⅜	5⅛	14⅛	15	235	395	310
			182-184	24			42½						33⅜				16½	240		
			213-215	24¾			45⅝			2⅞			35⅝				18¾		400	
23-26		8	182-184	24	19	26½	44½	37⅝	7	3⅞	8⅝	5	34⅜	3⅜	5⅝	14⅛	17	290	490	390
			213-215	24¾			47⅝			3¼			36⅝				19¼			
			254-256	26		31⅛	51⅞						42			19½	24⅝	315	510	
15-18	08	8	182-184	19	18¼	26⅞	44⅜	33½	6¾	3⅜	8⅝	6¼	34½	4½	5½	14⅛	16½	190	315	215
			213-215	19¾			47½			2⅞			36¾				18¾		320	
19-22			182-184	24	17¾	26⅞	44⅜	38	6¾	3⅜	8⅝	6¼	34½	4½	6¼	14⅛	16½	260	420	315
			213-215	24¾			47½			2⅞			36¾				18¾		425	
			254-256	26		32¼	51¾						42⅛			19½	24⅛	290	440	
23-26			213-215	24¾	19	26½	47⅝	37⅝	7	3¼	8⅝	5	36⅝	3⅜	5⅝	14⅛	19¼	320	495	400
			254-256	26		31⅞	51⅞						42			19½	24⅝		515	
			284-286	26¾			53						42¾				25⅜			
19-22	10	10	213-215	24¾	21¾	26⅞	47½	38	6¾	2⅞	8⅝	6¼	36¾	4½	6¼	14⅛	18¾	300	430	325
			254-256	26		32¼	51¾						42⅛			19½	24¼		450	
			284-286	26¾			54⅜						42⅞				24⅞			
23-26			254-256	26	23	33¼	53¼	39	7¼	3¼	10¾	7¼	43⅛	5	6¾	19½	24⅝	350	535	405
			284-286	26¾			54⅜						43⅞				25⅜			
			324-326	29¼		37¼	56⅞						46⅜			23½	27⅛	375	540	
23-26	12	12	284-286	28¼	23	37¼	54⅜	39	7¼	3¼	10¾	7¼	43⅞	5	6¾	23½	25⅜	390	550	410
			324-326	29¼			56⅞						46⅜				27⅛			

* Bare fan weight, pounds, is approximate for units with aluminum wheels, less motors. For units with steel wheels, add the difference in wheel weights from the table at left.

Tolerance: ± ⅛″

WHEEL WEIGHTS AND INERTIA [WR²=LBS.–FT.²]

Size	Aluminum Wt.[lbs.]	Aluminum WR²	Steel Wt.[lbs.]	Steel WR²
1404	8.5	1.43	18.0	3.04
1406	11.7	2.4	20.5	3.46
1504	8.75	1.69	19.0	3.68
1506, 1508	11.8	2.4	21.5	4.16
1604	9.0	1.98	20.0	4.41
1606, 1608	12.1	2.5	23.0	5.07
1704	9.25	2.3	21.0	5.22
1706, 1708	12.2	2.6	24.5	6.09
1804	9.5	2.65	22.0	6.13
1806, 1808	12.4	2.6	26.0	7.25
1904, 1906	12.0	3.73	29.5	9.16
1908, 1910	15.1	5.1	34.5	10.72
2004, 2006	12.25	4.22	31.0	10.67
2008, 2010	15.3	5.2	36.5	12.56
2104, 2106	12.5	4.74	32.5	12.33
2108, 2110	15.5	5.3	38.0	14.42
2204, 2206	12.75	5.31	34.0	14.16
2208, 2210	15.6	5.4	40.0	16.66
2306, 2308	18.5	8.42	46.0	20.93
2310, 2312	21.7	10.6	53.5	24.35
2406, 2408	18.75	9.29	48.0	23.79
2410, 2412	21.9	10.8	56.0	27.75
2506, 2508	19.0	10.22	50.0	26.89
2510, 2512	21.9	11.0	58.5	31.46
2606, 2608	19.25	11.2	52.0	30.24
2610, 2612	22.3	11.2	61.0	35.48

MATERIAL SPECIFICATIONS
U. S. STANDARD SHEET GAUGE TO 7 GAUGE

Wheel dia.	Housing: Scroll and sides	Housing: Side plates: Drive	Housing: Side plates: Inlet	Shaft dia. Arrangement: 1, 10	Shaft dia. Arrangement: 8	Bearings Arr. 1: Drive end	Bearings Arr. 1: Inboard	Bearings Arrangement: 8	Bearings Arrangement: 10	Drive key Arrangement: 8	Drive key Arrangement: 10
14-18	10	10	10	1 7/16	1 7/16	A	A	A	A	⅜	⅜
19-22	10	10	10	1 7/16	1 7/16	B	B	A	B	⅜	⅜
23-26	10	10	7	1 11/16	1 7/16	B	C	A	B	⅜	⅜

A–200 Series Ball B–22400 Series Roller C–300 Series Ball Tolerance: ± ⅛″

nyb reserves the right to substitute bearings of equal rating.

FLANGE DIMENSIONS [INCHES]

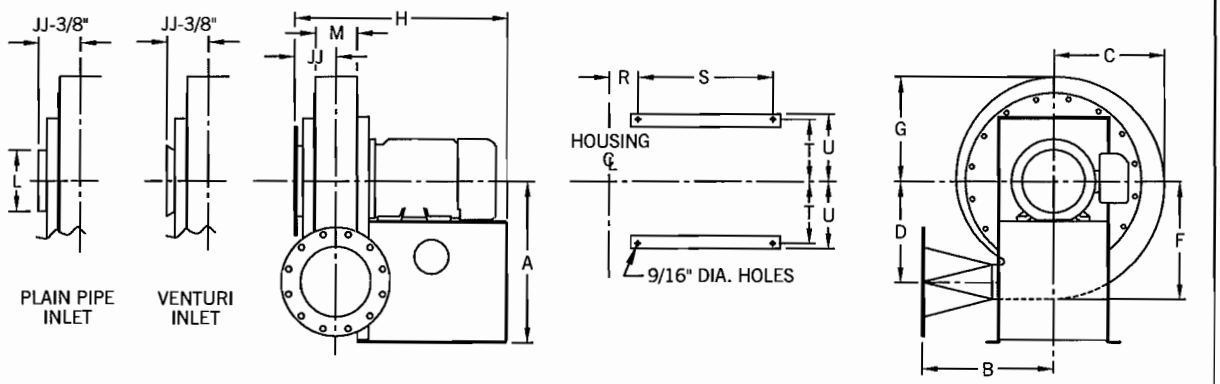
† Holes straddle centerline.
ANSI Class 125/150 hole pattern.
Flange thickness 3/8″

Flange size	I. D.	O. D.	Bolt circle	Holes† No. - Size
04	4	9	7½	8 - ¾″
06	6	11	9½	8 - ⅞″
08	8	13½	11¾	8 - ⅞″
10	10	16	14¼	12 - 1″
12	12	19	17	12 - 1″

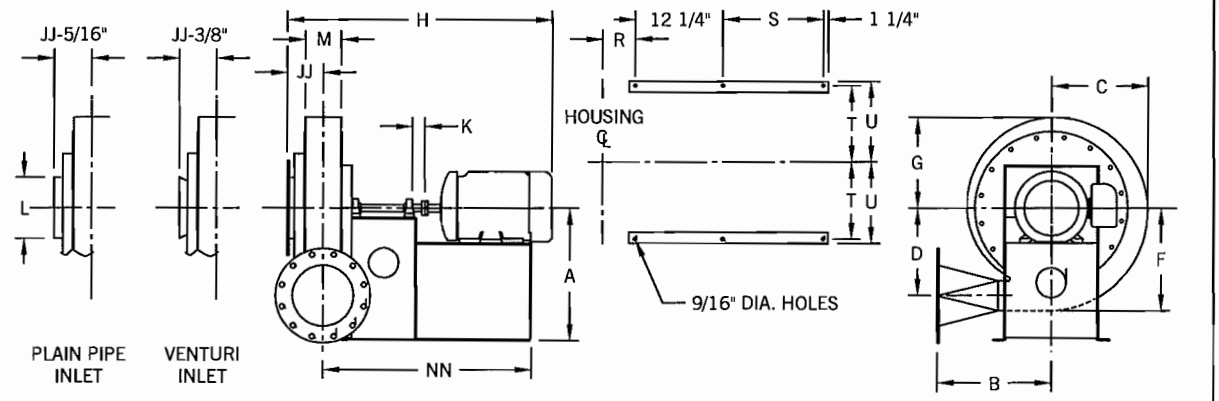
DRAWINGS

Dimensions not to be used for construction unless certified.

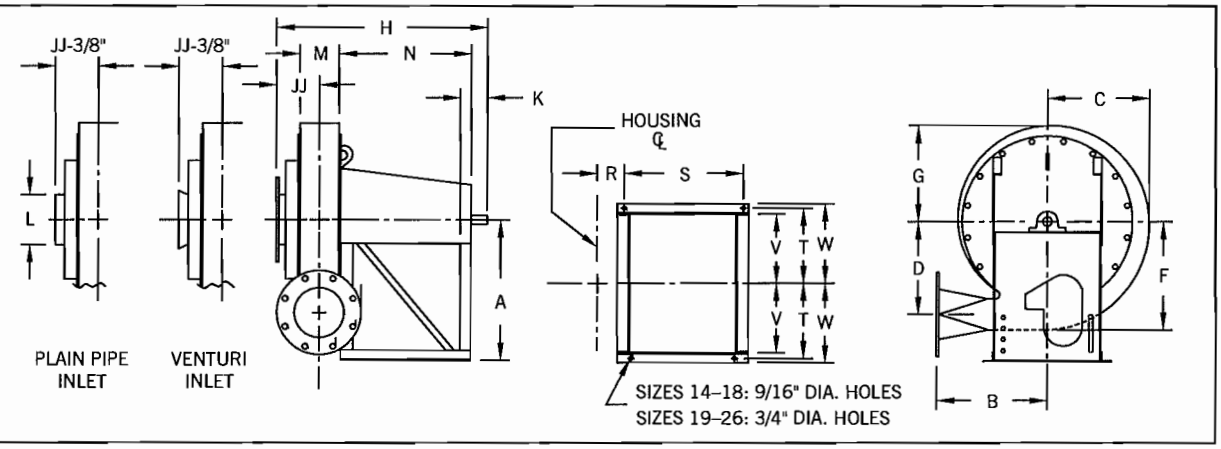
Arrangement 4 PRESSURE BLOWERS



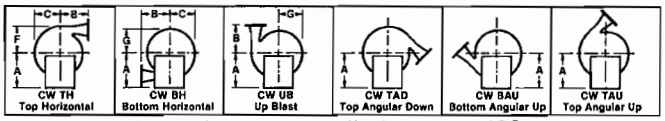
Arrangement 8 PRESSURE BLOWERS



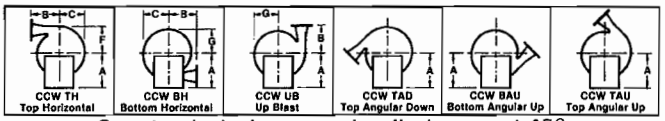
Arrangement 10 PRESSURE BLOWERS



FAN DISCHARGES—VIEWED FROM DRIVE SIDE



Clockwise—angular discharges at 45°



Counterclockwise—angular discharges at 45°

Housings are reversible and rotatable in 22½° increments except Down Blast and Bottom Angular Down which require special construction.
Arrangement 10 fans Sizes 19–22 are not rotatable in the field.

The New York Blower Company has a policy of continuous product development and reserves the right to change designs and specifications without notice.

nyb | The New York Blower Company®
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TEL: (630)794-5700•FAX:(630)794-5776•WEB: http://www.nyb.com•E-MAIL:nyb@nyb.com

INSTALLATION MAINTENANCE, OPERATING INSTRUCTIONS

IM-140

PRESSURE BLOWERS
TYPE HP PRESSURE BLOWERS

⚠ WARNING

THIS FAN HAS MOVING PARTS THAT CAN CAUSE SERIOUS BODILY INJURY. BEFORE OPERATING OR STARTING MAINTENANCE READ THE INSTALLATION AND MAINTENANCE INSTRUCTIONS AND THE AMCA SAFETY PRACTICES MANUAL PROVIDED WITH THIS FAN.

DURING OPERATION

1. KEEP BODY, HANDS, AND FOREIGH OBJECTS AWAY FROM THE INLET, THE OUTLET, AND THE OTHER MOVING PARTS OF THE FAN SUCH AS SHAFTS, BELTS, AND PULLEYS.

2. DO NOT OPERATE AT EXCESSIVE SPEEDS OR TEMPERATURES.

BEFORE STARTING MAINTENANCE WORK:

LOCK POWER SUPPLY IN OFF POSITION AND IMMOBILIZE FAN WHEEL.

98-0250

A WORD ABOUT SAFETY

The above **WARNING** decal appears on all **nyb** fans. Air moving equipment involves electrical wiring, moving parts, sound, and air velocity or pressure which can create safety hazards if the equipment is not properly installed, operated and maintained. To minimize this danger, follow these instructions as well as the additional instructions and warnings on the equipment itself.

All installers, operators and maintenance personnel should study AMCA Publication 410, "Recommended Safety Practices for Air Moving Devices", which is included as part of every shipment. Additional copies can be obtained by writing to New York Blower Company, 7660 Quincy St., Willowbrook, IL 60527.

ELECTRICAL DISCONNECTS

Every motor driven fan should have an independent disconnect switch to isolate the unit from the electrical supply. It should be near the fan and must be capable of being locked by maintenance personnel while servicing the unit, in accordance with OSHA procedures.

MOVING PARTS

All moving parts must have guards to protect personnel. Safety requirements vary, so the number and type of guards needed to meet company, local and OSHA standards must be determined and specified by the user. Never start a fan without having all safety guards installed. Check regularly for damaged or missing guards and do not operate any fan with guards removed. Fans can also become dangerous because of potential "windmilling", even though all electrical power is disconnected. Always block the rotating assembly before working on any moving parts.

SOUND

Some fans can generate sound that could be hazardous to exposed personnel. It is the responsibility of the system designer and user to determine sound levels of the system, the degree of personnel exposure, and to comply with applicable safety requirements to protect personnel from excessive noise. Consult **nyb** for fan sound power level ratings.

AIR PRESSURE AND SUCTION

In addition to the normal dangers of rotating machinery, fans present another hazard from the suction created at the fan inlet. This suction can draw materials into the fan where they become high velocity projectiles at the outlet. It can also be extremely dangerous to persons in close proximity to the inlet, as the forces involved can overcome the strength of most individuals. Inlets and outlets that are not ducted should be screened to prevent entry and discharge of solid objects.

ACCESS DOORS

⚠ DANGER

DO NOT OPEN UNTIL THE POWER SUPPLY HAS BEEN LOCKED OFF AND THE SHAFT HAS STOPPED ROTATING.
FAILURE TO DO THIS CAN RESULT IN SERIOUS BODILY INJURY.

98-0249

The above DANGER decal is placed on all **nyb** cleanout doors. These doors, as well as access doors to the duct system, should never be opened while the fan is in operation. Serious injury could result from the effects of air pressure or suction.

Bolted doors must have the door nuts or fasteners securely tightened to prevent accidental or unauthorized opening.

RECEIVING AND INSPECTION

The fan and accessories should be inspected on receipt for any shipping damage. Turn the wheel by hand to see that it rotates freely and does not bind. If dampers or shutters are provided, check these accessories for free operation of all moving parts.

F.O.B. factory shipping terms require that the receiver be responsible for inspecting the equipment upon arrival. Note damage or shortages on the Bill of Lading and file any claims for damage or loss in transit. **nyb** will assist the customer as much as possible; however, claims must be originated at the point of delivery.

HANDLING AND STORAGE

Fans should be lifted by the base, mounting supports, or lifting eyes only. Never lift a fan by the wheel, shaft, motor, motor bracket, housing inlet, outlet, or any fan part not designed for lifting. A spreader should always be used to avoid damage.

On a direct drive Arrangement 8 fan, lifting holes are provided in the motor base to assist in handling the fan assembly. These lifting holes should be used in conjunction with the lifting eyes when lifting and positioning the fan onto its foundation. A heavy round steel bar or appropriate fixture can be passed through the lifting holes to simplify attachment of the lifting device. Be sure to follow all local safety codes when moving heavy equipment.

Whenever possible, fans and accessories should be stored in a clean, dry location to prevent rust and corrosion of steel components. If outdoor storage is necessary, protection should be provided. Cover the inlet and outlet to prevent the accumulation of dirt and moisture in the housing. Cover motors with waterproof material. Refer to the bearing section for further storage instructions.

Check shutters for free operation and lubricate moving parts prior to storage. Inspect the stored unit periodically. **Rotate the wheel by hand every two weeks to redistribute grease on internal bearing parts.**

FAN INSTALLATION

nyb wheels are dynamically balanced when fabricated. Complete assembled fans are test run at operating speeds to check the entire assembly for conformance to **nyb** vibration limits. Nevertheless, all units must be adequately supported for smooth operation. **Ductwork or stacks should be independently supported as excess weight may distort the fan housing and cause contact between moving parts.** Where vibration isolators are used, consult the **nyb** certified drawing for proper location and adjustment.

Slab-Mounted Units

A correctly designed and level concrete foundation provides the best means of installing floor-mounted fans. The mass of the base must maintain the fan/driver alignment, absorb normal vibration, and resist lateral loads. The overall dimensions of the concrete base should extend at least six inches beyond the base of the fan. The weight of the slab should be two to three times the weight of the rotating assembly, including the motor. The foundation requires firmly anchored fasteners such as the anchor bolts shown in Figure 1.

Move the fan to the mounting location and lower it over the anchor bolts, leveling the fan with shims around the bolts. Fasten the fan securely. When grout is used, shim the fan at least 3/4-inch from the concrete base. (See Figure 1.) When isolation is used, check the **nyb** certified drawing for installation instructions.

Elevated Units

When an elevated or suspended structural steel platform is used, it must have sufficient bracing to support the unit load and prevent side sway. The platform should be of welded construction to maintain permanent alignment of all members.

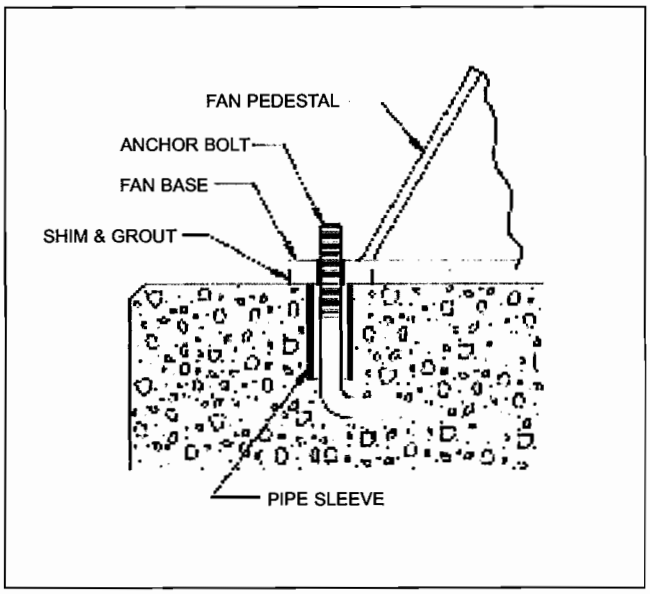


Figure 1

V-BELT DRIVE

Installation

1. Remove all foreign material from the fan and motor shafts. Coat shafts with machine oil for easier mounting. Mount the belt guard backplate at this time if partial installation is required prior to sheave mounting.
2. Mount sheaves on shafts after checking sheave bores and bushings for nicks or burrs. Avoid using force. If resistance is encountered, lightly polish the shaft with emery cloth until the sheave slides on freely. Tighten tapered bushing bolts sequentially so that equal torque is applied to each.
3. Adjust the motor on its base to a position closest to the fan shaft. Install belts by working each one over the sheave grooves until all are in position. Never pry the belts into place. On **nyb** packaged fans, sufficient motor adjustment is provided for easy installation of the proper size belts.
4. Adjust sheaves and the motor shaft angle so that the sheave faces are in the same plane. Check this by placing a straightedge across the face of the sheaves. Any gap between the edge and sheave faces indicates misalignment. Important: This method is only valid when the width of the surface between the belt edge and the sheave face is the same for both sheaves. When they are not equal, or when using adjustable-pitch sheaves, adjust so that all belts have approximately equal tension. Both shafts should be at the right angles to the center belt.

Belt Tensioning

1. Check belt tension with a tensioning gage and adjust using the motor slide base. Excess tension shortens bearing life while insufficient tension shortens belt life, can reduce fan performance and may cause vibration. The lowest allowable tension is that which prevents slippage under full load. Belts may slip during start-up, but slipping should stop as soon as the fan reaches full speed. For more precise tensioning methods, consult the drive manufacturer's literature.
2. Recheck setscrews, rotate the drive by hand and check for rubbing, then complete the installation of the belt guard.

3. Belts tend to stretch somewhat after installation. Recheck tension after several days of operation. Check sheave alignment as well as setscrew and/or bushing bolt tightness.

COUPLING

Coupling alignment should be checked after installation and prior to start up. Alignment is set at the factory, but shipping, handling, and installation can cause misalignment. Also check for proper coupling lubrication. For details on lubrication and for alignment tolerances on the particular coupling supplied, see the manufacturer's installation and maintenance supplement in the shipping envelope.

Installation

Most **nyb** fans are shipped with the coupling installed. In cases where the drive is assembled after shipping, install the coupling as follows:

1. Remove all foreign material from fan and motor shafts and coat with machine oil for easy mounting of coupling halves.
2. Mount the coupling halves on each shaft, setting the gap between the faces specified by the manufacturer. Avoid using force. If mounting difficulty is encountered, lightly polish the shaft with emery cloth until the halves slide on freely.

Alignment

1. Align the coupling to within the manufacturer's limits for parallel and angular misalignment (see Figure 2). A dial indicator or laser can also be used for alignment where greater precision is desired. Adjustments should be made by moving the motor to change shaft angle, and by the use of foot shims to change motor shaft height. Do not move the fan shaft or bearing.
2. When correctly aligned, install the flexible element and tighten all fasteners in the coupling and motor base. Lubricate the coupling if necessary.
3. Recheck alignment and gap after a short period of operation, and recheck the tightness of all fasteners in the coupling assembly.

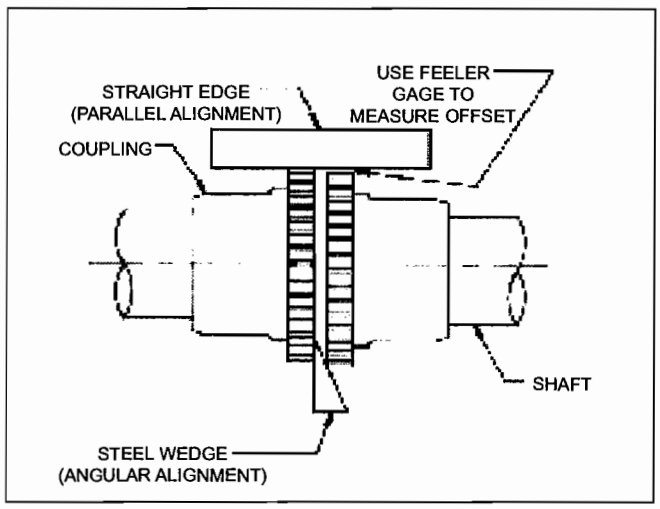


Figure 2

START-UP

Safe operation and maintenance includes the selection and use of appropriate safety accessories for the specific installation. This is the responsibility of the system designer and requires consideration of equipment location and accessibility as well as adjacent components. All safety accessories must be installed properly prior to start-up.

Safe operating speed is a function of system temperature and wheel design. Do not under any circumstances exceed the maximum safe fan speed published in the **nyb** engineering supplement, which is available from your **nyb** field sales representative.

⚠ CAUTION

BEFORE INITIAL OPERATION:

1. **TIGHTEN ALL SET SCREWS IN FAN WHEEL.**
2. **TIGHTEN ALL SET SCREWS IN BEARINGS.**
3. **REPEAT AFTER 8 HOURS OF OPERATION.**
4. **REPEAT AGAIN AFTER TWO WEEKS OPERATION.**

98-0271

Procedure

1. If the drive components are not supplied by **nyb**, verify with the manufacturer that the starting torque is adequate for the speed and inertia of the fan.
2. Inspect the installation prior to starting the fan. Check for any loose items or debris that could be drawn into the fan or dislodged by the fan discharge. Check the interior of the fan as well. Turn the wheel by hand to check for binding.
3. Check drive installation and belt tension.
4. Check the tightness of all setscrews, nuts and bolts. When furnished, tighten hub setscrews with the wheel oriented so that the setscrew is positioned underneath the shaft.
5. Install all remaining safety devices and guards. Verify that the supply voltage is correct and wire the motor. "Bump" the starter to check for proper wheel rotation.
6. Use extreme caution when testing the fan with ducting disconnected. Apply power and check for unusual sounds or excessive vibration. If either exists, see the section on Common Fan Problems. To avoid motor overload, do not run the fan for more than a few seconds if ductwork is not fully installed. On larger fans, normal operating speed may not be obtained without motor overload unless ductwork is attached. Check for correct fan speed and complete installation. Ductwork and guards must be fully installed for safety.
7. Setscrews should be rechecked after a few minutes, eight hours and two weeks of operation (see Tables 1 & 2 for correct tightening torques).

NOTE: Shut the fan down immediately if there is any sudden increase in fan vibration.

Table 1 - WHEEL SETSCREW TORQUES

Setscrew Size Diameter (in.)	Carbon Steel Setscrew Torque*	
	lb.-in.	lb.-ft.
1/2	600	50
5/8	--	97
3/4	--	168

*** Stainless Steel setscrews are not hardened and should not be tightened to more than 1/2 the values shown.**

Table 2 - BEARING SETSCREW TORQUE, lb.-in.

Setscrew Diameter	Manufacturer				
	Link-Belt	Sealmaster	SKF	McGill	Dodge
1/4	90	65	50	85	--
5/16	185	125	165	165	160

Note: Split pillow block bearings are fixed to the shaft with tapered sleeves and generally do not have setscrews.

FAN MAINTENANCE

nyb fans are manufactured to high standards with quality materials and components. Proper maintenance will ensure a long and trouble-free service life.

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

The key to good fan maintenance is regular and systematic inspection of all fan parts. Inspection frequency is determined by the severity of the application and local conditions. Strict adherence to an inspection schedule is essential.

Regular fan maintenance should include the following:

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards. Clean or replace the wheel as required.
2. Check the V-belt drive for proper alignment and tension (see section on V-belt drives). If belts are worn, replace them as a set, matched to within manufacturer's tolerances. Lubricate the coupling of direct-drive units and check for alignment (see section on couplings).
3. Lubricate the bearings, but do not over lubricate (see the bearing section for detailed specifications).
4. Ceramic-felt shaft seals require no maintenance, although worn seals should be replaced. When lip-type shaft seals are provided, lubricate them with "NEVER-SEEZ" or other anti-seize compound.
5. During any routine maintenance, all setscrews and bolts should be checked for tightness. See the table for correct torques.
6. When installing a new wheel, the proper wheel-to-inlet clearance must be maintained (see Figure 3).

WHEEL BALANCE

Airstreams containing particulate or chemicals can cause abrasion or corrosion of the fan parts. This wear is often uneven and can lead to significant wheel unbalance over time. When such wear is discovered, a decision must be made as to whether to rebalance or replace the wheel.

The soundness of all parts should be determined if the original thickness of components is reduced. Be sure there is no hidden structural damage. The airstream components should also be cleaned to remove any build-up of foreign material. Specialized equipment can be used to rebalance a cleaned wheel that is considered structurally sound.

Balance weights should be rigidly attached at a point that will not interfere with the housing nor disrupt airflow. Remember that centrifugal forces can be extremely high at the outer radius of a fan wheel. Welding is the preferred method of balance weight attachment. Be sure to ground the welder directly to the fan wheel. Otherwise, the welding current could pass through the fan bearings and damage them.

WHEEL-INLET CLEARANCE

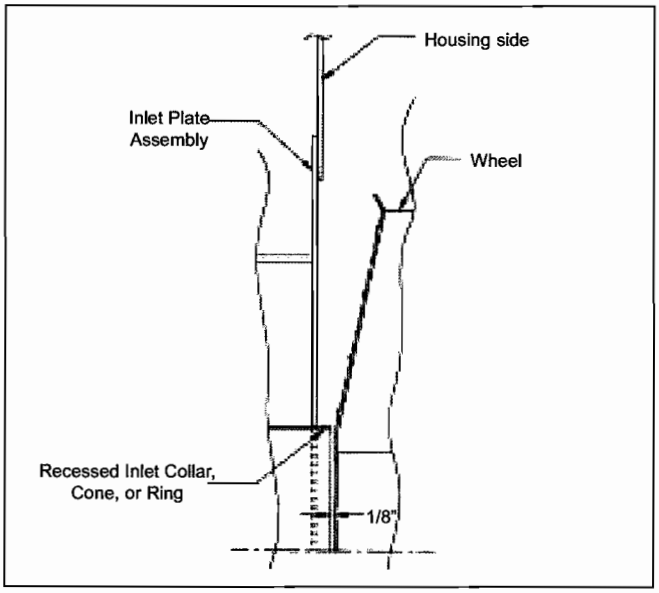


Figure 3

BEARINGS

Storage

Any stored bearing can be damaged by condensation caused by temperature variations. Therefore, **nyb** fan bearings are filled with grease at the factory to exclude air and moisture. Such protection is adequate for shipment and subsequent immediate installation.

For long term or outdoor storage, mounted bearings should be regreased and wrapped with plastic for protection. **Rotate the fan wheel by hand at least every two weeks to redistribute grease on internal bearing parts.** Each month the bearings should be purged with new grease to remove condensation, since even a filled bearing can accumulate moisture. Use caution when purging, as excessive pressure can damage the seals. Rotate the shaft while slowly adding grease.

Operation

Check the setscrew torque before start-up (see table for correct values). Since bearings are completely filled with grease at the factory, they may run at an elevated temperature during initial operation. Surface temperatures may reach 180°F. and grease may bleed from the bearing seals. This is normal and no attempt should be made to replace lost grease. Bearing surface temperatures will decrease when the internal grease quantity reaches a normal operating level. Relubrication should follow the recommended schedule.

Lubrication

Use the table for relubrication scheduling according to operating speed and shaft diameter. Bearings should be lubricated with a premium quality lithium-based grease conforming to NLGI Grade 2. Examples are:

Mobil	-	Mobilith AW2	Chevron	-	Amolith #2
Texaco	-	Premium RB	Shell	-	Alvania #2

These greases are for bearing surface temperatures of 40°F. to 180°F. For surface temperatures of 181°F. to 230°F. use Mobilith SHC220.

Do not use "high temperature" greases, as many are not formulated to be compatible with fan bearings.

Add grease to the bearing while running the fan or rotating the shaft by hand. Be sure all guards are in place if lubrication is performed while the fan is operating. Add just enough grease to cause a slight purging at the seals. Except on split pillowblocks. Completely filled bearings will run hotter until a sufficient amount of grease is purged out of the seals.

Split pillowblock bearings (Link-Belt P-LB6800 & P-LB6900, SKF SAF 22500, Dodge SAF-XT) should be cleaned and repacked at approximately every eighth lubrication interval. This requires removal of the bearing cap. Clean out old grease and repack the bearing with fresh grease. Pack the bearing fully and fill the housing reservoir to the bottom of the shaft on both sides of the bearing. Replace the bearing cap, being careful not to mix caps as they are not interchangeable from one bearing to another. **Do not over lubricate.**

BEARING LUBRICATION INTERVAL [months]

RPM / Shaft	1 - 500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000	3001-3500	3501-4000
1 7/16	6 / 6	6 / 4	5-6 / 4	4-6 / 2	4-6 / 2	3-5 / 1	2-4 / 1	2-4 / 1
1 11/16	6 / 6	6 / 4	4-6 / 2	4-6 / 1	2-4 / 1	2-4 / 1	2 / 1-2	1-2 / 1-2
2 3/16			6	4-6	4	2-4	2	--
2 7/16			6	4-6	4	2-4	2	--
2 15/16			4-6	4-6	2-4	2	1-2	--

Ball Bearings & Split Split Pillowblock → / ← Non- Split Pillowblock Spherical Roller Bearings
Spherical Roler Bearings

NOTE:

1. **These are general recommendations only; specific manufacturer's recommendations may vary slightly.**
2. **Assumes clean environment, -20°F. to 120°F.**
   a. **Consult The New York Blower Company for operation below -20°F. ambient.**
   b. **Ambient temperatures greater than 120°F. will shorten bearing life.**
   c. **Under extremely dirty conditions, lubricate more frequently.**
3. **Assumes horizontal mounting configuration. For vertically mounted applications, lubricate twice as frequently.**

COMMON FAN PROBLEMS

Excessive Vibration

A common complaint regarding industrial fans is "excessive vibration". **nyb** is careful to ensure that each unit is precisely balanced prior to shipment; however, there are many other causes of vibration including:

1. Loose mounting bolts, setscrews, bearings or couplings.
2. Misalignment or excessive wear of couplings or bearings.
3. Misaligned or unbalanced motor.
4. Bent shaft due to mishandling or material impact.
5. Accumulation of foreign material on the wheel.
6. Excessive wear or erosion of the wheel.
7. Excessive system pressure or restriction of airflow due to closed dampers.
8. Inadequate structural support, mounting procedures or materials.
9. Externally transmitted vibration.

Inadequate Performance

1. Incorrect testing procedures or calculations.
2. Fan running too slowly.
3. Fan wheel rotating in wrong direction or installed backwards on shaft.
4. Wheel not properly centered relative to inlet cone.
5. Damaged or incorrectly installed cut off sheet or diverter.
6. Poor system design, closed dampers, air leaks, clogged filters, or coils.
7. Obstructions or sharp elbows near inlets.
8. Sharp deflection of airstream at fan outlet.

Excessive Noise

1. Fan operating near "stall" due to incorrect system design or installation.
2. Vibration originating elsewhere in the system.
3. System resonance or pulsation.
4. Improper location or orientation of fan intake and discharge.
5. Inadequate or faulty design of supporting structures.
6. Nearby sound reflecting surfaces.
7. Loose accessories or components.
8. Loose drive belts.
9. Worn bearings.

Premature Component Failure

1. Prolonged or major vibration.
2. Inadequate or improper maintenance.
3. Abrasive or corrosive elements in the airstream or surrounding environment.
4. Misalignment or physical damage to rotating components or bearings.
5. Bearing failure from incorrect or contaminated lubricant or grounding through the bearings while arc welding.
6. Excessive fan speed.
7. Extreme ambient or airstream temperatures.
8. Improper belt tension.
9. Improper tightening of wheel setscrews.

REPLACEMENT PARTS

It is recommended that only factory-supplied replacement parts be used. **nyb** fan parts are built to be fully compatible with the original fan, using specific alloys and tolerances. These parts carry a standard **nyb** warranty.

When ordering replacement parts, specify the part name, **nyb** shop and control number, fan size, type, rotation (viewed from drive end), arrangement and bearing size or bore. Most of this information is on the metal nameplate attached to the fan base.

For assistance in selecting replacement parts, contact your local **nyb** representative or visit: http://www.nyb.com.

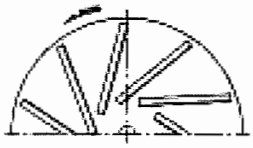
Example: Part required: Wheel/shaft assembly
Shop/control number: B-10106-100
Fan description: Size 2206A10 Pressure Blower
Rotation: Clockwise
Arrangement: 4

Suggested replacement parts include:

Wheel	Component parts: Damper
Shaft [1]	Motor
Bearings*	Coupling*
Shaft Seal*	Sheaves*
	V-Belts*

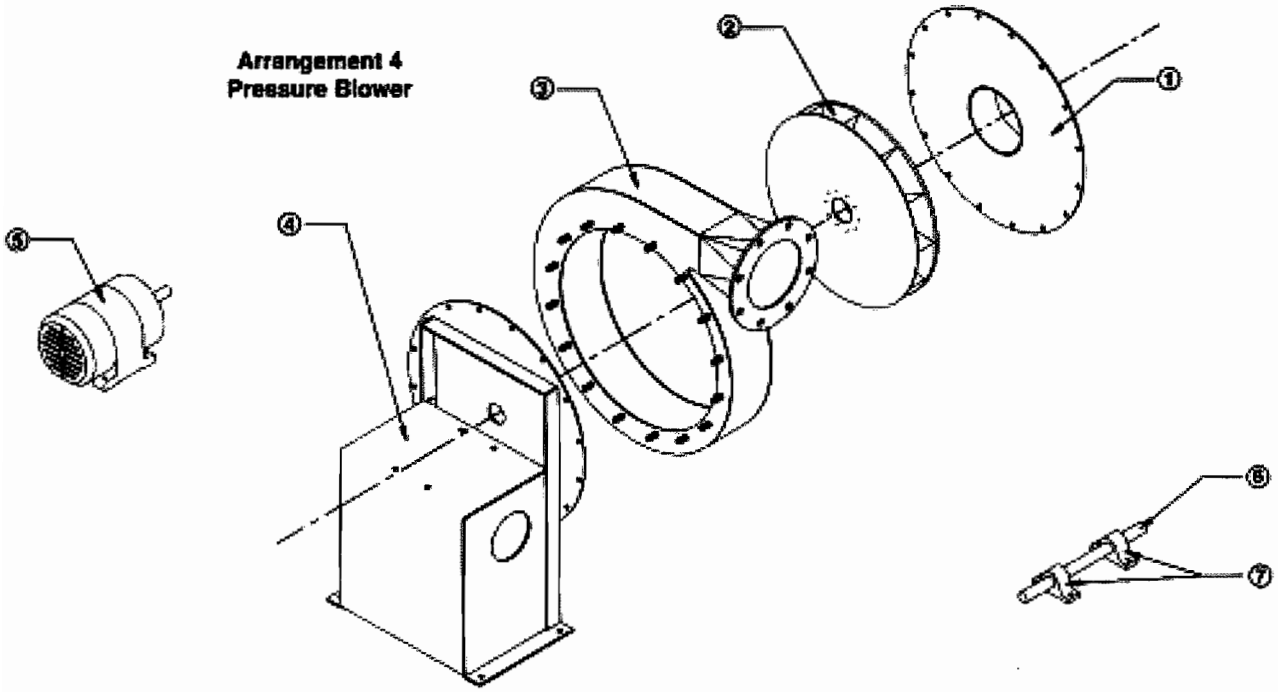
[1] For Arrangement 1/8 fan only.

SPECIFY ROTATION AS VIEWED FROM DRIVE SIDE

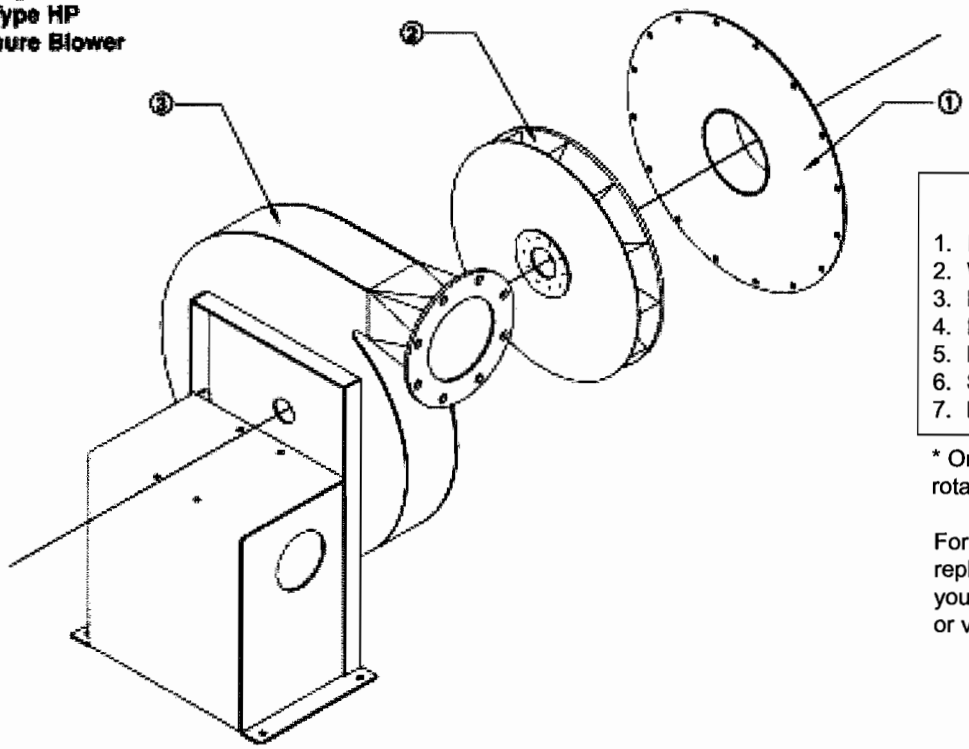


ARROW INDICATES COUNTER CLOCKWISE ROTATION

Arrangement 4
Pressure Blower



Arrangement 4
Type HP
Pressure Blower



Parts List

1. Inlet Plate Assembly
2. Wheel*
3. Housing*
4. Pedestal Assembly
5. Motor
6. Shaft
7. Bearings

* Order for parts must specify rotation.

For assistance in selecting replacement parts, contact your local **nyb** representative or visit: http://www.nyb.com.

Form 402
Printed in U.S.A.

General Information

- Overview
- Specifications
- Performance Data
- Parts List
- Drawings

More Information

- Where To Buy
- Baldor Sales Offices

| Return to List

AC Motors | 200 & 575 Volt |

Performance Data: EM4106T-8

Create PDF (Note: Please disable any browser popup blockers.)

Product Number Data

Rated Output	20 HP	Hertz	60	NEMA Nom. Eff.	91
Volts	200	Phase	3	Power Factor	90
Full Load Amps	52	NEMA Design Code	B	Service Factor	1.15
Speed	3510	LR KVA Code	G	Rating - Duty	40C AMB-CONT

(Typical performance - Not guaranteed values)

General Characteristics at 200 V, 60 Hz, 20 HP

Full Load Torque	29.9 LB-FT	Starting Current	347 Amps
Start Configuration	DOL	No-Load Current	14.1 Amps
Break Down Torque	86.3 LB-FT	Line-line Resistance @ 25° C	0.108 Ohms
Pull-Up Torque	41.5 LB-FT	Temperature Rise, C @ FL (in deg)	67
Locked-Roter Torque	48.6 LB-FT	Temp. Rise @ S.F. Load (in deg)	85

Load Characteristics at 200 V, 60 Hz, 20 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	60	80	87	90	90	89	90
Efficiency	88.1	92.1	92.1	91.4	90.1	89	90.6
Speed (rpm)	3579	3557	3536	3512	3486	3458	3496
Line Amperes	20.4	29.5	40.7	52.3	66.2	81.1	60.6

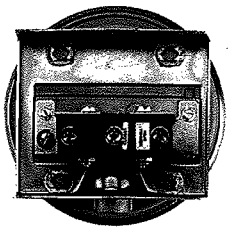
* For certified information, contact your local Baldor office.

Series 1800

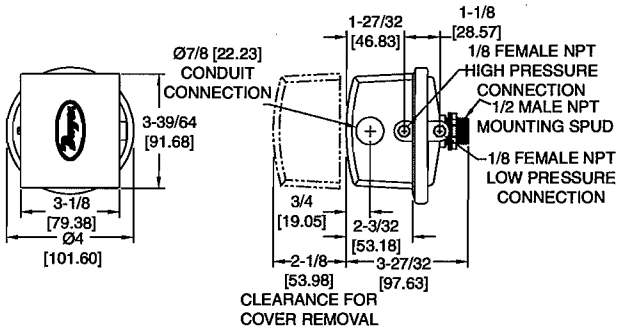
Low Differential Pressure Switches for General Industrial Service

Set points from 0.07" to 85" W.C. Repetitive accuracy within 2%.

Model 1823 pressure switch. UL and CSA Listed, FM approved.



Series 1823 pressure switch. Conduit enclosure removed to show electric switch.



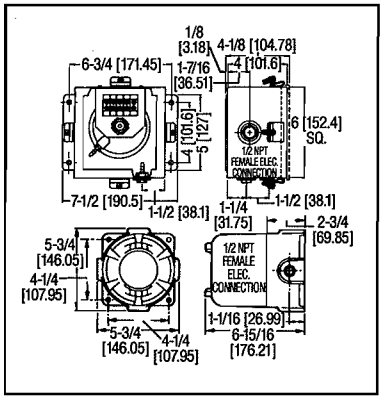
Construction and dimensions. Series 1823 pressure switches.

Essential for industrial environments, the Series 1800 combines small size and low price with 2% repeatability for enough accuracy for all but the most demanding applications. Set point adjustment inside the mounting stud permits mounting switch on one side of a wall or panel with adjustment easily accessible on the opposite side. UL and CSA listed, FM and CENELEC approved.

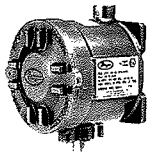
SPECIAL MODELS AVAILABLE

Weatherproof Housing
16 ga. steel enclosure with gasketed cover (NEMA 4) for wet or oily conditions. Withstands 200 hour salt spray test. Wt. 5¼ lbs. (2.5 kg). Switch must be factory installed. Change 1823 base number to 1824 and add -WP suffix.
Example: 1824-1 -WP

Explosion-Proof Housing
Cast iron base with aluminum cover. Rated Class I, Div. 1 & 2, Groups C, D; Class II, Div. 1 & 2, Groups E, F, G; Class III and NEMA 7 CD, 9 EFG. Wt. 7½ lbs. (3.4kg). Switch must be factory installed. Change base number to 1824 and add -EXPL suffix.
Example: 1824-1-EXPL



CENELEC Approved Housing. Cast iron base with brass cover. Explosion-proof housing, Cenelec approved, EExd and NEMA-7&9 rated; Change base number to 1824 and add -CN suffix.
Example: 1824-1-CN



MIL Environmental Construction — Unlisted Model 1820 can be furnished with a special sealed snap switch for protection against high humidity, fungus and/or military applications. Similar to Model 1823 except dead band is slightly greater and some lower setpoints may not be possible. To order, add suffix -MIL.
Example: 1820-2-MIL.

No. A-389 Mounting bracket is 16 ga. steel, zinc plated and dichromate dipped for corrosion resistance. Provides rugged, permanent mounting and speeds installation.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.

Wetted Materials: Consult Factory.

Temperature limits: -30 to 180°F (-34 to 82.2°C). 1823-00, -20 to 180°F (-28.9 to 82.2°C).

Pressure Limits: 10 psig (68.95 kPa) continuous, 25 psig (172.4 kPa) surge.

Switch Type: Single-pole double-throw (SPDT).

Repeatability: ±2%.

Electrical Rating: 15 A @ 120-480 VAC, 60 Hz. Resistive 1/8 HP @125 VAC, 1/4 HP @ 250 VAC, 60 Hz. De-rate to 10 A for operation at high cycle rates.

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 inside mounting spud.

Weight: 1 lb., 5 oz. (595g).

Agency Approvals: CE , UL, CSA, Cenelec, FM.

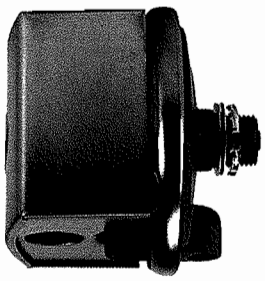
CAUTION: FOR USE ONLY WITH AIR OR COMPATIBLE GASES.

SERIES 1823 SWITCHES — STOCKED MODELS OPERATING RANGES, DEADBANDS & PRICES

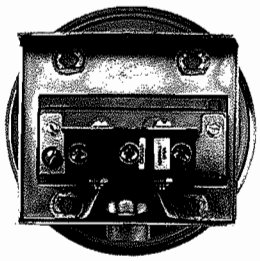
Model Number	Operating Range, Inches W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1823-00	0.07 to 0.22	0.05	0.05
1823-0	0.15 to 0.5	0.06	0.06
1823-1	0.3 to 1.0	0.08	0.08
1823-2	0.5 to 2.0	0.10	0.12
1823-5	1.5 to 5.0	0.14	0.28
1823-10	2.0 to10	0.18	0.45
1823-20	3 to 22	0.35	0.70
1823-40	5 to 44	0.56	1.10
1823-80	9 to 85	1.30	3.0

Series 1800 Low Differential Pressure Switches for General Industrial Service

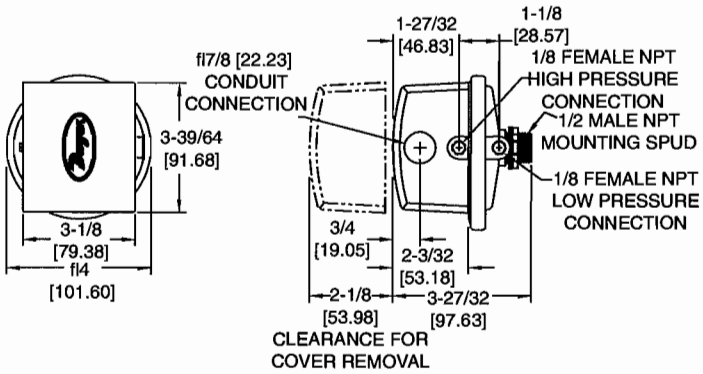
Specifications — Installation and Operating Instructions



Model 1823 pressure switch. UL and CSA Listed, FM and CENELEC approved.



Series 1823 pressure switch. Conduit enclosure removed to show electric switch.



Construction and dimensions. Series 1823 pressure switches.

One of our most popular pressure switches. Combines small size and low price with 2% repeatability for enough accuracy for all but the most demanding applications. Set point adjustment inside the mounting switch on one side of a wall or panel with adjustment easily accessible on the opposite side.

***Model 1823 shown; (1823 replaces 1820, 1821 and 1822 which are similar).**

Environmental (MIL) Switch

Unlisted Model 1820 can be furnished with special snap switch sealed against the environment for high humidity and/or for government applications. Similar to standard Model 1823 except dead band is slightly greater. Specify Model 1820 (Range No.) "MIL" in ordering.

SERIES 1823 SWITCHES — OPERATING RANGES & DEADBANDS

Model Number	Operating Range, Inches W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1823-00	0.07 to 0.22	0.05	0.05
1823-0	0.15 to 0.5	0.06	0.06
1823-1	0.3 to 1.0	0.08	0.08
1823-2	0.5 to 2.0	0.10	0.12
1823-5	1.5 to 5.0	0.14	0.28
1823-10	2.0 to10	0.18	0.45
1823-20	3 to 22	0.35	0.70
→ 1823-40	5 to 44	0.56	1.10
1823-80	9 to 85	1.30	3.0

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.

Wetted Materials: Consult Factory.

Temperature Limits: -30 to 180°F (-34 to 82.2°C). 1823-00, -20 to 180°F (-28.9 to 82.2°C).

Pressure Limits: 10 psig (68.95 kPa) continuous, 25 psig (172.4 kPa) surge.

Switch Type: Single-pole double-throw (SPDT).

Repeatability: ±2%.

Electrical Rating: 15 A @ 120-480 VAC, 60 Hz. Resistive 1/8 HP @125 VAC, 1/4 HP @ 250 VAC, 60 Hz. De-rate to 10 A for operation at high cycle rates.

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 inside mounting spud.

Weight: 1 lb, 5 oz (595 g).

Agency Approvals: CE, UL, CSA, FM.

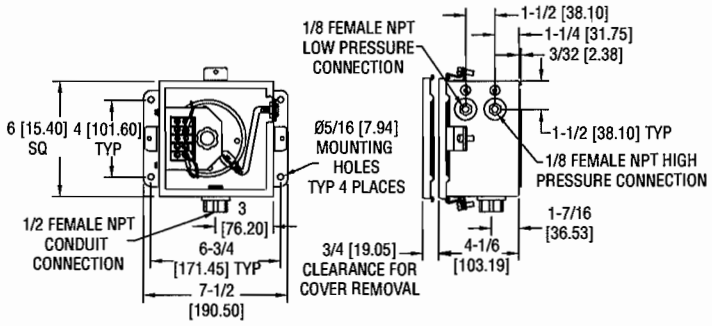
DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

INSTALLATION

1. Select a location free form excessive vibration and where oil or water will not drip upon the switch. See special housings for unusual conditions.
2. **While not required, positioning the pressure connections down is recommended.** Mount the switch with the diaphragm in a vertical plane. Switch with the diaphragm in a vertical plane. Switch must be recalibrated for each change in operating position.
3. Connect switch to source of pressure differential. Metal tubing with 1/4" O.D. is recommended but any tubing system which will not restrict the air flow is satisfactory. Note that the low pressure connection may be made to the 1/2" spud at the back of the switch if desired. If so connected, drill 1/16" diameter holes in the Spring Retainer flange and the head of Adjustment Screw to provide opening to the switch interior and plug the other low pressure connection.
4. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common", "norm open", and "norm closed". The normally open contacts close and the normally closed contact open when pressure increases beyond the set point.
5. Switch loads should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with high load inductance or rapid cycle rates. whenever and 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 prolonged switch life.

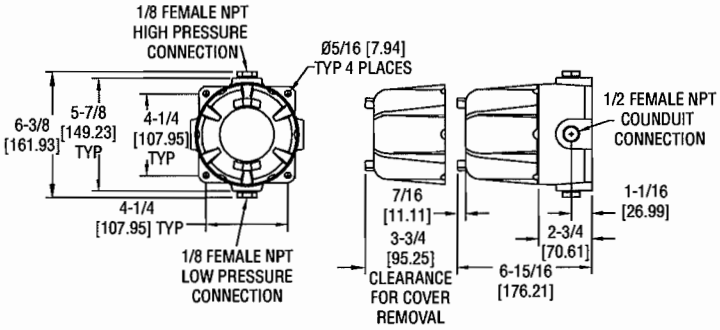
ADJUSTMENT

1. If the switch has been factory preset, check the set-point before placing in service to assure it has not shifted in transit.
2. If switching has not been preset or it is desired to change the point, observe the following procedure:
   a. To adjust the set point turn the slotted Adjustment Screw clockwise to increase the set point and counterclockwise to decrease the set point.
   b. The following is a recommended procedure for calibrating or checking calibration: 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 slowly. Note the manometer and pressure switch will have different response characteristics due to different internal volumes, lengths of tubing, oil drainage, etc. Be certain switch is checked in position it will assume in use, i.e. vertical, horizontal, etc.



Weatherproof Enclosure

16 ga. steel enclosure for unusually wet or oily conditions. Withstands 200 hour salt spray test. Gasketed cover. Weight 5-1/2 lb (2.5 kg). Switch must be installed at factory. Specify "WP" in addition to switch catalog number.



Explosion-Proof Housing

Cast iron base and aluminum dome cover. Approximate weight 7-1/2 lb (3.4 kg). Specify "EXPL" in addition to switch catalog number.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.

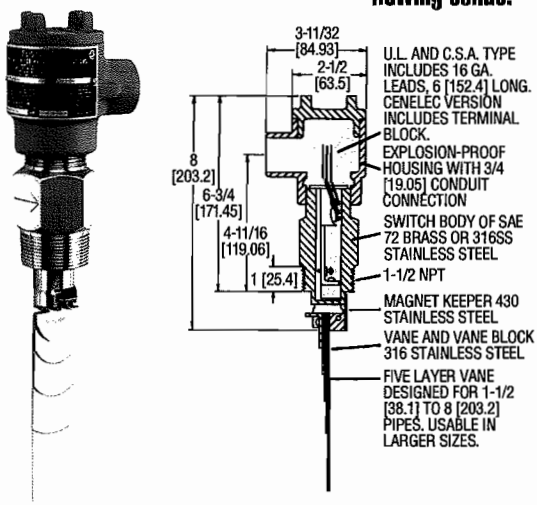
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

Flow

Series V4

FLOTECT® Vane Operated Flow Switch

Field adjustable — Dependable protection against flow variation or stopping in pipelines for fluids, gases and flowing solids.



Rugged and reliable the Flotect V4 flow switch operates automatically to protect equipment and pipeline systems agaist damage from reduction or loss of flow. The V4 is time tested being installed in thousands of pipelines and processing plants around the world. A unique magnetically actuated switching design gives superior performance. There are no bellows, springs, or seals to fail. Instead, a free-swinging vane attracts a magnet within the solid metal switch body, actuating a snap switch by means of a simple lever arm.

FEATURES

- Leak proof body machined from bar stock
- Choice of custom vane calibrated for your application, Model V4, or field adjustable multilayer vane, Model V4-2-U (see set point chart)
- Weatherproof, designed to meet NEMA 4
- Explosion-proof (listing included in specifications)
- Installs directly and easily into pipeline with a thredolet, tee, or flange (see application drawings)
- Can be used in pipes 1-1/2˝ and up
- Electrical assembly can be easily replaced without removing the unit from installation so that the process does not have to be shut down
- High pressure rating of 1000 psig (69 bar) with the brass body and 2000 psig (138 bar) with the 316 SS body

APPLICATIONS

- Protects pumps, motors and other equipment against low or no flow
- Controls sequential operation of pumps
- Automatically starts auxillary pumps and engines
- Stops liquid cooled engines, machines and processing when coolant flow is interrupted
- Shuts down burner when air flow through heating coil fails
- Controls dampers according to flow

SPECIFICATIONS

Service: Gases or liquids compatible with wetted materials.
Wetted Materials:
Vane: 316 SS
Body: Brass or 316 SS standard.
Magnet Keeper: 430 SS standard, 316 SS optional.
Options: Other materials also available, consult factory (e.g. PVC, Hastelloy, Nickel, Monel, Titanium).
Temperature Limit: 275° F (135° C) standard, MT high temperature option 400° F (205° C) [MT option not UL, CSA, or CENELEC/SAA].
Pressure Limit: Brass body 1000 psig (69 bar), 316 SS body 2000 psig (138 bar), optional 5000 psig (345 bar) available with 316 SS body and SPDT switch only.
Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups C and D; Class II, Groups E, F, and G. CENELEC EExd IIB T6 (T amb = 75° C). SAA: Exd IIB T6 (T amb = 75° C), Zone I. Also FM approved.
Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL, FM and CENELEC/SAA models 10A @ 125/250 VAC. CSA models: 5A @ 125/250 VAC; 5A res., 3A ind. @ 30 VDC. MV option: 1A @125 VAC; 1A res., .5A ind. @ 30 VDC. MT option: 5A @ 125/250 VAC. [MT and MV option not UL, CSA, FM or CENELEC/SAA].
Electrical Connections: UL and CSA models: 16 AWG, 6˝ (152 mm) long. CENELEC/SAA unit: Terminal block.
Conduit Connection: 3/4˝ female NPT.
Process Connection: 1-1/2˝ male NPT.
Mounting Orientation: Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipe with up flow) available.
Set Point Adjustment: For universal vane: five vane combinations.
Weight: 4 lbs. 8 oz. (1.9 kg).

STOCKED MODELS in bold

Model	Description
V4-2-U	Brass body, universal vane
V4-SS-2-U	316SS* body, universal vane
V4	Brass body, custom vane
V4-SS	316SS* body, custom vane

*316SS body with 430SS magnet keeper. For 316SS magnet keeper, specify: add -316

Options (add as a suffix to the model number):

-D, DPDT contacts.....
-MV, Gold Plated Contacts, options for dry circuits
(see electrical rating in specification, no listings or approvals).....
-MT, High Temperature, option rated 400° F (204° C)
(see electrical rating in specifications, no listings or approvals.....
-TRI (increasing flow), -TRD (decreasing flow), Time Delay Relay,
option with 2 SPDT contacts, adjustable from 0-1 to 0-31 minutes.
(no listings or approvals).....
-316, 316 SS Magnet Keeper, option to replace standard 430 SS.....
-CN, CENELEC/SAA, listed construction .....
-V, Vertical Up Flow, option for upward flow in vertical pipe .....

Consult factory for price and availabilty of fittings for V4 installation. Thredolets, bushings, and tees are available in a variety of sizes and materials.

For custom vane models, please supply factory with following information: pipe size, flow direction (horizontal, up), mounting, pressure, temperature, specific gravity, flow rates (maximum normal, actuation/deactuation*), etc.

*When both values are supplied, note which is critical.

V4 Universal Vane Flow Charts

Values shown in both charts are nominal. If normal flows exceed actuation rates by less than 10%, custom vanes are recommended. Figures are based on standard vertical installation in a 1-1/2" thredolet in a horizontal run of pipe.

APPROXIMATE ACTUATION/DEACTUATION FLOW RATES FOR COLD WATER.
UPPER FIGURES IN GPM. LOWER FIGURES IN LPM

VANE LAYERS	1.5"PIPE	2"PIPE	3"PIPE	4"PIPE	6"PIPE	8"PIPE	10"PIPE	12"PIPE	14"PIPE	16"PIPE	18"PIPE	20"PIPE
1	7-3 26.67-11.67	15-8 56.7-30	45-22 167-83.3	95-40 367-150	210-120 800-450	375-175 1417-667	600-300 2267-1133	900-450 3400-1700	1200-600 4550-2267	1400-800 5300-3033	2000-1000 7567-3783	2400-1200 9083-4550
1&2		7-4 26.7-15	23-14 86.7-53.3	50-35 190-132	130-90 500-333	230-150 867-567	450-250 1700-950	650-350 2467-1317	900-500 3400-1900	1200-650 4550-2467	1450-800 5483-3033	1800-1000 6817-3783
1,2,&3			11-7 41.7-26.7	27-19 102-71.7	80-60 300-233	160-115 600-433	300-180 1133-683	450-275 1700-1033	600-350 2267-1317	750-450 2750-2083	1000-600 3783-2267	1200-700 4550-2650
1,2,3,&4				17-12 65-45	60-45 233-167	120-90 450-333	230-150 867-567	310-200 1167-750	430-280 1633-1067	550-360 2083-1367	700-450 2650-1700	850-550 3217-2083
1,2,3,4,&5					40-30 152-113	80-65 300-250	135-100 517-383	200-140 750-533	290-200 1100-750	360-250 1367-950	460-325 1733-1233	575-400 2183-1517

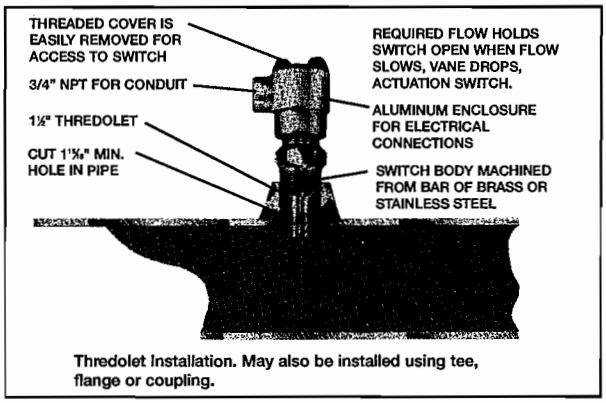
Actuation rates are based on cold water at a specific gravity of 1.0. For fluids of different specific gravity, actuation rates may be approximated by dividing the rate shown by the square root of the specific gravity.

APPROXIMATE ACTUATION/DEACTUATION FLOW RATES FOR AIR.
UPPER FIGURES IN SCFM. LOWER FIGURES IN LPM

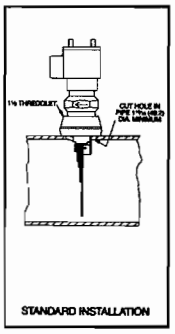
VANE LAYERS	1.5"PIPE	2"PIPE	3"PIPE	4"PIPE	6"PIPE	8"PIPE	10"PIPE	12"PIPE	14"PIPE	16"PIPE	18"PIPE	20"PIPE
1	32-17 20-8	65-32 30-20	210-105 100-50	400-200 190-90	950-475 450-220	1550-850 730-400	2400-1300 1100-600	3450-1900 1600-900	4700-2600 2200-1200	6400-3500 3000-1700	8000-4400 3800-2100	10000-5500 4700-2600
1&2		23-13 10-6	120-70 60-30	195-140 90-70	550-375 260-180	1100-700 520-330	1850-1200 870-570	2700-1750 1300-800	3400-2200 1600-1000	4800-3100 2300-1500	6000-3900 2800-1800	7400-4800 3500-2300
1,2,&3			60-48 30-20	135-100 60-50	375-265 180-130	725-500 340-240	1200-850 570-400	1850-1300 870-610	2600-1800 1200-800	3350-2350 1600-1100	4300-3000 2000-1400	5300-3700 2500-1700
1,2,3,&4				65-50 30-20	260-200 120-90	500-400 240-190	875-700 410-330	1250-1000 590-470	1900-1500 900-710	2500-2000 1200-900	3100-2500 1500-1200	3900-3100 1800-1500
1,2,3,4,&5					130-100 60-50	310-250 150-120	650-525 310-250	1000-800 470-380	1600-1250 760-590	2200-1750 1040-830	2800-2250 1300-1100	3550-2850 1700-1300

Actuation rates are based on air at standard conditions. For gases at other pressures, temperatures, or specific gravities, consult factory for equivalent flow approximations.

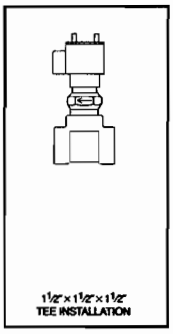
APPLICATION DRAWINGS FOR FLOTECT® AUTOMATIC FLOW SWITCHES



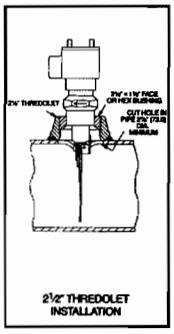
Thredolet Installation. May also be installed using tee, flange or coupling.



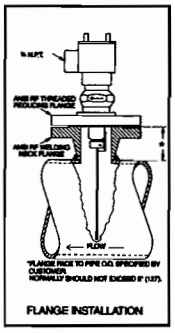
STANDARD INSTALLATION



1½" × 1½" × 1½" TEE INSTALLATION

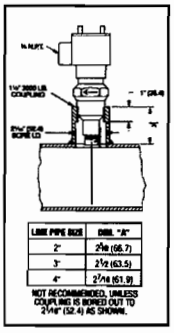


2½" THREDOLET INSTALLATION



FLANGE INSTALLATION

2" × 2" × 2" TEE INSTALLATION



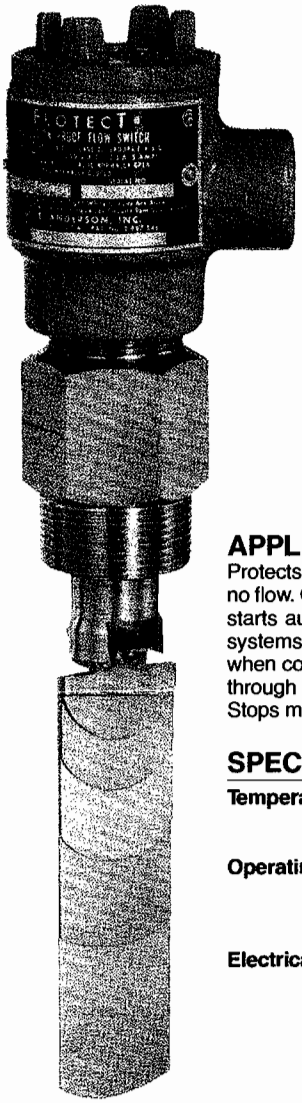
FLOTECT Vane Operated Flow Switch

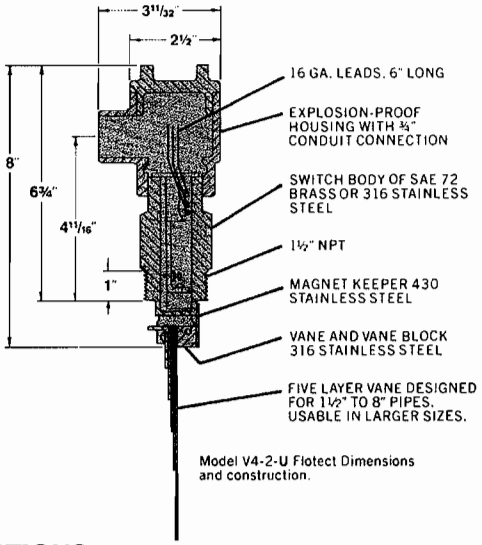
INSTALLATION AND OPERATING INSTRUCTIONS

Explosion-Proof; U.L. and C.S.A. listed – Class I, Groups C, D; Class II, Groups E, F, G.
CENELEC: EExd 11B T6.

Dependable protection against flow variation or stopping in pipelines for fluids, gasses and flowing solids.

Supplied with custom or universal multi-layer vanes for field installation in pipes from 1½".

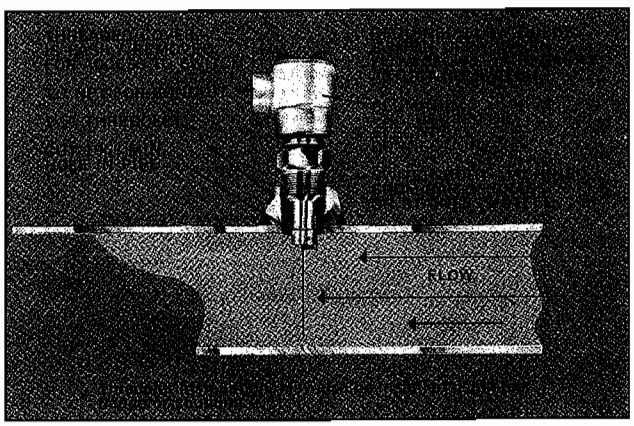




Model V4-2-U Flotect Dimensions and construction.

Compact and reliable, the Flotect V4 Flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. Installed in thousands of pipelines and processing plants around the world, this unique magnetically actuated switching design gives superior performance. Universal multi-layer vane accommodates pipe sizes from 1½" up. Custom vanes are available with factory calibration. There are no bellows, springs, or seals to fail. Instead, the free-swinging vane attracts a magnet within the solid metal switch body above, actuating a snap switch by means of a simple lever arm.

Features include: Simplicity of design and a leak-proof switch body, machined from bar stock for pressures to 2000 psig, (138 bar), it eliminates the possibility of process fluid entering the switch compartment. The threaded conduit enclosure cover permits easy inspection or replacement of electrical assembly without shutting down the process, or removing electrical conduit. Power must be disconnected. The unit fits directly into pipeline with tee, thredolet or flange for easy installation. Pendulum-like vane action responds accurately to fluid flow rate. The custom vane or multi-layer vane is sensitive to low velocity flows, yet it is rugged enough to withstand high flow surges. If desired, a delay timer can be wired into the installation. All units are explosion-proof and listed with U.L. and C.S.A. for Class I, Groups C and D, Class II, Groups E, F, and G or are flame-proof to CENELEC EExd IIB T6.



APPLICATIONS

Protects motors, pumps and other equipment against low flow and no flow. Controls sequential operation of pumps, etc. Automatically starts auxiliary pumps and engines or actuates alarm and signal systems. Stops water cooled engines, machines and processes when coolant flow is interrupted. Shuts down burner when air flow through heating coil fails. Controls dampers according to flow. Stops machines if cooling oil flow ceases.

SPECIFICATIONS

Temperature limits:	Standard 275°F (135°C). High temperature option (not U.L., C.S.A. or CENELEC), 400°F (205°C) max.
Operating Pressure:	Brass 1000psig (69bar) 316S.S. 2000psig(138bar) Ratings to 5000psig(345bar) available (SPDT only).
Electrical Rating:	U.L. and CENELEC: 10A@125/250 Vac C.S.A.; 5A@125/250 Vac, 5A resistive 3A inductive@30Vdc Optional ratings (not UL, CSA or CENELEC); MV option; Gold contacts, 1.0A@125 Vac MT option: 400°F (205°C), 5A@125/250Vac
Wiring:	U.L./C.S.A. unit; 16 gauge copper wire, 6" long, mechanically and solder bonded to switch. CENELEC unit: Terminal board.
Switch body:	One piece milled and bored Brass or 316 SS. Other materials on request.
Vane:	316 SS 1 9/16" (40mm) wide. Std. trim includes 430 SS and silver solder. Other materials on request.
Piping Connection:	1½" NPT std for mounting in 1½" thredolet. For other mounting see back page. Thredolet fittings available.
Installation:	Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipes) on request.
Weight:	4lb.-5oz. (1.96Kg)
Options:	All 316SS wetted parts. Teflon coated wetted parts. DPDT circuits. Cartridge heater to melt paraffin, etc. Time delay relay.

INSTALLATION

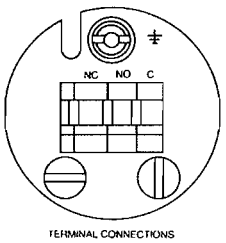
1. Remove packing material from switch body-cap and remove tape from magnet keeper. Adjust vane length if necessary on multi-layer vanes only. Install switch in thredolet previously welded to line. In some cases, it may be necessary to install the switch in a flange or tee. Note: extreme care must be excercised in welding the fitting to the line so that it is plumb and level.

2. The arrow on the side of the switch must point in the direction of flow.

3. **U.L. and C.S.A. units only:** Thread connecting wires through conduit and connect.
   Black – Common
   Blue – N.O.
   Red – N.C.

Note: Double pole, double throw switches have dual black, blue and red leads. These are connected in the same manner as single pole, double throw switches, as described above.

CENELEC units only: Wire in accordance with local electrical codes. Cable should enter enclosure housing through an approved Ex cable gland (not supplied). Stripped and tinned leads are simply pushed into wire entry of terminal block. Depress spring release with small screwdriver when inserting or removing fine stranded leads. Be sure strands do not bridge across terminal spacing. Double pole, double throw switches have dual terminal blocks.



TERMINAL CONNECTIONS

Note: The switch is deactivated and contacts are in normal condition when there is no flow in the line.

4. Make sure conduit or cable are properly sealed. Electrical components must be kept free of moisture, including condensation, at all times. **CAUTION:** To prevent ignition of hazardous atmosphere, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in operation.

5. Inspect and clean wetted parts at regular intervals.

6. **CENELEC units only:** The "T" class is dependent upon the ambient temperature of the media. The approved ratings are: T6 at 75°C, T5 at 90°C; T4 at 125°C; T3 at 135°C.

7. Custom vane units have been calibrated at factory to meet requirements. Do not change.

ADJUSTMENT OF MULTI-LAYER VANE

Remove only those layers which are too long. Leave the smaller layers to reinforce the vane. The longest vane fits 6" (150mm) or larger pipe, the second longest vane fits 4" (100mm) pipe, etc. Actuation-Deactuation rates are shown in the charts on the next page.
To remove vane layers, proceed as follows:

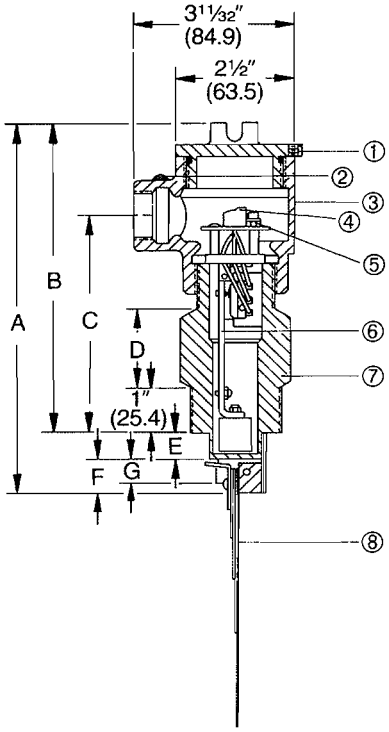
1. Remove the two screws and lockwashers holding the layers together. Do not lose these special corrosion resistant type 316 stainless steel screws and lockwashers.

2. Remove the unwanted layers.

3. Resecure the vane with the original two screws and lockwashers.

4. With a hammer, lightly peen the ends of the screws so that they can't back out.

5. If you lose the screws or lockwashers, don't replace with other parts which may corrode and break. That would void the warrantee and might cause severe damage to equipment located downstream of the switch.



CENELEC unit shown, for U.L./C.S.A. unit see first page.

DIM.	V4		V4-2	
	IN.	MM	IN.	MM
A	8 3/16	208	8	203
B	6	152	6 3/4	171
C	4 1/16	119	3 15/16	100
D	1	25.4	1 3/4	44
E	1 5/16	33	9/16	14
F	7/8	22	1 1/16	17
G	1 1/16	17	1/2	13

PARTS LIST

1. Cover lock. (CENELEC unit only).
2. External ground. (CENELEC unit only).
3. Enclosure housing and cover.
4. Terminal block. (CENELEC unit only, UL/CSA unit has 6" leads).
5. Internal ground.
* 6. Magnet arm and switch assembly.
7. Switch body.
* 8. Vane assembly.

*Approved replacement parts.

APPROXIMATE ACTUATION-DEACTUATION FLOW RATES FOR COLD WATER

UPPER FIGURES IN GPM. LOWER FIGURES IN M3/HR.

VANE LAYERS	1.5" PIPE	2" PIPE	3" PIPE	4" PIPE	6" PIPE	8" PIPE	10" PIPE	12" PIPE	14" PIPE	16" PIPE	18" PIPE	20" PIPE
1	7- 3 1.6-0.7	15- 8 3.4-1.8	45-22 10- 5	95-40 22- 9	210-120 48- 27	375-175 85- 40	600-300 136- 68	900-450 204-102	1200-600 273-136	1400-800 318-182	2000-1000 454- 227	2400-1200 545- 273
1&2		7- 4 1.6-0.9	23- 14 5.2-3.2	50- 35 11.4-7.9	130-90 30-20	230-150 52- 34	450-250 102- 57	650-350 148- 79	900-500 204-114	1200-650 273-148	1450-800 329-182	1800-1000 409- 227
1, 2&3			11- 7 2.5-1.6	27- 19 6.1-4.3	80-60 18-14	160-115 36- 26	300-180 68- 41	450-275 102- 62	600-350 136- 79	750-450 170-102	1000-600 227-136	1200-700 273-159
1, 2, 3&4				17- 12 3.9-2.7	60-45 14-10	120-90 27-20	230-150 52- 34	310-200 70- 45	430-280 98- 64	550-360 125- 82	700-450 159-102	850-550 193-125
1, 2, 3, 4&5					40- 30 9.1-6.8	80-65 18-15	135-100 31- 23	200-140 45- 32	290-200 66- 45	360-250 82- 57	460-325 104- 74	575-400 131- 91

Actuation rates are based on cold water at a specific gravity of 1.0. For fluids of different specific gravity, actuation rates may be approximated by dividing the rate shown by the square root of the specific gravity.

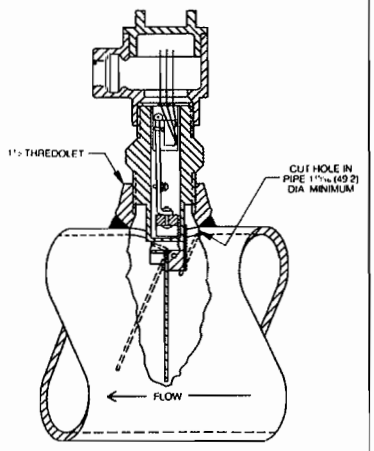
APPROXIMATE ACTUATION-DEACTUATION FLOW RATES FOR AIR

UPPER FIGURES IN SCFM. LOWER FIGURES IN NM3/S.

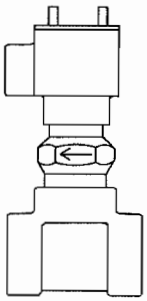
VANE LAYERS	1.5" PIPE	2" PIPE	3" PIPE	4" PIPE	6" PIPE	8" PIPE	10" PIPE	12" PIPE	14" PIPE	16" PIPE	18" PIPE	20" PIPE
1	32- 17 0.02-0.008	65- 32 0.03-0.02	210- 105 0.10-0.05	400- 200 0.19-0.09	950- 475 0.45-0.22	1550- 850 0.73-0.40	2400-1300 1.1- 0.6	3450-1900 1.6- 0.9	4700-2600 2.2- 1.2	6400-3500 3.0- 1.7	8000-4400 3.8- 2.1	10000-5500 4.7- 2.6
1&2		23- 13 0.01-0.006	120- 70 0.06-0.03	195- 140 0.09-0.07	550- 375 0.26-0.18	1100- 700 0.52-0.33	1850-1200 0.87- 0.57	2700-1750 1.3- 0.8	3400-2200 1.6- 1.0	4800-3100 2.3- 1.5	6000-3900 2.8- 1.8	7400-4800 3.5- 2.3
1, 2&3			60- 48 0.03-0.02	135- 100 0.06-0.05	375- 265 0.18-0.13	725- 500 0.34-0.24	1200- 850 0.57-0.40	1850-1300 0.87- 0.61	2600-1800 1.2- 0.8	3350-2350 1.6- 1.1	4300-3000 2.0- 1.4	5300-3700 2.5 1.7
1, 2, 3&4				65- 50 0.03-0.02	260- 200 0.12-0.09	500- 400 0.24-0.19	875- 700 0.41-0.33	1250-1000 0.59- 0.47	1900-1500 0.90- 0.71	2500-2000 1.2- 0.9	3100-2500 1.5- 1.2	3900-3100 1.8- 1.5
1, 2, 3, 4&5					130- 100 0.06-0.05	310- 250 0.15-0.12	650- 525 0.31-0.25	1000- 800 0.47-0.38	1600-1250 0.76- 0.59	2200-1750 1.04- 0.83	2800-2250 1.3- 1.1	3550-2850 1.7- 1.3

Values shown in both charts are nominal. If normal flows exceed actuation rates by less than 10%, custom vanes are recommended. Figures are based on standard vertical installation in a 1½" thredolet in a horizontal run of pipe.

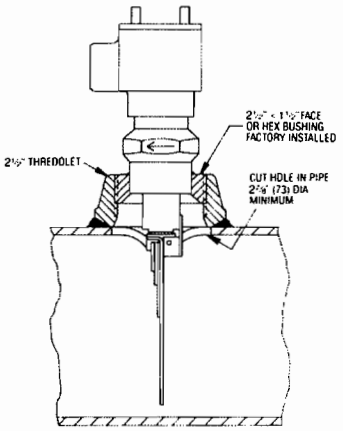
APPLICATION DRAWINGS FOR FLOTECT®
AUTOMATIC FLOW SWITCHES



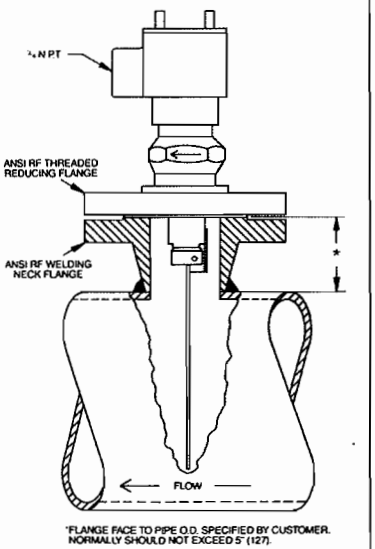
STANDARD INSTALLATION



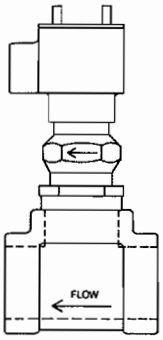
1½" × 1½" × 1½"
TEE INSTALLATION



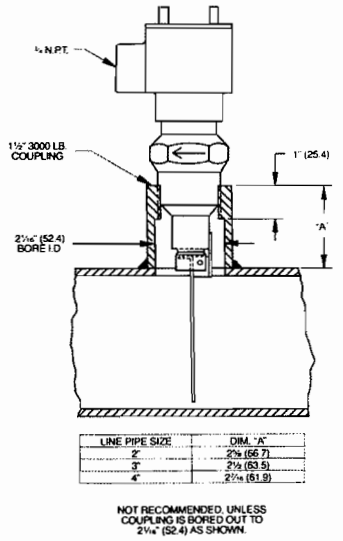
2½" THREDOLET INSTALLATION



FLANGE INSTALLATION



2" × 2" × 2" TEE
INSTALLATION



W. E. ANDERSON DIV., DWYER INSTRUMENTS, INC.
P.O. Box 358
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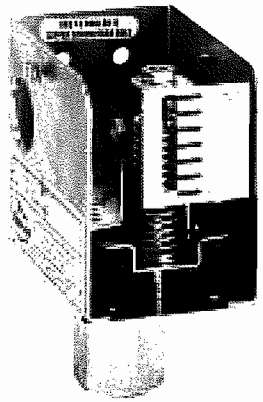
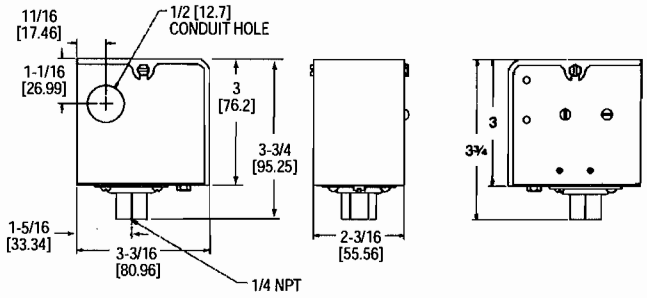
Phone: 219/879-8000 Telex: 25916
Fax: 219/872-9057

LITHO IN U.S.A. 2/92
FR 82-440629-00

Series CS Low Cost Diaphragm Pressure Switches

Specifications – Installation and Operating Instructions





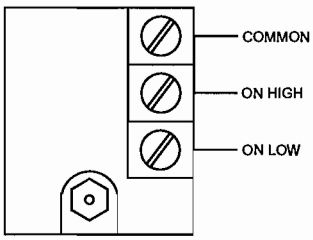
The Series CS Low Cost Diaphragm Pressure Switch is ideal for instrument panels, small compressors and general industrial applications. Visible set point and easy-to-wire SPDT snap switch reduce installation time. This switch operates in any position and is vibration resistant.

INSTALLATION/MOUNTING

The control can be pipe mounted. Do not twist the case when installing. Use wrench on the pressure connection flats.

WIRING

All wiring must conform to the National Electrical code and local regulations. Do not install control to handle loads in excess of electrical rating shown in specifications or as indicated on instructions inside control cover. Connect wiring to screw terminals depending on the action required. Common and High contacts will close and Common and Low contacts will open when increasing pressure (or vacuum) reaches set point. The reverse will occur when pressure (or vacuum) drops below the set point less the deadband.



WIRING DIAGRAM
TOP VIEW

CAUTIONS: Do not oil any parts. Mount control securely. Never exceed electrical rating for switch. Use only with compatible.

WARNING

A failure resulting in injury or damage can be caused by over-pressure, excessive vibration or pressure pulsation, excessive temperature, corrosion of pressure containing parts and movement assembly, electrical overload or other misuse.

PHYSICAL DATA

Temperature Limits: -30 to 150°F (-34.4 to 65.6°C)
Pressure Connections: 1/4" NPT(F)
Electrical Ratings: 12 A @ 120 VAC; 8 A @ 240 VAC; 7A @ 277 VAC; 1/8 HP @ 120 VAC; 1/4 HP @ 240 VAC
Switch Type: SPDT snap acting
Conduit Opening: 1/2"
Wiring Connections: Three screw type, common, N.O., N.C.
Set Point Adjustment: Screw type, inside cover
Housing: Galvanized steel, NEMA 1
Diaphragm: Buna-N/Nylon
Calibration Spring: Plated steel
Installation: Any position
Weight: 1/2 lb. (0.23 kg)

Model No.	Adjustable Operating Range	Fixed Deadband		Max. Pressure
		Maximum	Minimum	
CS-1	1-30" Hg. Vac. 2.5-75 cm Hg.Vac	1.5" Hg. 3.8 cm Hg. Vac	1" Hg. VAC 2.5 cm Hg. Vac	30 psig
CS-3	10-100" w.c. 2.5-250 cm w.c.	7" w.c. 17.8 cm w.c.	5" w.c. 12.7 cm w.c.	30 psig
CS-10	1-10 psig 0.07-0.7 kg/cm²	0.4 psig 0.03 kg/cm²	0.25 psig 0.02 kg/cm²	30 psig
CS-30	1-30 psig 0.07-2.1 kg/cm²	1.0 psig 0.07 kg/cm²	0.5 psig 0.035 kg/cm²	50 psig
CS-150	10-150 psig 0.07-10.5 kg/cm²	5 psig 0.35 kg/cm²	1.5 psig 0.1 kg/cm²	175 psig

Printed in U.S.A. 4/01
FR#90-442119-00 Rev. 2

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-Grundfos Redi-Flo 4 Submersible Pumps
-Omron Sysdrive 3G3JV Compact Simplified Inverter
-Mercoid AP Series Pressure Switch
-Gems Sensor Warrick 3W1/3W2 Wire Suspended Electrode
-Anchor Scientific Mini-Float

TROUBLE SHOOTING

Trouble Shooting Operational Notes

A. Any switch in the "HAND" position will operate the corresponding circuit under any alarm condition, except for a motor temperature fault or a circuit overload. The "HAND" position is for diagnostics or to clear alarms. The system should never be left unattended while any switch is in the "HAND" position.

B. To reset an alarm, switch all Hand-Off-Auto (HOA's) switches to the "OFF" position. Then the press the "RESET" button. If the panel will not reset, then an alarm condition still exists.

C. Upon powering the panel, alarm lights will be lit. The panel must be reset every time power is disconnected.

D. This system includes run hour meters for each major motor.

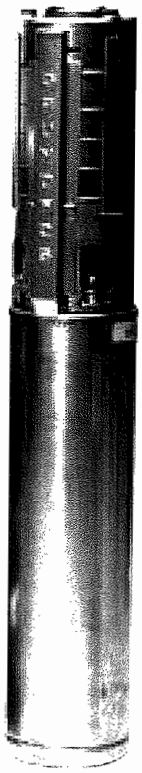
System	Problem	Possible cause	Solution
Well Pump	Pump will run in "HAND" but not in "AUTO"	Alarm condition	Clear any alarm condition and reset the control panel. See Attachment 10 for alarm interlocks.
		Pump down latch not active	Check to see if the well level switch high is closed. If not, then wait for the well to fill with water. If it is closed, see the next section.
	Pump will not run in the "HAND" position	Tripped circuit protector	Open the inner door and reset the circuit protector. A tripped circuit protect can be an indication of a problem. Inspect the system thoroughly and check the operating conditions.
		Motor temperature switch is inoperative	Check to see that the motor temperature switch has been wired, or that there is a jumper, if a switch is not present.
		Faulty pump	Refer to manual or contact CARBONAIR for help in diagnosing faulty pump.
	Pump operating, but at reduced performance	Incorrect pump rotation	Verify and change rotation
		Pumping sediment	The pump may be too close to the bottom of the well. Move the pump up.
		Pump restricted	Inspect and clean all effluent lines.

GRUNDFOS **INSTRUCTIONS**

Redi-Flo4

Stainless Steel Submersible Pumps for Environmental Applications

(US) **Installation and operating instructions**



Please leave these instructions with the pump for future reference.

BE › THINK › INNOVATE ›

GRUNDFOS

SAFETY WARNING

Grundfos Stainless Steel Submersible Pumps

Your Grundfos Redi-Flo4 Environmental Pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

Shipment Inspection

Examine the components carefully to make sure no damage has occurred to the pump-end, motor, cable or control box during shipment.

This Grundfos Redi-Flo4 Environmental Pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage. During unpacking and prior to installation, **make sure that the pump is not contaminated, dropped or mishandled.**

The motor is equipped with an electrical cable. **Under no circumstance should the cable be used to support the weight of the pump.**

You will find a loose data plate wired to the pump. It should be securely mounted at the well or attached to the control box.

PRE-INSTALLATION CHECKLIST

Before beginning installation, the following checks should be made. They are all critical for the proper installation of this submersible pump.

A. Condition of the Well

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. Dispose of discharged materials in accordance with the specific job site requirements. The stainless steel construction of the Redi-Flo4 Environmental Pump makes it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy groundwater.

Determine the maximum depth of the well, and the drawdown level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

PRE-INSTALLATION CHECKLIST

B. Condition of the Water

Redi-Flo4 pumps are designed for pumping cold groundwater that is free of air or gases. Decreased pump performance and life expectancy can occur if the groundwater is not cold or contains air or gases.

C. Installation Depth

Pumping sand or well sediment can occur when the pump motor is installed lower than the top of the well screen or within five feet of the well bottom. This can reduce the performance and life expectancy of the pump and should be avoided.

If the pump is to be installed in a lake, containment pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in Table A.

D. Electrical Supply

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual electrical supply.

WIRE CABLE TYPE

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor insulation should have a continuous Teflon® jacket with no splices and must be suitable for use with submersible pumps.

INSTALLATION

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

A back-up wrench should be used when the riser pipe is attaching a riser pipe or metallic nipple to the pump. The pump should only be gripped by the flats on the top of the discharge chamber. **The body of the pump, cable guard or motor should not be gripped under any circumstance.**

If Steel Riser Pipe Is Used:

An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

INSTALLATION

After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.** When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump-end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage.

If Plastic or Flexible Riser Pipe Is Used:

Use the correct compound recommended by the pipe manufacturer or specific job specifications. Besides making sure that joints are securely fastened, the use of a torque arrester is recommended when using these types of pipe.

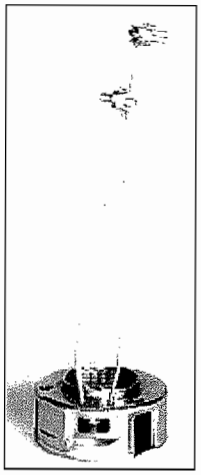
Do not connect the first plastic or flexible riser section directly to the pump. Always attach a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals using an approved clip or tape to prevent sagging, looping and possible cable damage.

IMPORTANT - Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe. Leave enough slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. If the depth setting is critical, check with the manufacturer of the pipe to determine how to compensate for pipe stretch.

When these types of pipe are used, it is recommended that a safety cable be attached to the pump to lower and raise it. The discharge piece of Redi-Flo4 submersibles is designed to accommodate this cable (Figure 4).

FIGURE 4



Protect the Well from Contamination

While installing the pump, proper care should be used not to introduce foreign objects or contaminants into the well. The well should be finished off above grade to protect against surface water from entering the well, causing contamination.

NOTE: Teflon® is a registered trademark of DuPont.

ELECTRICAL

WARNING: To reduce the risk of electrical shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in Table C.

If voltage variations are larger than ± 10%, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current.

Engine-Driven Generators

If the Redi-Flo4 pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contracted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

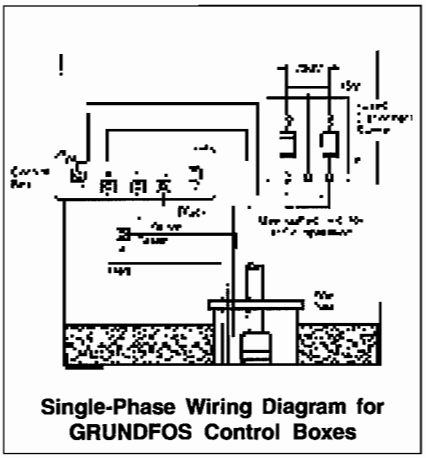
Control Box/Panel Wiring

Single-phase motors must be connected as indicated in the motor control box. A typical single-phase wiring diagram using a Grundfos control box is shown (Figure 5-A).

High Voltage Surge Arresters

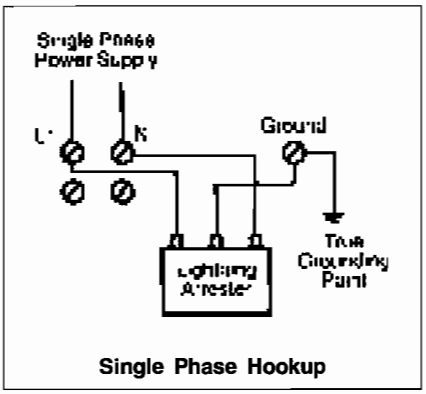
A high voltage surge arrester should be used to protect the motor against lightning and switching surges. The correct voltage-rated surge arrester should be installed on the supply(line) side of the control box (Figure 5-B). **The arrester must be grounded in accordance with the National Electric Code, local codes and regulations.**

FIGURE 5-A



Single-Phase Wiring Diagram for GRUNDFOS Control Boxes

FIGURE 5-B



Single Phase Hookup

ELECTRICAL

Control Box and Surge Arrester Grounding

The control box shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations. The ground wire should be a bare copper conductor at least the same size as the drop cable wire size. The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be: a grounding rod driven into the water strata, steel well casing submerged into the water lower than the pump setting level, and steel discharge pipes without insulating couplings. If plastic discharge pipe and well casing are used, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel. Do not ground to a gas supply line. Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.

Wiring Checks

Before making the final wiring connections of the drop cable to the control box terminal, it is a good practice to check the insulation resistance to ensure that the cable is good. Measurements for a new installation must be at least 1,000,000 ohm. Do not start the pump if the measurement is less than this. If it is higher, finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box and high voltage surge arrester have been grounded.

START-UP

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

A. Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.

B. If required, make provisions to capture discharged fluids for disposal.

C. Adjust the gate valve one-third open.

D. Start the pump and let it operate until the water runs clear of sand and silt.

E. As the water clears, slowly open the gate valve in small increments until the desired flow rate of clear water is reached. The pump should not be operated beyond its maximum flow rating and should not be stopped until the groundwater runs clear.

F. If the groundwater is clean and clear when the pump is first started, the valve should still be opened until the desired flow rate is reached.

G. Disconnect the temporary piping arrangements and complete the final piping connections.

H. **Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed.** This can result in motor damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

I. Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

OPERATION

A. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling, and operation of controls. **Under no circumstances should be the pump be operated for any prolonged periods of time with the discharge valve closed.** This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

B. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 7.

TROUBLESHOOTING

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following charts cover most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above-ground checks before pulling the pump from the well.

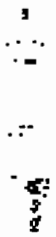
Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well. WARNING: Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.

TROUBLESHOOTING

Preliminary Tests

SUPPLY VOLTAGE



How to Measure

By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box. On single-phase units, measure between line and neutral.

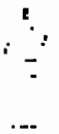
What It Means

When the motor is under load, the voltage should be within ± 10% of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

CURRENT MEASUREMENT



How to Measure

By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box. See the Electrical Data, Table C, for motor amp draw information.

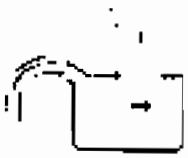
Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What It Means

If the amp draw exceeds the listed service factor amps (SFA), check for the following:

1. Loose terminals in control box or possible cable defect. Check winding and insulation resistances.
3. Too high or low supply voltage.
4. Motor windings are shorted.
5. Pump is damaged causing a motor overload.

WINDING RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table C. Cable resistance values are in Table D.

What It Means

If all the ohm values are normal, and the cable colors correct, the windings are not damaged. If any one ohm value is less than normal, the motor may be shorted. If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open. If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in Electrical Data, Table C.

INSULATION RESISTANCE

How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohm or mega ohmmeter, set the scale selector to Rx 100K and zero-adjust the meter.

Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).

What It Means

For ohm values, refer to table below. Motors of all Hp, voltage, phase and cycle duties have the same value of insulation resistance.

TROUBLESHOOTING CHART

OHM VALUE	MEGAOHM VALUE	CONDITION OF MOTOR AND LEADS
		Motor not yet installed:
2,000,000 (or more)	2.0	New Motor.
1,000,000 (or more)	1.0	Used motor which can be reinstalled in the well.
		Motor in well (Ohm readings are for drop cable plus motor):
500,000 - 1,000,000	0.5 - 1.0	A motor in reasonably good condition.
20,000 - 500,000	0.02 - 0.5	A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.
10,000 - 20,000	0.01 - 0.02	A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long.
less than 10,000	0 - 0.01	A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.

A. Pump Does Not Run

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. No power at pump panel.	Check for voltage at panel.	If no voltage at panel, check feeder panel for tripped circuits.
2. Fuses are blown or circuit breakers are tripped.	Remove fuses and check for continuity with ohmmeter.	Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
3. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
4. Motor and/or cable are defective.	Turn off power. Disconnect motor leads from control box. Measure the lead to lead resistances with the ohmmeter (Rx1). Measure lead to ground values with ohmmeter (Rx100K). Record measured values.	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
5. Defective capacitor.	Turn off the power, then discharge capacitor. Disconnect leads and check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.	If there is no needle movement, replace the capacitor.

TROUBLESHOOTING CHART

B. Pump Runs But Does Not Deliver Water

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Groundwater level in well is too low or well is collapsed.	Check well draw-down.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Integral pump check valve is blocked.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shut-off. After taking reading, open valve to its previous position. Convert PSI to feet. (For water: PSI x 2.31 ft/PSI = ____ ft.), and add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.	If not close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and reinstall.
3. Inlet strainer is clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
4. Pump is damaged.	Same as B.2 above.	If damaged, repair as necessary. Rinse out pump and re-install.

C. Pump Runs But at Reduced Capacity

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Draw-down is larger than anticipated.	Check drawdown during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
3. Pump strainer or check valve are clogged.	Remove pump and inspect.	Clean, repair, rinse out pump and reinstall.
4. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.

D. Pump Cycles Too Much

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts.	Re-adjust switch or replace if defective.
2. Level control is not properly set or is defective.	Check setting and operation.	Re-adjust setting (refer to manufacturer data.) Replace if defective.
3. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.

TROUBLESHOOTING CHART

E. Fuses Blow or Circuit Breakers Trip

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. High or low voltage.	Check voltage at pump panel. If not within ± 10%, check wire size and length of run to pump panel.	If wire size is correct, contact power company. If not, correct and/or replace as necessary.
2. Control box wiring and components.	Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.	Correct as required.
3. Defective capacitor.	Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If no meter movement, replace the capacitor.
4. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

TECHNICAL DATA

Table A

Minimum Water Flow Requirements for Submersible Pump Motors

MOTOR DIAMETER	CASING OR SLEEVE I.D. IN INCHES	MIN. FLOW PAST THE MOTOR (GPM)
4"	4	1.2
	5	7
	6	13
	7	21
	8	30

NOTES:

1. A flow inducer or sleeve must be used if the water enters the well above the motor or if there is insufficient water flow past the motor.
2. The minimum recommended water velocity over 4" motors is 0.25 feet per second.

Table B

Guide for Engine-Driven Generators in Submersible Pump Applications

	MINIMUM KILOWATT RATING OF GENERATOR FOR THREE-WIRE SUBMERSIBLE PUMP MOTORS	
MOTOR HP	EXTERNALLY REGULATED GENERATOR	INTERNALLY REGULATED GENERATOR
0.33 HP	1.5 KW	1.2 KW
0.50	2.0	1.5
0.75	3.0	2.0
1.0	4.0	2.5
1.5	5.0	3.0

NOTES:

1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single phase motors.
2. Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.
3. If the generator rating is in KVA instead of kilowatts, multiply the above ratings by 1.25 to obtain KVA.

TECHNICAL DATA

Table C

Electrical Data – 60 Hz Submersible Pump Motors

GRUNDFOS MOTORS

HP	PH	VOLT	SER. FACT.	CIRC. BRK. OR STD. FUSE	DUAL ELEMENT FUSE	AMPERAGE FULL LOAD	AMPERAGE LOCK ROTOR	AMPERAGE S.F. AMPS	FULL LOAD EFF.	FULL LOAD POWER FACTOR	LINE-TO-LINE RESISTANCE (OHMS) Blk-Yel	LINE-TO-LINE RESISTANCE (OHMS) Red-Yel	KVA CODE **	MAX. THRUST (LBS)	GRUNDFOS PART NO.
											Delta				
4-Inch, Single Phase, 2-Wire Motors (control box not required)															
1/3	1	230	1.75	15	5	3.4	25.7	4.6	59.0	77.0	6.8-8.2		S	770	79.952301
1/2	1	230	1.60	15	7	4.5	34.5	6.0	62.0	76.0	5.2-6.3		R	770	79.952302
3/4	1	230	1.50	20	9	6.9	40.5	8.4	62.0	75.0	3.2-3.8		N	770	79.952303
1	1	230	1.40	25	12	8.0	48.4	9.8	63.0	82.0	2.5-3.1		M	770	79.952304
1-1/2	1	230	1.30	35	15	10.0	62.0	13.1	64.0	85.0	1.9-2.3		L	770	79.952305
4-Inch, Single Phase, 3-Wire Motors															
1/3	1	230	1.75	15	5	3.4	14.0	4.6	59.0	77.0	6.8-8.3	17.3-21.1	L	770	79.453301
1/2	1	230	1.60	15	7	4.5	21.5	6.0	62.0	76.0	4.7-5.7	15.8-19.6	L	770	79.453302
3/4	1	230	1.50	20	9	6.9	31.4	8.4	62.0	75.0	3.2-3.9	14-17.2	L	770	79.453303
1	1	230	1.40	25	12	8.0	38.0	9.8	63.0	82.0	2.6-3.1	10.3-12.5	K	770	79.453304
1-1/2	1	230	1.30	35	15	9.4	45.9	11.6	69.0	89.0	1.9-2.3	7.8-9.6	H	770	79.453305

FRANKLIN MOTORS

(refer to the Franklin Submersible Motors Application Maintenance Manual)

TECHNICAL DATA

Table D

Total Resistance of Drop Cable (OHMS)

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the **control box to the motor and back.**

To determine the resistance:

1. Disconnect the drop cable leads from the control box.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance. Motor resistances can be found in the Electrical Data Chart, Table C.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.
6. The measured values should be approximately equal to the calculated values.

Wire Resistances

DISTANCE FROM CONTROL BOX TO PUMP MOTOR (FT.)	12 AWG WIRE RESISTANCE (OHMS)	14 AWG WIRE RESISTANCE (OHMS)
10	0.03	0.05
20	0.06	0.10
30	0.10	0.15
40	0.13	0.21
50	0.16	0.26
60	0.19	0.31
70	0.23	0.36
80	0.26	0.41
90	0.29	0.46
100	0.32	0.51
110	0.36	0.57
120	0.39	0.62
130	0.42	0.67
140	0.45	0.72
150	0.49	0.77
160	0.52	0.82
170	0.55	0.87
180	0.58	0.93
190	0.62	0.98
200	0.65	1.03

NOTES

NOTES

BE › THINK › INNOVATE ›

LIMITED WARRANTY

Redi-Flo4 Environmental Pumps manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS' manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Grundfos Pumps Corporation
17100 W. 118th Terrace
Olathe, Kansas 66061
Telephone: (913) 227-3400
Fax: (913) 227-3500

Grundfos Canada, Inc.
2941 Brighton Rd.
Oakville, Ontario L6H 6C9
Telephone: (905) 829-9533
Fax: (905) 829-9512

Bombas Grundfos de Mexico, S.A. de C.V.
Boulevard TLC #15, Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. Mexico
Telephone: 52-8-144-4000
Fax: 52-8-144-4010

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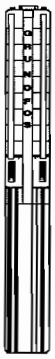


GRUNDFOS

Typical Specification for Redi-Flo4, 4" Environmental Submersible Pumps and Motors

1.0 Scope

1.1 The submersible pump and motor shall be designed for continuous submerged operation.

1.2 The pump shall be driven by a motor attached below the pump section.

1.3 The pump unit shall be Grundfos Redi-Flo pump model_____ or equal.

2.0 System Capacity and Electrical Requirements

2.1 The pump shall have a capacity of _____ U.S. GPM when operated against a total dynamic head of _____ feet of water.

2.2 The motor shall be_____ horsepower, rated for _____ volts, _____ phase, _____ hertz.

2.3 The cable between the motor and the above ground connection shall be at least ____ feet in length.

3.0 Pump Design and Materials of Construction

3.1 There shall be a built-in integral check valve made of 300 Series stainless steel. The check valve seat shall be Teflon® with a 300 Series stainless steel insert.

3.2 The pump bowls, impellers, guide vanes and filter screen shall be 300 Series stainless steel.

3.3 Each impeller shall have a Teflon® seal ring around its eye or skirt to reduce hydraulic losses.

3.4 There shall be a Teflon® shaft bearing located either above or below each impeller.

3.5 A 300 Series stainless steel filter screen shall be included as part of the suction inlet assembly.

3.6 A 300 Series stainless steel priming inducer shall be included to provide lubricating flow and to prime the pump should the fluid pumping level fall below the first impeller.

3.7 The stainless steel nameplates shall be affixed to the pump. The pump model shall be stamped into the nameplate. No inks or dyes shall be used.

4.0 Motor Design and Materials of Construction

4.1 The motor shall be a squirrel-cage induction motor designed for submersible operation in conformance with NEMA standards.

4.2 All materials in contact with the pumped fluids shall be 300 Series stainless steel or Viton®.

4.3 The motor shall not use any oils or greases for lubrication of bearings.

4.4 A flexible Viton® diaphragm shall be provided to permit expansion and contraction of the internal motor lubricating and cooling fluid.

4.5 The motor shall be constructed of Viton®.

4.6 A sand slinger made of Viton® shall be included.

5.0 Motor Cable Design and Materials of Construction

5.1 The cable shall be continuous with no splices.

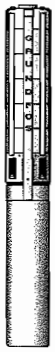
5.2 The connector boot shall be constructed of Viton®. The connector shall be constructed of 300 Series stainless steel. The motor wire shall be AWG12 with Teflon® insulation.

GRUNDFOS®

Redi-Flo4 Environmental Submersible Pumps

25E

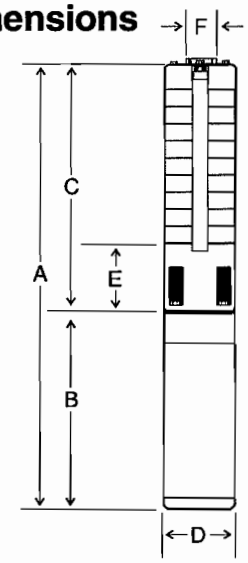
Submittal Data 3450 RPM 60 Hertz



JOB or CUSTOMER:	
ENGINEER:	
CONTRACTOR:	
SUBMITTED BY:	DATE:
APPROVED BY:	DATE:
ORDER NO:	DATE:
SPECIFICATION REF:	

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENTS

Dimensions



Technical Data

FLOW RANGE: 18 to 32 U.S. GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
Maximum Operating Temperature: 104°F (40°C)
Maximum Submergence Pressure: 220 PSI
Maximum Number of Starts Per Hour: 100
Minimum Recommended Flow Past Motor: 0.25 ft./sec.

(NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1 ½" NPT

MATERIALS OF CONSTRUCTION: See reverse side.

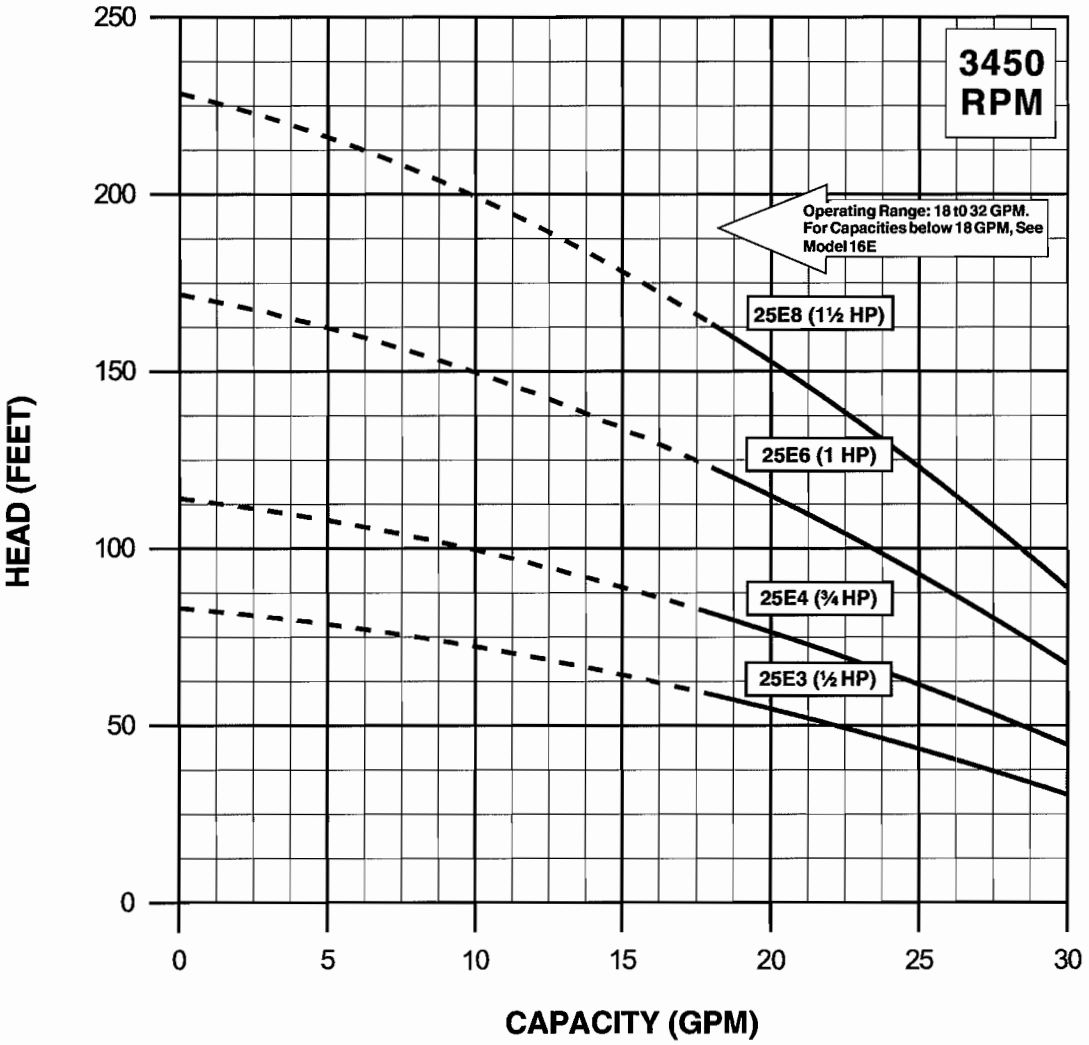
INSTALLATION: Unit to be installed vertically for submerged operation.

Electrical Data, Dimensions, and Weights ①

Pump Type	Motors				DIMENSIONS IN INCHES							
	HP	SF	PH	Volts	Overall Length A	Motor Length B	Pump End Length C	Max. Dia. D	Inlet E	Disch. Pipe Size (NPT) F	Net Weight (Lbs.)②	Ship. Weight (Lbs.)②
25E3	½	1.60	1	230	19 3/8	10 13/16	8 9/16	3 31/32	3 ¼	1 ½	24	25
25E4	¾	1.50	1	230	20 13/16	11 3/8	9 7/16	3 31/32	3 ¼	1 ½	25	27
25E6	1	1.40	1	230	23 1/16	12	11 1/16	3 31/32	3 ¼	1 ½	27	29
25E8	1 ½	1.30	1	230	26 5/16	13 9/16	12 ¾	3 31/32	3 ¼	1 ½	28	30

① Data for Grundfos MS402E motors. ② Does not include motor leads.

Performance Curves



Materials of Construction

REDI-FLO4 PUMP END

Description	Material
Check Valve Housing, Check Valve, Diffuser Chamber, Impeller, Suction Interconnector, Inlet Screen, Pump Shaft, Straps, Cable Guard, Priming Inducer	304 SS
Check Valve Seat	304 SS &Teflon®
Impeller Seal Ring	Teflon®
Coupling	316/431 SS
Intermediate Bearings	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR

Description	Material
NEMA Top, Studs & Fasteners, Stator Housing, Fill Plug Screw	304 SS
Nuts	316 SS
Sand Slinger	FPM
Shaft Extension	431 SS
Diaphragm	FPM
Fill Plug Washer	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS

Description	Material
Connector Sleeve	304 SS
Connector Potting	Scotch Cast #4® Epoxy w/FPM Cap
Connector Plug	FPM
Lead Insulation	Teflon®
Conductor	Stranded Copper, 12 AWG

NOTES: Specifications are subject to change without notice.
Teflon® is a registered trademark of DuPont.
Scotch Cast #4® is a registered trademark of 3M Company.

GRUNDFOS®

GRUNDFOS Pumps Corporation • 3131 N. Business Park Ave. Fresno, CA 93727
Customer Service Centers: Allentown, PA • Fresno, CA
Phone: (800)333-1366 • Fax: (800)333-1363
Canada: Oakville, Ontario • **Mexico:** Apodaca, N.L.

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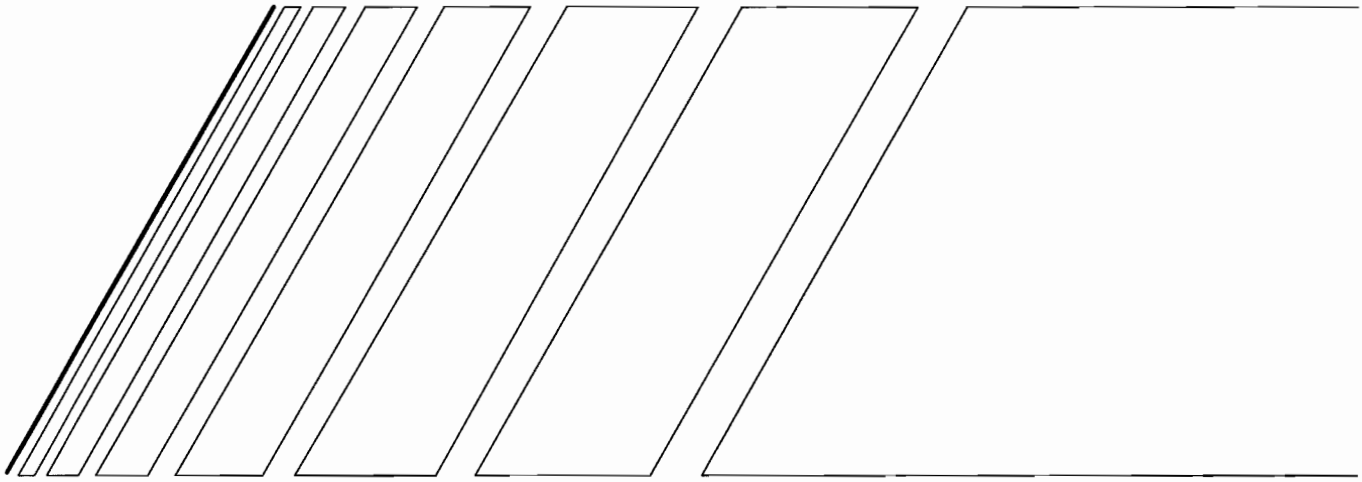
OMRON



USER'S MANUAL

SYSDRIVE 3G3JV SERIES

Compact Simplified Inverter

Thank you for choosing this SYSDRIVE 3G3JV-series product. Proper use and handling of the product will ensure proper product performance, will lengthen product life, and may prevent possible accidents.
Please read this manual thoroughly and handle and operate the product with care.

NOTICE

1. This manual describes the functions of the product and relations with other products. You should assume that anything not described in this manual is not possible.
2. Although care has been given in documenting the product, please contact your OMRON representative if you have any suggestions on improving this manual.
3. The product contains potentially dangerous parts under the cover. Do not attempt to open the cover under any circumstances. Doing so may result in injury or death and may damage the product. Never attempt to repair or disassemble the product.
4. We recommend that you add the following precautions to any instruction manuals you prepare for the system into which the product is being installed.
   - Precautions on the dangers of high-voltage equipment.
   - Precautions on touching the terminals of the product even after power has been turned OFF. (These terminals are live even with the power turned OFF.)
5. Specifications and functions may be changed without notice in order to improve product performance.

Items to Check Before Unpacking

Check the following items before removing the product from the package:

- Has the correct product been delivered (i.e., the correct model number and specifications)?
- Has the product been damaged in shipping?
- Are any screws or bolts loose?

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠**DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠**WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠**Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PC" means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

General Precautions

Observe the following precautions when using the SYSDRIVE Inverters and peripheral devices.

This manual may include illustrations of the product with protective covers removed in order to describe the components of the product in detail. Make sure that these protective covers are on the product before use.

Consult your OMRON representative when using the product after a long period of storage.

⚠ **WARNING** Do not touch the inside of the Inverter. Doing so may result in electrical shock.

⚠ **WARNING** Operation, maintenance, or inspection must be performed after turning OFF the power supply, confirming that the CHARGE indicator (or status indicators) are OFF, and after waiting for the time specified on the front cover. Not doing so may result in electrical shock.

⚠ **WARNING** Do not damage, pull on, apply stress to, place heavy objects on, or pinch the cables. Doing so may result in electrical shock.

⚠ **WARNING** Do not touch the rotating parts of the motor under operation. Doing so may result in injury.

⚠ **WARNING** Do not modify the product. Doing so may result in injury or damage to the product.

⚠ **Caution** Do not store, install, or operate the product in the following places. Doing so may result in electrical shock, fire or damage to the product.

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠ **Caution** Do not touch the Inverter radiator, regenerative resistor, or Servomotor while the power is being supplied or soon after the power is turned OFF. Doing so may result in a skin burn due to the hot surface.

⚠ **Caution** Do not conduct a dielectric strength test on any part of the Inverter. Doing so may result in damage to the product or malfunction.

⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations. Not doing so may result in equipment damage.

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields and magnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

Transportation Precautions

⚠ **Caution** Do not hold by front cover or panel , instead, hold by the radiation fin (heat sink) while transporting the product. Doing so may result in injury.

⚠ **Caution** Do not pull on the cables. Doing so may result in damage to the product or malfunction.

⚠ **Caution** Use the eye-bolts only for transporting the Inverter. Using them for transporting the machinery may result in injury or malfunction.

Installation Precautions

⚠ **WARNING** Provide an appropriate stopping device on the machine side to secure safety. (A holding brake is not a stopping device for securing safety.) Not doing so may result in injury.

⚠ **WARNING** Provide an external emergency stopping device that allows an instantaneous stop of operation and power interruption. Not doing so may result in injury.

⚠ **Caution** Be sure to install the product in the correct direction and provide specified clearances between the Inverter and control panel or with other devices. Not doing so may result in fire or malfunction.

⚠ **Caution** Do not allow foreign objects to enter inside the product. Doing so may result in fire or malfunction.

⚠ **Caution** Do not apply any strong impact. Doing so may result in damage to the product or malfunction.

Wiring Precautions

⚠ **WARNING** Wiring must be performed only after confirming that the power supply has been turned OFF. Not doing so may result in electrical shock.

⚠ **WARNING** Wiring must be performed by authorized personnel. Not doing so may result in electrical shock or fire.

⚠ **WARNING** Be sure to confirm operation only after wiring the emergency stop circuit. Not doing so may result in injury.

⚠ **WARNING** Always connect the ground terminals to a ground of 100 Ω or less for the 200-V AC class, or 10 Ω or less for the 400-V AC class. Not connecting to a proper ground may result in electrical shock.

⚠ **Caution** Install external breakers and take other safety measures against short-circuiting in external wiring. Not doing so may result in fire.

⚠ **Caution** Confirm that the rated input voltage of the Inverter is the same as the AC power supply voltage. An incorrect power supply may result in fire, injury, or malfunction.

⚠ **Caution** Connect the Braking Resistor and Braking Resistor Unit as specified in the manual. Not doing so may result in fire.

⚠ **Caution** Be sure to wire correctly and securely. Not doing so may result in injury or damage to the product.

⚠ **Caution** Be sure to firmly tighten the screws on the terminal block. Not doing so may result in fire, injury, or damage to the product.

⚠ **Caution** Do not connect an AC power to the U, V, or W output. Doing so may result in damage to the product or malfunction.

Operation and Adjustment Precautions

⚠ **WARNING** Turn ON the input power supply only after mounting the front cover, terminal covers, bottom cover, Operator, and optional items. Not doing so may result in electrical shock.

⚠ **WARNING** Do not remove the front cover, terminal covers, bottom cover, Operator, or optional items while the power is being supplied. Not doing so may result in electrical shock or damage to the product.

⚠ **WARNING** Do not operate the Operator or switches with wet hands. Doing so may result in electrical shock.

⚠ **WARNING** Do not touch the inside of the Inverter. Doing so may result in electrical shock.

⚠ **WARNING** Do not come close to the machine when using the error retry function because the machine may abruptly start when stopped by an alarm. Doing so may result in injury.

⚠ **WARNING** Do not come close to the machine immediately after resetting momentary power interruption to avoid an unexpected restart (if operation is set to be continued in the processing selection function after momentary power interruption is reset). Doing so may result in injury.

⚠ **WARNING** Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed. Not doing so may result in injury.

⚠ **WARNING** Be sure confirm that the RUN signal is turned OFF before turning ON the power supply, resetting the alarm, or switching the LOCAL/REMOTE selector. Doing so while the RUN signal is turned ON may result in injury.

⚠ **Caution** Be sure to confirm permissible ranges of motors and machines before operation because the Inverter speed can be easily changed from low to high. Not doing so may result in damage to the product.

⚠ **Caution** Provide a separate holding brake when necessary. Not doing so may result in injury.

⚠ **Caution** Do not perform a signal check during operation. Doing so may result in injury or damage to the product.

⚠ **Caution** Do not carelessly change settings. Doing so may result in injury or damage to the product.

Maintenance and Inspection Precautions

⚠ **WARNING** Do not touch the Inverter terminals while the power is being supplied.

⚠ **WARNING** Maintenance or inspection must be performed only after turning OFF the power supply, confirming that the CHARGE indicator (or status indicators) is turned OFF, and after waiting for the time specified on the front cover. Not doing so may result in electrical shock.

⚠ **WARNING** Maintenance, inspection, or parts replacement must be performed by authorized personnel. Not doing so may result in electrical shock or injury.

⚠ **WARNING** Do not attempt to take the Unit apart or repair. Doing either of these may result in electrical shock or injury.

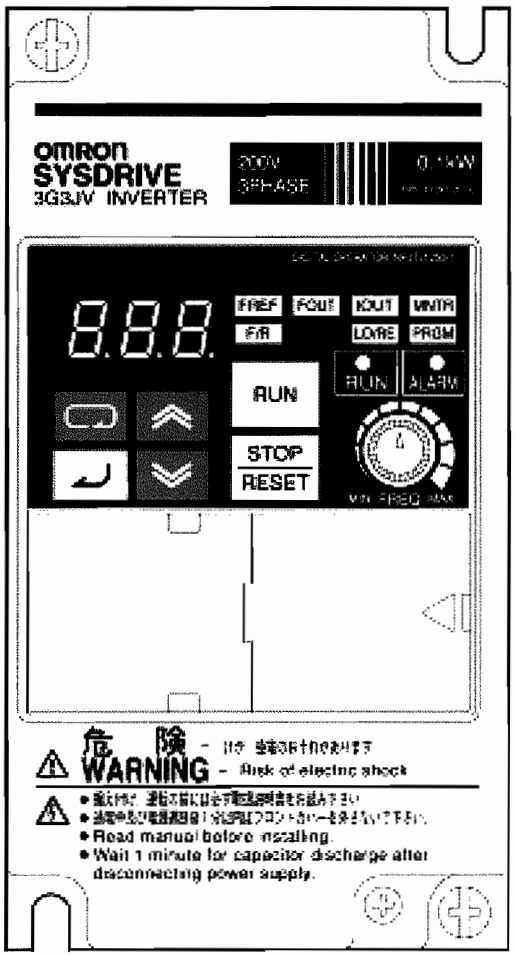
⚠ **Caution** Carefully handle the Inverter because it uses semiconductor elements. Careless handling may result in malfunction.

⚠ **Caution** Do not change wiring, disconnect connectors, the Operator, or optional items, or replace fans while power is being supplied. Doing so may result in injury, damage to the product, or malfunction.

Warning Labels

Warning labels are pasted on the product as shown in the following illustration. Be sure to follow the instructions given there.

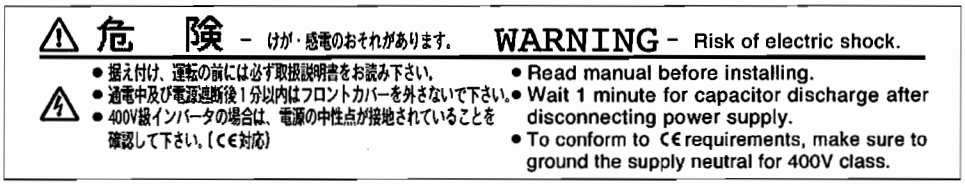
■ Warning Labels



■ Contents of Warning

- For 3G3JV-A2001-A to model -A2007-A (0.1 to 0.75 kW) and 3G3JV-AB001-A to -AB004-A (0.1 to 0.4 kW):

- For 3G3JV-A2015-A to model -A2037-A (1.5 to 3.7 kW), 3G3JV-AB007-A to -AB015-A (0.75 to 1.5 kW), and 3G3JV-A4002-A to -A4037-A (0.2 to 3.7 kW):



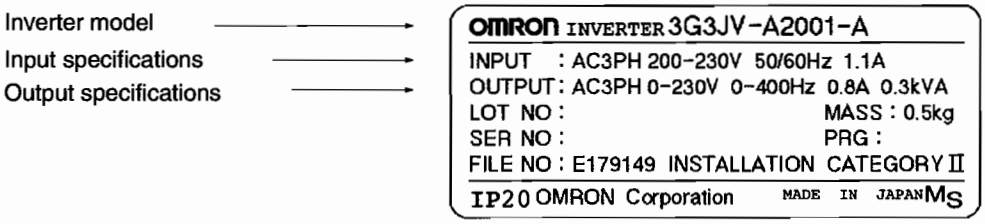
Checking Before Unpacking

■ Checking the Product

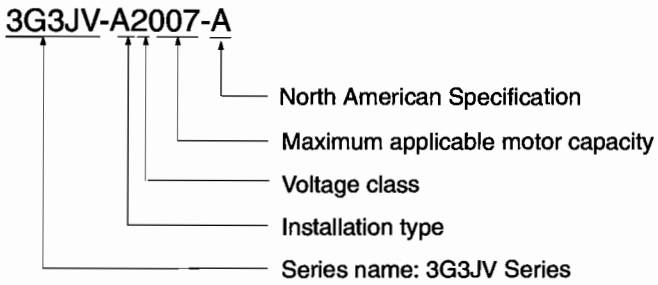
On delivery, always check that the delivered product is the SYSDRIVE 3G3JV Inverter that you ordered.

Should you find any problems with the product, immediately contact your nearest local sales representative.

● Checking the Nameplate



● Checking the Model



Maximum Applicable Motor Capacity

001	0.1 (0.1) kW
002	0.25/0.37 (0.2) kW
004	0.55 (0.4) kW
007	1.1 (0.75) kW
015	1.5 (1.5) kW
022	2.2 (2.2) kW
037	3.7 (3.7) kW

Note The figures in parentheses indicate capacities for motors used outside Japan.

Voltage Class

2	Three-phase 230-V AC input (230-V class)
B	Single-phase 230-V AC input (230-V class)
4	Three-phase 460-V AC input (460-V class)

Installation Type

A	Panel-mounting models (IP10 min.) or Closed wall mounting

• Checking for Damage

Check the overall appearance and check for damage or scratches resulting from transportation.

■ Checking the Accessories

This manual is the only accessory provided with the 3G3JV. Set screws and other necessary parts must be provided by the user.

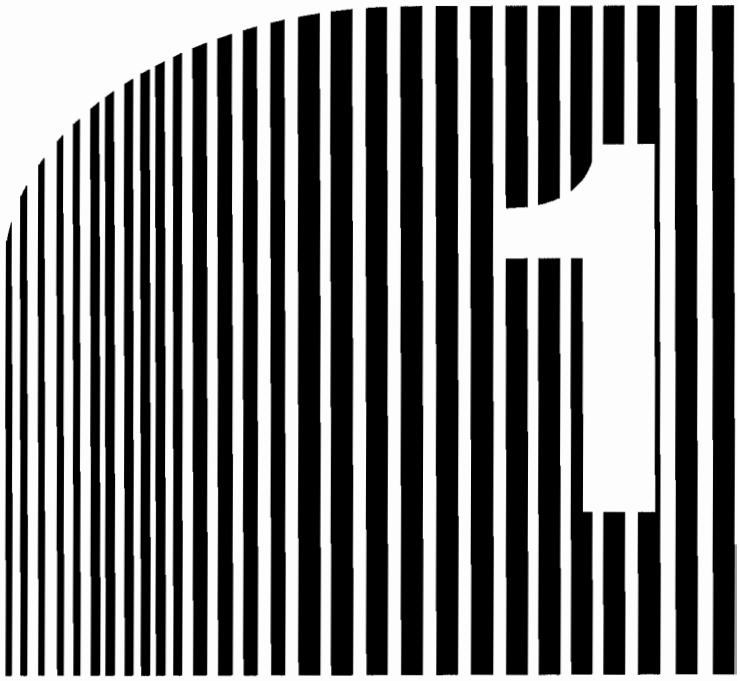
About this Manual

This manual is divided into the chapters described in the following table. Information is organized by application area to enable you to use the manual more efficiently.

Chapter	Contents
Chapter 1 Overview	Describes features and nomenclature.
Chapter 2 Design	Provides dimensions, installation methods, wiring methods, peripheral device design information, and peripheral device selection information.
Chapter 3 Preparing for Operation and Monitoring	Describes nomenclature and Digital Operator procedures for operating and monitoring Inverters.
Chapter 4 Test Run	Describes the method for controlling a motor through the frequency adjuster on the front of the Inverter. This can be used for trial operation of the system.
Chapter 5 Basic Operation	Describes basic Inverter control functions for users not familiar with Inverters. The functions that must be understood to drive a motor with an Inverter are described.
Chapter 6 Advanced Operation	Describes all of the functions provided by the Inverter. These functions will enable more advanced applications, and includes functions that will improve motor control through the Inverter, such as responsiveness (torque characteristics), increasing speed accuracy, PID control, overtorque detection, and other functions.
Chapter 7 Maintenance Operations	Provides maintenance, inspection, and troubleshooting information.
Chapter 8 Specifications	Provides Inverter specifications, as well as the specifications and dimensions of peripheral devices.
Chapter 9 List of Parameters	Lists basic information on Inverter parameters as a reference for users already familiar with Inverter operation. Parameters are listed in order with the page numbers of further information for easy reference.
Chapter 10 Using the Inverter for a Motor	Describes information on using the Inverter for a motor.

Table of Contents

Table of Contents



Chapter 1

• Overview •

1-1 Function

The compact simple SYSDRIVE 3G3JV-Series Inverter ensures greater ease of use than any conventional model.
The 3G3JV Inverter meets EC Directives and UL/cUL standard requirements for world-wide use.

■ SYSDRIVE 3G3JV Inverter Models

- The following 3-phase and single-phase 230-V AC-class, and 3-phase 460-V AC-class 3G3JV models are available.

Rated voltage	Protective structure	Maximum applied motor capacity	Model
3-phase 230 V AC	Panel-mounting models (conforming to IP20)	0.1 (0.1) kW	3G3JV-A2001-A
		0.25 (0.2) kW	3G3JV-A2002-A
		0.55 (0.4) kW	3G3JV-A2004-A
		1.1 (0.75) kW	3G3JV-A2007-A
		1.5 (1.5) kW	3G3JV-A2015-A
		2.2 (2.2) kW	3G3JV-A2022-A
		3.7 (3.7) kW	3G3JV-A2037-A
Single-phase 230 V AC	Panel-mounting models (conforming to IP20)	0.1 (0.1) kW	3G3JV-AB001-A
		0.25 (0.2) kW	3G3JV-AB002-A
		0.55 (0.4) kW	3G3JV-AB004-A
		1.1 (0.75) kW	3G3JV-AB007-A
		1.5 (1.5) kW	3G3JV-AB015-A
3-phase 460 V AC	Panel-mounting models (conforming to IP20)	0.37 (0.2) kW	3G3JV-A4002-A
		0.55 (0.4) kW	3G3JV-A4004-A
		1.1 (0.75) kW	3G3JV-A4007-A
		1.5 (1.5) kW	3G3JV-A4015-A
		2.2 (2.2) kW	3G3JV-A4022-A
		3.7 (3.7) kW	3G3JV-A4037-A

Note 1. The figures in parentheses indicate capacities for motors used outside Japan.

Note 2. It is not possible to connect a Braking Resistor or Braking Unit to a 3G3JV-series Inverter. Select an Inverter from another series if the application requires braking control.

■ International Standards (EC Directives and UL/cUL Standards)

The 3G3JV Inverter meets the EC Directives and UL/cUL standard requirements for worldwide use.

Classification		Applicable standard
EC Directives	EMC Directive	EN50081-2 and EN5008-2
	Low-voltage Directive	prEN50178
UL/cUL		UL508C

■ Versatile Easy-to-use Functions

- Incorporates the functions and operability ensured by the conventional 3G3EV Series.
- Easy to initialize and operate with the FREQ adjuster on the Digital Operator.
- Ease of maintenance. The cooling fan is easily replaceable. The life of the cooling fan can be prolonged by turning on the cooling fan only when the Inverter is in operation.

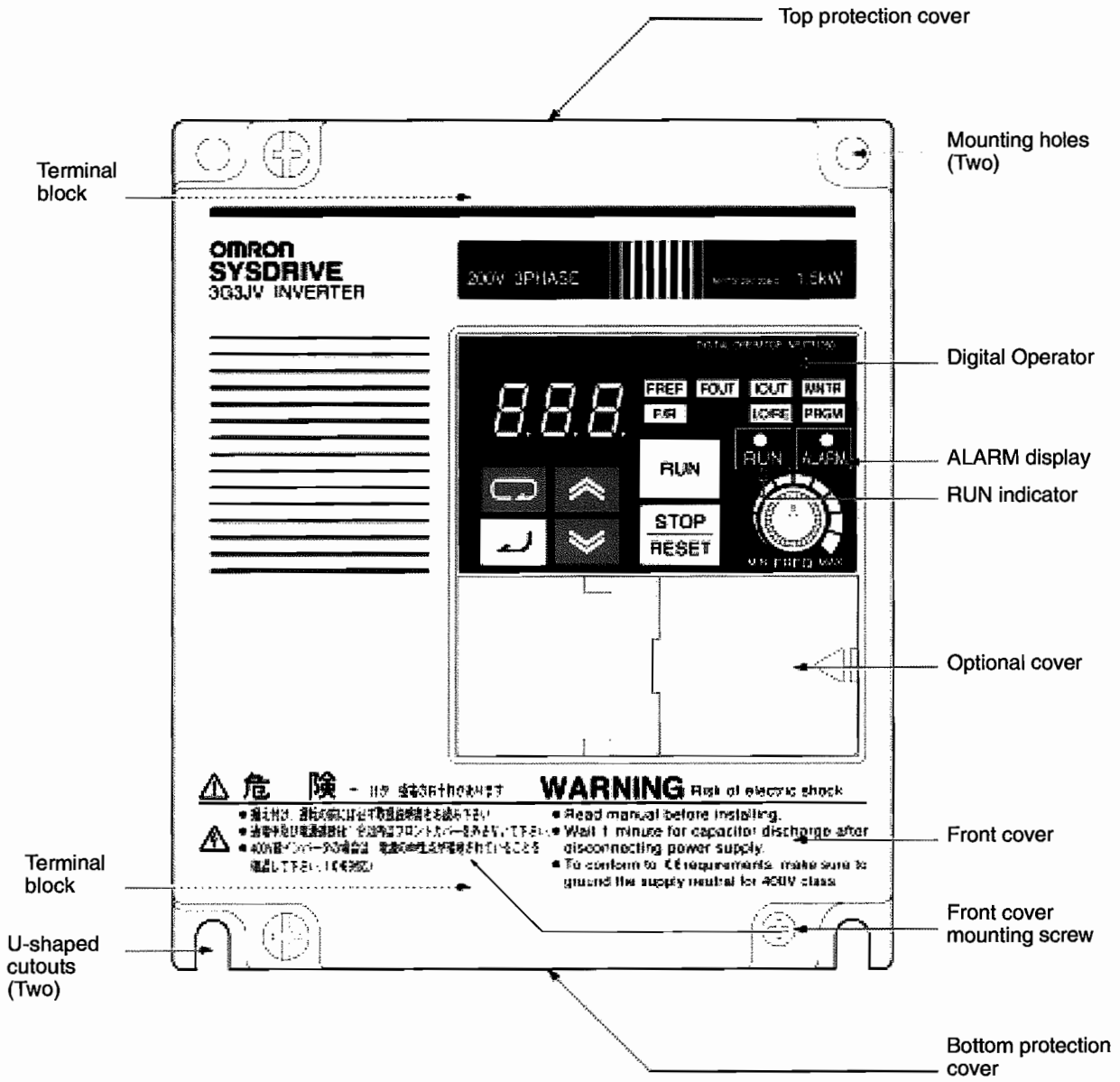
■ Suppression of Harmonics

Connects to DC reactors, thus suppressing harmonics more effectively than conventional AC reactors.

Further improvement in the suppression of harmonics is possible with the combined use of the DC and AC reactors.

1-2 Nomenclature

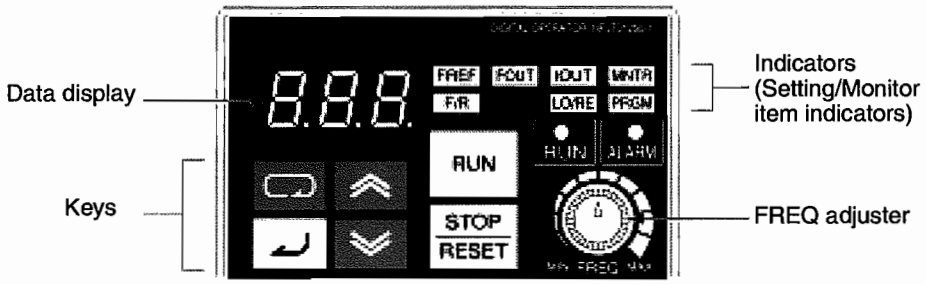
■ Panel



Note 1. The front cover functions as a terminal cover. The Digital Operator Unit cannot be removed.

Note 2. Instead of mounting holes, each of the following models has two U-shaped cutouts located diagonally.
3G3JV-A2001-A (0.1 kW), 3G3JV-A2002-A (0.25 kW), 3G3JV-A2004-A (0.55 kW), and 3G3JV-A2007-A (1.1 kW) 3G3JV-AB001-A (0.1 kW), 3G3JV-AB002-A (0.25 kW), and 3G3JV-AB004-A (0.55 kW)

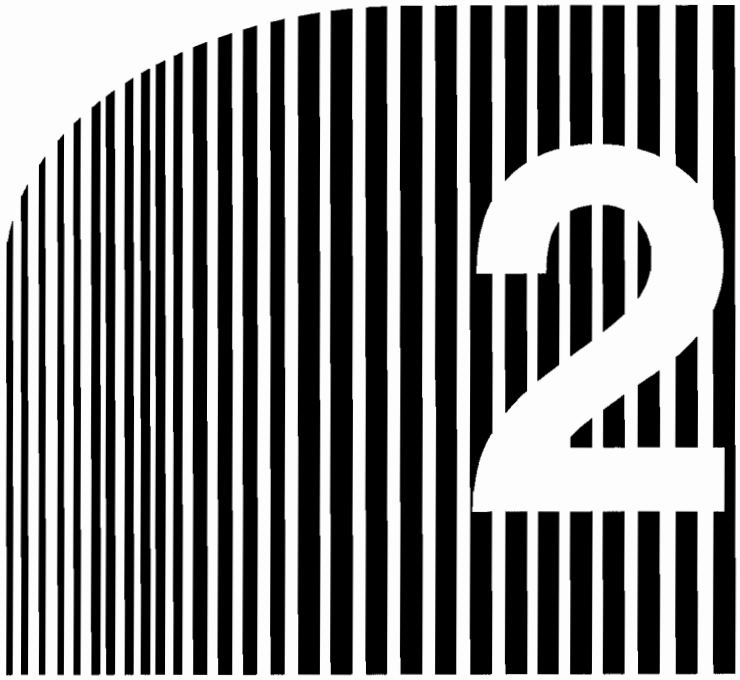
■ Digital Operator



Appearance	Name	Function
	Data display	Displays relevant data items, such as frequency reference, output frequency, and parameter set values.
MIN MAX FREQUENCY	FREQ adjuster	Sets the frequency reference within a range between 0 Hz and the maximum frequency.
FREF	FREF indicator	The frequency reference can be monitored or set while this indicator is lit.
FOUT	FOUT indicator	The output frequency of the Inverter can be monitored while this indicator is lit.
IOUT	IOUT indicator	The output current of the Inverter can be monitored while this indicator is lit.
MNTR	MNTR indicator	The values set in U01 through U10 are monitored while this indicator is lit.
F/R	F/R indicator	The direction of rotation can be selected while this indicator is lit when operating the Inverter with the RUN Key.
LO/RE	LO/RE indicator	The operation of the Inverter through the Digital Operator or according to the set parameters is selectable while this indicator is lit. **Note** This status of this indicator can be only monitored while the Inverter is in operation. Any RUN command input is ignored while this indicator is lit.
PRGM	PRGM indicator	The parameters in n01 through n79 can be set or monitored while this indicator is lit. **Note** While the Inverter is in operation, the parameters can be only monitored and only some parameters can be changed. Any RUN command input is ignored while this indicator is lit.
	Mode Key	Switches the setting and monitor item indicators in sequence. Parameter being set will be canceled if this key is pressed before entering the setting.
	Increment Key	Increases multi-function monitor numbers, parameter numbers, and parameter set values.
	Decrement Key	Decreases multi-function monitor numbers, parameter numbers, and parameter set values.

Appearance	Name	Function
↵	Enter Key	Enters multi-function monitor numbers, parameter numbers, and internal data values after they are set or changed.
RUN	RUN Key	Starts the Inverter running when the 3G3JV is in operation with the Digital Operator.
STOP / RESET	STOP/RESET Key	Stops the Inverter unless parameter n06 is set to disable the STOP Key. Functions as a Reset Key when an Inverter error occurs. (See note.)

Note For safety reasons, the reset will not work while a RUN command (forward or reverse) is in effect. Wait until the RUN command is OFF before resetting the Inverter.



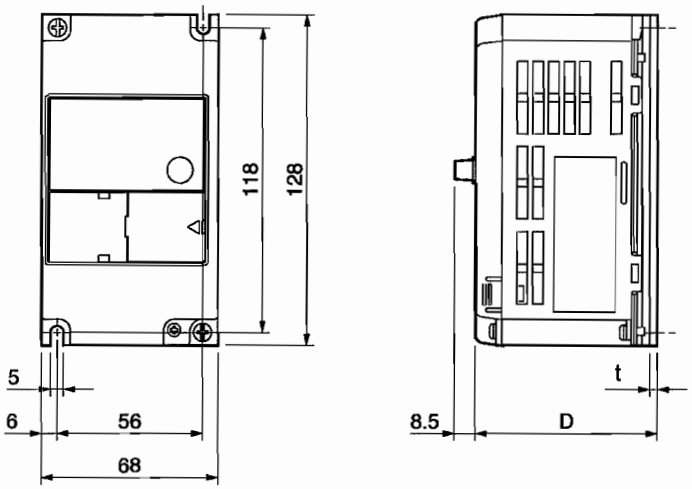
Chapter 2

• Design •

2-1 Installation

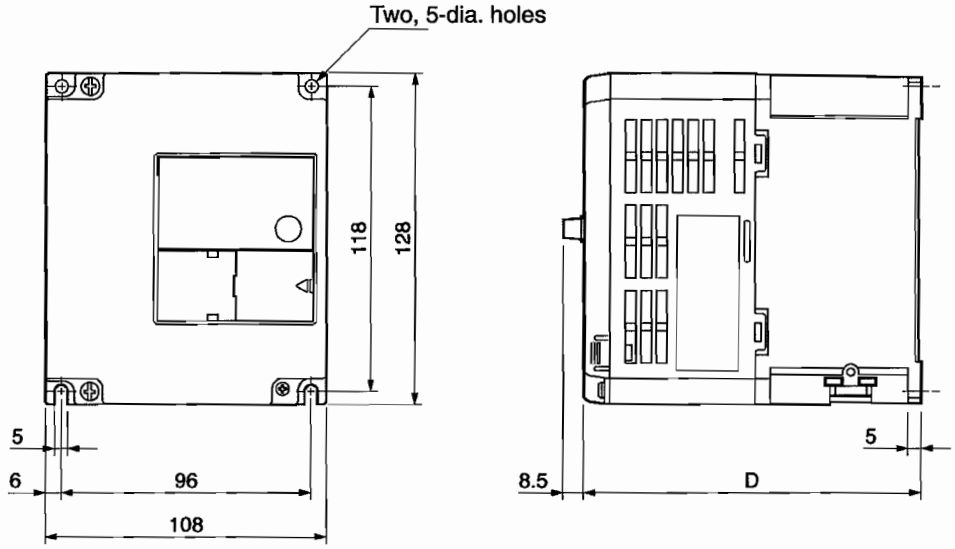
2-1-1 Dimensions

- **3G3JV-A2001-A to 3G3JV-A2007-A (0.1 to 0.75 kW) 3-phase 230-V AC Input**
  3G3JV-AB001-A to 3G3JV-AB004-A (0.1 to 0.4 kW) Single-phase 230-V AC Input



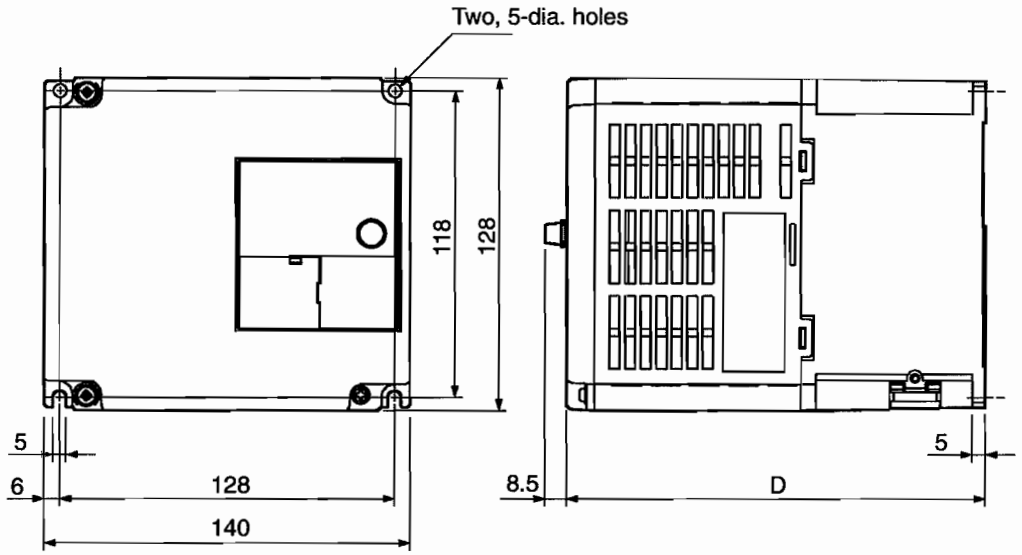
Rated voltage	Model 3G3JV-	Dimensions (mm)		Weight (kg)
		D	t	
3-phase 230 V AC	A2001-A	70	3	Approx. 0.5
	A2002-A	70	3	Approx. 0.5
	A2004-A	102	5	Approx. 0.8
	A2007-A	122	5	Approx. 0.9
Single-phase 230 V AC	AB001-A	70	3	Approx. 0.5
	AB002-A	70	3	Approx. 0.5
	AB004-A	112	5	Approx. 0.9

- **3G3JV-A2015-A to 3G3JV-A2022-A (1.5 to 2.2 kW) 3-phase 230-V AC Input**
  3G3JV-AB007-A to 3G3JV-AB015-A (0.75 to 1.5 kW) Single-phase 230-V AC Input
  3G3JV-A4002-A to 3G3JV-A4022-A (0.2 to 2.2 kW) 3-phase 460-V AC Input



Rated voltage	Model 3G3JV-	Dimensions (mm)	Weight (kg)
		D	
3-phase 230 V AC	A2015-A	129	Approx. 1.3
	A2022-A	154	Approx. 1.5
Single-phase 230 V AC	AB007-A	129	Approx. 1.5
	AB015-A	154	Approx. 1.5
3-phase 460 V AC	A4002-A	81	Approx. 1.0
	A4004-A	99	Approx. 1.1
	A4007-A	129	Approx. 1.5
	A4015-A	154	Approx. 1.5
	A4022-A	154	Approx. 1.5

- **3G3JV-A2037-A (3.7 kW) 3-phase 230-V AC Input**
  3G3JV-A4037-A (3.7 kW) 3-phase 460-V AC Input



Rated voltage	Model 3G3JV-	Dimensions (mm)	Weight (kg)
		D	
3-phase 230 V AC	A2037-A	161	Approx. 2.1
3-phase 460 V AC	A4037-A	161	Approx. 2.1

2-1-2 Installation Conditions

⚠ **WARNING** Provide an appropriate stopping device on the machine side to secure safety. (A holding brake is not a stopping device for securing safety.) Not doing so may result in injury.

⚠ **WARNING** Provide an external emergency stopping device that allows an instantaneous stop of operation and power interruption. Not doing so may result in injury.

⚠ **Caution** Be sure to install the product in the correct direction and provide specified clearances between the Inverter and control panel or with other devices. Not doing so may result in fire or malfunction.

⚠ **Caution** Do not allow foreign objects to enter inside the product. Doing so may result in fire or malfunction.

⚠ **Caution** Do not apply any strong impact. Doing so may result in damage to the product or malfunction.

■ Installation Direction and Dimensions

- Install the Inverter under the following conditions.

  Ambient temperature for operation (panel-mounting): –10°C to 50°C

  Humidity: 95% or less (no condensation)

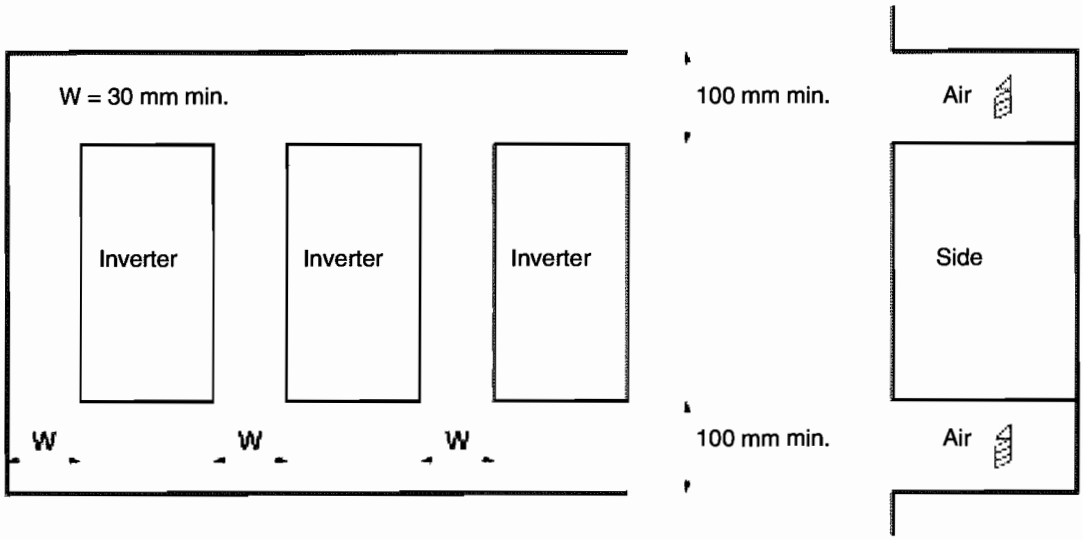
- Install the Inverter in a clean location free from oil mist and dust. Alternatively, install it in a totally enclosed panel that is completely protected from floating dust.
- When installing or operating the Inverter, always take special care so that metal powder, oil, water, or other foreign matter does not get into the Inverter.
- Do not install the Inverter on inflammable material such as wood.

■ Direction

- Install the Inverter on a vertical surface so that the characters on the nameplate are oriented upward.

■ Dimensions

- When installing the Inverter, always provide the following clearances to allow normal heat dissipation from the Inverter.



■ Ambient Temperature Control

- To enhance operation reliability, the Inverter should be installed in an environment free from extreme temperature changes.
- If the Inverter is installed in an enclosed environment such as a box, use a cooling fan or air conditioner to maintain the internal air temperature below 50°C.
  The life of the built-in electrolytic capacitors of the Inverter is prolonged by maintaining the internal air temperature as low as possible.
- The surface temperature of the Inverter may rise approximately 30°C higher than the ambient temperature. Be sure to keep away equipment and wires from the Inverter as far as possible if the equipment and wires are easily influenced by heat.

■ Protecting Inverter from Foreign Matter during Installation

- Place a cover over the Inverter during installation to shield it from metal power produced by drilling. Upon completion of installation, always remove the cover from the Inverter. Otherwise, ventilation will be affected, causing the Inverter to overheat.

2-2 Wiring

⚠ **WARNING** Wiring must be performed only after confirming that the power supply has been turned OFF. Not doing so may result in electrical shock.

⚠ **WARNING** Wiring must be performed by authorized personnel. Not doing so may result in electrical shock or fire.

⚠ **WARNING** Be sure to confirm operation only after wiring the emergency stop circuit. Not doing so may result in injury.

⚠ **WARNING** Always connect the ground terminals to a ground of 100 Ω or less for the 200-V AC class, or 10 Ω or less for the 400-V AC class. Not connecting to a proper ground may result in electrical shock.

⚠ **Caution** Install external breakers and take other safety measures against short-circuiting in external wiring. Not doing so may result in fire.

⚠ **Caution** Confirm that the rated input voltage of the Inverter is the same as the AC power supply voltage. An incorrect power supply may result in fire, injury, or malfunction.

⚠ **Caution** Connect the Braking Resistor and Braking Resistor Unit as specified in the manual. Not doing so may result in fire.

⚠ **Caution** Be sure to wire correctly and securely. Not doing so may result in injury or damage to the product.

⚠ **Caution** Be sure to firmly tighten the screws on the terminal block. Not doing so may result in fire, injury, or damage to the product.

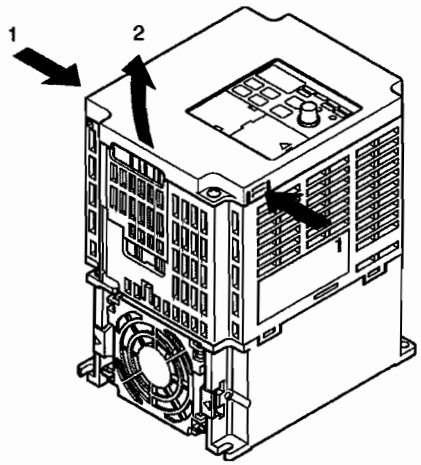
⚠ **Caution** Do not connect an AC power to the U, V, or W output. Doing so may result in damage to the product or malfunction.

2-2-1 Removing and Mounting the Covers

It is necessary to remove the front cover, optional cover, top protection cover, and the bottom protection cover from the Inverter to wire the terminal block.
Follow the instructions below to remove the covers from the Inverter.
To mount the covers, take the opposite steps.

■ Removing the Front Cover

- Loosen the front cover mounting screws with a screwdriver.
- Press the left and right sides of the front cover in the arrow 1 directions and lift the bottom of the cover in the arrow 2 direction to remove the front cover as shown in the following illustration.

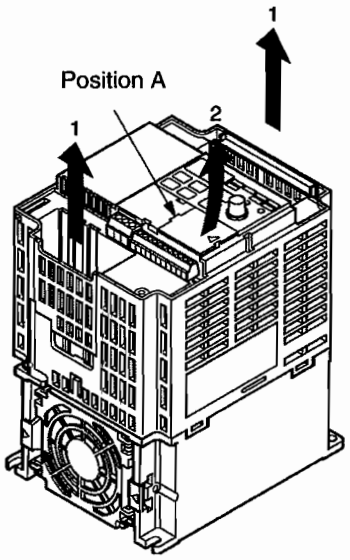


■ Removing the Top and Bottom Protection Covers and Optional Cover

• Removing the Top and Bottom Protection Covers

- After removing the front cover, pull the top and bottom protection covers in the arrow 1 directions.

- **Removing the Optional Cover**
- After removing the front cover, lift the optional cover in the arrow 2 direction based on position A as a fulcrum.

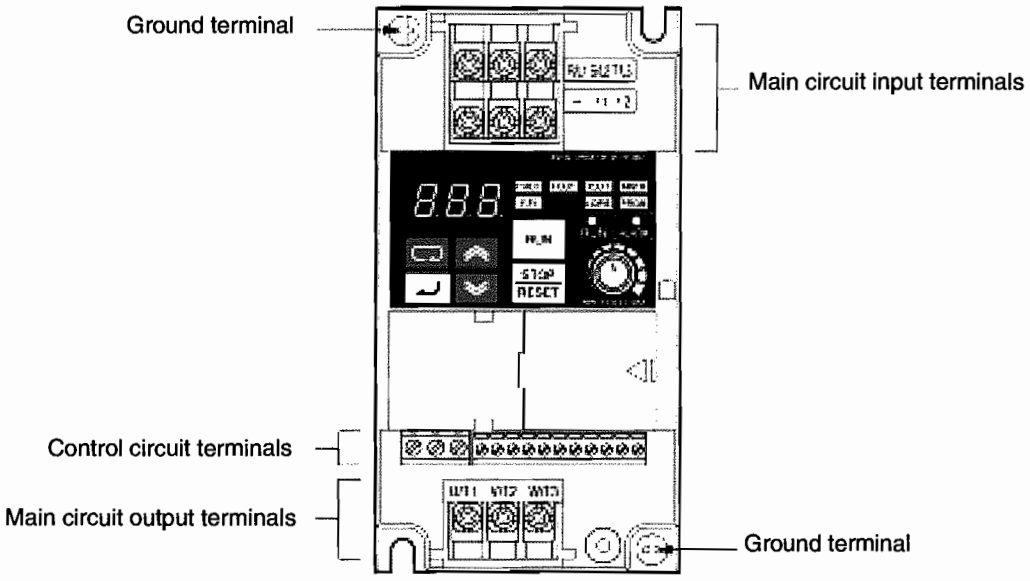


Note The front cover functions as a terminal cover. The Digital Operator cannot be removed.

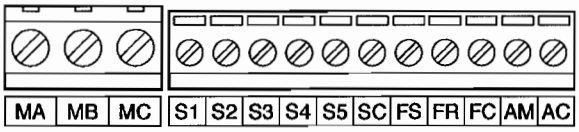
2-2-2 Terminal Block

Before wiring the terminal block, be sure to remove the front cover, top protection cover, and the bottom protection cover.

■ Position of Terminal Block



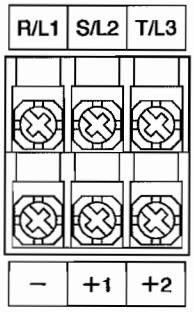
■ Arrangement of Control Circuit Terminals



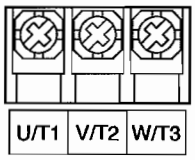
■ Arrangement of Main Circuit Terminals

- **3G3JV-A2001-A to 3G3JV-A2007-A 3G3JV-AB001-A to 3G3JV-AB004-A**

Main Circuit Input Terminals (Upper Side)

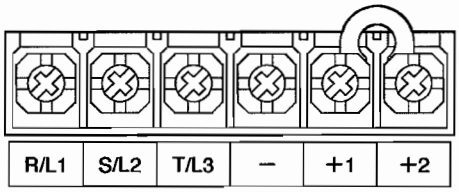


Main Circuit Output Terminals (Lower Side)

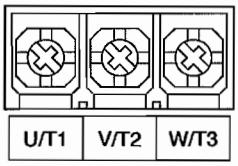


- **3G3JV-A2015-A to 3G3JV-A2037-A 3G3JV-AB007-A to 3G3JV-AB015-A 3G3JV-A4002-A to 3G3JV-A4037-A**

Main Circuit Input Terminals (Upper Side)



Main Circuit Output Terminals (Lower Side)



■ Main Circuit Terminals

Symbol	Name	Description
R/L1 S/L2 T/L3	Power supply input terminals	3G3JV-A2□: 3-phase 200 to 230 V AC 3G3JV-AB□: Single-phase 200 to 240 V AC 3G3JV-A4□: 3-phase 380 to 460 V AC **Note** Connect single-phase input to terminals R/L1 and S/L2.
U/T1 V/T2 W/T3	Motor output terminals	3-phase power supply output for driving motors. 3G3JV-A2□: 3-phase 200 to 230 V AC 3G3JV-AB□: 3-phase 200 to 240 V AC 3G3JV-A4□: 3-phase 380 to 460 V AC
+1 +2 –	Connection terminals +1 and +2: DC reactor connection terminals +1 and –: DC power supply input terminals	Connect the DC reactor for suppressing harmonics to terminals +1 and +2. When driving the Inverter with DC power, input the DC power to terminals +1 and –. (Terminal +1 is a positive terminal.)
⏚	Ground terminal	Be sure to ground the terminal under the following conditions. 3G3JV-A2□: Ground at a resistance of 100 Ω or less. 3G3JV-AB□: Ground at a resistance of 100 Ω or less. 3G3JV-A4□: Ground at a resistance of 10 Ω or less, and connect to the power supply's neutral phase to conform to EC Directives. **Note** Be sure to connect the ground terminal directly to the motor frame ground.

Note The maximum output voltage corresponds to the power supply input voltage of the Inverter.

■ Control Circuit Terminals

Symbol		Name	Function	Signal level
Input	S1	Forward/Stop	Forward at ON. Stops at OFF.	Photocoupler 8 mA at 24 V DC
	S2	Multi-function input 1 (S2)	Set by parameter n36 (Reverse/Stop)	**Note** NPN is the default setting for these terminals. Wire them by providing a common ground. No external power supply is required. To provide an external power supply and wire the terminals through a common positive line, however, set the SW7 to PNP and make sure that the power supply is at 24 V DC ±10%.
	S3	Multi-function input 2 (S3)	Set by parameter n37 (External fault: Normally open)	
	S4	Multi-function input 3 (S4)	Set by parameter n38 (Fault reset)	
	S5	Multi-function input 4 (S5)	Set by parameter n39 (Multi-step reference 1)	
	SC	Sequence input common	Common for S1 through S5	
	FS	Frequency reference power supply	DC power supply for frequency reference use	20 mA at 12 V DC
	FR	Frequency reference input	Input terminal for frequency reference use	0 to 10 V DC (input impedance: 20 kΩ)
	FC	Frequency reference common	Common for frequency reference use	

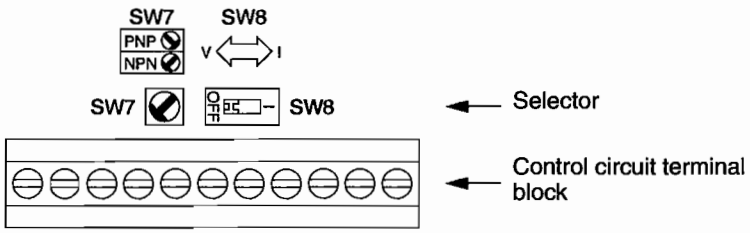
Symbol		Name	Function	Signal level
Output	MA	Multi-function contact output (Normally open)	Set by parameter n40 (during running)	Relay output 1 A max. at 30 V DC 1 A max. at 250 V AC
	MB	Multi-function contact output (Normally closed)		
	MC	Multi-function contact output common	Common for MA and MB use	
	AM	Analog monitor output	Set by parameter n44 (Output frequency)	2 mA max. at 0 to 10 V DC
	AC	Analog monitor output common	Common for AM use	

Note 1. Depending on the parameter settings, various functions can be selected for multi-function inputs and multi-function contacts outputs.

Note 2. Functions in parentheses are default settings.

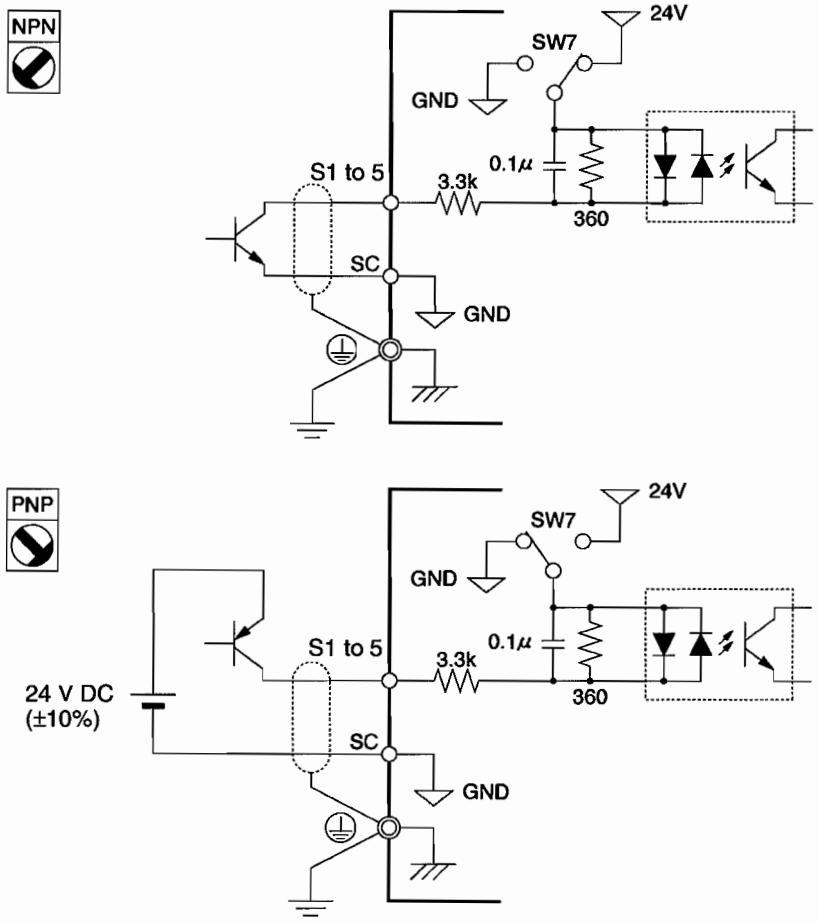
■ Selecting Input Method

- Switches SW7 and SW8, both of which are located above the control circuit terminals, are used for input method selection.
  Remove the front cover and optional cover to use these switches.



• Selecting Sequence Input Method

• By using SW7, NPN or PNP input can be selected as shown below.

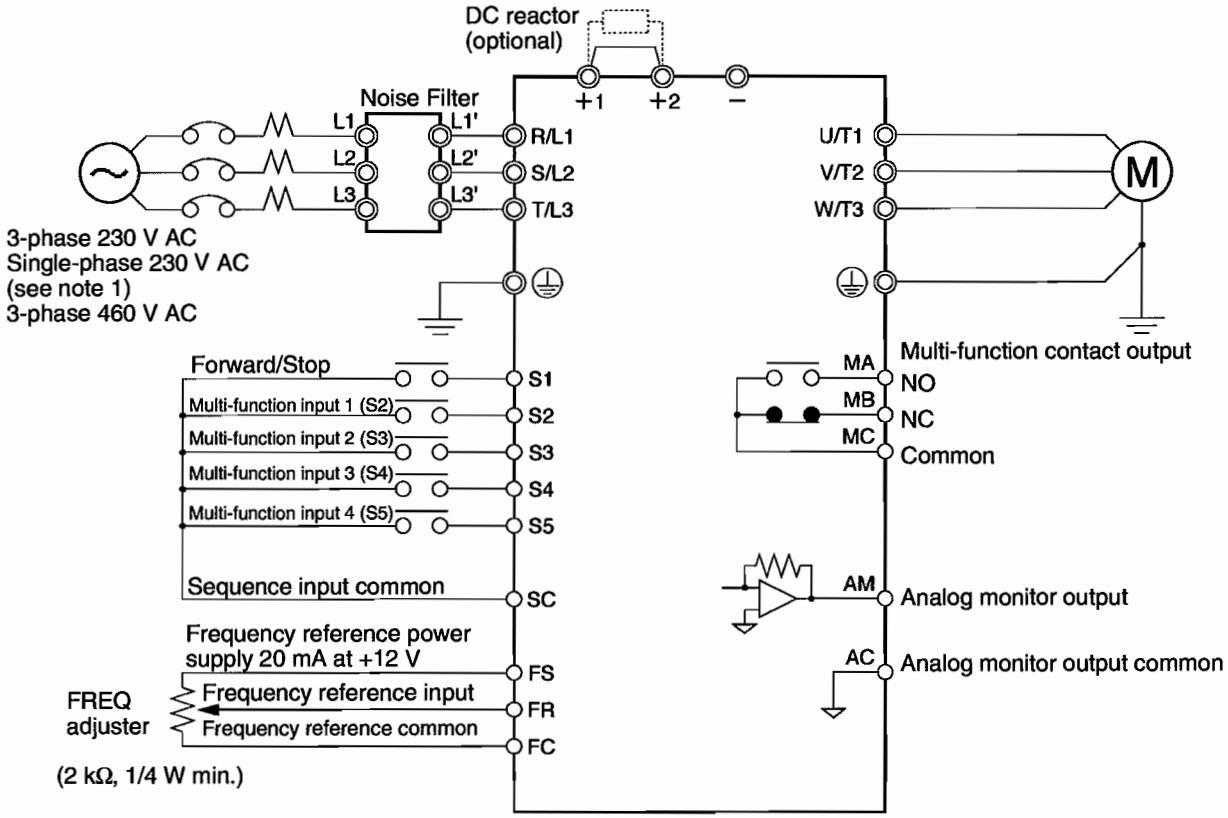


• Selecting Frequency Reference Input Method

• By using SW8, frequency reference voltage or current input can be selected.
Parameter settings are required together with the selection of the frequency reference input method.

Frequency reference input method	SW8 setting	Frequency reference selection (parameter n03)
Voltage input	V (OFF)	Set value 2
Current input	I (ON)	Set value 3 or 4

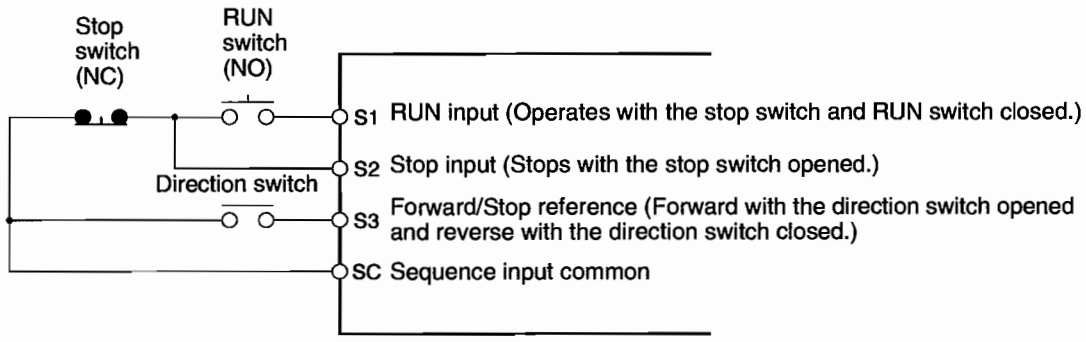
2-2-3 Standard Connections



Note **1.** Connect single-phase 230 V AC to terminals R/L1 and S/L2 of the 3G3JV-AB□.

Note **2.** The braking resistor cannot be connected because no braking transistor is incorporated.

• Example of 3-wire Sequence Connections



Note Set parameter n37 for 3-wire sequence input.

2-2-4 Wiring around the Main Circuit

■ Wire Size, Terminal Screw, Screw Tightening Torque, and Molded-case Circuit Breaker Capacities

- For the main circuit and ground, always use 600-V polyvinyl chloride (PVC) cables.
- If any cable is long and may cause voltage drops, increase the wire size according to the cable length.

• 3-phase 230-V AC Model

Model 3G3JV-	Terminal symbol	Terminal screw	Screw tightening torque (N•m)	Wire size (mm^2)	Recommended wire size (mm^2)	Molded-case circuit breaker capacity (A)
A2001-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	5
	⏚					
A2002-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	5
	⏚					
A2004-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	5
	⏚					
A2007-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	10
	⏚					
A2015-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	2	20
	⏚					
A2022-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	3.5	20
	⏚					
A2037-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M4	1.2 to 1.5	2 to 5.5	5.5	30
	⏚					

• Single-phase 230-V AC Model

Model 3G3JV-	Terminal symbol	Terminal screw	Terminal torque (N•m)	Wire size (mm^2)	Recommended wire size (mm^2)	Circuit breaker capacity (A)
AB001-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	5
	⏚					
AB002-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	5
	⏚					
AB004-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	0.75 to 2	2	10
	⏚					
AB007-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	3.5	20
	⏚				2	
AB015-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	5.5	20
	⏚				2	

• 3-phase 460-V AC Model

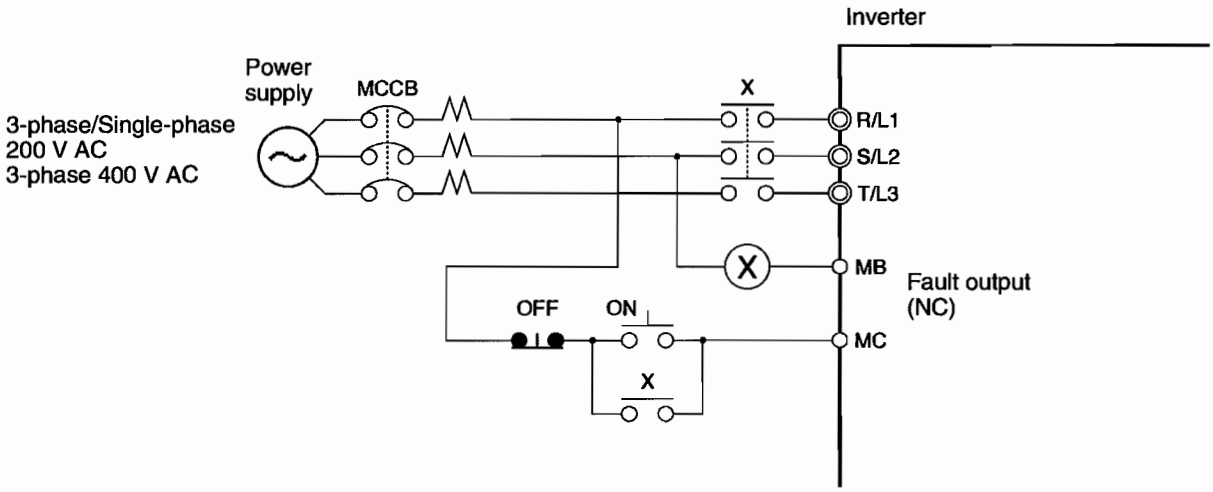
Model 3G3JV-	Terminal symbol	Terminal screw	Terminal torque (N•m)	Wire size (mm^2)	Recommended wire size (mm^2)	Circuit breaker capacity (A)
A4002-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	2	5
	⏚					
A4004-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	2	5
	⏚					
A4007-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	2	5
	⏚					
A4015-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	2	10
	⏚					
A4022-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M4	1.2 to 1.5	2 to 5.5	2	10
	⏚					
A4037-A	R/L1, S/L2, T/L3, –, +1, +2, U/T1, V/T2, W/T3	M4	1.2 to 1.5	2 to 5.5	2	20
	⏚				3.5	

■ Wiring on the Input Side of the Main Circuit

• Installing a Molded-case Circuit Breaker

Always connect the power input terminals (R/L1, S/L2, and T/L3) and power supply via a molded case circuit breaker (MCCB) suitable to the Inverter.

- Install one MCCB for every Inverter used.
- Choose an appropriate MCCB capacity according to the *Circuit breaker capacity* column in the table on the previous page.
- For the MCCB's time characteristics, be sure to consider the Inverter's overload protection (one minute at 150% of the rated output current).
- If the MCCB is to be used in common among multiple Inverters, or other devices, set up a sequence such that the power supply will be turned off by a fault output, as shown in the following diagram.



• Installing a Ground Fault Interrupter

Inverter outputs use high-speed switching, so high-frequency leakage current is generated.

In general, a leakage current of approximately 100 mA will occur for each Inverter (when the power cable is 1 m) and approximately 5 mA for each additional meter of power cable.

Therefore, at the power supply input area, use a special-purpose breaker for Inverters, which detects only the leakage current in the frequency range that is hazardous to humans and excludes high-frequency leakage current.

- For the special-purpose breaker for Inverters, choose a ground fault interrupter with a sensitivity amperage of at least 10 mA per Inverter.
- When using a general leakage breaker, choose a ground fault interrupter with a sensitivity amperage of 200 mA or more per Inverter and with an operating time of 0.1 s or more.

• Installing a Magnetic Contactor

If the power supply of the main circuit is to be shut off because of the sequence, a magnetic contactor can be used instead of a molded-case circuit breaker.

When a magnetic contactor is installed on the primary side of the main circuit to stop a load forcibly, however, the regenerative braking does not work and the load coasts to a stop.

- A load can be started and stopped by opening and closing the magnetic contactor on the primary side. Frequently opening and closing the magnetic contactor, however, may cause the Inverter to break down. In order not to shorten the service life of the Inverter's internal relays and electrolytic capacitors, it is recommended that the magnetic contactor is used in this way no more than once every 30 minutes.
- When the Inverter is operated with the Digital Operator, automatic operation cannot be performed after recovery from a power interruption.

• Connecting Input Power Supply to the Terminal Block

Input power supply can be connected to any terminal on the terminal block because the phase sequence of input power supply is irrelevant to the phase sequence (R/L1, S/L2, and R/L3).

• Installing an AC Reactor

If the Inverter is connected to a large-capacity power transformer (660 kW or more) or the phase advance capacitor is switched, an excessive peak current may flow through the input power circuit, causing the converter unit to break down.

To prevent this, install an optional AC reactor on the input side of the Inverter.

This also improves the power factor on the power supply side.

• Installing a Surge Absorber

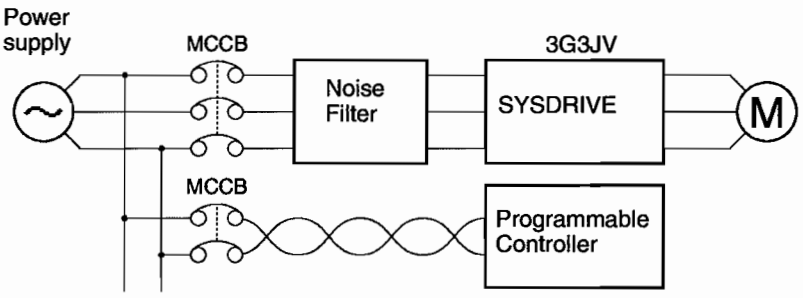
Always use a surge absorber or diode for the inductive loads near the Inverter. These inductive loads include magnetic contactors, electromagnetic relays, solenoid valves, solenoid, and magnetic brakes.

• Installing a Noise Filter on the Power Supply Side

The Inverter's outputs uses high-speed switching, so noise may be transmitted from the Inverter to the power line and adversely effect other devices in the vicinity. It is recommended that a Noise Filter be installed at the Power Supply to minimize noise transmission. Noise will also be reduced from the power line to the Inverter.

Wiring Example 1

Input Noise Filters



Note Use a Noise Filter designed for the Inverter. A general-purpose Noise Filter will be less effective and may not reduce noise.

■ Wiring on the Output Side of the Main Circuit

• Connecting the Terminal Block to the Load

Connect output terminals U/T1, V/T2, and W/T3 to motor lead wires U, V, and W.

Check that the motor rotates forward with the forward command. Switch over any two of the output terminals to each other and reconnect if the motor rotates in reverse with the forward command.

• Never Connect a Power Supply to Output Terminals

Never connect a power supply to output terminals U/T1, V/T2, or W/T3.

If voltage is applied to the output terminals, the internal circuit of the Inverter will be damaged.

• Never Short or Ground Output Terminals

If the output terminals are touched with bare hands or the output wires come into contact with the Inverter casing, an electric shock or grounding will occur. This is extremely hazardous.

Also, be careful not to short the output wires.

• Do not Use a Phase Advancing Capacitor or Noise Filter

Never connect a phase advance capacitor or LC/RC Noise Filter to the output circuit.

Doing so will result in damage to the Inverter or cause other parts to burn.

• Do not Use an Electromagnetic Switch of Magnetic Contactor

Do not connect an electromagnetic switch of magnetic contactor to the output circuit.

If a load is connected to the Inverter during running, an inrush current will actuate the overcurrent protective circuit in the Inverter.

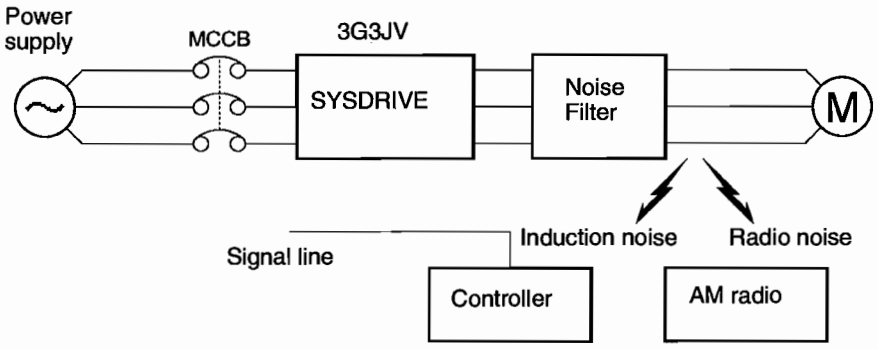
• Installing a Thermal Relay

The Inverter has an electronic thermal protection function to protect the motor from overheating. If, however, more than one motor is operated with one inverter or a multi-polar motor is used, always install a thermal relay (THR) between the Inverter and the motor and set n33 to 2 (no thermal protection).

In this case, program the sequence so that the magnetic contactor on the input side of the main circuit is turned off by the contact of the thermal relay.

• Installing a Noise Filter on the Output Side

Connect a Noise Filter to the output side of the Inverter to reduce radio noise and induction noise.

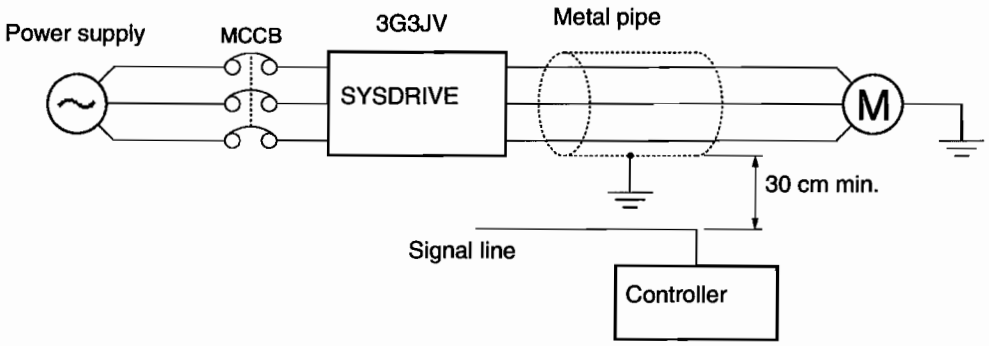


Induction Noise: Electromagnetic induction generates noise on the signal line, causing the controller to malfunction.

Radio Noise: Electromagnetic waves from the Inverter and cables cause the broadcasting radio receiver to make noise.

• Countermeasures against Induction Noise

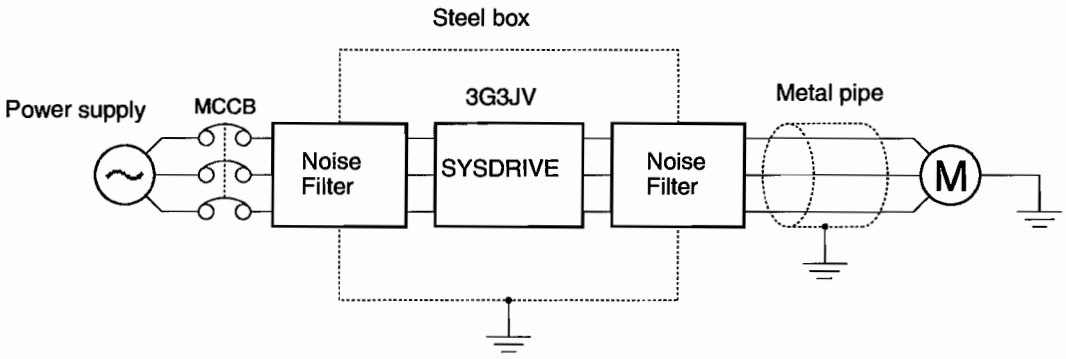
As described previously, a Noise Filter can be used to prevent induction noise from being generated on the output side. Alternatively, cables can be routed through a grounded metal pipe to prevent induction noise. Keeping the metal pipe at least 30 cm away from the signal line considerably reduces induction noise.



• Countermeasures against Radio Interference

Radio noise is generated from the Inverter as well as the input and output lines. To reduce radio noise, install Noise Filters on both input and output sides, and also install the Inverter in a totally enclosed steel box.

The cable between the Inverter and the motor should be as short as possible.



• Cable Length between Inverter and Motor

As the cable length between the Inverter and the motor is increased, the floating capacity between the Inverter outputs and the ground is increased proportionally. The increase in floating capacity at the Inverter outputs causes the high-frequency leakage current to increase, and this may adversely affect peripheral devices and the current detector in the Inverter's output section. To prevent this from occurring, use a cable of no more than 100 meters between the Inverter and the motor. If the cable must be longer than 100 meters, take measures to reduce the floating capacity by not wiring in metallic ducts, by using separate cables for each phase, etc.

Also, adjust the carrier frequency (set in n46) according to the cable length between the Inverter and the motor, as shown in the following table.

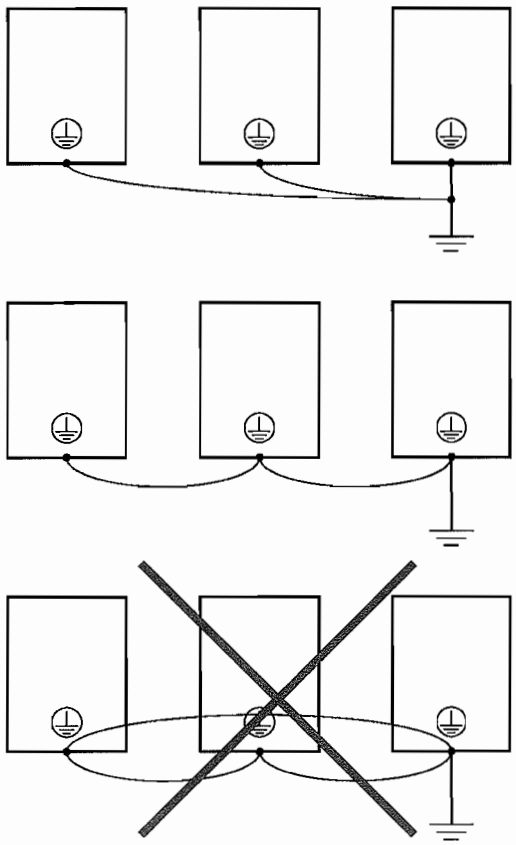
Cable length	50 m or less	100 m or less	More than 100 m
Carrier frequency	10 kHz max.	5 kHz max.	2.5 kHz

Note Single-phase motors cannot be used.
The Inverter is not suited for the variable speed control of single-phase motors.
The rotation direction of a single-phase motor is determined by the capacitor starting method or phase-splitting starting method to be applied when starting the motor.
In the capacitor starting method, however, the capacitor may be damaged by a sudden electric discharge of the capacitor caused by the output of the Inverter. On the other hand, the starting coil may burn in the phase-splitting starting method because the centrifugal switch does not operate.

■ Ground Wiring

- Always use the ground terminal with the following ground resistance:
  200-V Inverter: 100 Ω or less
  400-V Inverter: separate ground,10 Ω or less
- Do not share the ground wire with other devices such as welding machines or power tools.
- Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.
  Leakage current flows through the Inverter. Therefore, if the distance between the ground electrode and the ground terminal is too long, the potential on the ground terminal of the Inverter will become unstable.

• When using more than one Inverter, be careful not to loop the ground wire.



■ Countermeasures against Harmonics

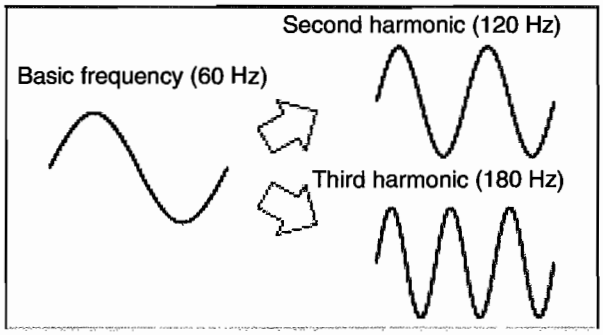
With the continuing development of electronics, the generation of harmonics from industrial machines has been causing problems recently.
The Ministry of International Trade and Industry provided some guidelines in September 1994 for the suppression of harmonics from electrical household appliances and electrical equipment in Japan. Since then, the problem has been drawing considerable attention.
Refer to the following information for the definition of harmonics (i.e., harmonic currents with voltages) and countermeasures against the generation of harmonics from the Inverter.

• Harmonics

Definition

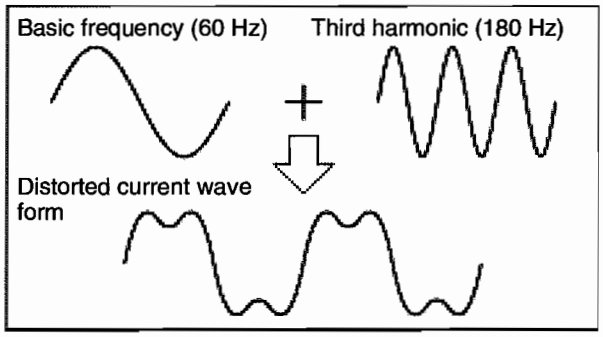
Harmonics consist of electric power produced from AC power and alternating at frequencies that are integral multiples of the frequency of the AC power.

The following frequencies are harmonics of a 60- or 50-Hz commercial power supply.
Second harmonic: 120 (100) Hz
Third harmonic: 180 (150) Hz



Problems Caused by Harmonics Generation

The waveform of the commercial power supply will be distorted if the commercial power supply contains excessive harmonics. Machines with such a commercial power supply will malfunction or generate excessive heat.



• Causes of Harmonics Generation

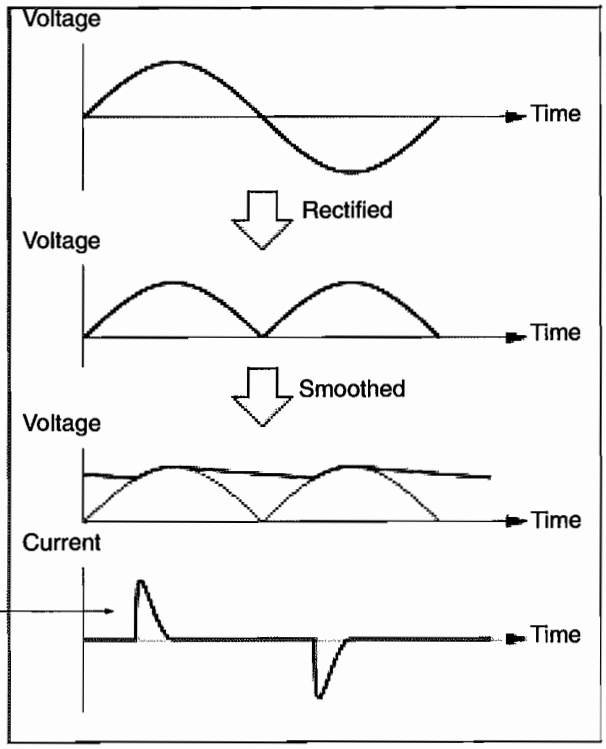
- Usually, electric machines have built-in circuitry that converts commercial AC power supply into DC power.
  Such AC power, however, contains harmonics due to the difference in current flow between DC and AC.

Obtaining DC from AC Using Rectifiers and Capacitors

DC voltage is obtained by converting AC voltage into a pulsating one-side voltage with rectifiers and smoothing the pulsating one-side voltage with capacitors. Such AC current, however, contains harmonics.

Inverter

The Inverter as well as normal electric machines has an input current containing harmonics because the Inverter converts AC into DC. The output current of the Inverter is comparatively high. Therefore, the ratio of harmonics in the output current of the Inverter is higher than that of any other electric machine.



A current flows into the capacitors. The current is different from the voltage in waveform.

• Countermeasures with Reactors against Harmonics Generation

DC/AC Reactors

The DC reactor and AC reactor suppress harmonics and currents that change suddenly and greatly.

The DC reactor suppresses harmonics better than the AC reactor. The DC reactor used with the AC reactor suppresses harmonics more effectively.

The input power factor of the Inverter is improved by suppressing the harmonics of the input current of the Inverter.

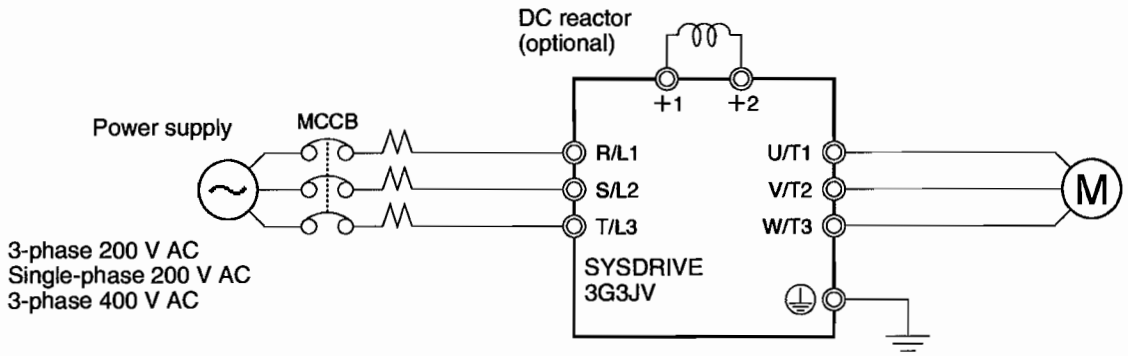
Connection

Connect the DC reactor to the internal DC power supply of the Inverter after shutting off the power supply to the Inverter and making sure that the charge indicator of the Inverter turns off.

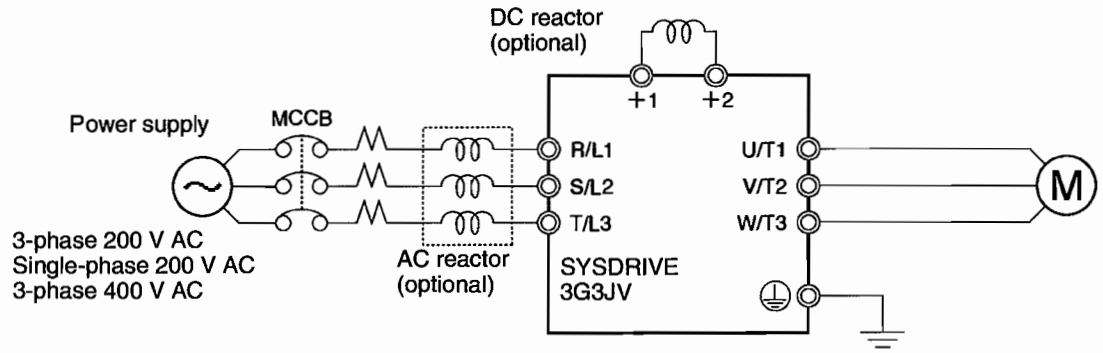
Do not touch the internal circuitry of the Inverter in operation, otherwise an electric shock or burn injury may occur.

Wiring Method

• With DC Reactor



• With DC and AC Reactors



Reactor Effects

Harmonics are effectively suppressed when the DC reactor is used with the AC reactor as shown in the following table.

Harmonics suppression method	Harmonic generation rate (%)							
	5th harmonic	7th harmonic	11th harmonic	13th harmonic	17th harmonic	19th harmonic	23rd harmonic	25th harmonic
No reactor	65	41	8.5	7.7	4.3	3.1	2.6	1.8
AC reactor	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
DC reactor	30	13	8.4	5	4.7	3.2	3.0	2.2
DC and AC reactors	28	9.1	7.2	4.1	3.2	2.4	1.6	1.4

2-2-5 Wiring Control Circuit Terminals

A control signal line must be 50 m maximum and separated from power lines.
The frequency reference must be input into the Inverter through shielded, twisted-pair wires.

■ Wiring of Control I/O Terminals

Wire each control I/O terminal under the following conditions.

• Wires and Tightening Torque

Multi-function Contact Output (MA, MB, and MC)

Terminal screw size	Tightening torque N • m	Wire	Wire size	Recommended wire size	Cable
M3	0.5 to 0.6	Single wire	0.5 to 1.25 (20 to 16)	0.75 (18)	Cable with polyethylene sheath
		Stranded wire	0.5 to 1.25 (20 to 16)		

Sequential Input (S1 through S5 and SC) and Analog Monitor Output (AM or AC)

Terminal screw size	Tightening torque N • m	Wire	Wire size	Recommended wire size	Cable
M2	0.22 to 0.25	Single wire	0.5 to 1.25 (20 to 16)	0.75 (18)	Cable with polyethylene sheath
		Stranded wire	0.5 to 0.75 (20 to 18)		

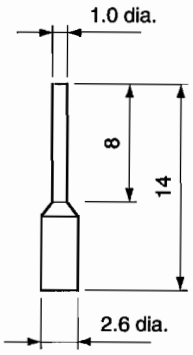
Frequency Reference Input (FR, FS, and FC)

Terminal screw size	Tightening torque N • m	Wire	Wire size	Recommended ire size	Cable
M2	0.22 to 0.25	Single wire	0.5 to 1.25 (20 to 16)	0.75 (18)	Special cable with polyethylene sheath and shield for measurement use
		Stranded wire	0.5 to 0.75 (20 to 18)		

• Solderless Terminal Size

The use of solderless terminals for the control circuit terminals is recommended for the reliability and ease of connection.

Note Make sure that the wire size is 0.5 mm^2 when using the following solderless terminal.



Model: Phoenix Contact's A1 0.5-8 WH

(Size: mm)

• Wiring Method

1. Loosen the terminal screws with a thin-slotted screwdriver.
2. Insert the wires from underneath the terminal block.
3. Tighten each terminal screw firmly to a torque specified in the previous tables.

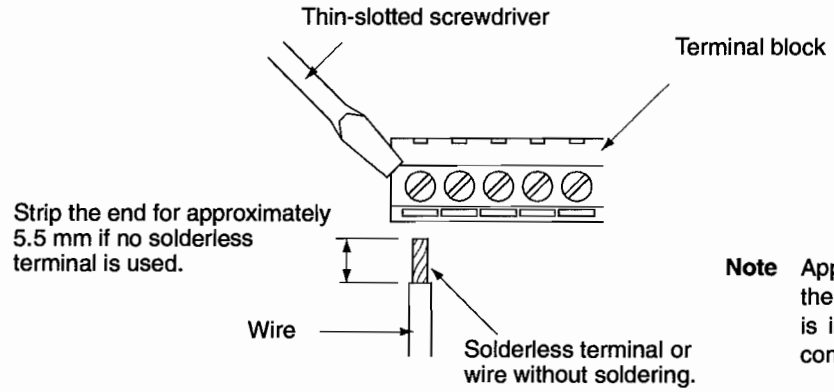
Note **1.** Always separate the control signal line from the main circuit cables and other power cables.

Note **2.** Do not solder the wires to the control circuit terminals. The wires may not contact well with the control circuit terminals if the wires are soldered.

Note **3.** The end of each wire connected to the control circuit terminals must be stripped for approximately 5.5 mm.

Note **4.** Connect the shield wire to the ground terminal of the 3G3JG. Do not connect the shield wire to the device side being controlled.

Note **5.** Be sure to insulate the shield wire with tape so that the shield wire will not come into contact with other signal wires or equipment.



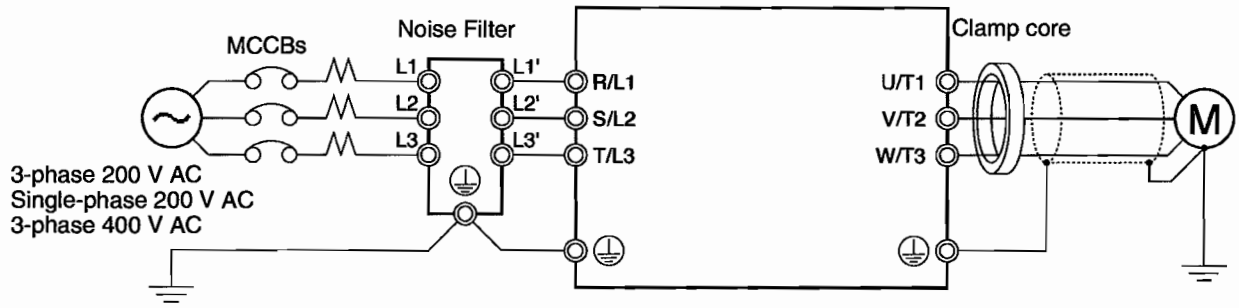
Note Applying excessive torque may damage the terminal block. If the tightening torque is insufficient, however, wires may disconnect.

2-2-6 Conforming to EC Directive

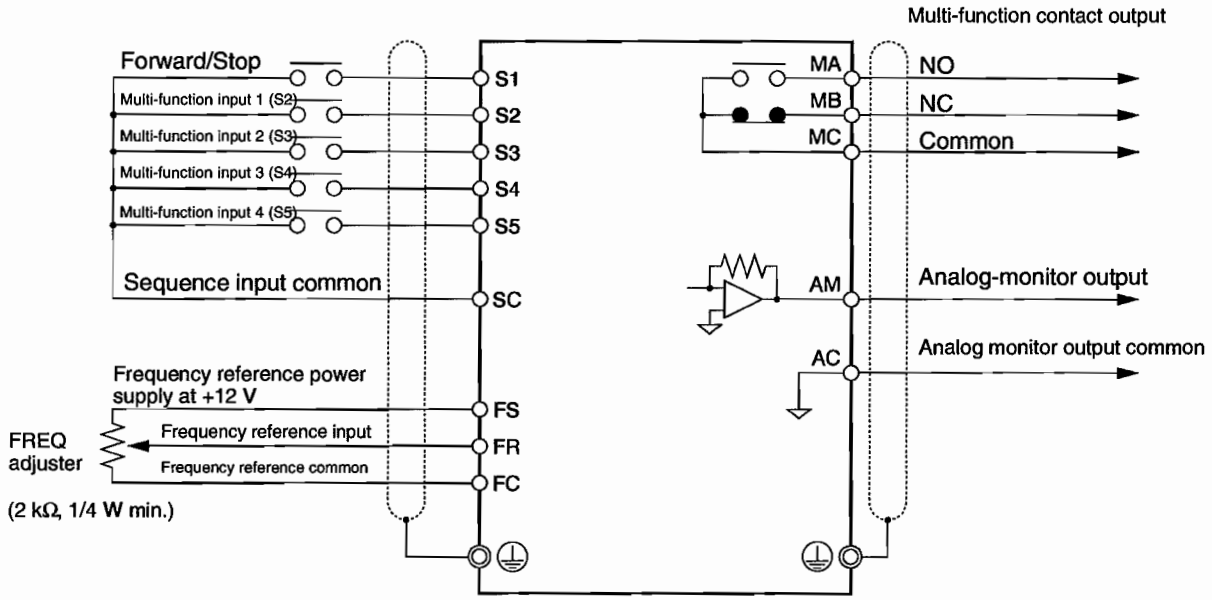
The following description provides the wiring method of the Inverter to meet EC Directive requirements. If the following requirements are not satisfied, the whole equipment incorporating the Inverter will need further confirmation.

■ Standard Connection

• Main Circuit Terminals



• Control Circuit Terminals



Note I/O signals can be connected to a single shielded cable.

• Wiring the Power Supply

Make sure that the Inverter and Noise Filter are grounded together.

- Always connect the power input terminals (R/L1, S/L2, and T/L3) and power supply via a dedicated Noise Filter.
- Reduce the length of the ground wire as much as possible.
- Locate the Noise Filter as close as possible to the Inverter. Make sure that the cable length between the Noise Filter and the Inverter does not exceed 40 cm.
- The following Noise Filters are available.

3-phase 230-V AC Noise Filter

Inverter	3-phase 230-V AC Noise Filter (Rasmi)	
Model 3G3JV-	**Model RASMI**	**Rated current (A)**
A2001-A/A2002-A/ A2004-A/A2007-A	RS2010J7	10
A2015-A/A2022-A	RS2020J7	16
A2037-A	RS2030J7	26

Single-phase 230-V AC Noise Filter

Inverter	Single-phase 230-V Noise Filter (Rasmi)	
Model 3G3JV-	**Model RASMI**	**Rated current (A)**
AB001-A/AB002-A/AB004-A	RS1010J7	10
AB007-A/AB015-A	RS1020J7	20

3-phase 460-V AC Noise Filter

Inverter	3-phase 230-V AC Noise Filter (Rasmi)	
Model 3G3JV-	**Model RASMI**	**Rated current (A)**
A4002-A/A4004-A	RS3005J7	5
A4007-A/A4015-A/A4022-A	RS3010J7	10
A4037-A	RS3020J7	15

• Connecting a Motor to the Inverter

- When connecting a motor to the Inverter, be sure to use a cable with a braided shield.
- Reduce the length of the cable as short as possible and ground the shield on the Inverter side as well as the motor side. Make sure that the cable length between the Inverter and the motor does not exceed 20 cm. Furthermore, connect a clamp core (Clamp Filter) close to the output terminals of the Inverter.

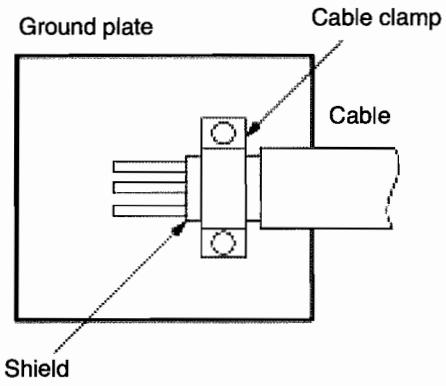
Product	Model	Manufacturer
Clamp Filter	2CAT3035-1330	TDK

• Wiring a Control Cable

- Be sure to connect a cable with a braided shield to the control circuit terminals.
- Ground the shield on the Inverter side only.

• Grounding the Shield

In order to ground the shield securely, it is recommended that a cable clamp be directly connected to the ground plate as shown below.



■ LVD Conformance

- Always connect the Inverter and power supply via a molded case circuit breaker (MCCB) suitable to the Inverter for protecting the Inverter from damage that may result from short-circuiting.
- Use one MCCB per Inverter.
- Select a suitable MCCB from the following table.
- With 400-V Inverters, it is necessary to ground to the power supply's neutral phase.

230-V Models

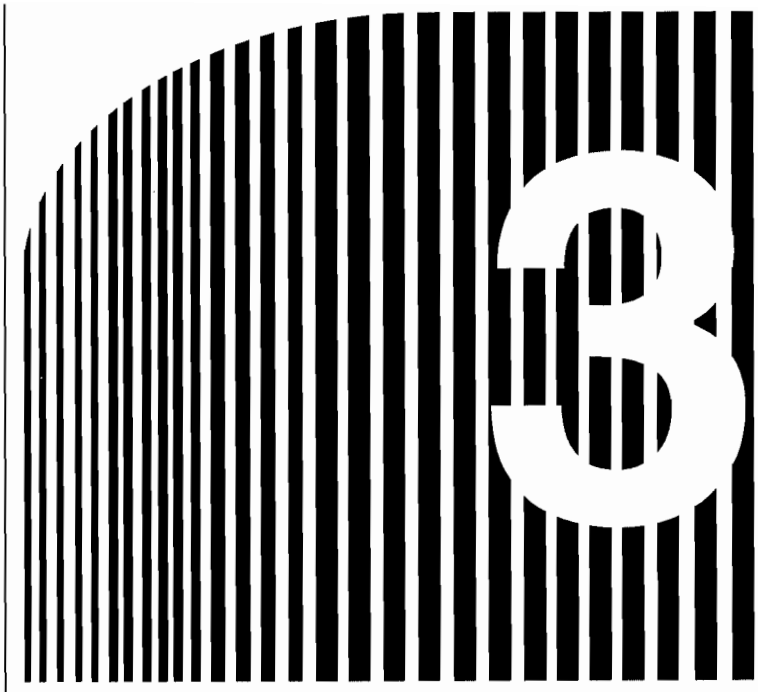
Inverter	MCCB (Mitsubishi Electric)	
Model 3G3JV-	Type	Rated current (A)
A2001-A	NF30	5
A2002-A		5
A2004-A		5
A2007-A		10
A2015-A		20
A2022-A		20
A2037-A		30
AB001-A	NF30	5
AB002-A		5
AB004-A		10
AB007-A		20
AB015-A		20

460-V Models

Inverter	MCCB (Mitsubishi Electric)	
Model 3G3JV-	**Type**	**Rated current (A)**
A4002-A	NF30	5
A4004-A		5
A4007-A		5
A4015-A		10
A4022-A		10
A4037-A		20

To satisfy LVD (Low-voltage Directive) requirements, the system must be protected by a molded case circuit breaker (MCCB) when a short-circuit occurs. A single MCCB may be shared with more than one Inverter or with other machines. In that case, however, take some appropriate measures so that the MCCB will protect all the Inverters from the occurrence of any single short-circuit.

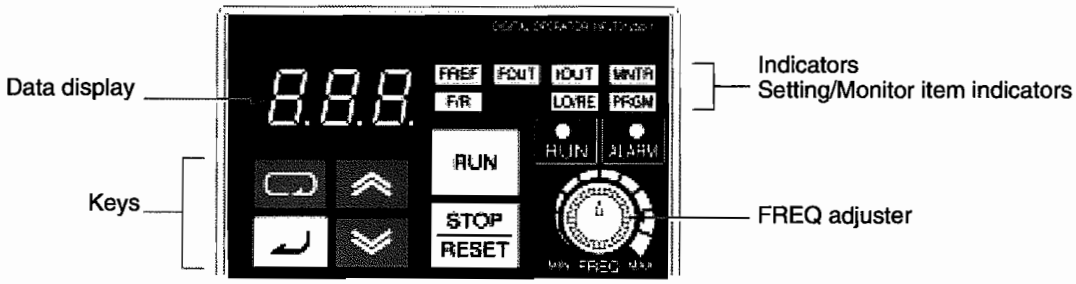
The frequency reference power supply (FS) of the Inverter is of basic insulation construction. When connecting the Inverter to peripheral devices, be sure to increase the degree of insulation.



Chapter 3

• Preparing for Operation and Monitoring •

3-1 Nomenclature



Appearance	Name	Function
	Data display	Displays relevant data items, such as frequency reference, output frequency, and parameter set values.
 MIN MAX FREQUENCY	FREQ adjuster	Sets the frequency reference within a range between 0 Hz and the maximum frequency.
FREF	FREF indicator	The frequency reference can be monitored or set while this indicator is lit.
FOUT	FOUT indicator	The output frequency of the Inverter can be monitored while this indicator is lit.
IOUT	IOUT indicator	The output current of the Inverter can be monitored while this indicator is lit.
MNTR	MNTR indicator	The values set in U01 through U10 are monitored while this indicator is lit.
F/R	F/R indicator	The direction of rotation can be selected while this indicator is lit, when operating the Inverter with the RUN Key.
LO/RE	LO/RE indicator	The operation of the Inverter through the Digital Operator or according to the parameters set is selectable while this indicator is lit. **Note** This status of this indicator can be only monitored while the Inverter is in operation. Any RUN command input is ignored while this indicator is lit.
PRGM	PRGM indicator	The parameters in n01 through n79 can be set or monitored while this indicator is lit. **Note** While the Inverter is in operation, the parameters can be only monitored and only some parameters can be changed. The RUN command input is ignored while this indicator is lit.
	Mode Key	Switches the setting and monitor item indicators in sequence. Parameter setting being made is canceled if this key is pressed before entering the setting.
	Increment Key	Increases multi-function monitor numbers, parameter numbers, and parameter set values.
	Decrement Key	Decreases multi-function monitor numbers, parameter numbers, and parameter set values.

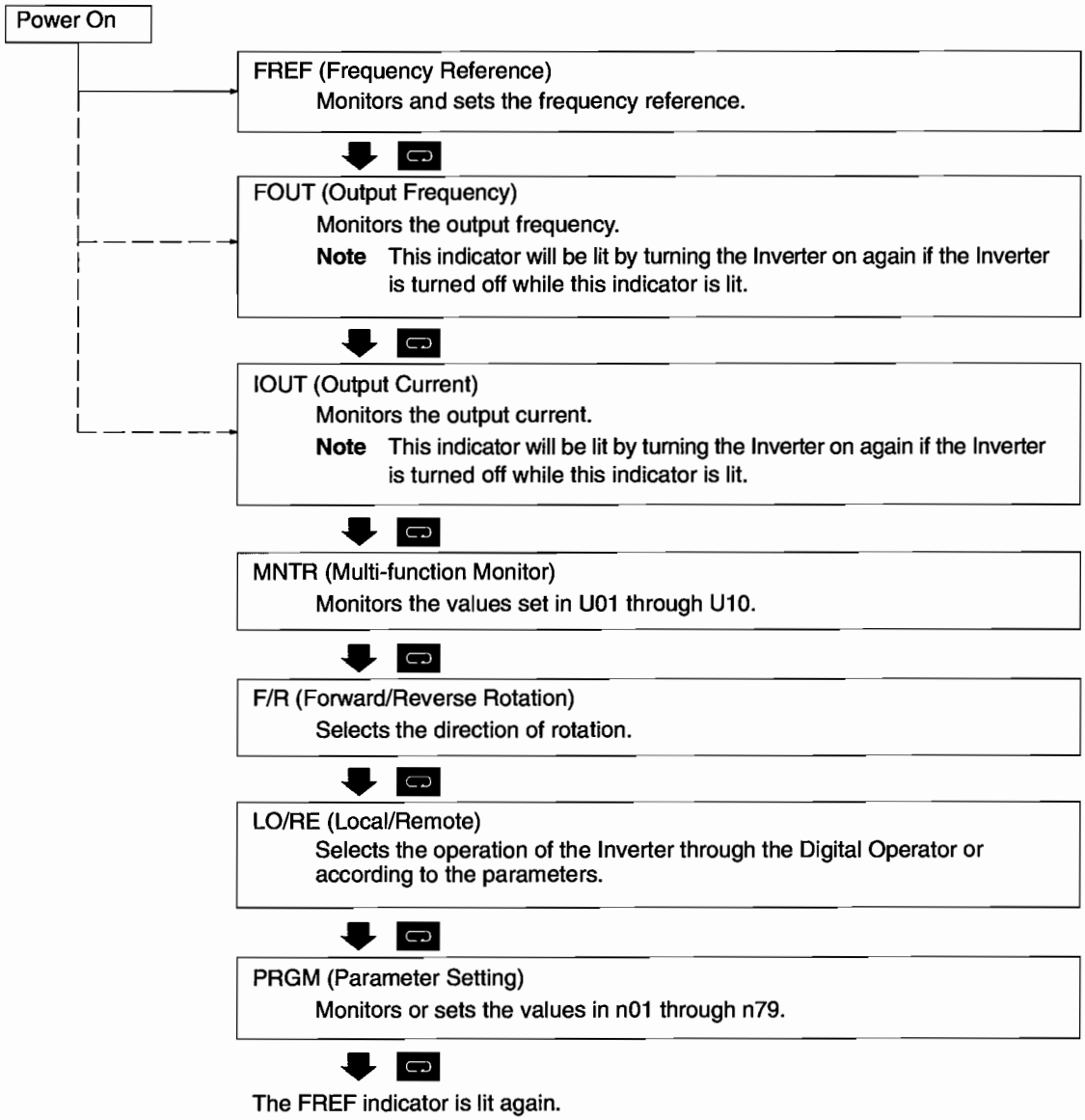
Appearance	Name	Function
[↵]	Enter Key	Enters multi-function monitor numbers, parameter numbers, and internal data values after they are set or changed.
[RUN]	RUN Key	Starts the Inverter running when the 3G3FV is in operation with the Digital Operator.
[STOP/RESET]	STOP/RESET Key	Stops the Inverter unless n06 is set to disable the STOP Key. Functions as a Reset Key when an Inverter error occurs. (See note.)

Note For safety's reasons, the reset will not work while a RUN command (forward or reverse) is in effect. Wait until the RUN command is OFF before resetting the Inverter.

3-2 Outline of Operation

■ Selecting Indicators

Whenever the Mode Key is pressed, an indicator is lit in sequence beginning with the FREF indicator. The data display indicates the item corresponding to the indicator selected.
The FOUT or IOUT indicator will be lit by turning the Inverter on again if the Inverter is turned off while the FOUT or IOUT indicator is lit. The FREF indicator will be lit by turning the Inverter on again if the Inverter is turned off while an indicator other than the FOUR or IOUT indicator is lit.



■ Example of Frequency Reference Settings

Key sequence	Indicator	Display example	Explanation
	FREF	6.0	Power On **Note** If the FREF indicator has not been lit, press the Mode Key repeatedly until the FREF indicator is lit.
▲ ▼	FREF	60.0	Use the Increment or Decrement Key to set the frequency reference. The data display will flash while the frequency reference is set. (see note 1)
↵	FREF	60.0	Press the Enter Key so that the set value will be entered and the data display will be lit. (see note 1)

Note **1.** The Enter Key need not be pressed when performing the setting for n08. The frequency reference will change when the set value is changed with the Increment or Decrement Key while the data display is continuously lit.

Note **2.** The frequency reference can be set in either of the following cases.

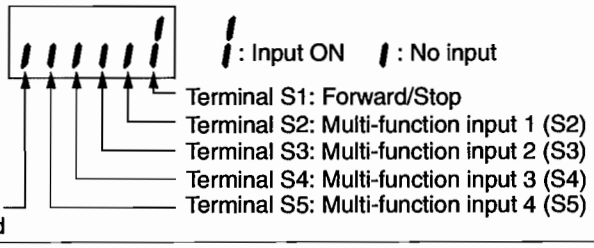
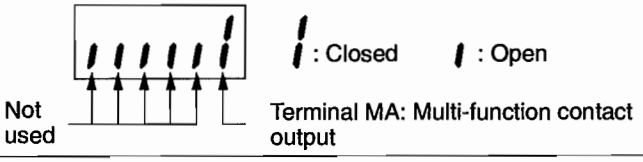
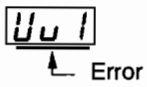
- Parameter n03 for frequency reference selection is set to 1 (i.e., frequency reference 1 is enabled) and the Inverter is in remote mode.
- Parameter n07 for frequency selection in local mode is set to 1 (i.e., the Digital Operator is enabled) and the Inverter is in local mode.
- Frequency references 2 through 8 are input for multi-step speed operation.

Note **3.** The frequency reference can be changed, even during operation.

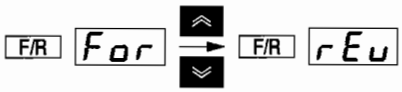
■ Example of Multi-function Display

Key sequence	Indicator	Display	Explanation
	FREF	6.0	Power On
MODE	MNTR	U01	Press the Mode Key repeatedly until the MNTR indicator is lit. U01 will be displayed.
▲ ▼	MNTR	U05	Use the Increment or Decrement Key to select the monitor item to be displayed.
↵	MNTR	283	Press the Enter Key so that the data of the selected monitor item will be displayed.
MODE	MNTR	U05	The monitor number display will appear again by pressing the Mode Key.

• Status Monitor

Item	Display	Display unit	Function
U01	Frequency reference	Hz	Monitors the frequency reference. (Same as FREF)
U02	Output frequency	Hz	Monitors the output frequency. (Same as FOUT)
U03	Output current	A	Monitors the output current. (Same as IOUT)
U04	Output voltage	V	Monitors the internal output voltage reference value of the Inverter.
U05	DC bus voltage	V	Monitors the DC voltage of the internal main circuit of the Inverter.
U06	Input terminal status	---	Shows the ON/OFF status of inputs. 
U07	Output terminal status	---	Shows the ON/OFF status of outputs. 
U09	Error log (most recent one)	---	Displays the latest error. 
U10	Software No.	---	OMRON use only.

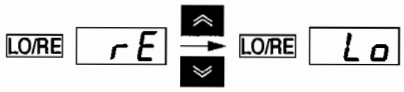
■ Example of Forward/Reverse Selection Settings



Key sequence	Indicator	Display example	Explanation
	F/R	For	Press the Mode Key repeatedly until the F/R indicator is lit. The present setting will be displayed. For: Forward; rEv: Reverse
	F/R	rEv	Use the Increment or Decrement Key to change the direction of motor rotation. The direction of motor rotation selected will be enabled when the display changes after the key is pressed.

Note The direction of motor rotation can be changed, even during operation.

■ Example of Local/Remote Selection Settings



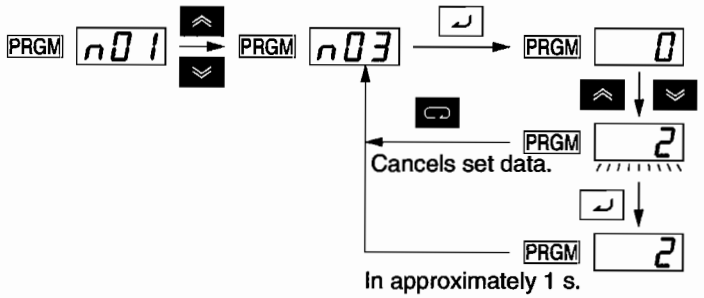
Key sequence	Indicator	Display example	Explanation
MODE	LO/RE	rE	Press the Mode Key repeatedly until the LO/RE indicator is lit. The present setting will be displayed. rE: Remote; Lo: Local
▲ ▼	LO/RE	Lo	Use the Increment or Decrement Key to set the Inverter to local or remote mode. The selection will be enabled when the display changes after the key is pressed.

Note 1. Local or remote selection is possible only when the Inverter is not in operation. The present setting can be monitored when the Inverter is in operation.

Note 2. Local or remote settings in multi-function input terminals can be changed through the multi-function input terminals only.

Note 3. Any RUN command input will be ignored while the LO/RE indicator is lit. To enable a RUN command, first turn the RUN command OFF and then press the Mode Key to display an item that has a green indicator (FREF to MNTR). Then input the RUN command again.

■ Example of Parameter Settings

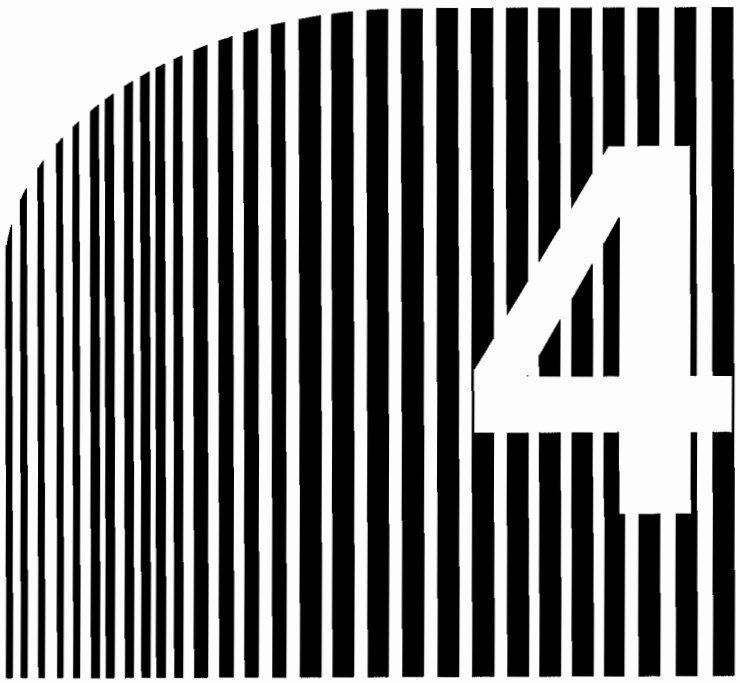


Key sequence	Indicator	Display example	Explanation
	FREF	0.0	Power On
MODE	PRGM	n01	Press the Mode Key repeatedly until the PRGM indicator is lit.
▲ ▼	PRGM	n03	Use the Increment or Decrement Key to set the parameter number.
ENTER	PRGM	0	Press the Enter Key. The data of the selected parameter number will be displayed.
▲ ▼	PRGM	2	Use the Increment or Decrement Key to set the data. At that time the display will flash.
ENTER	PRGM	2	Press the Enter Key so that the set value will be entered and the data display will be lit. (see note 1)
In approximately 1 s.	PRGM	n03	The parameter number will be displayed.

Note 1. To cancel the set value, press the Mode Key instead. The parameter number will be displayed.

Note 2. There are parameters that cannot be changed while the Inverter is in operation. Refer to the list of parameters. When attempting to change such parameters, the data display will not change by pressing the Increment or Decrement Key.

Note 3. Any RUN command input will be ignored while the Parameter Setting (PRGM) indicator is lit. To enable a RUN command, first turn the RUN command OFF and then press the Mode Key to display an item that has a green indicator (FREF to MNTR). Then input the RUN command again.



Chapter 4

• Test Run •

⚠ **WARNING** Turn ON the input power supply only after mounting the front cover, terminal covers, bottom cover, Operator, and optional items. Not doing so may result in electrical shock.

⚠ **WARNING** Do not remove the front cover, terminal covers, bottom cover, Operator, or optional items while the power is being supplied. Not doing so may result in electrical shock or damage to the product.

⚠ **WARNING** Do not operate the Operator or switches with wet hands. Doing so may result in electrical shock.

⚠ **WARNING** Do not touch the inside of the Inverter. Doing so may result in electrical shock.

⚠ **WARNING** Do not come close to the machine when using the error retry function because the machine may abruptly start when stopped by an alarm. Doing so may result in injury.

⚠ **WARNING** Do not come close to the machine immediately after resetting momentary power interruption to avoid an unexpected restart (if operation is set to be continued in the processing selection function after momentary power interruption is reset). Doing so may result in injury.

⚠ **WARNING** Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed. Not doing so may result in injury.

⚠ **WARNING** Be sure confirm that the RUN signal is turned OFF before turning ON the power supply, resetting the alarm, or switching the LOCAL/REMOTE selector. Doing so while the RUN signal is turned ON may result in injury.

⚠ **Caution** Be sure to confirm permissible ranges of motors and machines before operation because the Inverter speed can be easily changed from low to high. Not doing so may result in damage to the product.

⚠ **Caution** Provide a separate holding brake when necessary. Not doing so may result in injury.

⚠ **Caution** Do not perform a signal check during operation. Doing so may result in injury or damage to the product.

⚠ **Caution** Do not carelessly change settings. Doing so may result in injury or damage to the product.

4-1 Procedure for Test Run

1. Installation and Mounting

Install the Inverter according to the installation conditions. Refer to page 2-2. Ensure that the installation conditions are met.

2. Wiring and Connection

Connect to the power supply and peripheral devices. Refer to page 2-7. Select peripheral devices which meet the specifications and wire correctly.

3. Power Connection

Carry out the following pre-connection checks before turning on the power supply.

- Always ensure that a power supply to the correct voltage is used and that the power input terminals (R/L1, S/L2, and T/L3) are wired correctly.

  3G3JV-A2□-A: 3-phase 200 to 230 V AC

  3G3JV-AB□-A: Single-phase 200 to 240 V AC (Wire R/L1 and S/L2)

  3G3JV-A4□-A: 3-phase 380 to 460 V AC

- Make sure that the motor output terminals (U/T1, V/T2, and W/T3) are connected to the motor correctly.
- Ensure that the control circuit terminals and the control device are wired correctly. Make sure that all control terminals are turned off.
- Set the motor to no-load status (i.e., not connected to the mechanical system).
- Having conducted the above checks, connect the power supply.

4. Check the Display Status

Check to be sure that there are no faults in the Inverter.

- If the display at the time the power is connected is normal, it will read as follows:

  RUN indicator: Flashes

  ALARM indicator: Off

  Setting/Monitor indicators: FREF, FOUT, or IOUT is lit.

  Data display: Displays the corresponding data of the indicator that is lit.

- When a fault has occurred, the details of the fault will be displayed. In that case, refer to *Chapter 7 Maintenance Operations* and take necessary remedies.

5. Initializing Parameters

Initialize the parameters.

- Set n01 to 8 for initialization in 2-wire sequence.

6. Setting Parameters

Set the parameters required for a test run.

- Set the rated motor current in order to prevent the motor from burning due to overloading.

7. No-load Operation

Start the no-load motor using the Digital Operator.

- Set the frequency reference using the Digital Operator and start the motor using key sequences.

8. Actual Load Operation

Connect the mechanical system and operate using the Digital Operator.

- When there are no difficulties using the no-load operation, connect the mechanical system to the motor and operate using the Digital Operator.

9. Operation

Basic Operation:
Operation based on the basic settings required to start and stop the Inverter. Refer to page 5-1.

Advanced Operation:
Operation that uses PID control or other functions. Refer to page 6-1.

- For operation within standard parameters, refer to *Chapter 5 Basic Operation*.
- Refer to *Chapter 5 Basic Operation* and *Chapter 6 Advanced Operation* for the various advanced functions, such as stall prevention, carrier frequency setting, overtorque detection, torque compensation, and slip compensation.

4-2 Operation Example

1 Power Connection

■ Checkpoints before Connecting the Power Supply

- Check that the power supply is of the correct voltage and that the motor output terminals (R/L1, S/L2, and T/L3) are connected to the motor correctly.

  3G3JV-A2□-A: Three-phase 200 to 230 V AC

  3G3JV-AB□-A: Single-phase 200 to 240 V AC (Wire R/L1 and S/L2)

  3G3JV-A4□-A: 3-phase 380 to 460 V AC

- Make sure that the motor output terminals (U/T1, V/T2, and W/T3) are connected to the motor correctly.
- Ensure that the control circuit terminals and the control device are wired correctly. Make sure that all control terminals are turned off.
- Set the motor to no-load status (i.e., not connected to the mechanical system).

■ Connecting the Power Supply

- After conducting the above checks, connect the power supply.

2 Check the Display Status

- If the display is normal when the power is connected, it will read as follows:

  Normal

  RUN indicator: Flashes

  ALARM indicator: Off

  Setting/Monitor indicators: FREF, FOUT, or IOUT is lit.

  Data display: Displays the corresponding data for the indicator that is lit.

- When a fault has occurred, the details of the fault will be displayed. In that case, refer to *Chapter 7 Maintenance Operations* and take necessary action.

  Fault

  RUN indicator: Flashes

  ALARM indicator: Lit (fault detection) or flashes (alarm detection)

  Setting/Monitor indicators: FREF, FOUT, or IOUT is lit.

  Data display: The fault code, such as UV1, is displayed. The display will differ depending on the type of fault.

3 Initializing Parameters

- Initialize the parameters using the following procedure.
- To initialize the parameters, set n01 to 8.

Key sequence	Indicator	Display example	Explanation
	FREF	0.0	Power On
MODE	PRGM	n01	Press the Mode Key repeatedly until the PRGM indicator is lit.
ENTER	PRGM	1	Press the Enter Key. The data of n01 will be displayed.
▲ ▼	PRGM	8	Use the Increment or Decrement Key to set n01 to 8. The display will flash.
ENTER	PRGM	8	Press the Enter Key so that the set value will be entered and the data display will be lit.
In approximately 1 s.	PRGM	n01	The parameter number will be displayed.

4 Setting the Motor Current Parameter

- Set the motor current parameter in n32 in order to prevent the motor from burning due to overloading.

■ Setting the Rated Motor Current

- Check the rated current on the motor nameplate and set the motor current parameter.
- This parameter is used for the electronic thermal function for motor overload detection (OL1). By setting the correct parameter, the overloaded motor will be protected from burning.

n32	**Rated Motor Current**			**Changes during operation**	No
Setting range	0.0% to 120% (A) of rated output current of the Inverter	**Unit of setting**	0.1 A	**Default setting**	(see note 1)

Note 1. The standard rated current of the maximum applicable motor is the default rated motor current.

Note 2. Motor overload detection (OL1) is disabled by setting the parameter to 0.0.

Key sequence	Indicator	Display example	Explanation
	PRGM	n01	Displays the parameter number.
▲ ▼	PRGM	n32	Use the Increment or Decrement Key until n32 is displayed.
ENTER	PRGM	1.9	Press the Enter Key. The data of n32 will be displayed.
▲ ▼	PRGM	1.8	Use the Increment or Decrement Key to set the rated motor current. The display will flash.
ENTER	PRGM	1.8	Press the Enter Key so that the set value will be entered and the data display will be lit.
In approximately 1 s.	PRGM	n32	The parameter number will be displayed.

5 No-load Operation

- Start the no-load motor (i.e., not connected to the mechanical system) using the Digital Operator.

Note Before operating the Digital Operator, check that the FREQ adjuster is set to MIN.

■ Forward/Reverse Rotation with the Digital Operator

Key sequence	Indicator	Display example	Explanation
MODE	FREF	0.0	Press the Mode Key to turn on the FREF indicator. Monitors the frequency reference.
RUN	FREF	0.0	Press the RUN Key. The RUN Indicator will be lit.
	FREF	10.0	Turn the FREQ adjuster clockwise slowly. The monitored frequency reference will be displayed. The motor will start rotating in the forward direction according to the frequency reference.
MODE	F/R	For	Press the MODE Key to turn on the F/R indicator. "For" will be displayed.
▲ ▼	F/R	rEv	Use the Increment or Decrement Key to change the direction of motor rotation. The direction of motor rotation selected will be enabled when the display is changed after the Key is pressed.

- After changing the frequency reference or the rotation direction, check that there is no vibration or abnormal sound from the motor.
- Check that no faults have occurred in the Inverter during operation.

■ Stopping the Motor

- On completion of operating the motor in the no-load state in the forward or reverse direction, press the STOP/RESET Key. The motor will stop.

6 Actual Load Operation

- After checking the operation with the motor in no-load status, connect the mechanical system and operate with an actual load.

Note Before operating the Digital Operator, check that the FREQ adjuster is set to MIN.

■ Connecting the System

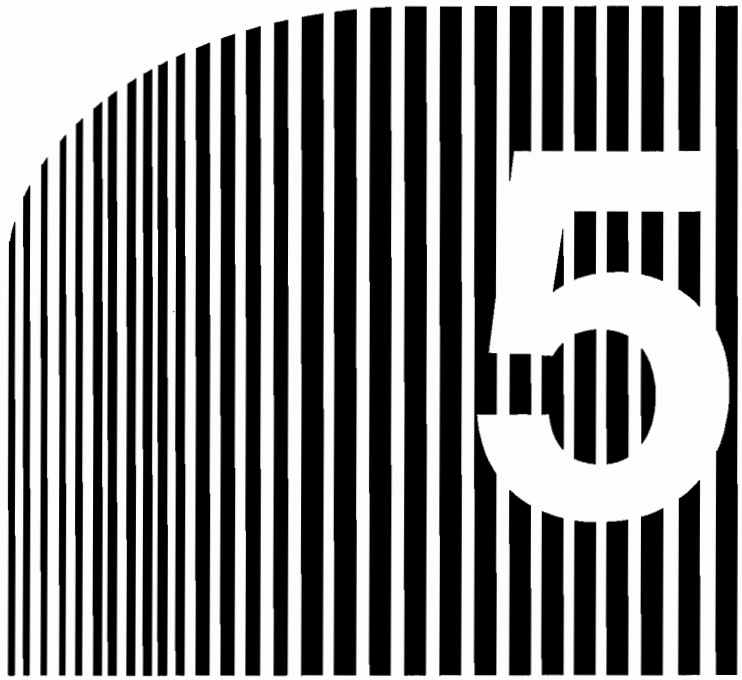
- After confirming that the motor has stopped completely, connect the mechanical system.
- Be sure to tighten all the screws when fixing the motor axis in the mechanical system.

■ Operation Using the Digital Operator

- In case a fault occurs during operation, make sure the Stop Key on the Digital Operator is easily accessible.
- Use the Digital Operator in the same way as no-load operation.
- First set the frequency reference to a low speed of one tenth the normal operating speed.

■ Checking the Operating Status

- Having checked that the operating direction is correct and that the machine is operating smoothly at slow speed, increase the frequency reference.
- After changing the frequency reference or the rotation direction, check that there is no vibration or abnormal sound from the motor. Check the monitor display (IOUT or multi-function monitor U03) to ensure that the output current is not becoming excessive.



Chapter 5

• Basic Operation •

This section explains the basic settings required to operate and stop the Inverter.
The settings of parameters described here will be sufficient for simple Inverter operations.
First, make these basic settings, then skip to the explanations of those special functions, even when your application requires special functions, such as stall prevention, carrier frequency setting, overtorque detection, torque compensation, slip compensation. Refer to *Chapter 6 Advanced Operation*.

5-1 Initial Settings

- The following initial settings are required.

  Parameter Write-prohibit Selection/Parameter Initialization (n01): Set n01 to 1 so that n01 through n79 can be set or displayed.

  Rated Motor Current (n32): Check the rated current on the motor nameplate and set the parameter.

■ Setting the Parameter Write-prohibit Selection/Parameter Initialization (n01)

- Set n01 to 1 so that n01 through n79 can be set or displayed.

n01	**Parameter Write-prohibit Selection/Parameter Initialization**			**Changes during operation**	No
Setting range	0, 1, 6, 8, 9	**Unit of setting**	1	**Default setting**	1

Note This parameter makes it possible to write-prohibit parameters, change the parameter set or displayed range, or initialize all parameters to default values.

Set Values

Value	Description
0	Only n01 can be displayed and set. The n02 through n79 parameters can be displayed only.
1	The n01 through n79 parameters can be displayed and set.
6	Only the error log memory is cleared.
8	Enables the initialization of all parameters in 2-wire sequence so that the parameters will return to default values.
9	Enables the initialization of all parameters in 3-wire sequence.

■ Setting the Rated Motor Current (n32)

Set the rated motor current (n32) in order to prevent the motor from burning due to overloading.

Check the rated current on the motor nameplate and set the parameter.

This parameter is used for the electronic thermal function for motor overload detection (OL1). By setting the correct parameter, the overloaded motor will be protected from burning.

n32	**Rated Motor Current**			**Changes during operation**	No
Setting range	0.0% to 120% (A) of rated output current of Inverter	**Unit of setting**	0.1 A	**Default setting**	(see note 1)

Note **1.** The standard rated current of the maximum applicable motor is the default rated motor current.

Note **2.** Motor overload detection (OL1) is disabled by setting the parameter to 0.0.

5-2 V/f Control

■ Setting the V/f Patterns (n09 to n15)

- Set the V/f pattern so that the motor output torque is adjusted to the required load torque.
- The 3G3JV incorporates an automatic torque boost function. Therefore, a maximum of 150% torque can be output at 3 Hz without changing the default settings. Check the system in trial operation and leave the default settings as they are if no torque characteristic changes are required.

n09	**Maximum Frequency (FMAX)**			**Changes during operation**	No
Setting range	50.0 to 400 (Hz)	**Unit of setting**	0.1 Hz (See note 1.)	**Default setting**	60.0

n10	**Maximum Voltage (VMAX)**			**Changes during operation**	No
Setting range	1 to 255 (V) (See note 2.)	**Unit of setting**	1 V	**Default setting**	230 (See note 2.)

n11	**Maximum Voltage Frequency (FA)**			**Changes during operation**	No
Setting range	0.2 to 400 (Hz)	**Unit of setting**	0.1 Hz (See note 1.)	**Default setting**	60.0

n12	**Middle Output Frequency (FB)**			**Changes during operation**	No
Setting range	0.1 to 399 (Hz)	**Unit of setting**	0.1 Hz (See note 1.)	**Default setting**	1.5

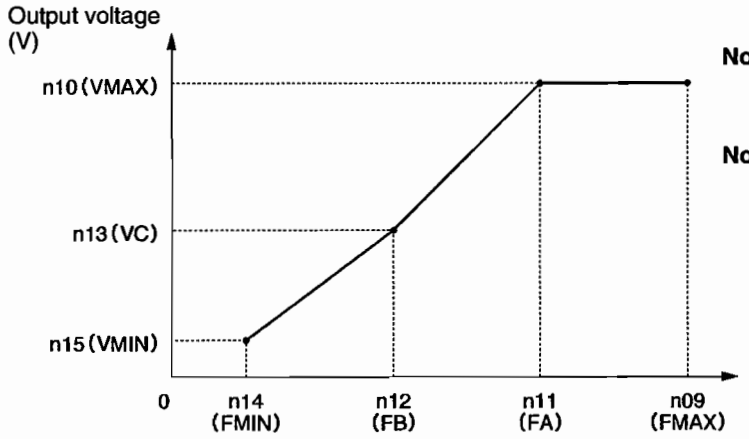
n13	**Middle Output Frequency Voltage (VC)**			**Changes during operation**	No
Setting range	1 to 255 (V) (See note 2.)	**Unit of setting**	1 V	**Default setting**	12 (See note 2.)

n14	**Minimum Output Frequency (FMIN)**			**Changes during operation**	No
Setting range	0.1 to 10.0 (Hz)	**Unit of setting**	0.1 Hz	**Default setting**	1.5

n15	**Minimum Output Frequency Voltage (VMIN)**			**Changes during operation**	No
Setting range	1 to 50 (V) (See note 2.)	**Unit of setting**	1 V	**Default setting**	12 (See note 2.)

Note 1. Values will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or greater.

Note **2.** With 460-V Inverters, the values for the upper limit of setting ranges and the default settings will be twice those given in the above table.



Note **1.** Set the parameters so that the following condition will be satisfied.
n14 ≤ n12 < n11 ≤ n09

Note **2.** The value set in n13 will be ignored if parameters n14 and n12 are the same in value.

- Set the rated motor input frequency to the maximum voltage frequency (FMAX) while the rated motor input voltage is set to the maximum output voltage (VMAX).
- The vertical-axis load or the load with high viscous friction may require high torque at low speed. If the torque is insufficient at low speed, increase the voltage in the low-speed range by 1 V, provided that no overload (OL1 or OL2) is detected. If an overload is detected, decrease the set values or consider the use of an Inverter model with a higher capacity.
- The required torque of fan or pump control increases in proportion to the square of the speed. By setting a quadratic V/f pattern to increase the voltage in the low-speed range, the power consumption of the system will increase.

5-3 Setting the Local/Remote Mode

The 3G3JV operates in local or remote mode. The following description provides information on these modes and how to select them.

■ Basic Concept

Operation mode	Basic concept	Description
Remote	The Inverter in a system operates according to the control signal of the host controller.	RUN Command Selectable from two types and set in n02. Frequency Reference Selectable from five types and set in n03.
Local	The Inverter in a system operates independently in this mode so that the Inverter can be checked independently.	RUN Command Starts with the RUN Key of the Digital Operator and stops with the STOP/RESET Key. Frequency Reference Set with the Digital Operator or the FREQ adjuster. Set with frequency reference selection in local mode in n07.

■ Local/Remote Selection Methods

- The following two selection methods are available to set the Inverter to local or remote mode. While the operation command is being input, however, the Inverter cannot be set to local mode from remote mode or vice versa.
  - Select the mode with the LO/RE Key of the Digital Operator.
  - Set any one of multi-function inputs 1 through 4 (n36 through n39) to 17 to set the Inverter to local mode with control input turned ON.

Note If the above setting is made, mode selection will be possible only with multi-function input, and not with the Digital Operator.

- The Inverter always goes into remote mode when the power is turned ON. Therefore, to operate immediately after powerup, set up the RUN command and frequency reference settings in remote mode in advance.

5-4 Selecting the Operation Command

The following description provides information on how to input operation commands to start or stop the Inverter or change the direction of rotation of the Inverter.
Two types of command input methods are available. Select either one of them according to the application.

■ Selecting the Operation Mode (n02)

- Select the method of operation mode input to start or stop the Inverter.
- The following method is enabled in remote mode only. The command can be input through key sequences on the Digital Operator.

n02	**Operation Command Selection**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	1

Set Values

Value	Description
0	The RUN and STOP/RESET Keys of the Digital Operator are enabled.
1	Multi-function input in 2- or 3-wire sequence through the control circuit terminals is enabled.

■ Selecting the STOP/RESET Key Function (n06)

- When parameter n02 is set to 1, set whether or not to use the STOP/RESET Key of the Digital Operator to stop the Inverter in remote mode. The STOP/RESET Key is always enabled in local mode regardless of the setting in n02.

n06	**STOP Key Function Selection**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The STOP/RESET Key of the Digital Operator is enabled.
1	The STOP/RESET Key of the Digital Operator is disabled. This setting is available only when the Digital Operator is selected for operation command input.

5-5 Setting the Frequency Reference

5-5-1 Selecting the Frequency Reference

The following description provides information on how to set the frequency reference in the Inverter. Select the method according to the operation mode.
Remote mode: Select and set one out of five frequency references in n03.
Local mode: Select and set one out of two frequency references in n07.

■ Selecting the Frequency Reference (n03) in Remote Mode

- Select the input method of frequency references in remote mode.
- Five frequency references are available in remote mode. Select one of them according to the application.

n03	**Frequency Reference Selection**			**Changes during operation**	No
Setting range	0 to 4	**Unit of setting**	1	**Default setting**	2

Set Values

Value	Description
0	The FREQ adjuster of the Digital Operator is enabled. (see note 1)
1	Frequency reference 1 (n21) is enabled.
2	The frequency reference control terminal (for 0- to 10-V input) is enabled. (see note 2)
3	The frequency reference control terminal (for 4- to 20-mA current input) is enabled. (see note 3)
4	The frequency reference control terminal (for 0- to 20-mA current input) is enabled. (see note 3)

Note 1. The maximum frequency (FMAX) is set when the FREQ adjuster is set to MAX.

Note 2. The maximum frequency (FMAX) is set with 10 V input.

Note 3. The maximum frequency (FMAX) is set with 20 mA input, provided that SW8 on the control PCB is switched from V to I.

- The frequency reference set in n03 works as frequency reference 1 when the Inverter is in multi-step speed operation. The set values in n22 through n28 for frequency references 2 through 8 are enabled.

■ Selecting the Frequency Reference (n07) in Local Mode

- Select the input method of frequency references in local mode.
- Two frequency references are available in local mode. Select one of them according to the application.

n07	**Frequency Reference Selection in Local Mode**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The FREQ adjuster of the Digital Operator is enabled. (see note 1)
1	Key sequences on the Digital Operator are enabled. (see note 2)

Note 1. The maximum frequency (FMAX) is set when the FREQ adjuster is set to MAX.

Note 2. The frequency reference can be set with key sequences while the FREF indicator is lit or with the set value in n21 for frequency reference 1. In either case, the value is set in n21.

5-5-2 Upper and Lower Frequency Reference Limits

Regardless of the methods of operation mode and frequency reference input, the upper and lower frequency reference limits can be set.

■ Setting the Frequency Reference Upper and Lower Limits (n30 and n31)

- Set the upper and lower frequency reference limits as percentage based on the maximum frequency as 100%.

n30	**Frequency Reference Upper Limit**			**Changes during operation**	No
Setting range	0% to 110% (Max. frequency = 100%)	**Unit of setting**	1%	**Default setting**	100

n31	**Frequency Reference Lower Limit**			**Changes during operation**	No
Setting range	0% to 110% (Max. frequency = 100%)	**Unit of setting**	1%	**Default setting**	0

Note If n31 is set to a value less than the minimum output frequency (FMIN), the Inverter will have no output when a frequency reference less than the minimum output frequency input is ON.

5-5-3 Adjusting the Analog Input

Input characteristic adjustments may be necessary for analog frequency references to be input. At that time, use the following parameters for gain, bias, and filter time parameter adjustments.

■ FR Terminal Adjustments for Frequency Reference Input

• Gain and Bias Settings (n41 and n42)

- Set the input characteristics of analog frequency references in n41 (for the frequency reference gain) and n42 (for the frequency reference bias).
- Set the frequency of maximum analog input (10 V or 20 mA) in n41 as percentage based on the maximum frequency as 100%.
- Set the frequency of minimum analog input (0 V, 0 mA, or 4 mA) in n42 as percentage based on the maximum frequency as 100%.

n41	**Frequency Reference Gain**			**Changes during operation**	Yes
Setting range	0% to 255% (Max. frequency = 100%)	**Unit of setting**	1%	**Default setting**	100

n42	**Frequency Reference Bias**			**Changes during operation**	Yes
Setting range	–99% to 99% (Max. frequency = 100%)	**Unit of setting**	1%	**Default setting**	0

• Analog Frequency Reference Filter Time (n43)

- The digital filter with a first-order lag can be set for analog frequency references to be input.
- This setting is ideal if the analog input signal changes rapidly or the signal is subject to noise interference.
- The larger the set value is, the slower the response speed will be.

n43	**Analog Frequency Reference Filter Time**			**Changes during operation**	No
Setting range	0.00 to 2.00 (s)	**Unit of setting**	0.01 s	**Default setting**	0.10

5-5-4 Setting Frequency References through Key Sequences

The following description provides information on parameters related to frequency reference settings through key sequences on the Digital Operator

■ Setting Frequency References 1 through 8 and the Inching Frequency Command (n21 through n28 and n29)

A total of nine frequency references (frequency references 1 through 8) and an inching frequency command can be set together in the Inverter.

• Setting Frequency References 1 through 8 (n21 through n28)

n21	**Frequency Reference 1**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	6.0

n22	**Frequency Reference 2**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

n23	**Frequency Reference 3**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

n24	**Frequency Reference 4**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

n25	**Frequency Reference 5**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

n26	**Frequency Reference 6**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

n27	**Frequency Reference 7**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

n28	**Frequency Reference 8**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	0.0

Note 1. Values will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or over.

Note 2. Frequency reference 1 is enabled with n03 for frequency reference selection set to 1.

Note 3. Frequency references 2 through 8 are enabled by setting multi-step speed references 1, 2, and 3 in n36 through n39 for multi-function input. Refer to the following table for the relationship between multi-step speed references 1 through 3 and frequency references 1 through 8.

Frequency reference	Multi-step speed reference 1 (Set value: 6)	Multi-step speed reference 2 (Set value: 7)	Multi-step speed reference 3 (Set value: 8)
Frequency reference 1	OFF	OFF	OFF
Frequency reference 2	ON	OFF	OFF
Frequency reference 3	OFF	ON	OFF
Frequency reference 4	ON	ON	OFF
Frequency reference 5	OFF	OFF	ON
Frequency reference 6	ON	OFF	ON
Frequency reference 7	OFF	ON	ON
Frequency reference 8	ON	ON	ON

No multi-step speed reference 3 settings will be required if only frequency references 1 through 4 are used, for example. Any multi-step speed reference not set is regarded as turned-OFF input.

• Setting the Inching Frequency Command (n29)

• The inching frequency command must be set as multi-function input in order to use the inching frequency command.

n29	**Inching Frequency Command**			**Changes during operation**	Yes
Setting range	0.0 to max. frequency	**Unit of setting**	0.01 Hz (see note 1)	**Default setting**	6.0

Note 1. The value will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or over.

Note 2. In order to use the inching frequency command, one of the n36 through n39 parameters for multi-function input must be set to 10 as an inching frequency command. Parameter n29 is selectable by turning on the multi-function input set with the inching frequency command. The inching frequency command takes precedence over the multi-step speed reference (i.e., when the inching frequency command is ON, all multi-step speed reference input will be ignored).

■ Setting the Frequency Reference with the FREF Indicator Lit

- The frequency reference can be set while the FREF indicator of the Digital Operator is lit in the following cases.
  - Parameter n03 for frequency reference selection is set to 1, which enables frequency reference 1, and the Inverter is in remote mode.
  - Parameter n07 for frequency selection in local mode is set to 1, which enables key sequences on the Digital Operator, and the Inverter is in local mode.
  - Frequency references 2 through 8 are set with multi-step speed reference input.
- The frequency reference can be changed, even during operation.
- When the frequency reference is changed while the FREF indicator is lit, the corresponding parameter is changed simultaneously. For example, if frequency reference 2 has been selected with multi-function input (a multi-step speed reference), the set value in n22 (for frequency reference 2) will be changed simultaneously when the frequency reference is changed while the FREF indicator is lit.
- Take the following default steps, for example, to change the frequency reference with the FREF indicator lit.

Key sequence	Indicator	Display example	Explanation
	FREF	6.0	Power On **Note** If the FREF indicator has not been lit, press the Mode Key repeatedly until the FREF indicator is lit.
▲ ▼	FREF	60.0	Use the Increment or Decrement Key to set the frequency reference. The data display will flash while the frequency reference is set.
↵	FREF	60.0	Press the Enter Key so that the set value will be entered and the data display will be lit.

• Setting the Key Sequential Frequency (n08)

- The Enter Key need not be pressed when changing the setting in n08. In that case, the frequency reference will change when the set value is changed with the Increment or Decrement Key while the data display is continuously lit.

n08	Key Sequential Frequency Setting			Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

Set Values

Value	Description
0	Enter Key enabled (The set value is entered with the Enter Key pressed.)
1	Enter Key disabled (The set value set is entered immediately.)

5-6 Setting the Acceleration/Deceleration Time

The following description provides information on parameters related to acceleration and deceleration time settings.
Trapezoidal and S-shape acceleration and deceleration are available. Using the S-shape characteristic function for acceleration and deceleration can reduce shock to the machinery when stopping or starting.

■ Setting the Acceleration/Deceleration Time (n16 through n19)

- Two acceleration times and two deceleration times can be set.
- The acceleration time is the time required to go from 0% to 100% of the maximum frequency and the deceleration time is the time required to go from 100% to 0% of the maximum frequency. The actual acceleration or deceleration time is obtained from the following formula.

Acceleration/Deceleration time = (Acceleration/Deceleration time set value)
× (Frequency reference value) ÷ (Max. frequency)

Acceleration time 2 and deceleration time 2 are enabled by setting 11 for acceleration/deceleration time selection in any of the n36 through n39 parameters for multi-function input.

Deceleration time 2 is also enabled by emergency-stop settings 19, 20, 21, and 22 in any of the n36, n37, n38, and n39 parameters for multi-function input with n04 for interruption mode selection set to 0 (i.e., deceleration stop).

n16	**Acceleration time 1**			**Changes during operation**	Yes
Setting range	0.0 to 999 (s)	**Unit of setting**	0.1 s (see note)	**Default setting**	10.0

n17	**Deceleration Time 1**			**Changes during operation**	Yes
Setting range	0.0 to 999 (s)	**Unit of setting**	0.1 s (see note)	**Default setting**	10.0

n18	**Acceleration Time 2**			**Changes during operation**	Yes
Setting range	0.0 to 999 (s)	**Unit of setting**	0.1 s (see note)	**Default setting**	10.0

n19	**Deceleration Time 2**			**Changes during operation**	Yes
Unit of setting	0.0 to 999 (s)	**Unit of setting**	0.1 s (see note)	**Default setting**	10.0

Note Values will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or over.

■ S-shape Acceleration/Deceleration Characteristic (n20)

- Trapezoidal and S-shape acceleration and deceleration are available. Using the S-shape characteristic function for acceleration and deceleration can reduce shock to the machinery when stopping or starting.
- Any one of three S-shape acceleration/deceleration times (0.2, 0.5, and 1.0 s) is selectable.

n20	**S-shape Acceleration/Deceleration Characteristic**			**Changes during operation**	No
Setting range	0 to 3	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	No S-shape acceleration/deceleration characteristic (Trapezoidal acceleration/deceleration)
1	S-shape acceleration/deceleration characteristic time is 0.2 s
2	S-shape acceleration/deceleration characteristic time is 0.5 s
3	S-shape acceleration/deceleration characteristic time is 1.0 s

Note When the S-shape acceleration/deceleration characteristic time is set, the acceleration and deceleration times will be lengthened according to the S-shape at the beginning and end of acceleration/deceleration.

5-7 Selecting the Reverse Rotation-prohibit

This parameter is used to specify whether to enable or disable the reverse rotation command sent to the Inverter from the control circuit terminals or Digital Operator.
The parameter should be set to "not accept" when the Inverter is applied to systems that prohibit the reverse rotation of the Inverter.

■ Selecting the Reverse Rotation-prohibit (n05)

n05	**Reverse Rotation-prohibit Selection**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Accept
1	Not accept

5-8 Selecting the Interruption Mode

This parameter is used to specify the interruption mode when the STOP command is input.
The Inverter either decelerates or coasts to a stop according to the interruption mode selection.

■ Selecting the Interruption Mode (n04)

n04	**Interruption Mode Selection**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Frequency deceleration stop (See notes 1 and 2.)
1	Free running (See note 3.)

Note 1. The Inverter will decelerate to stop according to the setting in n17 for deceleration time 1 if any of the n36 through n39 parameters for multi-function input is not set to 11 for acceleration/deceleration time selection. If any one of the n36 through n39 multi-function input parameters is set to acceleration/deceleration time selection, the Inverter will decelerate to stop according to the selected setting of deceleration time when the STOP command is input.

Note 2. If the RUN signal is input again during a deceleration stop, deceleration will be stopped at the point of the input and acceleration will proceed at that frequency.

Note 3. Do not input a RUN signal during a free-running stop if the motor's rotation speed is not sufficient slowed. If a RUN signal is input under these conditions, a main circuit overvoltage (OV) or overcurrent (OC) will be detected.
To restart a free-running motor, set a speed search command in one of the multi-function inputs 1 to 4 (n36 to n39), use the speed search to detect the speed of the free running motor, and then accelerate smoothly.

5-9 Multi-function I/O

5-9-1 Multi-function Input

The 3G3JV incorporates four multi-function input terminals (S2 through S5). Inputs into these terminals have a variety of functions according to the application.

■ Multi-function Input (n36 through n39)

n36	**Multi-function Input 1 (S2)**			**Changes during operation**	No
Setting range	2 to 8, 10 to 22 (see note)	**Unit of setting**	1	**Default setting**	2

n37	**Multi-function Input 2 (S3)**			**Changes during operation**	No
Setting range	0, 2 to 8, 10 to 22 (see note)	**Unit of setting**	1	**Default setting**	5

n38	**Multi-function Input 3 (S4)**			**Changes during operation**	No
Setting range	2 to 8, 10 to 22 (see note)	**Unit of setting**	1	**Default setting**	3

n39	**Multi-function Input 4 (S5)**			**Changes during operation**	No
Setting range	2 to 8, 10 to 22, 34 (see note)	**Unit of setting**	1	**Default setting**	6

Note Do not set values outside the above setting ranges.

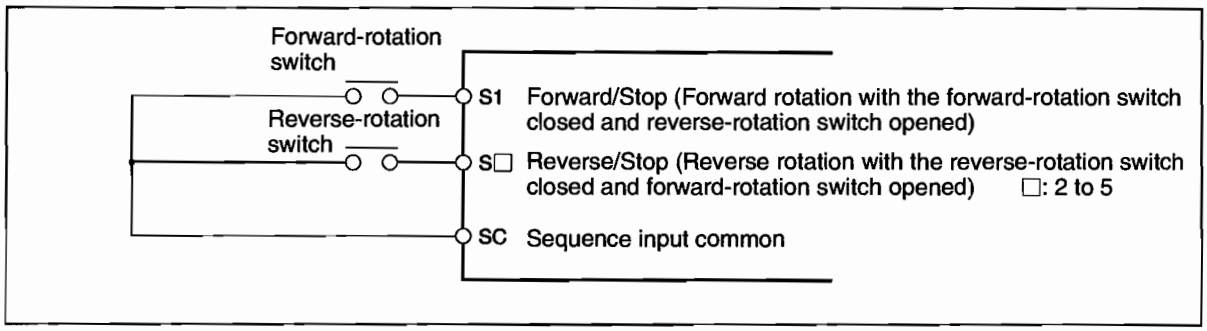
Set Values

Value	Function	Description
0	Forward/Reverse rotation command	3-wire sequence (to be set in n37 only) By setting n37 to 0, the set value in n36 is ignored and the following setting are forcibly made. S1: RUN input (RUN when ON) S2: STOP input (STOP when OFF) S3: Forward/Reverse rotation command (OFF: Forward; ON: Reverse)
2	Reverse/Stop	Reverse rotation command (2-wire sequence)
3	External fault (NO)	ON: External fault (FP□ detection: □ is a terminal number)
4	External fault (NC)	OFF: External fault (EF□ detection: □ is a terminal number)
5	Fault reset	ON: Fault reset (disabled while RUN command is input)
6	Multi-step speed reference 1	Signals to select frequency references 2 through 8. **Note** Refer to *5-5-4 Setting the Frequency References through Key Sequences* for the relationship between multi-step speed references and frequency references. **Note** Any multi-step speed reference not set is regarded as turned-OFF input.
7	Multi-step speed reference 2	
8	Multi-step speed reference 3	

Value	Function	Description
10	Inching frequency command	ON: Inching frequency command (taking precedence over the multi-step speed reference)
11	Acceleration/Deceleration time selection	ON: Acceleration time 2 and deceleration time 2 are selected.
12	External base block command (NO)	ON: Output shut off (while motor coasting to a stop and "bb" flashing)
13	External base block command (NC)	OFF: Output shut off (with motor free running and "bb" flashing)
14	Search command (Searching starts from maximum frequency)	ON: Speed search (Searching starts from n09)
15	Search command (Searching starts from preset frequency)	ON: Speed search
16	Acceleration/Decelera-tion-prohibit command	ON: Acceleration/Deceleration is on hold (running at parameter frequency)
17	Local or remote selection	ON: Local mode (operated with the Digital Operator) **Note** After this setting is made, mode selection with the Digital Operator is not possible.
19	Emergency stop fault (NO)	The Inverter stops according to the setting in n04 for interruption mode selection with the emergency stop input turned ON. n04 set to 0: Decelerates to stop at deceleration time 2 set in n19. n04 set to 1: Coasts to a stop. **Note** NO: Emergency stop with the contact closed. NC: Emergency stop with the contact opened. **Note** Fault: Fault output is ON and reset with RESET input. Alarm output is ON (no reset required). **Note** "STP" is displayed (lit with fault input ON and flashes with alarm input ON)
20	Emergency stop alarm (NO)	
21	Emergency stop fault (NC)	
22	Emergency stop alarm (NC)	
34	Up or down command	Up or down command (set in n39 only) By setting n39 to 34, the set value in n38 is ignored and the following settings are forcibly made. S4: Up command S5: Down command **Note** It is impossible to set the up or down command and multi-step speed references 1 through 3 together. **Note** For up and down command functions in detail, refer to *6-7-7 UP/DOWN Command Frequency Memory (n62).*

■ Operation in 2-wire Sequence (Set Value: 2)

- The Inverter operates in 2-wire sequence by setting a multi-function input parameter to 2 (reverse/stop).
- The following diagram shows a wiring example of the terminals in 2-wire sequence.



■ Operation in 3-wire Sequence (n37 = 0)

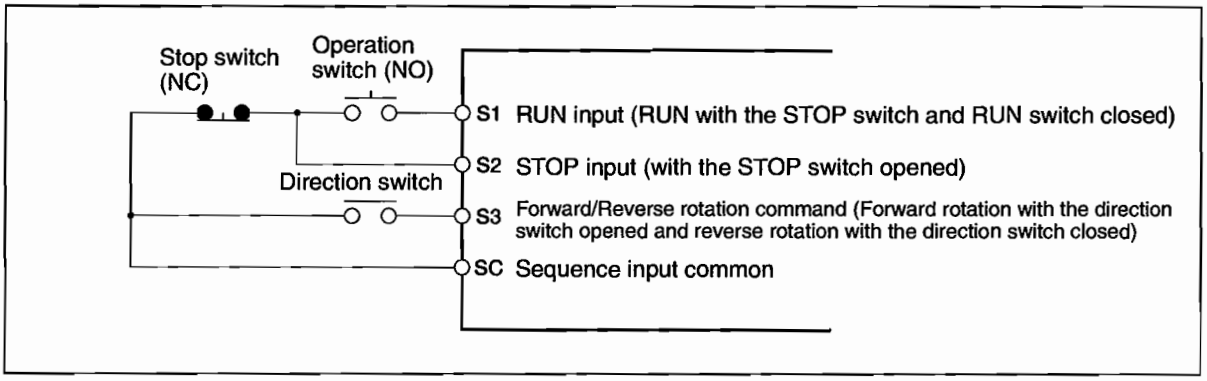
- The Inverter operates in 3-wire sequence by setting n37 for multi-function input 2 to 0.
- Only n37 can be set to 0 (3-wire sequence). By making this setting, the set value in n36 is ignored and the following settings are forcibly made.

  S1: RUN input (RUN when ON)

  S2: STOP input (STOP when OFF)

  S3: Forward/Reverse rotation command (OFF: Forward; ON: Reverse)

- The following diagram shows a wiring example of the terminals in 3-wire sequence.



■ External Base Block Command (Set Value: 11, 12)

When an SPST-NO (setting: 12) or SPST-NC (setting: 13) input is received, Inverter outputs are shut OFF. Use these inputs in the following cases to stop Inverter outputs.

- For switching the motor to free running status when applying an external brake.
- For stopping Inverter outputs before disconnecting motor wiring when changing the motor connections from the Inverter to a commercial power supply.

Note The external base block only shuts OFF the Inverter's output frequency, and the Inverter's internal frequency continues to be calculated as usual. Therefore, if the external base block is cleared

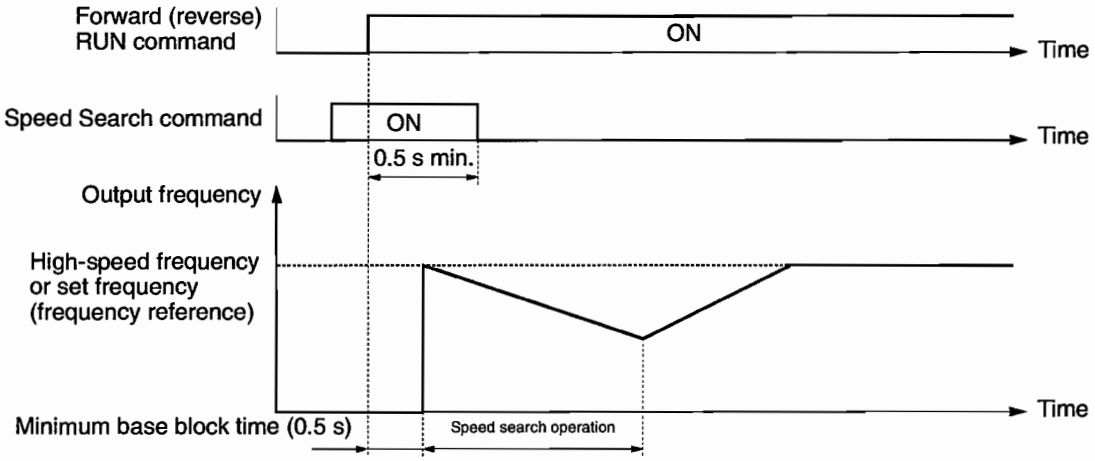
when the frequency is other than zero, the frequency calculated at that point will be output. Because of this, if the baseblock is cleared during deceleration while the motor is free running, a large discrepancy between the motor speed at that moment and the Inverter output frequency may result in a main circuit overvoltage (OV) or overcurrent (OC).

■ Speed Search (Set Value: 14, 15)

The speed search function is provided for smooth restarting without stopping a free running motor. Use it when switching the motor from commercial power supply operation to Inverter operation, when starting with the Inverter a motor turned by external force, etc.

The speed search function searches for the present motor frequency, from high frequency to low. When the motor's rotation speed is detected, it is accelerated from that frequency to the frequency reference according to the acceleration/deceleration time setting.

Speed Search Function



5-9-2 Multi-function Output

The 3G3JV incorporates two multi-function output terminals (MA and MB).
Output from these terminals has a variety of functions according to the application.

■ Selecting the Multi-function Output (n40)

n40	**Multi-function Output (MA/MB and MC)**			**Changes during operation**	No
Setting range	0 to 7, 10 to 17 (see note)	**Unit of setting**	1	**Default setting**	1

Note Do not set values outside the above setting ranges.

Set Values

Value	Function	Description
0	Fault output	ON: Fault output (with protective function working)
1	Operation in progress	ON: Operation in progress (with RUN command input or inverter output)
2	Frequency detection	ON: Frequency detection (with frequency reference coinciding with output frequency)
3	Idling	ON: Idling (at less than min. output frequency)
4	Frequency detection 1	ON: Output frequency □ frequency detection level (n58)
5	Frequency detection 2	ON: Output frequency □ frequency detection level (n58)
6	Overtorque being monitored (NO-contact output)	Output if any of the following parameter conditions is satisfied. • Overtorque detection function selection (n59) • Overtorque detection level (n60) • Overtorque detection time (n61) **Note** NO contact: ON with overtorque being detected; NC contact: OFF with overtorque being detected
7	Overtorque being monitored (NC-contact output)	
10	Alarm output	ON: Alarm being detected (Nonfatal error being detected)
11	Base block in progress	ON: Base block in progress (in operation with output shutoff)
12	RUN mode	ON: Local mode (with the Digital Operator)
13	Inverter ready	ON: Inverter ready to operate (with no fault detected)
14	Fault retry	ON: Fault retry (Inverter resetting with fault retry (n48) not set to 0)
15	UV in progress	ON: Undervoltage being monitored (main circuit undervoltage UV or UV1 detected)
16	Rotating in reverse direction	ON: Rotating in reverse direction
17	Speed search in progress	ON: Speed search in progress

Note Use "operation in progress" (set value: 1) or "idling" (set value: 3) setting for the timing for stopping the motor using a brake. To specify a precise stop timing, set "frequency detection 1" (set value: 4) or "frequency detection 2" (set value: 5), and set the frequency detection level (n58).

5-10 Analog Monitor Output

The 3G3JV incorporates analog monitor output terminals AM and AC.
These terminals have analog monitor values of output frequency or current.

■ Setting the Analog Monitor Output (n44 and n45)

- The output frequency or current as a monitored item is set in n44.
- The analog output characteristics are set as an analog monitor output gain in n45.

n44	**Analog Monitor Output**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

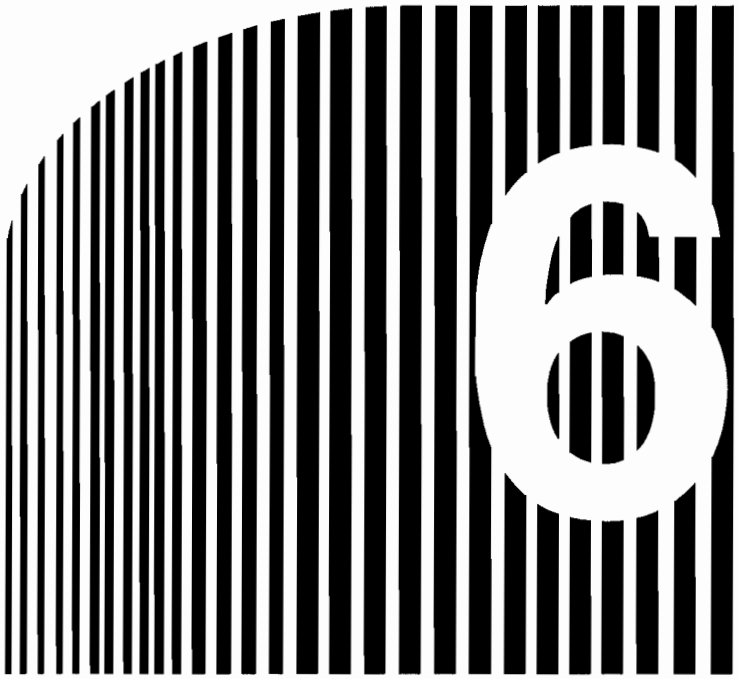
Set Values

Value	Description
0	Output frequency (Reference: 10 V at max. frequency)
1	Output current (Reference: 10 V with rated output current)

n45	**Analog Monitor Output Gain**			**Changes during operation**	Yes
Set range	0.00 to 2.00	**Unit of setting**	0.01	**Default setting**	1.00

Note 1. Set the multiplication ratio based on the set value in n44.
For example, if an output of 5 V is desired at maximum frequency (with n44 set to 0), set n45 to 0.50.

Note 2. The maximum output voltage of the analog monitor output terminals are 10 V.



Chapter 6

• Advanced Operation •

This chapter provides information on the use of advanced functions of the Inverter for operation.
Refer to this chapter to use the various advanced functions, such as stall prevention, carrier frequency setting, overtorque detection, torque compensation, and slip compensation.

6-1 Setting the Carrier Frequency

The carrier frequency of the 3G3JV can be fixed or varied in proportion to the output frequency.

n46	**Carrier Frequency Selection**			**Changes during operation**	No
Setting range	1 to 4, 7 to 9	**Unit of setting**	1	**Default setting**	(see note)

Note The default setting varies with the capacity of the Inverter model.

Set Values

Value	Description
1	2.5 kHz
2	5.0 kHz
3	7.5 kHz
4	10.0 kHz
7	2.5 kHz (12×): 12 times as high as output frequency (between 1.0 and 2.5 kHz)
8	2.5 kHz (24×): 24 times as high as output frequency (between 1.0 and 2.5 kHz)
9	2.5 kHz (36×): 36 times as high as output frequency (between 1.0 and 2.5 kHz)

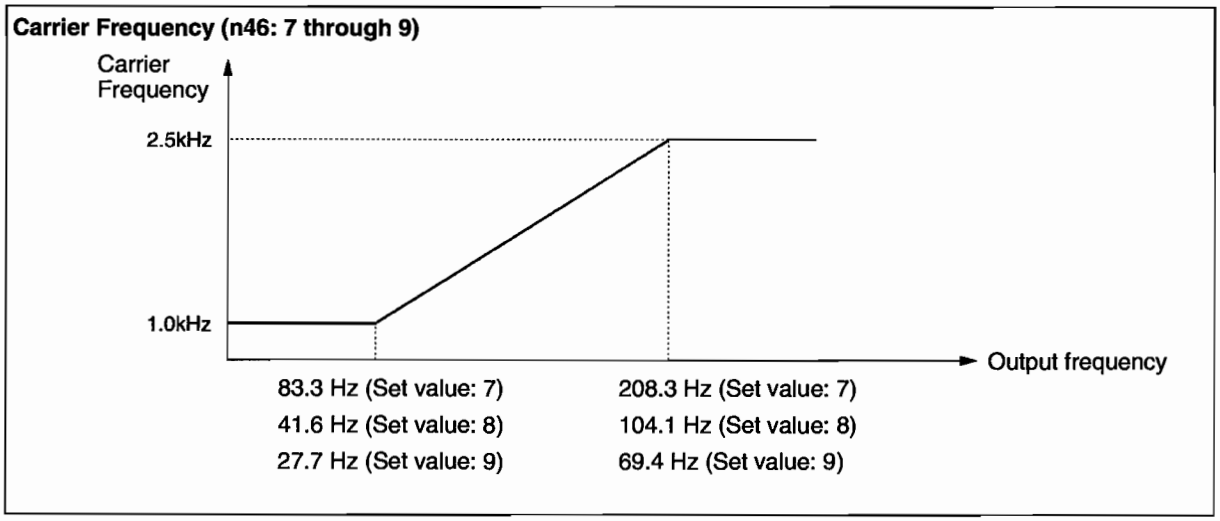
- The default setting does not need any changes in normal operation.
- Change the default setting in the following cases.

The wiring distance between the Inverter and motor is long:
Set the Inverter to a lower carrier frequency.

Reference carrier frequency: 10 kHz at a maximum wiring distance of 100 m and 5 kHz at a wiring distance exceeding 100 m.

Excessive speed or torque dispersion at low speed:
Set the carrier frequency to a lower value.

Note The carrier frequency changes as shown in the following graph with 7 through 9 set in n46.



- The Inverter cannot maintain rated output current with the carrier frequency set to a value higher than the default one.
  The following table shows the default value and a decrease in the output current of each Inverter model.
  Be sure to use the Inverter so that there will be no decrease in rated output current.

Voltage	Model 3G3JV-	Default setting	Rated output current (A)	Set to 3 Reduced rated output current (A)	Set to 4 Reduced rated output current (A)
3-phase 230 V	A2001-A	4 (10 kHz)	0.8	←	←
	A2002-A	4 (10 kHz)	1.6	←	←
	A2004-A	4 (10 kHz)	3.0	←	←
	A2007-A	4 (10 kHz)	5.0	←	←
	A2015-A	3 (7.5 kHz)	8.0	←	7.0
	A2022-A	3 (7.5 kHz)	11.0	←	10.0
	A2037-A	3 (7.5 kHz)	17.5	←	16.5
Single-phase 230 V	AB001-A	4 (10 kHz)	0.8	←	←
	AB002-A	4 (10 kHz)	1.6	←	←
	AB004-A	4 (10 kHz)	3.0	←	←
	AB007-A	4 (10 kHz)	5.0	←	←
	AB015-A	3 (7.5 kHz)	8.0	←	7.0
3-phase 460 V	A4002-A	3 (7.5 kHz)	1.2	←	1.0
	A4004-A	3 (7.5 kHz)	1.8	←	1.6
	A4007-A	3 (7.5 kHz)	3.4	←	3.0
	A4015-A	3 (7.5 kHz)	4.8	←	4.0
	A4022-A	3 (7.5 kHz)	5.5	←	4.8
	A4037-A	3 (7.5 kHz)	8.6	←	7.6

n75	**Low Carrier Frequency at Low Speed**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Low carrier frequency at low speed disabled.
1	Low carrier frequency at low speed enabled.

- Normally set n75 to 0.
- When the output frequency is 5 Hz or higher and the output current rate is 110% or less, the carrier frequency will be automatically reduced to 2.5 kHz with n75 set to 1. If the load is heavy at low speed, the Inverter will withstand higher overcurrent by suppressing the heat radiation of the Inverter caused by the carrier frequency.
- This function is enabled with 2, 3, or 4 set in n46 for carrier frequency.

6-2 DC Injection Braking Function

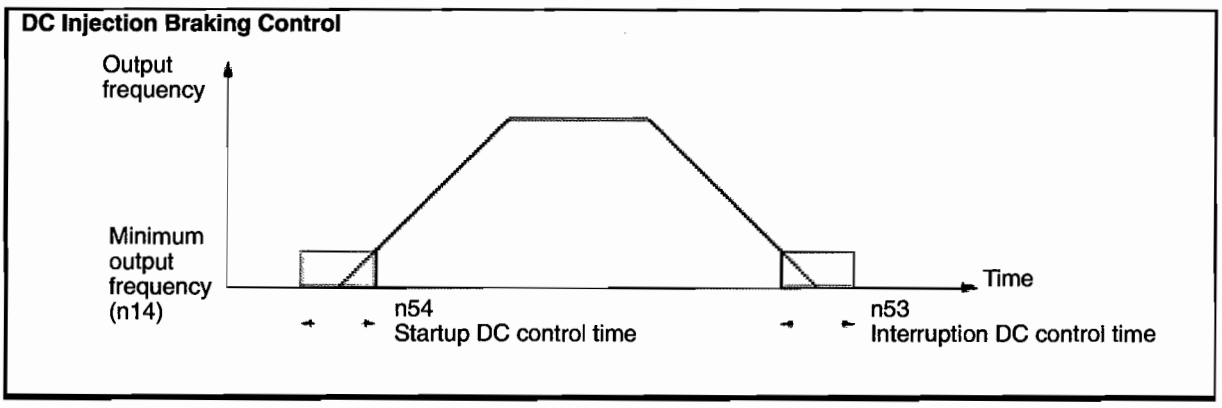
The DC injection braking function applies DC on the induction motor for braking control.
Startup DC Injection Braking:
This braking is used for stopping and starting the motor rotating by inertia with no regenerative processing.
DC Injection Braking to Stop:
Adjust the stop DC injection braking time if the motor rotating does not decelerate to a stop in normal operation due to inertia from a heavy load. By increasing the DC injection braking time or DC injection braking current, the time required for stopping the motor is reduced.

n52	**DC Control Current**			**Changes during operation**	No
Setting range	0 to 100 (%)	**Unit of setting**	1%	**Default setting**	50

n53	**Interruption DC Control Time**			**Changes during operation**	No
Setting range	0.0 to 25.5 (s)	**Unit of setting**	0.1 s	**Default setting**	0.0

n54	**Startup DC Control Time**			**Changes during operation**	No
Setting range	0.0 to 25.5 (s)	**Unit of setting**	0.1 s	**Default setting**	0.0

- Set the DC injection braking current as percentage based on the rated current of the Inverter as 100%.
- After the startup DC injection braking time is set, the Inverter starts up at minimum frequency on completion of the startup DC injection braking control of the Inverter.
- After the speed is reduced, the Inverter is switched to DC injection braking at minimum output frequency.



6-3 Stall Prevention Function

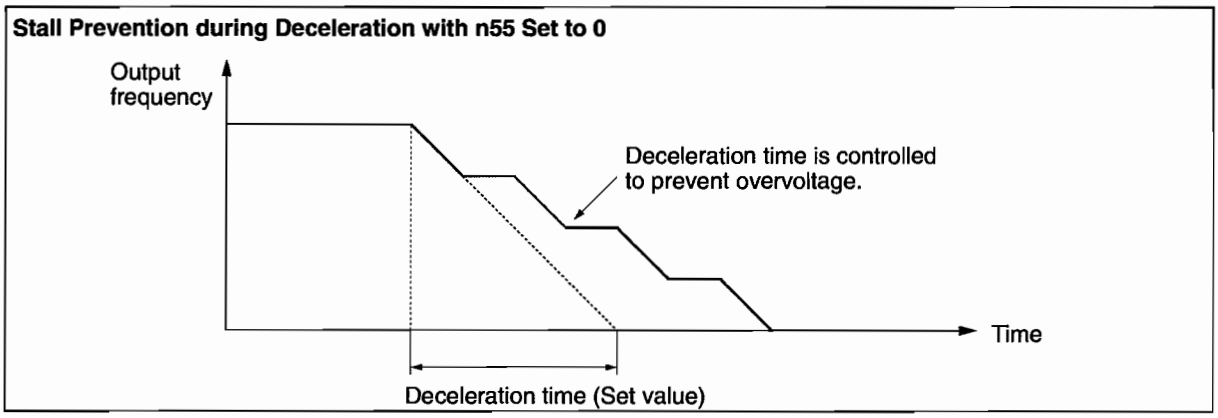
A stall will occur if the motor cannot keep up with the rotating magnetic field on the motor stator side when a large load is applied to the motor or a sudden acceleration/deceleration is performed.
In the 3G3JV, stall prevention functions can be set independently for accelerating, running, and decelerating conditions.

n55	**Stall Prevention Level during Deceleration**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Stall prevention during deceleration
1	No stall prevention during deceleration

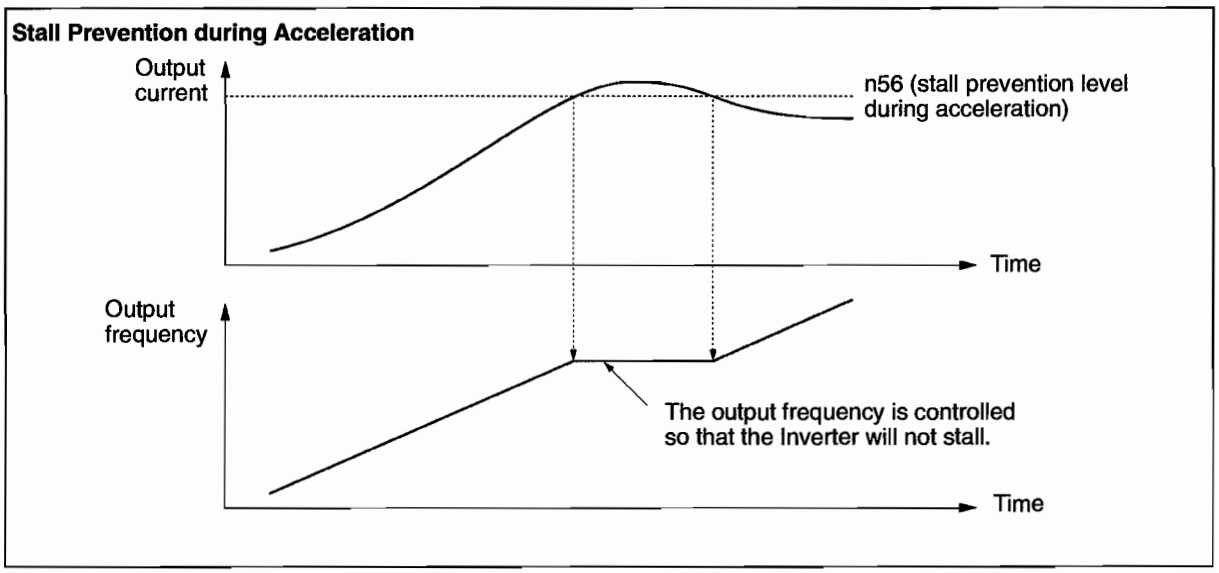
- If 1 is set, the motor will be decelerated according to the set deceleration time. If the deceleration time is too short, the main circuit may result in overvoltage.
- If 0 is set, the deceleration time will be automatically lengthened to prevent overvoltage.



n56	**Stall Prevention Level during Acceleration**			**Changes during operation**	No
Setting range	30 to 200 (%)	**Unit of setting**	1%	**Set Values**	170

Set Values

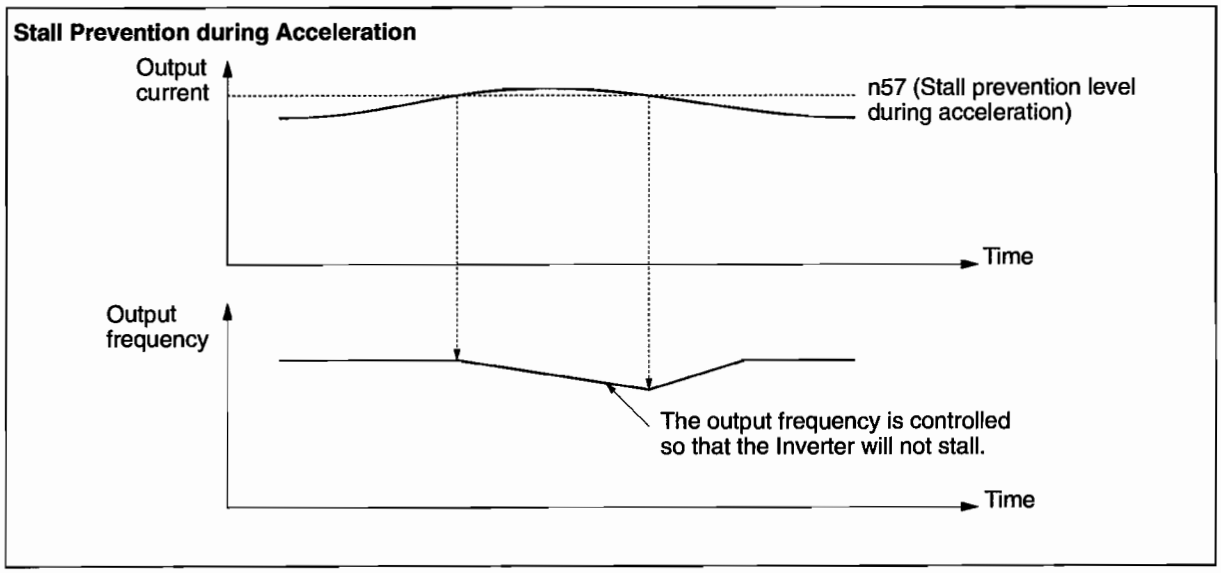
- This function is used to stop accelerating the load if the output current exceeds the set current value so that the Inverter will continue operating without stalling. The Inverter accelerates the load while the output current is the same as or less than the set value.
- Set the parameter as percentage based on the rated Inverter current as 100%.
- The default setting does not need any changes in normal operation.
- Decrease the set value if the capacity of the motor is smaller than that of the Inverter or the motor stalls with the default value.
  The set value is normally 2 or 3 times higher than the rated current of the motor. Set this current as percentage based on the rated inverter current as 100%.



n57	**Stall Prevention during Operation**			**Changes during operation**	No
Setting range	30 to 200 (%)	**Unit of setting**	1%	**Default setting**	160

Set Values

- This function will decrease the output frequency if the output current exceeds the set current value by a minimum of approximately 100 ms so that the Inverter will continue operating without stalling. The Inverter will increase the output frequency to return to the set frequency reference level when the output current is less than the set value.
- The Inverter accelerates or decelerates the output frequency according to the preset acceleration or deceleration time. (Acceleration time 1: n16, n17 or acceleration time 2: n18, n19)
- Set the parameter as percentage based on the rated Inverter current as 100%.
- The default setting does not need any changes in normal operation.
- Decrease the set value if the capacity of the motor is smaller than that of the Inverter or the motor stalls with the default value.
  The set value is normally 2 or 3 times higher than the rated current of the motor. Set this current in percentage based on the rated Inverter current as 100%.



6-4 Overtorque Detection Function

When an excessive load is applied to the equipment, the Inverter detects the overtorque condition through an increase in the output current.

n59	**Overtorque Detection Function Selection**			**Changes during operation**	No
Setting range	0 to 4	**Unit of setting**	1	**Default setting**	0

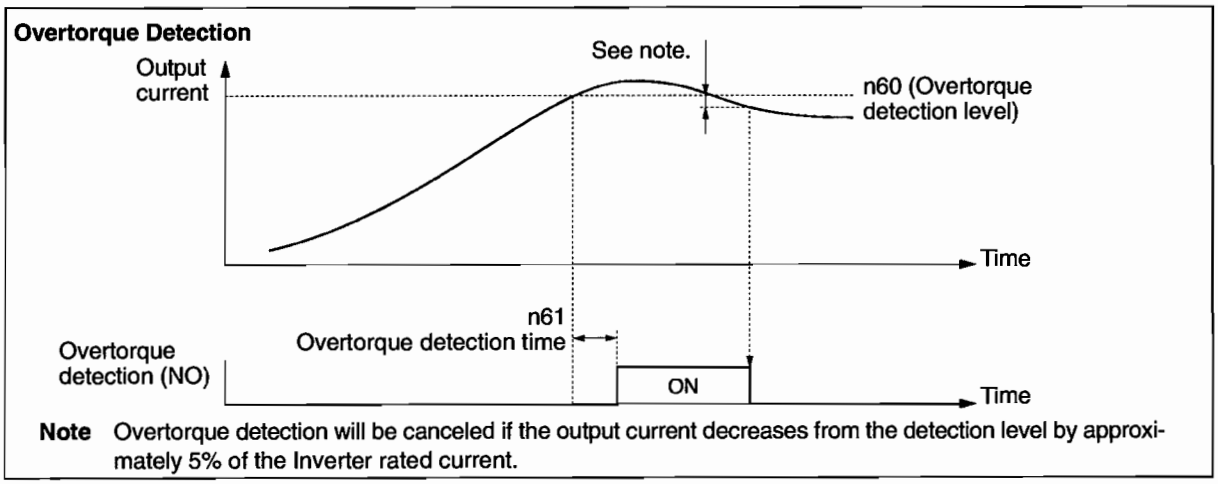
Set Values

Value	Description
0	Inverter does not monitor overtorque.
1	Inverter monitors overtorque only when speed is matched. It continues operation (issues warning) even after overtorque is detected.
2	Inverter monitors overtorque only when speed is matched. It discontinues operation (through protective function) when overtorque is detected.
3	Inverter always monitors overtorque during operation. It continues operation (issues warning) even after overtorque is detected.
4	Inverter always monitors overtorque during operation. It discontinues operation (through protective function) when overtorque is detected.

- Set n60 for overtorque detection level and n61 for overtorque detection time to enable the overtorque detection function. The Inverter will detect overtorque when the current the same as or higher than the detection level is output for the preset detection time.
- Set n40 for multi-function output to either of the following so that external overtorque detection output will be ON.

  Set Value: 6 for overtorque detection (NO)

  Set Value: 7 for overtorque detection (NC)



Note Overtorque detection will be canceled if the output current decreases from the detection level by approximately 5% of the Inverter rated current.

n60	**Overtorque Detection Level**			**Changes during operation**	No
Setting range	30 to 200 (%)	**Unit of setting**	1%	**Default setting**	160

Set Values

- Set the parameter as percentage based on the rated Inverter current as 100%.

n6 1	**Overtorque Detection Time**			**Changes during operation**	No
Setting range	0.1 to 10.0 (s)	**Unit of setting**	0.1 s	**Default setting**	0.1

Set Values

- Set the overtorque detection time.
- The Inverter will detect overtorque when the current the same as or higher than the detection level is output for the preset detection time.

6-5 Torque Compensation Function

This function increases the output torque of the Inverter by detecting an increase in the motor load.

n63	**Torque Compensation Gain**			**Changes during operation**	Yes
Setting range	0.0 to 2.5	**Unit of setting**	0.1	**Default setting**	1.0

Set Values

- The default setting does not need any changes in normal operation.
- Change the default setting in the following cases.

  The wiring distance between the Inverter and motor is long:
  Set the gain to a larger value.

  The capacity of the motor is lower than the maximum applicable motor capacity of the Inverter:
  Set the gain to a larger value.

  The motor vibrates:
  Set the gain to a smaller value.

- The torque compensation gain must be adjusted so that the output current at low speed will not exceed 50% of the rated output current of the Inverter, otherwise the Inverter may be damaged.

6-6 Slip Compensation Function

The slip compensation function calculates the motor torque according to the output current, and sets gain to compensate for output frequency.
This function is used to improve speed accuracy when operating with a load.

n64	**Motor Rated Slip**			**Changes during operation**	Yes
Setting range	0.0 to 20.0 (Hz)	**Unit of setting**	0.1 Hz	**Default setting**	(see note)

Note The default setting varies with the capacity of the Inverter model.

Set Values

- Set the rated slip value of the motor in use.
- This parameter is used as a slip compensation constant.
- Calculate the rated motor slip value from the rated frequency (Hz) and rpm on the motor nameplate by using the following formula.

$$\text{Rated slit value (Hz)} = \text{Rated frequency (Hz)} - \frac{\text{Rated rpm} \times \text{Number of poles}}{120}$$

n65	**Motor No-load Current**			**Changes during operation**	No
Setting range	0 to 99 (%)	**Unit of setting**	1%	**Default setting**	(see note)

Note The default setting varies with the capacity of the Inverter model.

Set Values

- Set the motor current with no load in percentage based on the rated motor current as 100%.
- Contact the motor manufacturer for the motor current with no load.
- This parameter is used as a slip compensation constant.

n66	**Slip Compensation Gain**			**Changes during operation**	Yes
Setting range	0.0 to 2.5	**Unit of setting**	0.1	**Default setting**	0.0 (see note)

Note This parameter is disabled with the value set to 0.0.

Set Values

- Set the parameter to 1.0 first and check the operation of the Inverter. Then fine-tune the gain with 0.1-gain increments or decrements.

  If the speed is lower than the target value, increase the set value.

  If the speed is higher than the target value, decrease the set value.

n67	**Slip Compensation Time Constant**			**Changes during operation**	No
Setting range	0.0 to 25.5 (s)	**Unit of setting**	0.1 s	**Default setting**	2.0

Set Values

- This parameter is used for the response adjustment of the slip compensation function.
- The default setting does not need any changes in normal operation.
- Change the default setting in the following cases.

The motor vibrates:	Set the value to a larger value.
The motor response is low:	Set the value to a smaller value.

6-7 Other Functions

The following description provides information on the other functions and parameter settings of the Inverter.

6-7-1 Motor Protection Characteristics (n33 and n34)

- This parameter setting is for motor overload detection (OL1).

n33	**Motor Protection Characteristic Selection**			**Changes during operation**	No
Setting range	0 to 2	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Protection characteristics for general-purpose induction motors
1	Protection characteristics for Inverter-dedicated motors
2	No protection

- This parameter is used to set the electric thermal characteristics of the motor to be connected.
- Set the parameter according to the motor.
- If a single Inverter is connected to more than one motor, set the parameter to 2 for no protection. The parameter is also disabled by setting n32 for rated motor current to 0.0. To protect each motor from overload, be sure to take an appropriate measure such as the installation of a thermal relay.

n34	**Motor Protection Time**			**Changes during operation**	No
Setting range	1 to 60 (min)	**Unit of setting**	1 min	**Default setting**	8

Set Values

- This parameter is used to set the electronic thermal protection constant of motor overload detection OL1.
- The default setting does not need any changes in normal operation.
- To set the parameter according to the characteristics of the motor, confirm the thermal time constant with the motor manufacturer and set the parameter with some margin. In other words, set the value a little shorter than the thermal time constant.
- To detect motor overloading more quickly, reduce the set value, provided that it does not cause any application problems.

6-7-2 Cooling Fan Operation Function (n35)

- This parameter is used to operate the cooling fan of the Inverter while the Inverter is turned on or only while the Inverter is in operation.

n35	**Cooling Fan Operation Selection**			**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The fan rotates only while the RUN command is input and for 1 minute after the Inverter stops operating.
1	The fan rotates while the Inverter is turned on.

- This parameter is available only if the Inverter incorporates a cooling fan.
- If the operation frequency of the Inverter is low, the life of the fan can be prolonged by setting the parameter to 0.

6-7-3 Momentary Power Interruption Compensation (n47)

- The parameter specifies the processing that will be performed when a momentary power interruption occurs.

n47	**Momentary Power Interruption Compensation**			**Changes during operation**	No
Setting range	0 to 2	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Disabled. (An undervoltage fault will be detected when there is momentary power interruption for 15 ms or more.)
1	The Inverter will continue operating if power is restored within 0.5 s. (see note 1)
2	The Inverter will restart when power is restored. (see note 2)

Note 1. If the parameter is set to 1, an undervoltage warning will be detected and the output of the Inverter will be shut off for 0.5 s when a momentary power interruption occurs. The Inverter will restart after speed searching if power is restored within 0.5 s. Undervoltage fault 1 will be detected if power failure continues for more than 0.5 s.

Note 2. If the parameter is set to 2, an undervoltage warning will be detected and the output of the Inverter will be shut off when a momentary power interruption occurs. The Inverter will then wait for power restoration.
When power is restored, the Inverter will restart after speed searching.

6-7-4 Fault Retry (n48)

⚠ **Caution** The Inverter may be break if the fault retry function is used.

If the Inverter breaks, take the following measures:
Be sure to install a no-fuse breaker (NFB).
Provide the Inverter and peripheral machines with a sequence so that the machines will stop operating when the Inverter has an operational fault.

- The fault retry function automatically resets and restarts the Inverter in the case the Inverter has an overvoltage fault, overcurrent fault, or ground fault.
- In the case of any other fault, the protective function operates instantly and the fault retry function does not operate.
- This function is to be used only if the user does not want to interrupt the mechanical system, even if this function may damage the Inverter.
- Set n40 for multi-function output to the following value so that external overtorque detection output will be turned on.

  Set value: 14 for fault retries

n48	**Fault Retry**			**Changes during operation**	No
Setting range	0 to 10	**Unit of setting**	1	**Default setting**	0

Set Values

- Set the number of fault retries required.
- The count of fault retries will be cleared in any of the following cases.

  The Inverter is normal for 10 minutes continuously after the latest fault retry was made.

  Power supply to the Inverter is interrupted.

  A fault reset is input.

6-7-5 Frequency Jump Function (n49 to n51)

- The frequency jump function prevents the Inverter from generating frequencies that make the mechanical system resonate.
- The frequency jump function can be used effectively to set two dead bands of a frequency reference.

n49	**Jump Frequency 1**			**Changes during operation**	No
Setting range	0.0 to 400 (Hz)	**Unit of setting**	0.1 Hz (see note)	**Default setting**	0.0

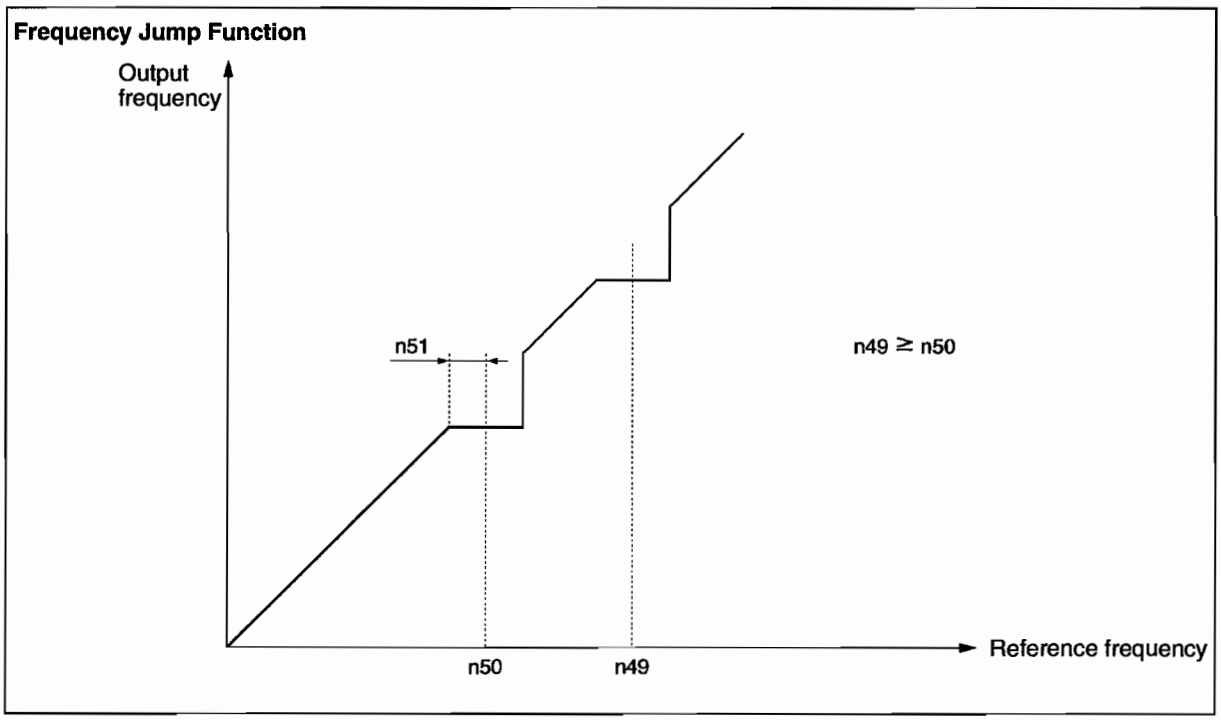
n50	**Jump Frequency 2**			**Changes during operation**	No
Setting range	0.0 to 400 (Hz)	**Setting range**	0.1 Hz (see note)	**Unit of setting**	0.0

n51	**Jump Width**			**Changes during operation**	No
Setting range	0.0 to 25.5 (Hz)	**Unit of setting**	0.1 Hz	**Default setting**	0.0

Note Values will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or greater.

Set Values

- Set n49 and n50 for jump frequencies 1 and 2 to the central values of jumping frequencies.
- These values must satisfy the following condition.
  n49 ≥ n50
- The value in n51 must be set for the jump width.
- This function is disabled with n51 set to 0.0.
- The operation of the Inverter within the dead bands is prohibited. While the Inverter is in acceleration or deceleration control, however, the Inverter does not jump the bands but changes the frequency smoothly.



6-7-6 Frequency Detection Function

- The 3G3JV has the following frequency detection functions.

  Frequency Detection:
  Detects that the frequency reference coincides with the output frequency.

  Frequency Detection Levels 1 and 2:
  Detects that the output frequency is the same as or higher or lower than the set value (frequency detection level) in n58.

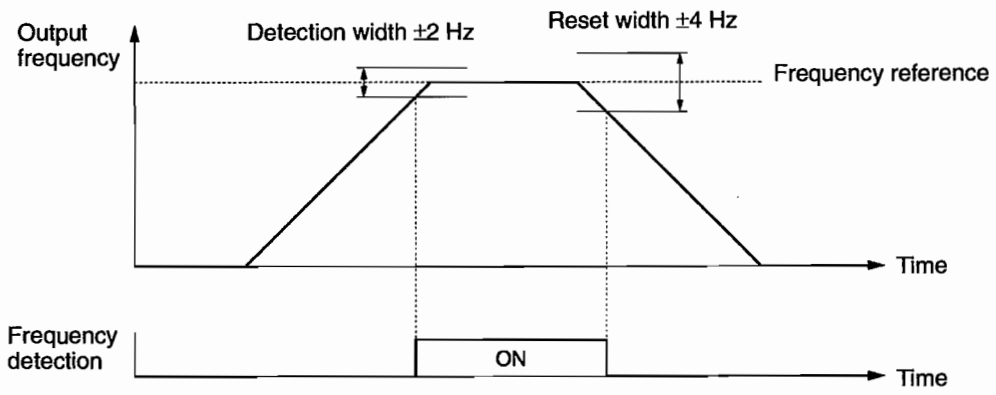
- The parameter n40 for multi-function output must be set for the frequency detection function.

■ Frequency Detection

• The parameter n40 for multi-function output must be set for frequency detection output.

Set value: 2 for frequency detection

Frequency Detection Operation



■ Frequency Detection Levels 1 and 2

• The parameter n40 for multi-function output must be set for frequency detection output.

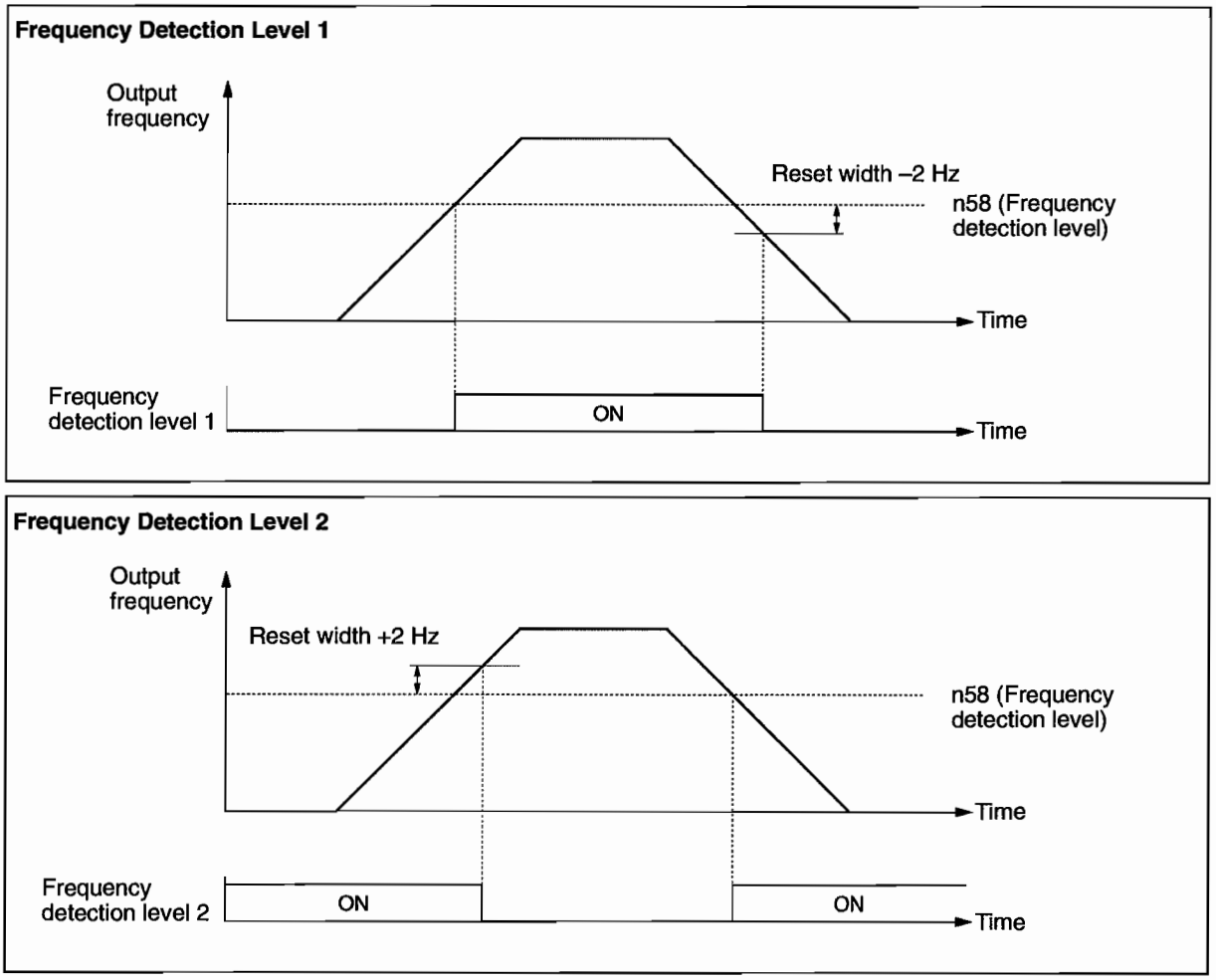
Set value: 4 for frequency detection level 1 (Output frequency≥ n58)

Set value: 5 for frequency detection level 2 (Output frequency ≤ n58)

• Set the frequency detection level in n58.

n58	**Frequency Detection Level**			**Changes during operation**	No
Setting range	0.0 to 400 (Hz)	**Unit of setting**	0.1 Hz (see note)	**Default setting**	0.0

Note The value will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or over.



6-7-7 UP/DOWN Command Frequency Memory (n62)

- This function changes the reference frequency by turning the UP and DOWN commands on and off.
- In order to use this function, set n39 for multi-function inputs 4 to 34. Then the multi-function input 3 (S4) and multi-function input 4 (S5) terminals are set as described below.

  Multi-function input 3 (S4): UP command (The value in n38 for multi-function input 3 is ignored.)

  Multi-function input 4 (S5): DOWN command
- The output frequency held by the UP/DOWN function will be stored in the memory if n62 for UP/DOWN command frequency memory is set to 1.
- By setting n62 to 1, the frequency reference kept on hold for 5 s or more will be retained even after a power interruption, and operation will be restarted at this frequency the next time the RUN command is input.
- The stored output frequency will be cleared from the memory if n62 is set to 0. The retained frequency is initialized with n01 for parameter initialization set to 8 or 9.

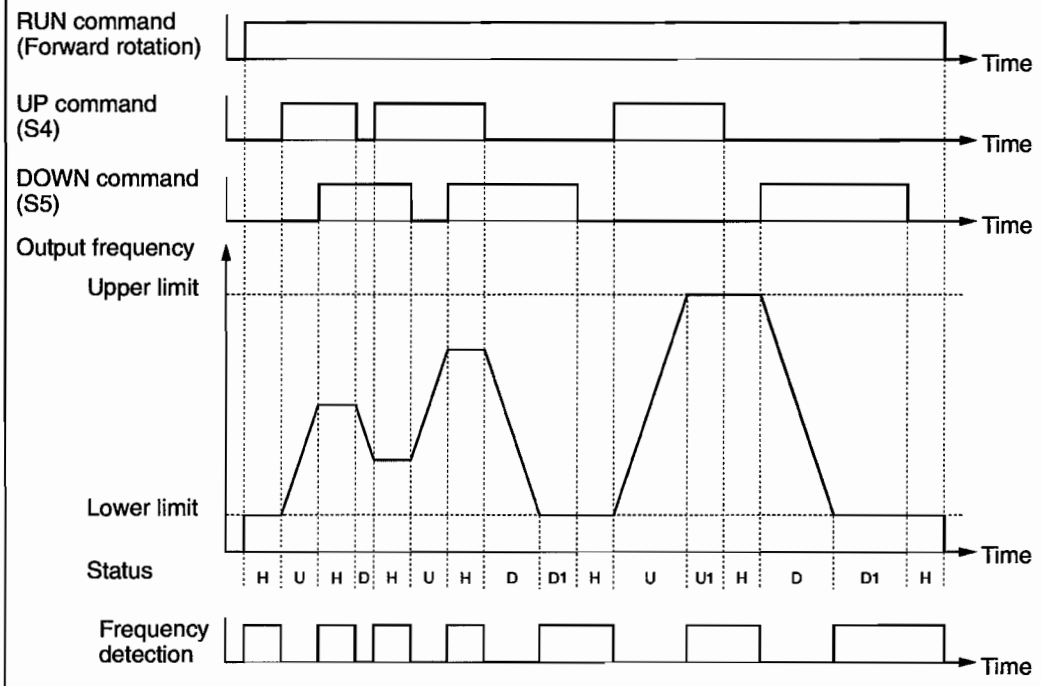
Note While this function is used, frequency references can be used with the UP/DOWN command or inching frequency command. All multi-step speed references are disabled.

n62	Frequency Hold Function Selector			Changes during operation	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The frequency on hold is not retained.
1	The frequency on hold for 5 s or more is retailed.

Operation of UP/DOWN Function



Note Status
U: UP (acceleration)
D: DOWN (deceleration)
H: Hold
U1: Frequency acceleration restricted by upper limit.
D1: Frequency deceleration restricted by lower limit.

- The following ON/OFF combinations of UP and DOWN commands are possible.

Command	Acceleration	Deceleration	Hold	Hold
S4 (UP command)	ON	OFF	OFF	ON
S5 (DOWN command)	OFF	ON	OFF	ON

- With the UP/DOWN function used, the output frequency has the following restrictions for upper and lower limits.

  Upper limit: The maximum frequency in n09 or the frequency reference upper limit in n30, whichever is smaller.

  Lower limit: The minimum output frequency in n14 or frequency reference lower limit in n31, whichever is smaller.

- When the RUN command for forward or reverse rotation is input, the Inverter will start operating at the lower limit regardless of whether the UP/DOWN command is input or not.
- When the UP/DOWN function and inching frequency command are both assigned to multi-function inputs, an inching frequency command input will have the highest priority.
- If n62 for UP/DOWN command frequency memory is set to 1, the output frequency held by the UP/DOWN function for 5 s or more will be stored in the memory. The output frequency will be held by the UP/DOWN function when both UP and DOWN commands are ON or OFF together.

6-7-8 Error History (n78)

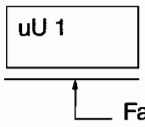
- The 3G3JV stores information on the latest error.
- The information on the latest error recorded is displayed by pressing the Enter Key after n78 for error history is displayed.
- The details of the information are the same as that obtained from the multi-function monitor U09.

n78	**Error History**			**Changes during operation**	---
Setting range	---	**Unit of setting**	---	**Default setting**	---

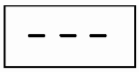
Note The information is read only.

Display Example

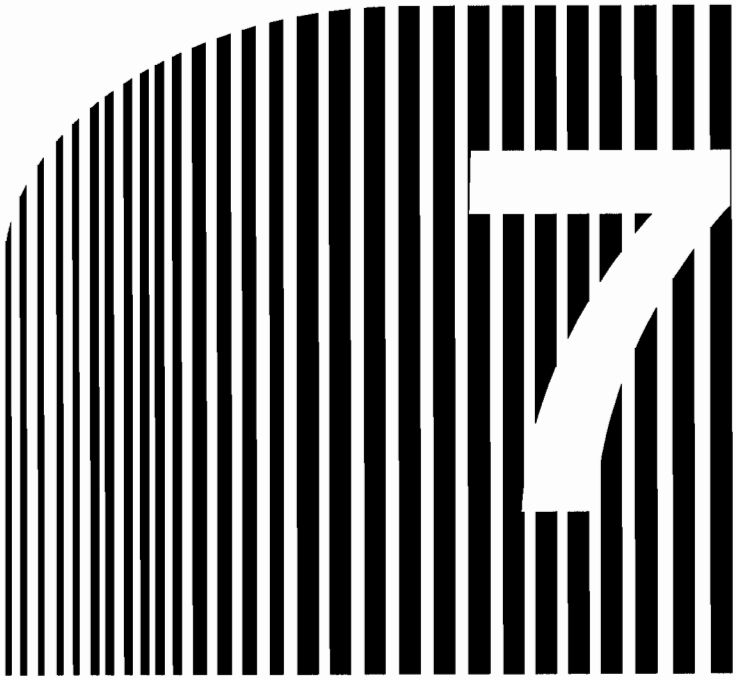
- Fault display



- No error stored



- To clear the error history, set n01 for parameter write-prohibit selection/parameter initialization to 6.



Chapter 7

• Maintenance Operations .

7-1 Protective and Diagnostic Functions

7-1-1 Fault Detection (Fatal Error)

The Inverter will detect the following faults if the Inverter or motor burns or the internal circuitry of the Inverter malfunctions. When the Inverter detects a fault, the fault code will be displayed on the Digital Operator, the fault contact output will operate, and the Inverter output will be shut off causing the motor to coast to a stop. The stopping method can be selected for some faults, and the selected stopping method will be used with these faults. If a fault has occurred, refer to the following table to identify and correct the cause of the fault. Use one of the following methods to reset the fault after restarting the Inverter. If the operation command is being input, however, the reset signal will be ignored. Therefore, be sure to reset the fault with the operation command turned off.

- Turn on the fault reset signal. A multi-function input (n36 to n39) must be set to 5 (Fault Reset).
- Press the STOP/RESET Key on the Digital Operator.
- Turn the main circuit power supply off and then on again.

■ Fault Displays and Processing

Fault display	Fault name and meaning	Probable cause and remedy
oC	**Overcurrent (OC)** The Inverter output current is as high as or higher than 200% of the rated output current.	• A short-circuit or ground fault has occurred and at the Inverter output. → Check and correct the motor power cable. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The motor capacity is too large for the Inverter. → Reduce the motor capacity to the maximum permissible motor capacity. • The magnetic contactor on the output side of the Inverter has been opened and closed. → Rearrange the sequence so that the magnetic contactor will not open or close while the Inverter has current output. • The output circuit of the Inverter is damaged. → Replace the Inverter.
ou	**Overvoltage (OV)** The main circuit DC voltage has reached the overvoltage detection level (200-V models: 410 V DC min.; 400-V models: 820 V DC min.).	• The deceleration time is too short. → Increase the deceleration time. • The power supply voltage is too high. → Decrease the voltage so it will be within specifications. • There is excessive regenerative energy due to overshooting at the time of acceleration. → Suppress the overshooting as much as possible.

Fault display	Fault name and meaning	Probable cause and remedy
Uv 1	**Main circuit undervoltage (UV1)** The main circuit DC voltage has reached the undervoltage detection level (230 V DC for the 3G3JV-A2□-A, 160 V DC for the 3G3JV-AB□-A, and 460 V DC for the 3G3JV-A4□-A).	• Power supply to the Inverter has phase loss, power input terminal screws are loose, or the power cable is disconnected. → Check the above and take necessary countermeasures. • Incorrect power supply voltage → Make sure that the power supply voltage is within specifications. • Momentary power interruption has occurred. → Use the momentary power interruption compensation (Set n47 so that the Inverter restarts after power is restored) → Improve the power supply. • The internal circuitry of the Inverter is damaged. → Change the Inverter.
oH	**Radiation fin overheated (OH)** The temperature of the radiation fins of the Inverter has reached 110°C ± 10°C.	• The ambient temperature is too high. → Ventilate the Inverter or install a cooling unit. • The load is excessive. → Reduce the load. → Decrease the Inverter capacity. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The acceleration/deceleration time is too short. → Increase the acceleration/deceleration time. • The ventilation is obstructed. → Change the location of the Inverter to meet the installation conditions. • The cooling fan of the Inverter does not work. → Replace the cooling fan.

Fault display	Fault name and meaning	Probable cause and remedy
oL 1	**Motor overload (OL1)** The electric thermal relay actuated the motor overload protective function.	• The load is excessive. → Reduce the load. → Decrease the Inverter capacity. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The value in n11 for maximum voltage frequency is low. → Check the motor nameplate and set n11 to the rated frequency. • The acceleration/deceleration time is too short. → Increase the acceleration/deceleration time. • The value in n32 for rated motor current is incorrect. → Check the motor nameplate and set n32 to the rated current. • The Inverter is driving more than one motor. → Disable the motor overload detection function and install an electronic thermal relay for each of the motors. The motor overload detection function is disabled by setting n32 to 0.0 or n33 to 2. • The motor protective time setting in n34 is short. → Set n34 to 8 (the default value).
oL2	**Inverter overload (OL2)** The electronic thermal relay has actuated the Inverter overload protective function.	• The load is excessive. → Reduce the load. • The V/f setting is incorrect. → Reduce the V/f set voltage. • The acceleration/deceleration time is too short. → Increase the acceleration/deceleration time. • The Inverter capacity is insufficient. → Use an Inverter model with a higher capacity.
oL3	**Overtorque detection (OL3)** There has been a current or torque the same as or greater than the setting in n60 for overtorque detection level and that in n61 for overtorque detection time. A fault has been detected with n59 for overtorque detection function selection set to 2 or 4.	• The mechanical system is locked or has a failure. → Check the mechanical system and correct the cause of overtorque. • The parameter settings were incorrect. → Adjust the n60 and n61 parameters according to the mechanical system. Increase the set values in n60 and n61.
GF	**Ground fault (GF)** The ground fault current at the output of the Inverter has exceeded the rated output current of the Inverter.	• A ground fault has occurred at the Inverter output. → Check the connections between the Inverter and motor and reset the fault after correcting its cause.

Fault display	Fault name and meaning	Probable cause and remedy
EF□	**External fault □ (EF□)** An external fault has been input from a multi-function input. A multi-function input 1, 2, 3, or 4 set to 3 or 4 has operated. The EF number indicates the number of the corresponding input (S2 to S5).	• An external fault was input from a multi-function input. → Remove the cause of the external fault. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.
F00	**Digital Operator transmission fault 1 (F00)** An initial memory fault has been detected	• The internal circuitry of the Inverter has a fault. → Turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F01	**Digital Operator transmission fault 2 (F01)** A ROM fault has been detected.	• The internal circuitry of the Inverter has a fault. → Turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F04	**Initial memory fault (F04)** An error in the built-in EEPROM of the Inverter has been detected.	• The internal circuitry of the Inverter has a fault. → Initialize the Inverter with n01 set to 8 or 9 and turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F05	**Analog-to-digital converter fault (F05)** An analog-to-digital converter fault has been detected.	• The internal circuitry of the Inverter has a fault. → Turn the Inverter off and on. → Replace the Inverter if the same fault occurs again.
F07	**Digital Operator fault (F07)** An error in the built-in control circuit of the Digital Operator has been detected.	• The internal circuitry of the Digital Operator has a fault. → Turn the Digital Operator off and on. → Replace the Digital Operator if the same fault occurs again.
SrP	**Emergency stop (STP)** An emergency stop alarm is input to a multi-function input. (A multi-function input 1, 2, 3, or 4 set to 19 or 21 has operated.)	• An emergency stop alarm is input to a multi-function input. → Remove the cause of the fault. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.
OFF	**Power supply error** • Insufficient power supply voltage • Control power supply fault • Hardware fault	• No power supply is provided. → Check and correct the power supply wire and voltage. • Terminal screws are loosened. → Check and tighten the terminal screws. • The Inverter is damaged. → Replace the Inverter.

7-1-2 Warning Detection (Nonfatal Error)

The warning detection is a type of Inverter protective function that does not operate the fault contact output and returns the Inverter to its original status once the cause of the error has been removed. The Digital Operator flashes and display the detail of the error. If a warning occurs, take appropriate countermeasures according to the table below.

Note Some warnings or some cases stop the operation of the Inverter as described in the table.

■ Warning Displays and Processing

Fault display	Warning name and Meaning	Probable cause and remedy
Uu (flashing)	**Main Circuit Undervoltage (UV)** The main circuit DC voltage has reached the undervoltage detection level (200 V DC for the 3G3JV-A2□-A, 160 V DC for the 3G3JV-AB□-A, and 400 V DC for the 3G3JV-A4□-A).	• Power supply to the Inverter has phase loss, power input terminal screws are loose, or the power line is disconnected. → Check the above and take necessary countermeasures. • Incorrect power supply voltage → Make sure that the power supply voltage is within specifications.
ou (flashing)	**Main Circuit Overvoltage** The main circuit DC voltage has reached the overvoltage detection level (200-V models: 410 V DC min.; 400-V models: 820 V DC min.).	• The power supply voltage is too high. → Decrease the voltage so it will be within specifications.
oH (flashing)	**Radiation fin overheated (OH)** The temperature of the radiation fins of the Inverter has reached 110°C ± 10°C.	• The ambient temperature is too high. → Ventilate the Inverter or install a cooling unit.
oL3 (flashing)	**Overtorque detection (OL3)** There has been a current or torque the same as or greater than the setting in n60 for overtorque detection level and that in n61 for overtorque detection time. A fault has been detected with n59 for overtorque detection function selection set to 1 or 3.	• The mechanical system is locked or has a failure. → Check the mechanical system and correct the cause of overtorque. • The parameter settings were incorrect. → Adjust the n60 and n61 parameters according to the mechanical system. Increase the set values in n60 and n61.
SEr (flashing)	**Sequence error (SER)** A sequence change has been input while the Inverter is in operation. Local or remote selection is input while the Inverter is in operation. **Note** The Inverter coasts to a stop.	• A sequence error has occurred. → Check and adjust the local or remote selection sequence as multi-function input.
bb (flashing)	**External base block (bb)** The external base block command has been input. **Note** The Inverter coasts to a stop.	• The external base block command has been input as multi-function input. → Remove the cause of external base block input. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.

Fault display	Warning name and Meaning	Probable cause and remedy
EF (flashing)	**Forward- and reverse-rotation input (EF)** The forward and reverse commands are input to the control circuit terminals simultaneously for 0.5 s or more. **Note** The Inverter stops according to the method set in n04.	• A sequence error has occurred. → Check and adjust the local or remote selection sequence.
STP (flashing)	**Emergency stop (STP)** The Digital Operator stops operating. The STOP/RESET Key on the Digital Operator is pressed while the Inverter is operating according to the forward or reverse command through the control circuit terminals. **Note** The Inverter stops according to the method set in n04.	• The parameter setting was incorrect. → Turn off the forward or reverse command once, check that the n06 parameter setting for STOP/RESET Key function selection, and restart the Inverter.
	The emergency stop alarm signal is input as multi-function input. A multi-function input 1, 2, 3, or 4 set to 20 or 22 has been used. **Note** The Inverter stops according to the method set in n04.	• An emergency stop alarm is input to a multi-function input. → Remove the cause of the fault. • The sequence is incorrect. → Check and change the external fault input sequence including the input timing and NO or NC contact.
FAn (flashing)	**Cooling fan fault (FAN)** The cooling fan has been locked.	• The cooling fan wiring has a fault. → Turn off the Inverter, dismount the fan, and check and repair the wiring. • The cooling fan in not in good condition. → Check and remove the foreign material or dust on the fan. • The cooling fan is beyond repair. → Replace the fan.

7-2 Troubleshooting

Due to parameter setting errors, faulty wiring, and so on, the Inverter and motor may not operate as expected when the system is started up. If that should occur, use this section as a reference and apply the appropriate measures.
Refer to *7-1 Protective and Diagnostic Functions*, if the contents of the fault are displayed,

7-2-1 Parameters Fail Set

■ The display does not change when the Increment or Decrement Key is pressed.

- Parameter write-prohibit is input.

  This occurs when n01 for parameter write-prohibit selection/parameter initialization is set to 0. Set n01 to an appropriate value according to the parameter to be set.

- The Inverter is operating.

  There are some parameters that cannot be set during operation. Refer to the list of parameters. Turn the Inverter off and then make the settings.

■ The Digital Operator does not display anything.

Turn the Inverter off and on. If the Digital Operator still does not display anything, the internal circuitry of the Inverter must have failed. Replace the Inverter.

7-2-2 Motor Fails to Operate

■ The motor does not operate with input through the control circuit terminals even though the frequency reference is correct.

- The operation method setting is incorrect.

  If parameter n02 for operation mode selection is not set to 1 to enable the control circuit terminals, the RUN command cannot be executed through the control circuit terminals.

  Check and correct the setting in n02.

- Input in 2-wire sequence while 3-wire sequence is in effect and vice-versa.

  The Inverter will operate in 3-wire sequence according to the RUN, stop, and forward/stop commands if n37 for multi-function input 2 is set to 0. At that time, the Inverter will not operate if input in 2-wire sequence is ON. On the other hand, the Inverter in 2-wire sequence will only rotate in the reverse direction if input in 3-wire sequence is ON.

  Check and correct the setting in n37 or change the input method of the RUN command.

- The Inverter is not in RUN mode.

  When the PRGM or LO/RE indicator (red indicator) of the Digital Operator is lit, the Inverter does not start.

  Cancel the RUN command, press the Mode Key to change the mode of the Inverter, and restart the Inverter with the green indicator lit.

- The frequency reference is too low.

  If the frequency reference is set below the minimum output frequency set in n14, the Inverter will not operate.

  Raise the frequency reference to at least the minimum output frequency.

- The Inverter is in local mode.

  The Inverter in local mode starts with the RUN command given with the RUN Key pressed.

  Check the LO/RE indicator. If the display is "Lo," the Inverter is in local mode. Press the Increment Key and set the Inverter to remote mode with "rE" displayed.

  If the above operation is not possible, a multi-function input is set to local/remote selection. In that case, the mode can be changed with the multi-function input only. Turn the corresponding input terminal OFF so that the Inverter will be set to remote mode.

- The wiring on the Inverter control circuit terminals is incorrect.

  The Inverter cannot check input signals if the input wiring on the control circuit terminals is incorrect.

  Operate the Digital Operator and check the input terminal status of multi-function monitor U06.

  The NPN or PNP input sequence is selectable. The NPN input sequence is the default setting.

  Refer to *2-2-2 Terminal Block* and check that the setting of switch SW7 and wiring are correct.

■ The motor does not operate with input through the control circuit terminals. (The frequency reference is zero or different from the set value.)

- The frequency reference setting is incorrect.

  The analog input of frequency references is ignored with the Digital Operator selected. The digital input of frequency references is ignored unless the Digital Operator is selected.

  Check that the setting in n03 for frequency reference selection coincides with the actual method of giving frequency instructions.

  Before using analog input, refer to *2-2-2 Terminal Block* and check that the setting of SW8 and the actual method (with voltage and current) of providing frequency references are correct.

- The Inverter is in local mode.

  Frequency references can be provided only through key sequences on the Digital Operator or with the FREQ adjuster to the Inverter in local mode.

  Check the LO/RE indicator. If the display is "Lo," the Inverter is in local mode. Press the Increment Key and set the Inverter to remote mode with "rE" displayed.

  If the above operation is not possible, the multi-function input will be set to local/remote selection. In that case, the mode can be changed with the multi-function input only. Turn the corresponding input terminal OFF so that the Inverter will be set to remote mode.

- The analog input gain or bias setting is incorrect.

  Check that the frequency reference gain in n41 and frequency reference bias in n42 are set according to the actual analog input characteristics.

■ The motor stops during acceleration or when a load is connected.

- The load may be too big.

  The 3G3JV has a stall prevention function and automatic torque boost function, but the motor responsiveness limit may be exceeded if acceleration is too rapid or if the load is too big.

  Lengthen the acceleration time or reduce the load. Also consider increasing the motor capacity.

■ The motor only rotates in one direction.

• Reverse rotation-prohibit is selected.

If n05 for reverse rotation-prohibit selection is set to 1 (reverse run prohibited), the Inverter will not accept reverse-rotation commands.

To use both forward and reverse rotation, set n05 to 0.

7-2-3 Motor Rotates in the Wrong Direction

• The output wiring of the motor is faulty.

When the U/T1, V/T2, and W/T3 terminals of the Inverter are properly connected to the T1(U), T2(V), and T3(W) terminals of the motor, the motor operates in a forward direction when a forward rotation command is executed. The forward direction depends on the maker and the motor type. Therefore, be sure to check the specifications.

Switching two wires among the U/T1, V/T2, and W/T3 will reverse the direction of rotation.

7-2-4 Motor Outputs No Torque or Acceleration is Slow

• The stall prevention level during running is too low.

If the value in n57 for stall prevention level during operation is too low, the speed will drop before torque output is turned ON.

Check to be sure that the set value is suitable.

• The stall prevention level during acceleration is too low.

If the value in n56 for stall prevention level during acceleration is too slow, the acceleration time will be too long.

Check to be sure that the set value is suitable.

7-2-5 Motor Deceleration is Slow

• The deceleration time setting is too long.

Check the deceleration time settings in n17 and n19.

• Stall Prevention during Deceleration

The Inverter incorporates a stall prevention function that will automatically prolong the period of deceleration if the motor has an excessive amount of regenerative energy. This function will operate if the period of deceleration is longer than the set value. If the period of deceleration needs to coincide with the set value, use an Inverter model with a larger capacity or a model incorporating a function to process regenerative energy (such as the SYSDRIVE 3G3MV or 3G3EV-series Inverter).

7-2-6 Motor Burns

• The load is too big.

If the load of the motor is too big and the motor is used with the effective torque exceeding the rated torque of the motor, the motor will burn out. For example, the rated torque of the motor and capacity may be limited to eight hours of use if the inscription on the motor states that the motor is rated for eight hours. If the 8-hour rated torque is used for normal operation, it may cause the motor to bun out.

Reduce the load amount by either reducing the load or lengthening the acceleration/deceleration time. Also consider increasing the motor capacity.

- The ambient temperature is too high.

  The rating of the motor is determined within a particular ambient operating temperature range. The motor will burn out if it runs continuously at the rated torque in an environment in which the maximum ambient operating temperature is exceeded.

  Lower the ambient temperature of the motor to within the acceptable ambient operating temperature range.

- The withstand voltage between the phases of the motor is insufficient.

  When the motor is connected to the output of the Inverter, a surge will be generated between the switching of the Inverter and the coil of the motor.

  Normally, the maximum surge voltage is approximately three times the input power supply voltage of the Inverter (i.e., approximately 600 V for 200-V models, and approximately 1,200 V for 400-V models).

  Therefore, the dielectric strength of the motor to be used must be higher than the maximum surge voltage.

7-2-7 Controller or AM Radio Receives Noise when Inverter is Started

- Noise derives from Inverter switching.

  Take the following actions to prevent noise.

  - Lower the carrier frequency of the Inverter in n46.

    The number of internal switching times is reduced, so noise can be reduced to some extent.

  - Install an Input Noise Filter.

    Install an Input Noise Filter on the power input area of the Inverter.

  - Install an Output Noise Filter.

    Install an Output Noise Filter on the output area of the Inverter.

  - Use metal tubing.

    Electric waves can be shielded by metal. Therefore, enclose the Inverter with a metal tube.

7-2-8 Ground Fault Interrupter is Actuated when Inverter is Started

- Leakage current flows through the Inverter.

  The Inverter performs internal switching. Therefore, a leakage current flows through the Inverter. This leakage current may actuate the ground fault interrupter, shutting the power off.

  Use a ground fault interrupter with a high leakage-current detection value (sensitivity amperage of 200 mA or more, operating time of 0.1 s or more) or one with high-frequency countermeasures for Inverter use.

  Reducing the carrier frequency value in n46 is also effective.
  In addition, remember that a leakage current increases in proportion to the cable length. Normally, approximately 5 mA of leakage current is generated for each meter of cable.

7-2-9 Mechanical Vibration

■ Mechanical system makes unusual noise.

- Resonance between the characteristic frequency of the mechanical system and the carrier frequency.

  There may be resonance between the characteristic frequency of the mechanical system and the carrier frequency. If the motor is running with no problems and the machinery system is vibrating with a high-pitched whine, it may indicate that this is occurring. To prevent this type of resonance, adjust the carrier frequency value in n46.

- Resonance between the characteristic frequency of a machine and the output frequency of the Inverter.

  There may be resonance between the characteristic frequency of a machine and the output frequency of the Inverter. To prevent this from occurring, use the frequency jump function with the constants set in n49 through n51 to change the output frequency or install vibration-proof rubber on the motor base to prevent the resonance of the mechanical system.

■ Vibration and hunting are occurring.

- Influence by the slip compensation function.

  The slip compensation function of the Inverter may influence the characteristic frequency of the mechanical system to cause vibration or hunting. In that case, increase the time constant in n67 for slip compensation. The larger this time constant is, however, the slower the response speed of the slip compensation function will be.

■ Motor vibrates excessively and does not rotate normally.

- Motor Phase Interruption

  If one or two of the three phases of the motor are open, the motor will vibrate excessively and will not rotate. Check that the motor is wired correctly without any disconnection. The same phenomenon will occur if the output transistor of the Inverter is open and damaged. Check the balance of the Inverter's output voltage as well.

7-2-10 Motor Rotates after Output of Inverter is Turned Off

- Insufficient DC Control

  If the motor continues operating at low speed, without completely stopping, and after a deceleration stop has been executed, it means that the DC braking is not decelerating enough.

  In such cases, adjust the DC control as described below.

  - Increase the parameter in n52 for DC control current.
  - Increase the parameter in n53 for interruption DC control time.

7-2-11 Detects OV when Motor Starts and Motor Stalls

- Insufficient DC control at startup

  Generation of OV and stalling can occur if the motor is turning when it is started.

  This can be prevented by slowing the rotation of the motor by DC braking before starting the motor.

  Increase the parameter in n54 for startup DC control time.

7-2-12 Output Frequency Does Not Reach Frequency Reference

- The frequency reference is within the jump frequency range.

  If the jump function is used, the output frequency stays within the jump frequency range.

  Make sure that the jump width settings in n49 through n50 for jump frequencies 1 and 2 and jump width in n51 are appropriate.

- The preset output frequency exceeds the upper-limit frequency.

  The upper-limit frequency can be obtained from the following formula.
  Maximum frequency in n09 × frequency reference upper limit in n30/100

  Make sure that the parameters in n09 and n30 are correct.

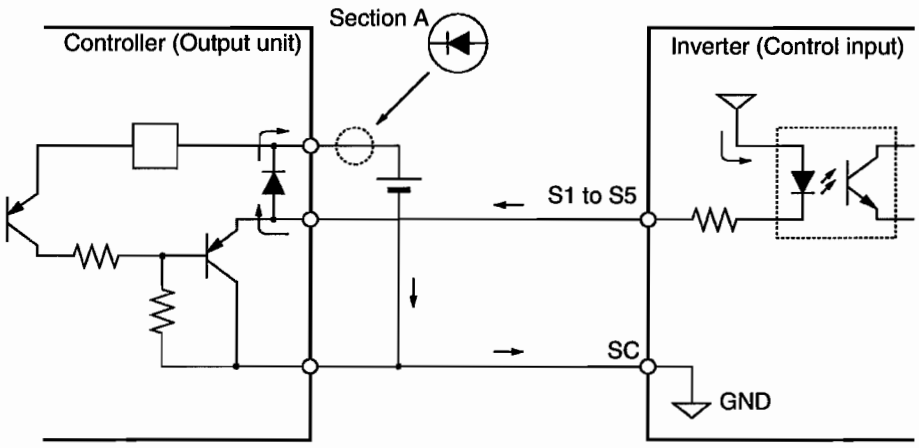
7-2-13 Inverter Does Not Run Because EF (Simultaneous Input of Forward and Reverse Commands) is Detected, or Motor Rotates Momentarily While Control Device Power is OFF

- Sequence Error

  An EF will be detected if a forward command and a reverse command are input simultaneously for 0.5 seconds or longer. Correct the sequence.

- Malfunction Due to Unwanted Current Path

  Inverter inputs may remain ON due to an unwanted current path for the controller outputs. With the wiring shown in the following table, if the controller output power supply is less than 24 V DC or if the power is OFF, the current indicated by the arrow will flow and the Inverter inputs will operate. If that occurs, insert a diode as shown in the diagram at point A.



7-3 Maintenance and Inspection

⚠ **WARNING** Do not touch the Inverter terminals while the power is being supplied.

⚠ **WARNING** Maintenance or inspection must be performed only after turning OFF the power supply, confirming that the CHARGE indicator (or status indicators) is turned OFF, and after waiting for the time specified on the front cover. Not doing so may result in electrical shock.

⚠ **WARNING** Maintenance, inspection, or parts replacement must be performed by authorized personnel. Not doing so may result in electrical shock or injury.

⚠ **WARNING** Do not attempt to take the Unit apart or repair. Doing either of these may result in electrical shock or injury.

⚠ **Caution** Carefully handle the Inverter because it uses semiconductor elements. Careless handling may result in malfunction.

⚠ **Caution** Do not change wiring, disconnect connectors, the Operator, or optional items, or replace fans while power is being supplied. Doing so may result in injury, damage to the product, or malfunction.

■ Daily Inspection

Check the following items with the system in operation.

- The motor should not be vibrating or making unusual noises.
- There should be no abnormal heat generation.
- The output current value shown on the monitor display should not be higher than normal.
- The cooling fan on the bottom of the Inverter should be operating normally, if the Inverter model has the cooling fan.

■ Periodic Inspection

Check the following items during periodic maintenance.

Before beginning inspection, be sure to turn off the power supply. Confirm that all the indicators on the front panel have turned off, and then wait until at least 1 minute has elapsed before beginning the inspection.

Be sure not to touch the terminals right after the power has been turned off. Otherwise, an electric shock may occur.

- The terminal screws of the Inverter should not loose.
- There should be no conductive dust or oil mist on the terminal block or inside the Inverter.
- The mounting screws of the Inverter should not be loose.

- No dirt or dust should be accumulating on the radiation fin.
- No dust should be accumulating on the vents of the Inverter.
- There should be no abnormalities in the outward appearance of the Inverter.
- There should be no unusual noises or vibration and the accumulated operating time should not exceeded the specifications.

■ Periodic Maintenance Parts

The Inverter is configured of many parts, and these parts must operate properly in order to make full use of the Inverter's functions. Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the Inverter operating normally over a long period of time, it is necessary to perform periodic inspections and replace parts according to their service life.

Periodic inspection standards vary with the installation environment and usage conditions of the Inverter.

The maintenance periods of the Inverter are described below. Keep them as reference.

Maintenance Periods (Reference)

- Cooling fan: 2 to 3 years
- Electrolytic capacitor: 5 years
- Fuse: 10 years

The usage conditions are as follows:

- Ambient temperature: 40°C
- Load factor: 80%
- Operation: 8 hours per day
- Installation: According to instructions in manual

It is recommended that the ambient temperature and power-on time be reduced as much as possible to extend of the life of the Inverter.

Note For details regarding maintenance, consult your OMRON representative.

■ Replacement of Cooling Fan

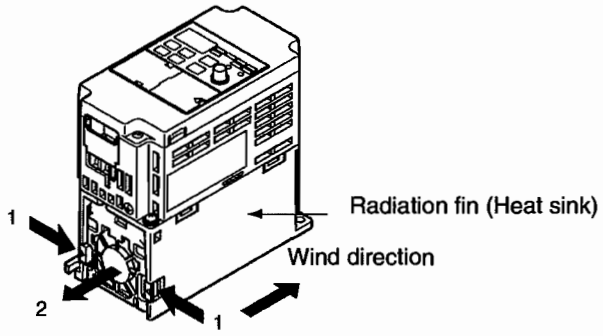
If the FAN fault is displayed or the cooling fan needs replacement, take the following steps to replace it.

• Cooling Fan Models

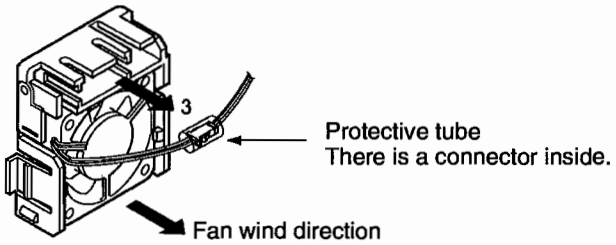
Inverter		Cooling Fan
3-phase 230-V AC	3G3JV-A2007-A	3G3IV-PFAN2007
	3G3JV-A2015-A or 3G3JV-A2022-A	3G3IV-PFAN2015J
	3G3JV-A2037-A	3G3IV-PFAN2037
Single-phase 230-V AC	3G3JV-AB015-A	3G3IV-PFAN2015J
3-phase 460-V AC	3G3JV-A4015-A or 3G3JV-A4022-A	3G3IV-PFAN2015J
	3G3JV-A4037-A	3G3IV-PFAN2037

• Replacing Cooling Fan (68- or 140-mm-wide Inverters)

1. Press the left and right sides of the fan cover located on the lower part of the radiation fin in the arrow 1 directions. Then lift the bottom of the Fan in the arrow 2 direction to remove the Fan as shown in the following illustration.



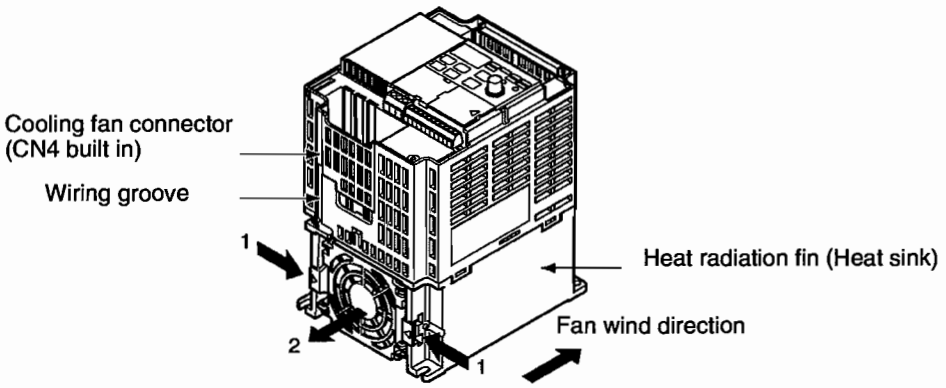
2. Hold the fan wire and pull the protective tube of the cover in the arrow 3 direction.



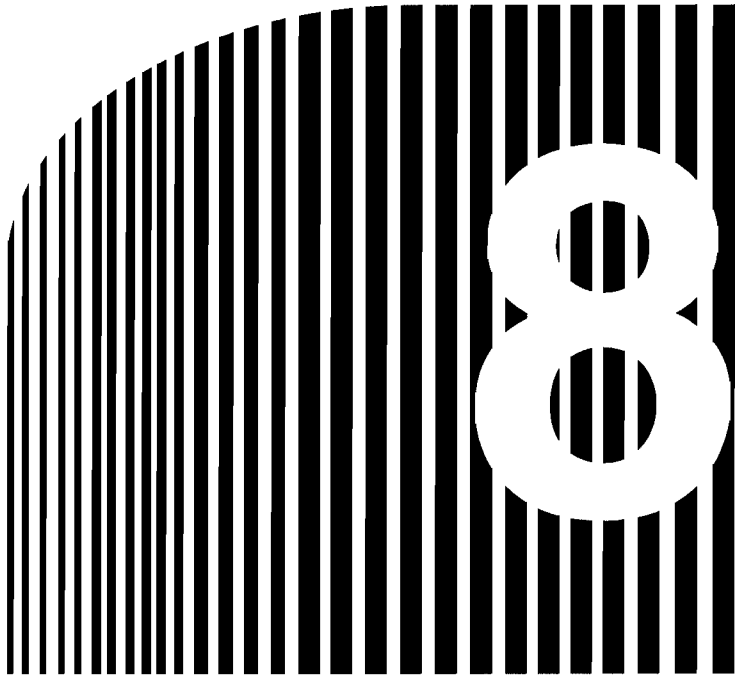
3. Slide the protective tube and remove the internal connector.
4. Remove the Fan from the fan cover.
5. Mount the new Fan on the fan cover. At this time, make sure that the wind direction of the Fan will be in the direction of the heat radiation fin.
6. Attach the connector, cover the connector with the protective tube, and insert the connector into the cover.
7. Mount the fan cover with the new Fan to the lower part of the heat radiation fin. Make sure that the fan cover snaps on securely with the heat radiation fin.

• Replacing Cooling Fan of 108-mm-wide Inverter Model

1. Dismount the front cover, bottom cover, and fan connector CN4.



2. Press the left and right sides of the fan cover located on the lower part of the radiation fin in the arrow 1 directions. Then lift the bottom of the Fan in the arrow 2 direction to remove the fan as shown in the following illustration.
   Disconnect the wire from the electrical inlet on the bottom of the plastic casing.
3. Remove the Fan from the fan cover.
4. Mount the new Fan on the fan cover. At this time, make sure that the wind direction of the fan will be in the direction of the heat radiation fin.
5. Mount the fan cover with the new Fan to the lower part of the heat radiation fin. Make sure that the fan cover snaps on securely with the heat radiation fin.
6. Wire the power line through the electrical inlet on the bottom of the plastic casing and the wiring groove into the internal circuitry of the Inverter.
7. Attach the wire to connector CN4 and attach the bottom cover and front cover.



Chapter 8

• Specifications •

8-1 Inverter Specifications

3-phase 230-V AC models	**Model 3G3JV-**		**A2001 -A**	**A2002 -A**	**A2004 -A**	**A2007 -A**	**A2015 -A**	**A2022 -A**	**A2037 -A**
	Power supply	**Rated voltage and frequency**	3-phase 200 to 230 V AC at 50/60 Hz						
		Allowable voltage fluctuation	–15% to 10%						
		Allowable frequency fluctuation	±5%						
	Power supply capacity (kVA) (See note 1.)		0.4	0.9	1.6	2.7	4.3	5.9	9.3
	Heat radiation (W)		13.0	18.0	28.1	45.1	72.8	94.8	149.1
	Weight (kg)		0.5	0.5	0.8	0.9	1.3	1.5	2.1
	Cooling method		Natural cooling			Cooling fan			

Single-phase 230-V AC models	**Model 3G3JV-**		**AB001 -A**	**AB002 -A**	**AB004 -A**	**AB007 -A**	**AB015 -A**	**---**	**---**
	Power supply	**Rated voltage and frequency**	Single-phase 200 to 240 V AC at 50/60 Hz						
		Allowable voltage fluctuation	–15% to 10%						
		Allowable frequency fluctuation	±5%						
	Power supply capacity (kVA) (See note 1.)		0.5	0.9	1.6	2.7	4.3	---	---
	Heat radiation (W) (See note 2.)		14.1	20.0	31.9	51.4	82.8	---	---
	Weight (kg)		0.5	0.5	0.9	1.5	1.5	---	---
	Cooling method		Natural cooling				Cooling fan		

Max. applicable motor capacity (kW)		0.1	0.2	0.4	0.75	1.5	2.2	3.7
Output specifications	**Rated output capacity (kVA)**	0.3	0.6	1.1	1.9	3.0	4.2	6.7
	Rated output current (A)	0.8	1.6	3.0	5.0	8.0	11.0	17.5
	Rated output voltage (V)	3-phase 200 to 240 V AC (according to the input voltage)						
	Max. output frequency	400 Hz parameter setting						
Control characteristics	**Harmonic-current countermeasures**	DC reactor (option) connection possible						
	Control method	Sine wave PWM (V/f control)						
	Carrier frequency	2.5 to 10.0 kHz (in vector control)						
	Frequency control range	0.1 to 400 Hz						
	Frequency precision (temperature characteristics)	Digital commands: ±0.01% (–10°C to 50°C) Analog commands: ±0.5% (25°C ± 10°C)						
	Frequency setting resolution	Digital commands: 0.1 Hz (less than 100 Hz) and 1 Hz (100 Hz or over) Analog commands: 0.06 Hz/60 Hz (equivalent to 1/1000)						
	Output frequency resolution	0.01 Hz						

Control characteristics	**Overload capacity**	150% of rated output current for 1 min
	External frequency set signal	Selectable with FREQ adjuster: 0 to 10 V DC (20 kΩ), 4 to 20 mA (250 Ω), and 0 to 20 mA (250 Ω)
	Acceleration/deceleration time	0.0 to 999 s (Independent acceleration and deceleration time settings: 2 types)
	Braking torque	Approx. 20% (Braking Resistor and Braking Unit cannot be connected.)
	Voltage/frequency characteristics	Set a user V/f pattern
Protective functions	**Motor protection**	Protection by electronic thermal
	Instantaneous overcurrent protection	Stops at approx. 250% of rated output current
	Overload protection	Stops in 1 min at approximately 150% of rated output current
	Overvoltage protection	Stops when main-circuit DC voltage is approximately 410 V
	Undervoltage protection	Stops when main-circuit DC voltage is approximately 200 V (160 V for single-phase 200-V AC model)
	Momentary power interruption compensation (selection)	Stops for 15 ms or more. By setting the Inverter to momentary power interruption mode, operation can be continued if power is restored within approximately 0.5 s.
	Cooling fin overheating	Detects at 110°C ± 10°C
	Grounding protection	Protection at rated output current level
	Charge indicator (RUN indicator)	Lit when the main circuit DC voltage is approximately 50 V or less.
Environment	**Location**	Indoors (with no corrosive gas, oil spray, or metallic dust)
	Ambient temperature	Operating: –10°C to 50°C
	Ambient humidity	Operating: 95% max. (with no condensation)
	Ambient temperature	–20°C to 60°C
	Altitude	1,000 m max.
	Insulation resistance	5 MΩ min. (Do not carry out any insulation resistance or withstand voltage tests)
	Vibration resistance	9.8 m/s^2 max. between 10 to 20 Hz 2.0 m/s^2 max. between 20 and 50 Hz
Degree of protection		Panel-mounting models: Conforms to IP20

Note 1. The power supply capacity is the capacity for the Inverter's rated output. It will vary depending on the impedance at the input power supply. (This is due to fluctuations in the power factor. The power factor can be improved by inserting an AC reactor.) There will also be variations in the ratio between the rated current of the motor that is used and the rated output current of the Inverter.

Note 2. The heat radiation is the electric power consumed in the Inverter at the Inverter's rated output.

3-phase 460-V AC models	Model 3G3JV-		A4002-A	A4004-A	A4007-A	A4015-A	A4022-A	A4037-A
	Power supply	Rated voltage and frequency	3-phase 380 to 460 V AC at 50/60 Hz					
		Allowable voltage fluctuation	–15% to 10%					
		Allowable frequency fluctuation	±5%					
	Power supply capacity (kVA) (See note 1.)		1.3	1.9	3.6	5.1	5.9	9.1
	Heat radiation (W) (See note 2.)		23.1	30.1	54.9	75.7	83.0	117.9
	Weight (kg)		1.0	1.1	1.5	1.5	1.5	2.1
	Cooling method		Natural cooling			Cooling fan		

Max. applicable motor capacity (kW)		0.2	0.4	0.75	1.5	2.2	3.7
Output specifications	Rated output capacity (kVA)	0.9	1.4	2.6	3.7	4.2	6.6
	Rated output current (A)	1.2	1.8	3.4	4.8	5.5	8.6
	Rated output voltage (V)	3-phase 380 to 460 V AC (according to the input voltage)					
	Max. output frequency	400 Hz parameter setting					
Control characteristics	Harmonic-current countermeasures	DC reactor (option) connection possible					
	Control method	Sine wave PWM (V/f control)					
	Carrier frequency	2.5 to 10.0 kHz (in vector control)					
	Frequency control range	0.1 to 400 Hz					
	Frequency precision (temperature characteristics)	Digital commands: ±0.01% (–10°C to 50°C) Analog commands: ±0.5% (25°C ± 10°C)					
	Frequency setting resolution	Digital commands: 0.1 Hz (less than 100 Hz) and 1 Hz (100 Hz or over) Analog commands: 0.06 Hz/60 Hz (equivalent to 1/1000)					
	Output frequency resolution	0.01 Hz					
	Overload capacity	150% of rated output current for 1 min					
	External frequency set signal	Selectable with FREQ adjuster: 0 to 10 V DC (20 kΩ), 4 to 20 mA (250 Ω), and 0 to 20 mA (250 Ω)					
	Acceleration/deceleration time	0.0 to 999 s (Independent acceleration and deceleration time settings: 2 types)					
	Braking torque	Approx. 20% (Braking Resistor and Braking Unit cannot be connected.)					
	Voltage/frequency characteristics	Set a user V/f pattern					

Protective functions	**Motor protection**	Protection by electronic thermal
	Instantaneous overcurrent protection	Stops at approx. 250% of rated output current
	Overload protection	Stops in 1 min at approximately 150% of rated output current
	Overvoltage protection	Stops when main-circuit DC voltage is approximately 820 V
	Undervoltage protection	Stops when main-circuit DC voltage is approximately 400 V
	Momentary power interruption compensation (selection)	Stops for 15 ms or more. By setting the Inverter to momentary power interruption mode, operation can be continued if power is restored within approximately 0.5 s.
	Cooling fin overheating	Detects at 110°C ± 10°C
	Grounding protection	Protection at rated output current level
	Charge indicator (RUN indicator)	Lit when the main circuit DC voltage is approximately 50 V or less.
Environment	**Location**	Indoors (with no corrosive gas, oil spray, or metallic dust)
	Ambient temperature	Operating: –10°C to 50°C
	Ambient humidity	Operating: 95% max. (with no condensation)
	Ambient temperature	–20°C to 60°C
	Altitude	1,000 m max.
	Insulation resistance	5 MΩ min. (Do not carry out any insulation resistance or withstand voltage tests)
	Vibration resistance	9.8 m/s^2 max. between 10 to 20 Hz 2.0 m/s^2 max. between 20 and 50 Hz
Degree of protection		Panel-mounting models: Conforms to IP20

Note 1. The power supply capacity is the capacity for the Inverter's rated output. It will vary depending on the impedance at the input power supply. (This is due to fluctuations in the power factor. The power factor can be improved by inserting an AC reactor.) There will also be variations in the ratio between the rated current of the motor that is used and the rated output current of the Inverter.

Note 2. The heat radiation is the electric power consumed in the Inverter at the Inverter's rated output.

8-2 Specifications of Accessories

8-2-1 List of Accessories

■ Mounting Accessory

Name	Model	Description
Fan Unit	3G3IV-PFAN□	Replacement for the existing cooling fan of the Inverter. Replace the cooling fan if it has reached the end of its service life or a warning of cooling fan failure (FAN) is indicated.

■ Separate Accessory

Name	Model	Description
Scaling Meter	K3TJ-V11□	Connected to the analog monitor output of the Inverter. The Scaling Meter displays the rpm or speed of the machine or line in actual units.

■ Dedicated Accessories

Name	Model	Description
DIN Track Mounting Bracket	3G3IV-PEZZ08122□	An adapter making it possible to easily mount the Inverter to DIN tracks.

■ Recommendable Separate Accessories

Name	Model	Description
EMC-conforming Input Noise Filter (Rasmi supplier)	RS□	A Noise Filter on the input side meeting the EC Directive's EMC requirements. The top of the Noise Filter has mounting screw holes with which the Inverter mounted to the Noise Filter can be secured.

8-2-2 Fan Unit

■ 3G3IV-PFAN□

The Fan Unit is a replacement for the presently installed cooling fan of the Inverter.

Replace the cooling fan if it has reached the end of its service life or a warning of cooling fan failure (FAN) is indicated.

■ Applicable Models

Inverter		Fan Unit
3-phase 230 V AC	3G3JV-A2007-A	3G3IV-PFAN2007
	3G3JV-A2015-A/-A2022-A	3G3IV-PFAN2015J
	3G3JV-A2037-A	3G3IV-PFAN2037
Single-phase 230 V AC	3G3JV-AB015-A	3G3IV-PFAN2015J
3-phase 460 V AC	3G3JV-A4015-A/-A4022-A	3G3IV-PFAN2015J
	3G3JV-A4037-A	3G3IV-PFAN2037

■ Replacement Method

Refer to *7-3 Maintenance and Inspection*.

8-2-3 Scaling Meter

■ K3TJ-V11□

The Scaling Meter is connected to the analog monitor output of the Inverter so that the Scaling Meter will display the rpm and speed values of the machines and lines in actual units.

■ Applicable Models

Model	Control power supply	Indicator
K3TJ-V111R	100 to 200 V AC	Red LED
K3TJ-V111G		Green LED
K3TJ-V116R	24 V DC insulated construction (see note)	Red LED
K3TJ-V116G		Green LED

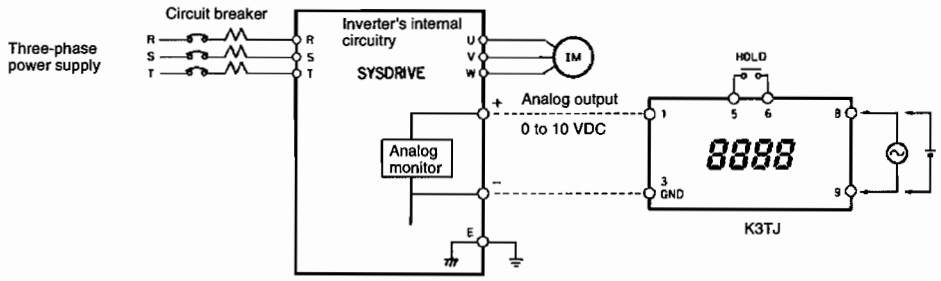
Note The power supply circuit and input circuit are insulated from each other.

■ Standard Specifications

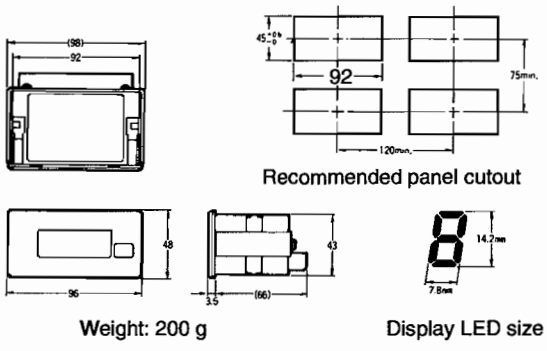
Sampling cycle	2 times/s
Display refresh cycle	2 times/s
Average processing method	Simple or continuous average processing
Number of average processing times	1, 2, 4, or 8
Max. number of display digits	4 (–9999 to 9999)
Indicator	14.2-mm-high 7-segment LED
Decimal point display	Parameter selector or Up and Down Keys
Scaling method	Parameter selector or Up and Down Keys for shifting and scaling adjustments
Scaling range	–1,999 to +9,999
Zero-limit range	0 to 99 digits
Over range	Flashing
Zero suppress	Available
External control	Present value hold (with rear terminals shorted)
Degree of protection (conforming to IEC)	Front panel: IP51 (see note) Casing: IP20 Terminals: IP00
Memory protection	Nonvolatile memory

Note The front panel ensures IP50, but the front panel with the K32-L493C Drip-proof Cover ensures IP51.

■ Wiring Example



■ External Dimensions (mm)



8-2-4 DIN Track Mounting Bracket

■ 3G3IV-PEZZ08122□

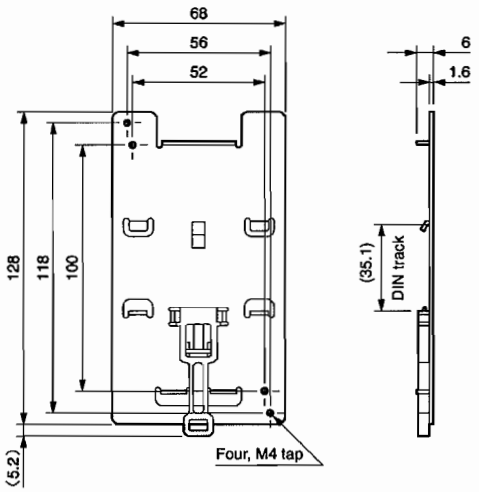
An adapter making it possible to easily mount the Inverter to DIN tracks.

■ Applicable Model

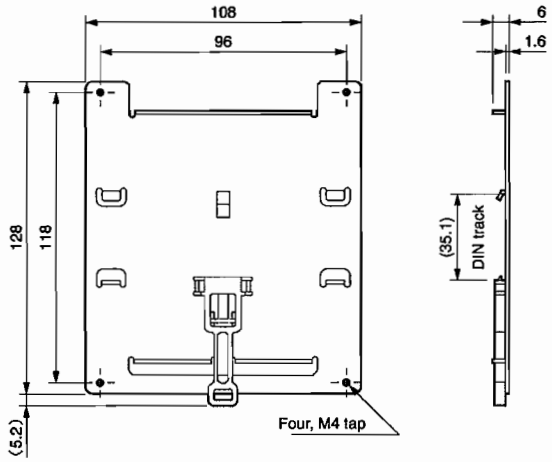
Inverter		DIN Track Mounting Bracket
3-phase 230 V AC	3G3JV-A2001-A/-A2002-A/ -A2004-A/-A2007-A	3G3IV-PEZZ08122A
	3G3JV-A2015-A/-A2022-A	3G3IV-PEZZ08122B
	3G3JV-A2037-A	3G3IV-PEZZ08122C
Single-phase 230 V AC	3G3JV-AB001-A/-AB002-A/-AB004-A	3G3IV-PEZZ08122A
	3G3JV-AB007-A/-AB015-A	3G3IV-PEZZ08122B
3-phase 460 V AC	3G3JV-A4002-A/-A4004-A/ -A4007-A/-A4015-A/-A4022-A	3G3IV-PEZZ08122B
	3G3JV-A4037-A	3G3IV-PEZZ08122C

■ External Dimensions (mm)

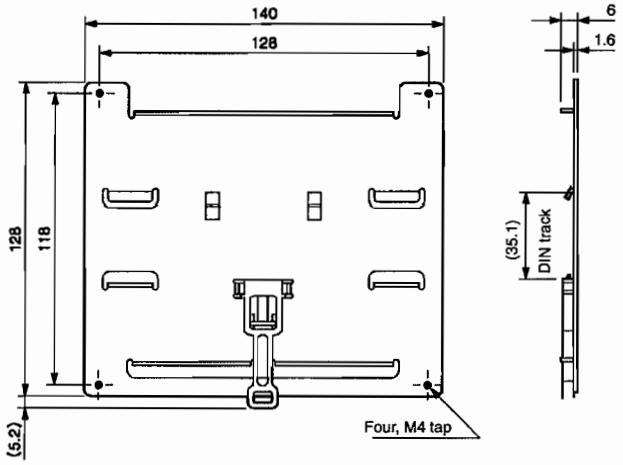
3G3IV-PEZZ08122A



3G3IV-PEZZ08122B



3G3IV-PEZZ08122C



8-3 Option Specifications

8-3-1 EMC-compatible Noise Filter

- Be sure to select an optimum Noise Filter from the following so that the Inverter will satisfy EMC directive requirements of the EC Directives.
- Connect the Noise Filter between the power supply and the input terminals (R/L1, S/L2, and T/L3) of the Inverter.
- The Inverter can be mounted to the upper side of the Noise Filter because the upper side of the Noise Filter incorporates mounting holes for the Inverter.

■ Standard Specifications

Noise Filters for 3-phase 230 V AC Inverter Models

Inverter	Noise Filter (Rasmi) for 3-phase 230 V AC Inverter models		
Model 3G3JV-	Model	Rated current (A)	Weight (kg)
A2001-A/A2002-A/ A2004-A/A2007-A	RS2010J7	10	0.8
A2015-A/A2022-A	RS2020J7	16	1.0
A2037-A	RS2030J7	26	1.3

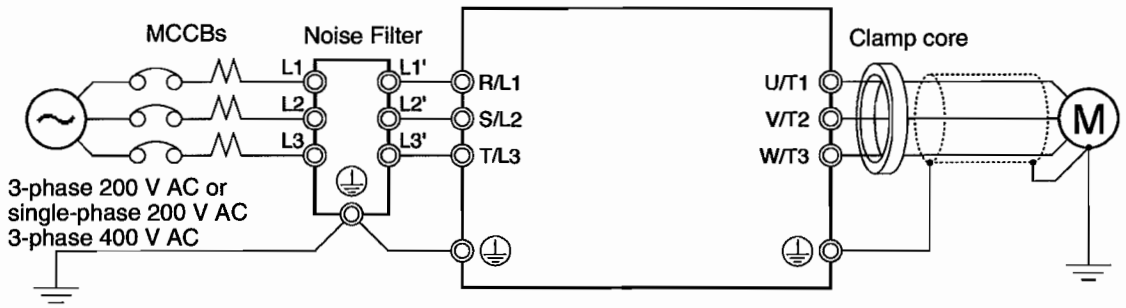
Noise Filters for Single-phase 230 V AC Inverter Models

Inverter	Noise Filter (Rasmi) for single-phase 230 V AC Inverter models		
Model 3G3JV-	Model	Rated current (A)	Weight (kg)
AB001-A/AB002-A/AB004-A	RS1010J7	10	0.6
AB007-A/AB015-A	RS1020J7	20	1.0

Noise Filters for 3-phase 460 V AC Inverter Models

Inverter	Noise Filter (Rasmi) for 3-phase 230 V AC Inverter models		
Model 3G3JV-	Model	Rated current (A)	Weight (kg)
A4002-A/A4004-A	RS3005J7	5	1.0
A4007-A/A4015-A/A4022-A	RS3010J7	10	1.0
A4037-A	RS3020J7	15	1.1

■ Connection Example

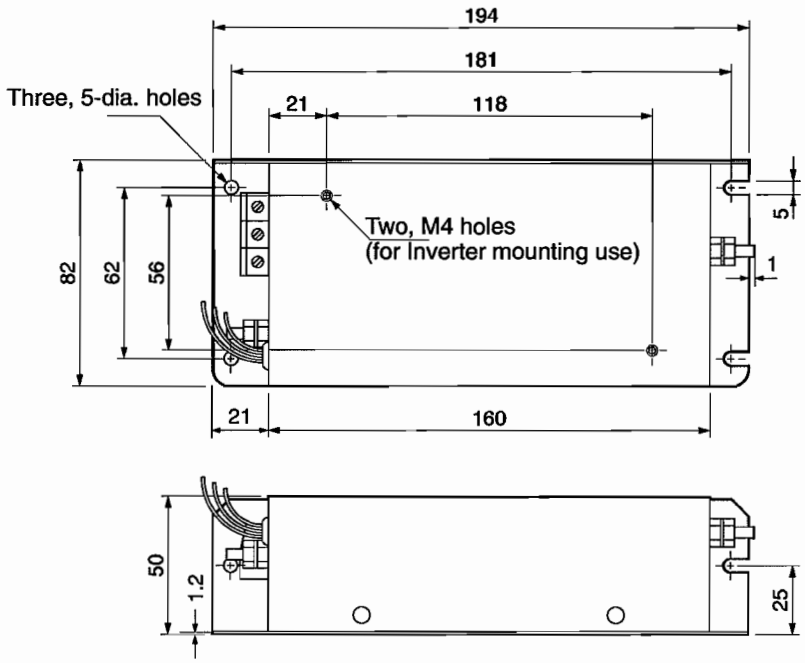


Note Please contact RASMI directly for filters: RASMI ELECTRONICS Ltd., United Kingdom. Phone +44 (01207) 291300. FAX +44 (01207) 291304.

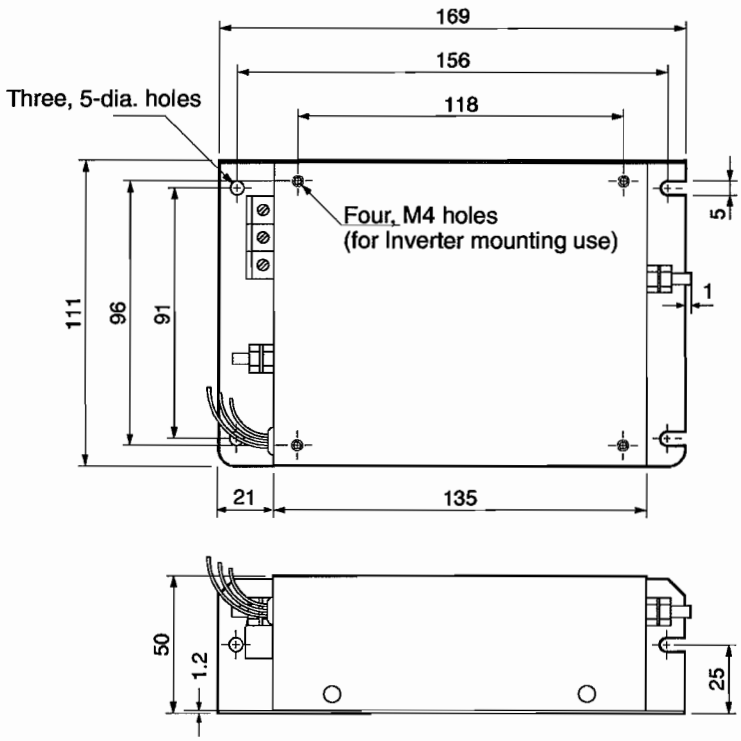
■ External Dimensions

Noise Filters for 3-phase 200 V AC Inverter Models

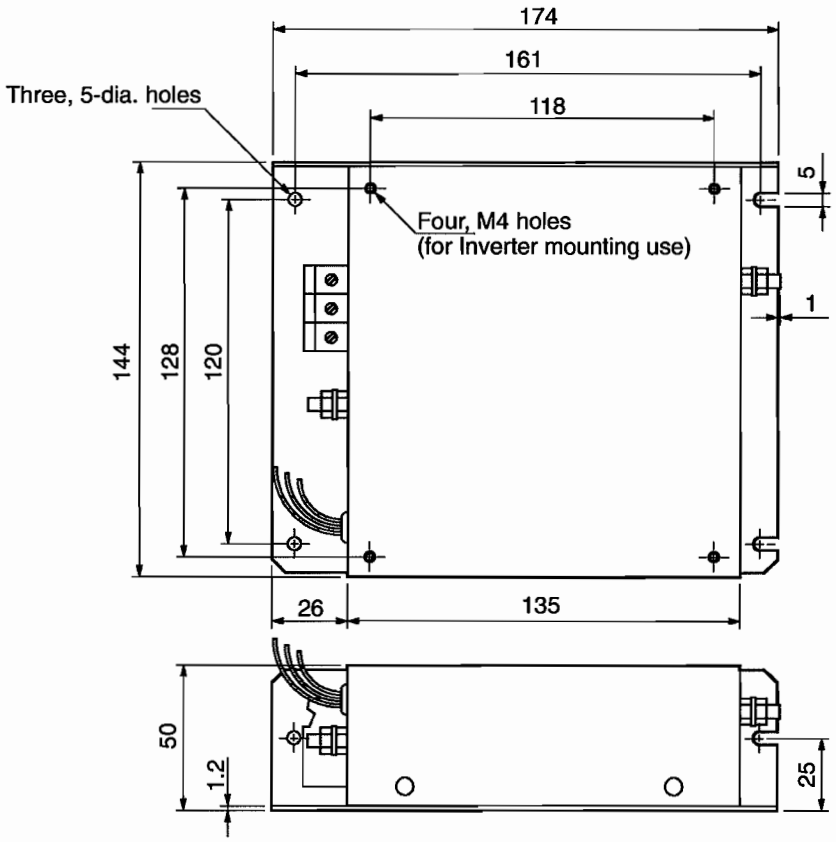
- **RS2010J7**



- **RS2020J7**

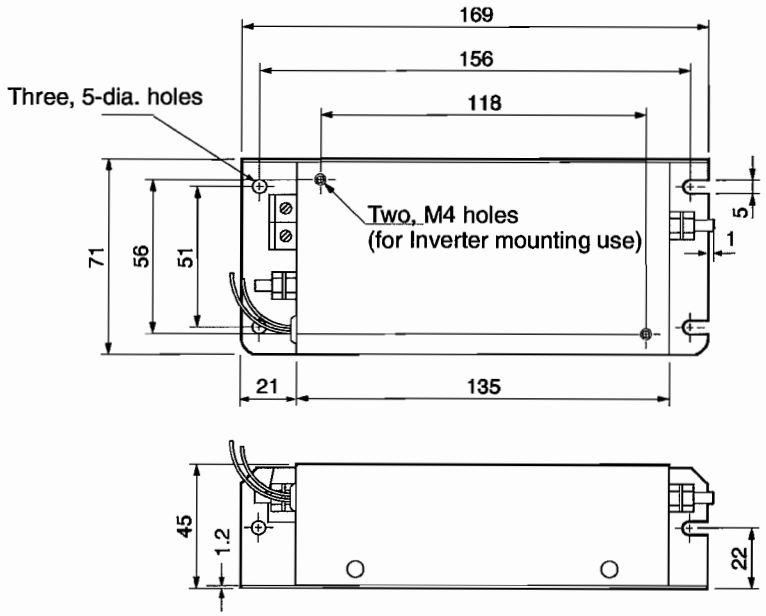


- **RS2030J7**

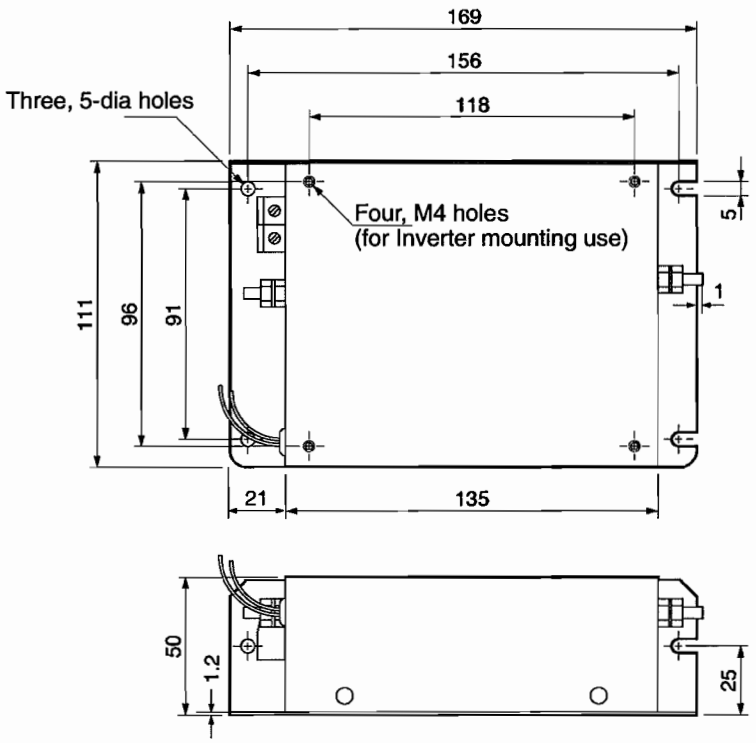


Noise Filters for Single-phase 230-V AC Models

- **RS1010J7**

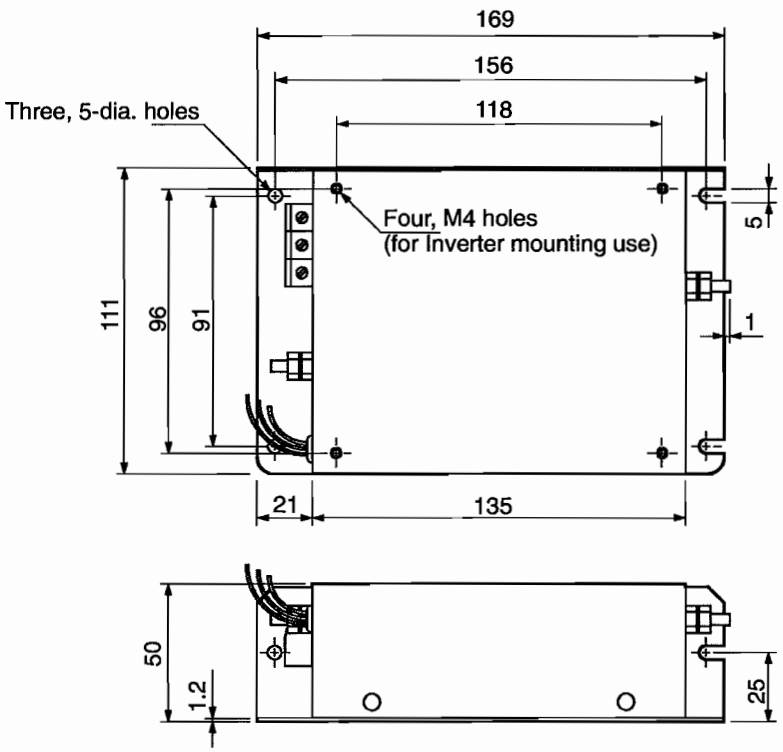


- **RS1020J7**

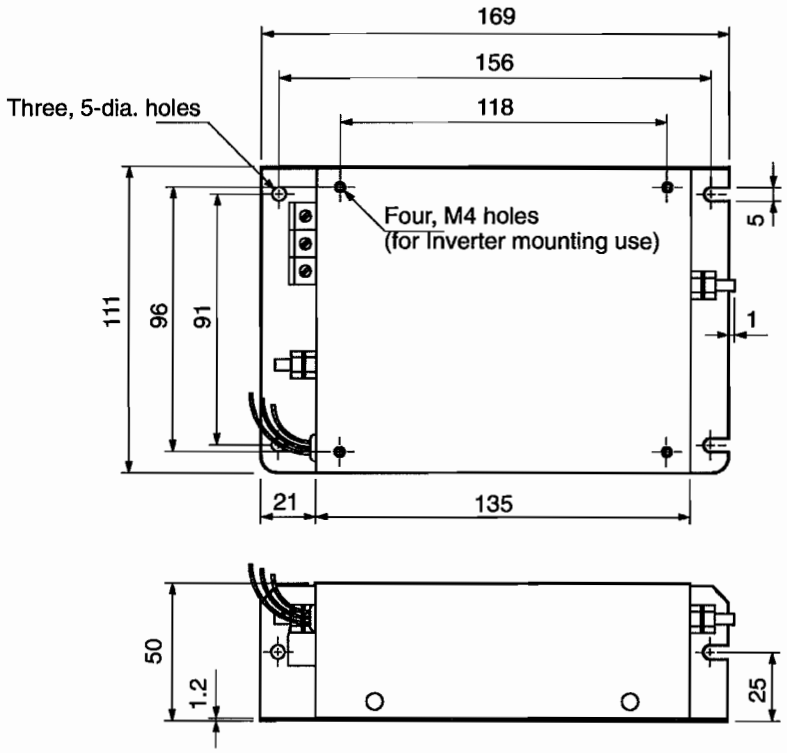


Noise Filters for 3-phase 460-V AC Models

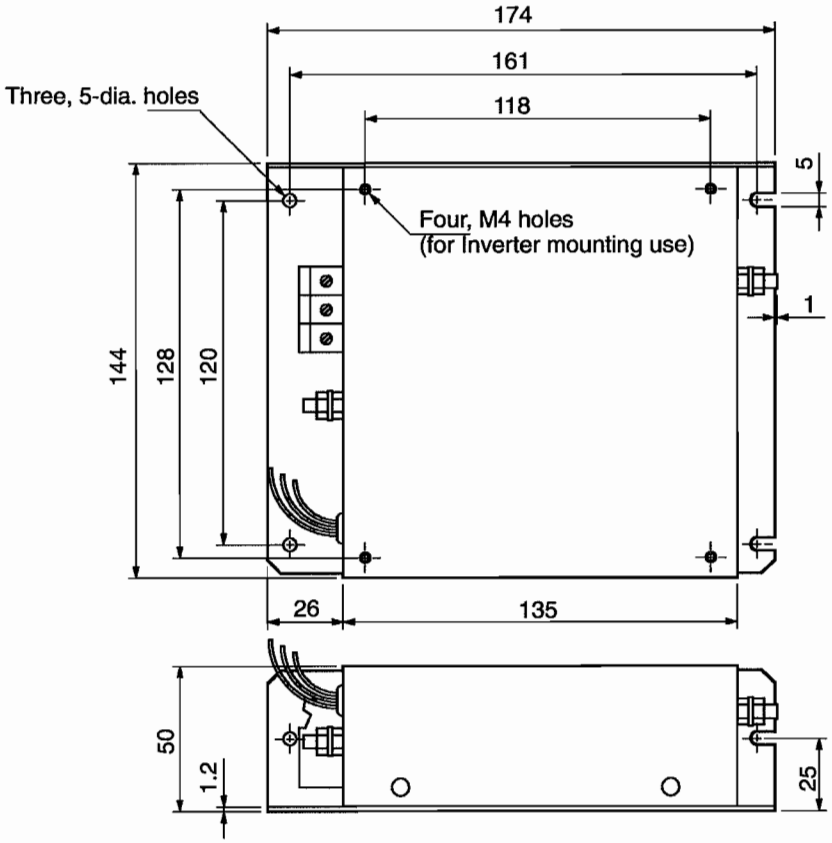
- **RS3005J7**

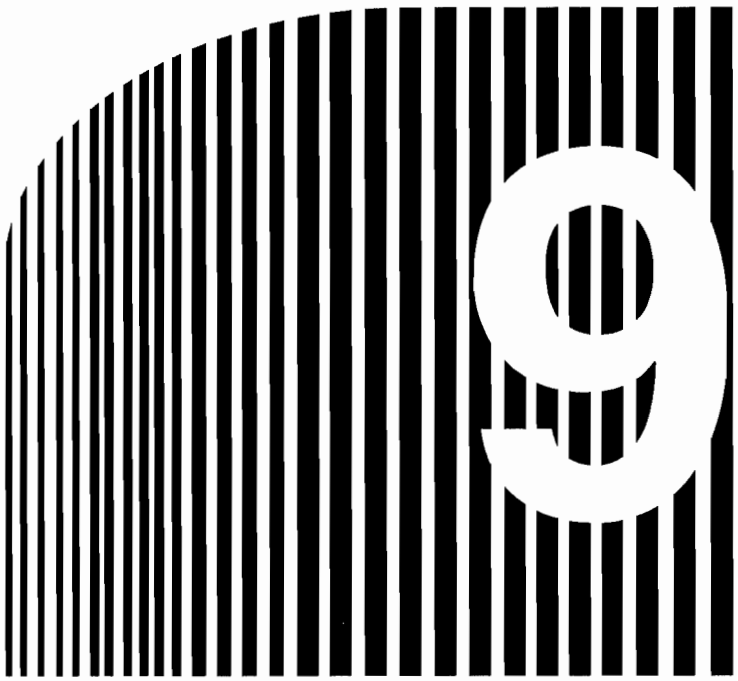


- **RS3010J7**


169
156
118
Three, 5-dia. holes
Four, M4 holes
(for Inverter mounting use)
5
1
111
96
91
21
135
50
1.2
25

- **RS3020J7**

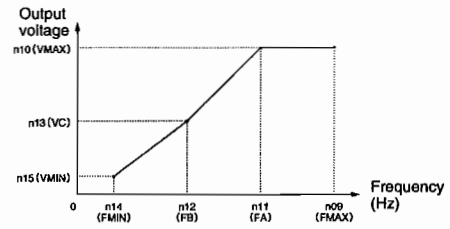

174
161
118
Three, 5-dia. holes
Four, M4 holes
(for Inverter mounting use)
5
1
144
128
120
26
135
50
1.2
25



Chapter 9

• List of Parameters •

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n01	Parameter write-prohibit selection/parameter initialization	Used to prohibit parameters to be written, sets parameters, or change the monitor range of parameters. Used to initialize parameters to default values. 0: Sets or monitors parameter n01. Parameters n02 through n79 can be monitored only. 1: Sets or monitors parameters n01 through n79. 6: Clears the error log. 8: Initializes parameters to default values in 2-wire sequence. (Japan) 9: Initializes parameters to default values in 3-wire sequence. (Japan) 10: For North America, initializes parameter in 2-wire sequence. 11: For North America, initializes parameter in 3-wire sequence.	0, 1, 6, 8, 9	1	1	No	5-2
n02	Operation mode selection	Used to select the input method for the RUN and STOP commands in remote mode. 0: The STOP/RESET Key on the digital Operator is enabled. 1: Multi-function inputs through the control circuit terminals in 2- or 3-wire sequence. **Note** The RUN command only through key sequences on the Digital Operator is acceptable in local mode.	0, 1	1	1	No	5-7
n03	Frequency reference selection	Used to set the input method for the frequency reference in remote mode. 0: Digital Operator 1: Frequency reference 1 (n21) 2: Frequency reference control circuit terminal (0 to 10 V) 3: Frequency reference control circuit terminal (4 to 20 mA) 4: Frequency reference control circuit terminal (0 to 20 mA)	0 to 4	1	2	No	5-8
n04	Interruption mode selection	Used to set the stopping method for use when the STOP command is input. 0: Decelerates to stop in preset time. 1: Coasts to stop (with output shut off by the STOP command)	0, 1	1	0	No	5-17
n05	Reverse rotation-prohibit selection	Used to select the operation with the reverse command input. 0: Reverse enabled. 1: Reverse disabled.	0, 1	1	0	No	5-16

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n06	STOP/RESET Key function selection	Used to select the stop method in remote mode with n02 for operation mode selection set to 1. 0: STOP/RESET Key of the Digital Operator enabled. 1: STOP/RESET Key of the Digital Operator disabled.	0, 1	1	0	No	5-7
n07	Frequency selection in local mode	Used to set the input method for the frequency reference in local mode. 0: The FREQ adjuster of the Digital Operator enabled. 1: Key sequences on the Digital Operator enabled.	0, 1	1	0	No	5-8
n08	Key sequential frequency setting	Used to enable the Enter Key for setting the frequency reference with the Increment and Decrement Keys. 0: The value is entered with the Enter Key pressed. 1: The value is enabled when the value is input.	0, 1	1	0	No	5-12
n09	Maximum frequency (FMAX)	Used to set the V/f pattern as the basic characteristic of the Inverter with output voltage per frequency set.	50.0 to 400	0.1 Hz (see note)	60.0	No	5-4
n10	Maximum voltage (VMAX)		1 to 255 (see note 2)	1 V	230 (see note 2)	No	5-4
n11	Maximum voltage frequency (FA)		0.2 to 400	0.1 Hz (see note 1)	60.0	No	5-4
n12	Middle output frequency (FB)	**Note** Set the parameters so that the following condition will be satisfied. $n14 \leq n12 < n11 \leq n09$	0.1 to 399	0.1 Hz (see note 1)	1.5	No	5-4
n13	Middle output frequency voltage (VC)	**Note** The value set in n13 will be ignored if parameters n14 and n12 are the same in value.	1 to 255 (see note 2)	1 V	12 (see note 2)	No	5-4
n14	Minimum output frequency (FMIN)		0.1 to 10.0	0.1 Hz	1.5	No	5-4
n15	Minimum output frequency voltage (VMIN)		1 to 50 (see note 2)	1 V	12.0 (see note 2)	No	5-4

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n16	Acceleration time 1	Acceleration time: The time required to go from 0% to 100% of the maximum frequency. Deceleration time: The time required to go from 100% to 0% of the maximum frequency. **Note** The actual acceleration or deceleration time is obtained from the following formula. Acceleration/Deceleration time = (Acceleration/Deceleration time set value) × (Frequency reference value) ÷ (Max. frequency)	0.0 to 999	0.1 s	10.0	Yes	5-14
n17	Deceleration time 1				10.0	Yes	5-14
n18	Acceleration time 2				10.0	Yes	5-14
n19	Deceleration time 2				10.0	Yes	5-14
n20	S-shape acceleration/deceleration characteristic	Used to set S-shape acceleration/deceleration characteristics. 0: No S-shape acceleration/deceleration (trapezoidal acceleration/deceleration) 1: S-shape acceleration/deceleration characteristic time 0.2 s 2: S-shape acceleration/deceleration characteristic time 0.5 s 3: S-shape acceleration/deceleration characteristic time 1.0 s **Note** When the S-shape acceleration/deceleration characteristic time is set, the acceleration and deceleration times will be lengthened according to the S-shape at the beginning and end of acceleration/deceleration.	0 to 3	1	0	No	5-15
n21	Frequency reference 1	Used to set internal frequency references. **Note** Frequency reference 1 is enabled in remote mode with n03 for frequency reference selection set to 1. **Note** These frequency references are selected with multi-step speed references (multi-function input). See the reference pages for the relationship between multi-step speed references and frequency references.	0.0 to max. frequency	0.1 Hz (see note 1)	6.0	Yes	5-10
n22	Frequency reference 2				0.0	Yes	5-10
n23	Frequency reference 3				0.0	Yes	5-10
n24	Frequency reference 4				0.0	Yes	5-10
n25	Frequency reference 5				0.0	Yes	5-10
n26	Frequency reference 6				0.0	Yes	5-10
n27	Frequency reference 7				0.0	Yes	5-10
n28	Frequency reference 8				0.0	Yes	5-10
n29	Inching frequency command	Used to set the inching frequency command. **Note** The inching frequency command is selected with the inching command (multi-function input). The inching frequency command takes precedence over the multi-step speed reference.			6.0	Yes	5-11

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n30	Frequency reference upper limit	Used to set the upper and lower frequency reference limits in percentage based on the maximum frequency as 100%. **Note** If n31 is set to a value less than the minimum output frequency (n14), the Inverter will have no output when a frequency reference less than the minimum output frequency input is input.	0 to 110	1%	100	No	5-9
n31	Frequency reference lower limit		0 to 110	1%	0	No	5-9
n32	Rated motor current	Used to set the rated motor current for motor overload detection (OL1) based on the rated motor current. **Note** Motor overload detection (OL1) is disabled by setting the parameter to 0.0. **Note** The rated motor current is default to the standard rated current of the maximum applicable motor.	0.0 to 120% of rated output current of the Inverter.	0.1 A	Varies with the capacity.	No	5-2
n33	Motor protection characteristics	Used to set the motor overload detection (OL1) for the electronic thermal characteristics of the motor. 0: Protection characteristics for general-purpose induction motors 1: Protection characteristics for inverter-dedicated motors 2: No protection **Note** If a single Inverter is connected to more than one motor, set the parameter to 2 for no protection. The parameter is also disabled by setting n32 for rated motor to 0.0.	0 to 2	1	0	No	6-14

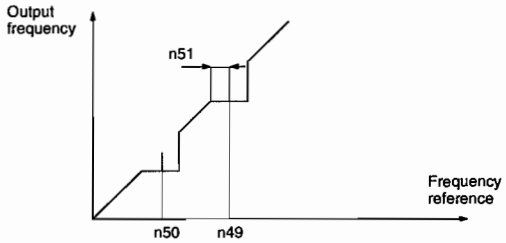
Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n34	Motor protective time setting	Used to set the electric thermal characteristics of the motor to be connected in 1-minute increments. **Note** The default setting does not require any changes in normal operation. **Note** To set the parameter according to the characteristics of the motor, check with the motor manufacturer the thermal time constant and set the parameter with some margin. In other words, set the value slightly shorter than the thermal time constant. **Note** To detect motor overloading quicker, reduce the set value, provided that it does not cause any application problems.	1 to 60	1 min	8	No	6-14
n35	Cooling fan operation function	Used to operate the Cooling Fan of the Inverter while the Inverter is turned on or only while the Inverter is in operation. 0: Rotates only while RUN command is input and for 1 minute after Inverter stops operating 1: Rotates while Inverter is turned on **Note** This parameter is available only if the Inverter incorporates a Cooling Fan. **Note** If the operation frequency of the Inverter is low, the life of the fan can be prolonged by setting the parameter to 0.	0, 1	1	0	No	6-14

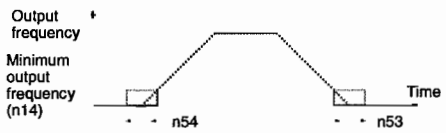
Parameter No.	Name	Description			Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n36	Multi-function input 1 (Input terminal S2)	Used to select the functions of multi-function input terminals S2 through S5.			2 to 8, 10 to 22	1	2	No	5-18
		Set value	**Function**	**Description**					
n37	Multi-function input 2 (Input terminal S3)	0	Forward/Reverse rotation command	3-wire sequence (to be set in n37 only) By setting n37 to 0, the set value in n36 is ignored and the following setting are forcibly made. S1: RUN input (RUN when ON) S2: STOP input (STOP when OFF) S3: Forward/Reverse rotation command (OFF: Forward; ON: Reverse)	0, 2 to 8, 10 to 22	1	5	No	5-18
n38	Multi-function input 3 (Input terminal S4)				2 to 8, 10 to 22	1	3	No	5-18
n39	Multi-function input 4 (Input terminal S5)				2 to 8, 10 to 22, 34	1	6	No	5-18
		2	Reverse/Stop	Reverse rotation command in 2-wire sequence (Reversed with the terminal turned ON)					
		3	External fault (NO)	ON: External fault (FP□ detection: □ is a terminal number)					
		4	External fault (NC)	OFF: External fault (EF□ detection: □ is a terminal number)					
		5	Fault reset	ON: Fault reset (disabled while RUN command is input)					
		6	Multi-step speed reference 1	Signals to select frequency references 1 through 8. Refer to *5-5-4 Setting Frequency References through Key Sequences* for the relationship between multi-step speed references and frequency references.					
		7	Multi-step speed reference 2						
		8	Multi-step speed reference 3						
		10	Inching frequency command	ON: Inching frequency command (taking precedence over the multi-step speed reference)					
		11	Acceleration/Deceleration time changeover	ON: Acceleration time 2 and deceleration time 2 are selected.					

Parameter No.	Name	Description			Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n39	Multi-function input 4 (Input terminal S5)	12	External base block command (NO)	ON: Output shut off (while motor coasting to a stop and "bb" flashing)	2 to 8, 10 to 22, 34	1	6	No	5-18
		13	External base block command (NC)	OFF: Output shut off (with motor free running and "bb" flashing)					
		14	Search command (Searching starts from maximum frequency)	ON: Speed search (Searching starts from n09)					
		15	Search command (Searching starts from preset frequency)	ON: Speed search					
		16	Acceleration/ Deceleration-prohibit command	ON: Acceleration/Deceleration is on hold (running at parameter frequency)					
		17	Local or remote selection	ON: Local mode (operated with the Digital Operator)					
		19	Emergency stop fault (NO)	The Inverter stops according to the setting in n04 for interruption mode selection with the emergency stop input turned ON. NO: Emergency stop with the contact closed. NC: Emergency stop with the contact opened. Fault: Fault output is ON and reset with RESET input. Alarm output is ON (no reset required). "STP" is displayed (lit with fault input ON and flashes with alarm input ON)				
		20	Emergency stop alarm (NO)						
		21	Emergency stop fault (NC)						
		22	Emergency stop alarm (NC)						
		34	Up or down command	Up or down command (set in n39 only) By setting n39 to 34, the set value in n38 is ignored and the following setting are forcibly made. S4: Up command S5: Down command					

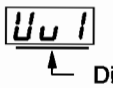
Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n40	Multi-function output (MA/MB and MC output terminals)	Used to select the functions of multi-function output terminals.	0 to 7, 10 to 17	1	1	No	5-21

Set value	Function	Description
0	Fault output	ON: Fault output (with protective function working)
1	Operation in progress	ON: Operation in progress
2	Frequency detection	ON: Frequency detection (with frequency reference coinciding with output frequency)
3	Idling	ON: Idling (at less than min. output frequency)
4	Frequency detection 1	ON: Output frequency $\geq$ frequency detection level (n58)
5	Frequency detection 2	ON: Output frequency $\leq$ frequency detection level (n58)
6	Overtorque being monitored (NO-contact output)	Output if any of the following parameter conditions is satisfied. n59: Overtorque detection function selection n60: Overtorque detection level n61: Overtorque detection time NO contact: ON with overtorque being detected NC contact: OFF with overtorque being detected
7	Overture being monitored (NC-contact output)	
8	Not used	---
9		
10	Alarm output	ON: Alarm being detected (Nonfatal error being detected)
11	Base block in progress	Base block in progress (in operation with output shut-off)
12	RUN mode	ON: Local mode (with the Digital Operator)
13	Inverter ready	ON: Inverter ready to operate (with no fault detected)
14	Fault retry	ON: Fault retry
15	UV in progress	ON: Undervoltage being monitored
16	Rotating in reverse direction	ON: Rotating in reverse direction
17	Speed search in progress	ON: Speed search in progress

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n41	Frequency reference gain	Used to the input characteristics of analog frequency references. Gain: The frequency of maximum analog input (10 V or 20 mA) in percentage based on the maximum frequency as 100%.	0 to 255	1%	100	Yes	5-9
n42	Frequency reference bias	Bias: The frequency of minimum analog input (0 V or 0 or 4 mA) in percentage based on the maximum frequency as 100%.	–99 to 99	1%	0	Yes	5-9
n43	Analog frequency reference time	Used to set the digital filter with a first-order lag for analog frequency references to be input.	0.00 to 2.00	0.01 s	0.10	No	5-10
n44	Analog monitor output	Used to set the output frequency or current as a monitored item. 0: Output frequency (10-V output at max. frequency with n45 set to 1.00). 1: Output current (10-V output with Inverter rated output current with n45 set to 1.00)	0, 1	1	0	No	5-23
n45	Analog monitor output gain	Used to set the output characteristics of analog monitor output.	0.00 to 2.00	0.01	1.00	Yes	5-23
n46	Carrier frequency selection	Used to set the carrier frequency. **Note** The default setting does not need any changes in normal operation. **Note** Refer to *6-1 Setting the Carrier Frequency* for details.	1 to 4, 7 to 9	1	Varies with the capacity.	No	6-2
n47	Momentary power interruption compensation	Used to specify the processing that is performed when a momentary power interruption occurs. 0: Inverter stops operating 1: Inverter continues operating if power interruption is 0.5 s or less. 2: Inverter restarts when power is restored.	0 to 2	1	0	No	6-15
n48	Fault retry	Used to set the number of times the Inverter is reset and restarted automatically in the case the Inverter has an overvoltage fault, overcurrent fault, or ground fault.	0 to 10	1	0	No	6-15
n49	Jump frequency 1	Used to set the frequency jump function.  **Note** These values must satisfy the following condition: n49 ≥ n50	0.0 to 400	0.1 Hz (see note 1)	0.0	No	6-16
n50	Jump frequency 2		0.0 to 400	0.1 Hz (see note 1)	0.0	No	6-16
n51	Jump width		0.0 to 25.5	0.1 Hz	0.0	No	6-16

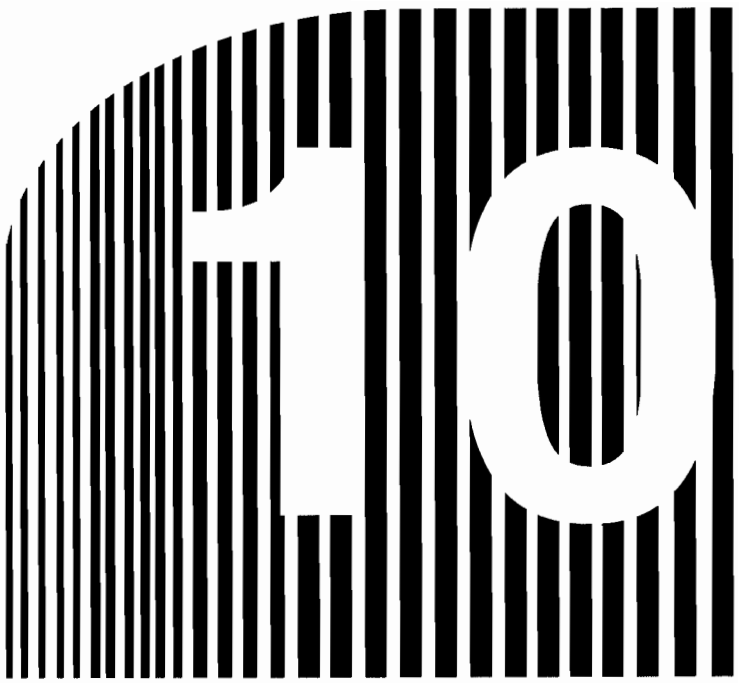
Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n52	DC control current	Used to impose DC on the induction motor for braking control. Set the DC braking current in percentage based on the rated current of the Inverter as 100%.	0 to 100	1%	50	No	6-5
n53	Interruption DC control time		0.0 to 25.5	0.1 s	0.0	No	6-5
n54	Startup DC control time		0.0 to 25.5	0.1 s	0.0	No	6-5
n55	Stall prevention during deceleration	Used to select a function to change the deceleration time of the motor automatically so that there will be no overvoltage imposed on the motor during deceleration. 0: Stall prevention during deceleration enabled 1: Stall prevention during deceleration disabled	0, 1	1	0	No	6-6
n56	Stall prevention level during acceleration	Used to select a function to stop the acceleration of the motor automatically for stall prevention during acceleration. Set the level in percentage based on the rated current of the Inverter as 100%.	30 to 200	1%	170	No	6-7
n57	Stall prevention level during operation	Used to select a function to reduce the output frequency of the Inverter automatically for stall prevention during operation. Set the level in percentage based on the rated current of the Inverter as 100%.	30 to 200	1%	160	No	6-8
n58	Frequency detection level	Used to set the frequency to be detected. **Note** The parameter n40 for multi-function output must be set for the output of frequency detection levels 1 and 2.	0.0 to 400	0.1 Hz	0.0	No	6-18
n59	Overtorque detection function selection	Used to enable or disable overtorque detection and select the processing method after overtorque detection. 0: Overtorque detection disabled 1: Overtorque detection only when speed coincides and operation continues (issues alarm) 2: Overtorque detection only when speed coincides and output shut off (for protection) 3: Overtorque always detected and operation continues (issues alarm) 4: Overtorque always detected and output shut off (for protection)	0 to 4	1	0	No	6-9
n60	Overtorque detection level	Used to set overtorque detection level. Set the level in percentage based on the rated current of the Inverter as 100%.	30 to 200	1%	160	No	6-9
n61	Overtorque detection time	Used to set the detection time of overtorque.	0.1 to 10.0	0.1 s	0.1	No	6-10

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n62	UP/DOWN command frequency memory	Used to store the adjusted frequency reference with the UP/DOWN function. 0: Frequency not stored 1: Frequency stored The frequency must be on hold for 5 s or more.	0, 1	1	0	No	6-19
n63	Torque compensation gain	Used to set the gain of the torque compensation function. The default setting does not need any changes in normal operation.	0.0 to 2.5	0.1	1.0	Yes	6-11
n64	Motor rated slip	Used to set the rated slip value of the motor in use. **Note** Used as the constant of the slip compensation function.	0.0 to 20.0	0.1 Hz	Varies with the capacity.	Yes	6-12
n65	Motor no-load current	Used to set the no-load current of the motor in use based on the rated motor current as 100%. **Note** Used as the constant of the slip compensation function.	0 to 99	1%	Varies with the capacity.	No	6-12
n66	Slip compensation gain	Used to set the gain of the slip compensation function. **Note** The slip compensation function is disabled with n66 set to 0.0.	0.0 to 2.5	0.1	0.0	Yes	6-12
n67	Slip compensation time constant	Used for the response speed of the slip compensation function. **Note** The default setting does not need any changes in normal operation.	0.0 to 25.5	0.1 s	2.0	No	6-12
n68	OMRON's control reference use	Do not change the set value.	---	---	0	---	---
n69	OMRON's control reference use	Do not change the set value.	---	---	0	---	---
n70	OMRON's control reference use	Do not change the set value.	---	---	0	---	---
n71	OMRON's control reference use	Do not change the set value.	---	---	2	---	---
n72	OMRON's control reference use	Do not change the set value.	---	---	2	---	---
n73	OMRON's control reference use	Do not change the set value.	---	---	10	---	---
n74	OMRON's control reference use	Do not change the set value.	---	---	0	---	---
n75	Low-speed carrier frequency reduction selection	Used to select a function to reduce the carrier frequency when Inverter is at low speed. 0: Function disabled 1: Function enabled **Note** Normally set n75 to 0.	0.1	1	0	No	6-4
n76	OMRON's control reference use	Do not change the set value	---	---	rdy	---	---
n77	OMRON's control reference use	Do not change the set value	---	---	0	---	---

Parameter No.	Name	Description	Setting range	Unit of setting	Default setting	Changes during operation	Reference page
n78	Error log	Used to display the latest error recorded.  **Note** "– – –" will be displayed if no error has been recorded. **Note** This parameter is monitored only.	---	---	---	---	6-21
n79	Software number	Used to display the software number of the Inverter for OMRON's control reference use. **Note** This parameter is monitored only.	---	---	---	---	---

Note **1.** Values will be set in 0.1-Hz increments if the frequency is less than 100 Hz and 1-Hz increments if the frequency is 100 Hz or over.

Note **2.** With 460-V Inverters, the values for the upper limit of setting ranges and the default settings will be twice those given in the above table.



Chapter 10

- **Using the Inverter for a Motor**

■ Using Inverter for Existing Standard Motor

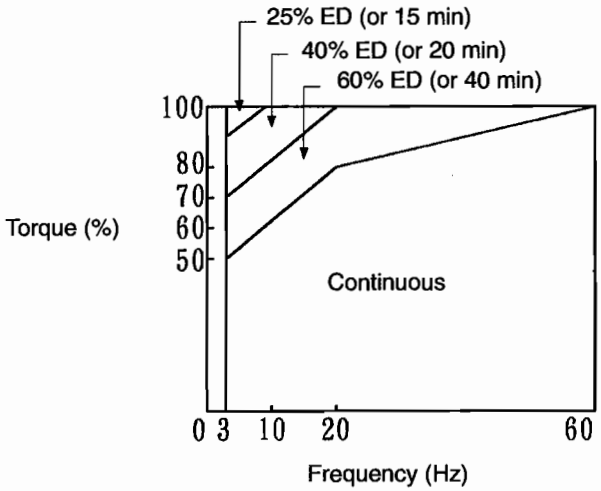
When a standard motor is operated with the Inverter, a power loss is lightly higher than when operated with a commercial power supply.

In addition, cooling effects also decline the low-speed range, resulting in an increase in the motor temperature. Therefore, motor torque should be reduced in the low speed range.

The following figure shows allowable load characteristics of a standard motor.

If 100% torque is continuously required in the low-speed range, use a special motor for use with Inverters.

Allowable Load Characteristics of Standard Motor



• High-speed Operation

When using the motor at high-speed (60 Hz or more), problems may arise in dynamic balance and bearing durability.

• Torque Characteristics

The motor may require more acceleration torque when the motor is operated with the Inverter than when operated with a commercial power supply. Check the load torque characteristics of the machine to be used with the motor to set a proper V/f pattern.

• Vibration

The 3G3JV Series employs high carrier PWM control to reduce motor vibration. When the motor is operated with the Inverter, motor vibration is almost the same as when operated with a commercial power supply.

Motor vibration may, however, become greater in the following cases.

- Resonance with the natural frequency of the mechanical system

  Take special care when a machine that has been operated at a constant speed is to be operated in variable speed mode.

  If resonance occurs, install vibration-proof rubber on the motor base.

- Imbalance rotor

  Take special care when the motor is operated at a high speed (60 Hz or more).

• Noise

Noise is almost the same as when the motor is operated with a commercial power supply. Motor noise, however, becomes louder when the motor is operated at a speed higher than the rated speed (60 Hz).

■ Using Inverter for Special Motors

• Pole-changing Motor

The rated input current of pole-changing motors differs from that of standard motors. Select, therefore, an appropriate Inverter according to the maximum input current of the motor to be used.

Before changing the number of poles, always make sure that the motor has stopped.

Otherwise, the overvoltage protective or overcurrent protective mechanism will be actuated, resulting in an error.

• Submersible Motor

The rated input current of submersible motors is higher than that of standard motors. Therefore, always select an Inverter by checking its rated output current.

When the distance between the motor and Inverter is long, use a cable thick enough to connect the motor and Inverter to prevent motor torque reduction.

• Explosion-proof Motor

When an explosion-proof motor or increased safety-type motor is to be used, it must be subject to an explosion-proof test in conjunction with the Inverter. This is also applicable when an existing explosion-proof motor is to be operated with the Inverter.

• Gearmotor

The speed range for continuous operation differs according to the lubrication method and motor manufacturer. In particular, the continuous operation of an oil-lubricated motor in the low speed range may result in burning. If the motor is to be operated at a speed higher than 60 Hz, consult with the manufacturer.

• Synchronous Motor

A synchronous motor is not suitable for Inverter control.

If a group of synchronous motors is individually turned on and off, synchronism may be lost.

• Single-phase Motor

Do not use the Inverter for a single-phase motor.

The motor should be replaced with a 3-phase motor.

■ Power Transmission Mechanism (Speed Reducers, Belts, and Chains)

If an oil-lubricated gear box or speed reducer is used in the power transmission mechanism, oil lubrication will be affected when the motor operates only in the low speed range. The power transmission mechanism will make noise and experience problems with service life and durability if the motor is operated at a speed higher than 60 Hz.

■ Motor Burnout Caused by Insufficient Dielectric Strength of Each Phase of Motor

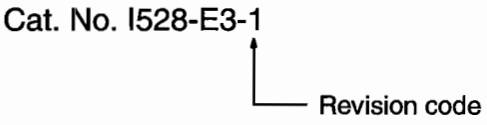
Surge occurs among the phases of the motor when the output voltage is switched.

If the dielectric strength of each phase of the motor is insufficient, the motor may burn out.

The dielectric strength of each phase of the motor must be higher than the maximum surge voltage. Normally, the maximum surge voltage is approximately three times the power voltage imposed on the Inverter.

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision.

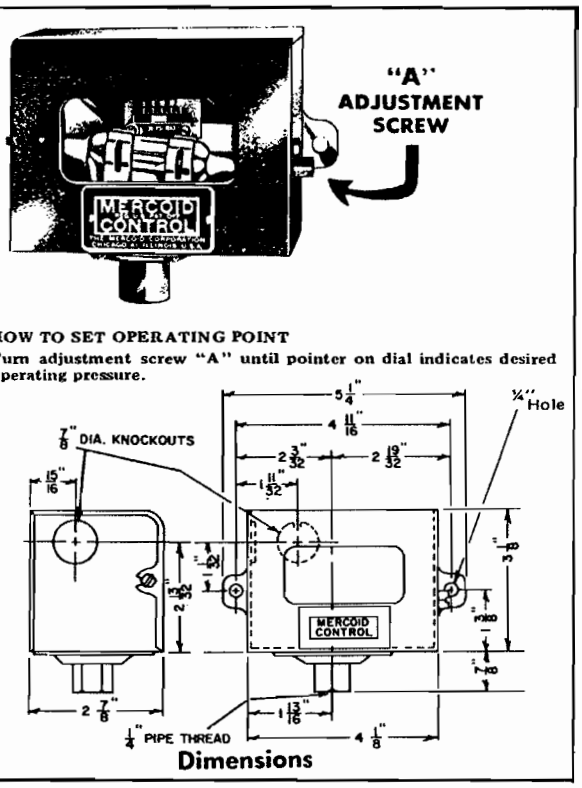
Revision code	Date	Revised content
I528-E1-1	May 1999	Original production
I528-E1-2	December 1999	The following Inverters with different capacities were added to the manual: 3G3JB-A2037/A4002/A4004/A4007/A4015/A4022/A4037, and additions and corrections were made. Specific changes are listed below. **Preliminary :** "Caution" changed to "WARNING" in 2 places under "Installation Precaution." Information for new models added under "Contents of Warning" and "Checking the Product". (In this list, the page numbers refer to the previous version.) **Page 1-2:** Information for new models added to first table. **Page 1-6:** Information added to STOP/RESET Key description. Note added after table. **Page 2-3:** Information added for new models. **Page 2-4:** "Caution" changed to "WARNING" in 2 places and order changed. **Page 2-11:** Information for new models added to graphics on top right. **Page 2-12:** Information for new models added to table. **Page 2-13:** Information added for new models. Note added after table. **Page 2-15:** Information for new models added to graphics. **Page 2-17:** Information added for new models. **Page 2-18:** Table for 400-V AC models added. **Page 2-19:** Information for new models added to diagram. **Page 2-20:** Information added for installing a magnetic contactor. **Page 2-21:** Information added regarding noise filters. **Page 2–24:** Information added regarding cable lengths between Inverters and motors. **Page 2-25:** Information added regarding ground wiring for 400-V models. **Page 2-28:** Information added to wiring method graphics. **Page 2-32:** Information added to main circuit terminals graphic. **Page 2-33:** Information for new models added to tables. **Page 2-34:** Information added regarding Low-voltage Directive conformance. **Page 3-3:** Information added regarding STOP/RESET Key. Note added after table. **Page 3-8:** Information added to note 3 following table. **Page 3-9:** Note 3 added after table. **Page 4-4:** Information added regarding power connection. **Page 4-6:** Information added regarding power connection. **Page 5-6:** Information added regarding local/remote selection methods. **Page 5-18:** Notes 2 and 3 added after table. **Page 5-22:** Information added regarding external base block command. **Page 5-23:** Note added after table. **Page 6-3:** Information for new models added to table. **Page 7-3:** Information for new models added to table. **Page 7-7:** Information for new models added to table. **Page 7-14:** Information added for new models. **Page 7-17:** Information added regarding errors and malfunctions. **Page 7-20:** Information added for new models. **Page 8-2:** Information added to first table regarding power supply capacity and braking torque. Notes added after table. Table for 400-V models added. **Page 8-4:** Model number changed in last table. **Page 8-5:** Information regarding input noise filter removed. Information regarding new models added to table. **Page 8-7:** Information added to table. **Page 8-8:** Information for new models added to tables. **Pages 8-8 and 8-9:** "3G3IV-PZZ08122" changed to "3G3IV-PEZZ08122." **Page 8-9:** Graphics added. **Page 8-10:** Information for new models added. **Page 8-11:** Information for new models added. **Pages 8-12 and 8-13:** Graphics added. **Page 8-14:** Information for new models added. **Page 8-15:** Information for new models added to table. **Pages 8-15 and 8-16:** Information regarding input noise filter removed. **Page 8-17:** Information for new models added to tables.
I528-E3-1	April 2000	Throughout the manual, North American part number changes were made. Some part numbers required that the part number would be changed to end in -A. RASMI filter part numbers were updated for North America (dropping types of prefixes, while also adding the suffix of 7). Some voltage changes were made, so that 230 VDC and 460 VDC could be correctly indicated. It was necessary to delete several sections including these: 8-2-6; 8-3-2; 8-3-3.

BULLETIN 06S

SERIES AP PRESSURE SWITCHES WITH MERCURY SWITCHES

INSTALLATION AND OPERATING INSTRUCTIONS

TYPE AP and AP-41
With Suffix Nos.
(153) -2, -3, -26, -36, -88, -89



OPERATION

A variation in control pressure causes the diaphragm to actuate the hermetically sealed mercury switch to open or close the electrical contact.

APPLICATION

TYPE AP with suffix numbers -153, -2, -3, -26, -36, -88, -89 are for use with mediums not injurious to steel, silver solder or Fairprene diaphragm.

TYPE AP-41 with suffix numbers -153, -2, -3, -26, -36, -88, -89 are for use with mediums not injurious to 316 SS and Teflon.

MOUNTING

Install control firmly in a **LEVEL POSITION** on a panel or smooth wall surface by means of the two mounting ears. Where pipe mounting is desired, control may be connected by means of the 1/4" I.P.S. connection. **Do not mount control by twisting the case, use a wrench on the square part of the 1/4" bottom pipe connection.**

To level, sight across the two cover screws or check the lower end of the glass opening in cover to see that instrument is lined up horizontally.

WIRING

Wire in accordance with local electrical codes or equipment manufacturer's instructions. See nameplate attached to inside of control case for terminal markings and electrical rating. **Do not overload - See electrical rating on nameplate located inside of control case. Do not oil any parts.**

ELECTRICAL RATING

CODE		CODE	
A–	4A. 120V. 2A. 240V. AC/DC (single phase AC 1/8 h.p.)	B–	10A. 120V. 5A. 240V. AC/DC (single phase AC 3/4 h.p. DC 1/3 h.p.)
C–	Non-Inductive AC heater only: 17A. 120/240/277V. AC Resistive	D–	1/2A. 120V. 1/4A. 240V. AC 1/4A. 120V. 1/8A. 240V. DC

RANGES—DIFFERENTIALS—ELECTRICAL RATINGS

Differential Non-Adjustable—(factory set)

ADJUSTABLE OPERATING RANGE PSIG.	SWITCH DIFFERENTIAL WITH POINTER SET AT LOW OR HI END OF SCALE		SWITCH ACTION ON PRESSURE RISE	ELEC. RATING SEE CODE	FOR MEDIA NOT INJURIOUS TO STEEL SILVER SOLDER OR NYLON & BUNA N	FOR MEDIA NOT INJURIOUS TO 316 SS & TEFLON
	LOW	HIGH				
10" Vac. 50" wc RANGE NO. 33	5" wc	6" wc	SP-DT	A	AP-153	AP-41-153
	5" wc	7" wc	SP-ST Opens	B	AP-2	AP-41-2
	5" wc	7" wc	SP-ST Closes	B	AP-3	AP-41-3
	1.5" wc	1.5" wc	SP-ST Closes	D	AP-88	AP-41-88
	2" wc	2" wc.	SP-ST Opens	D	AP-89	AP-41-89
1-20 PSIG. RANGE NO. 36	0.3 psig.	0.5 psig.	SP-DT	A	AP-153	AP-41-153
	0.5 psig.	1.0 psig.	SP-ST Opens	B	AP-2	AP-41-2
	0.5 psig.	1.0 psig.	SP-ST Closes	B	AP-3	AP-41-3
	0.75 psig.	1.25 psig.	SP-ST Opens	B&C	AP-36	AP-41-36
	0.75 psig.	1.25 psig.	SP-ST Closes	B&C	AP-26	AP-41-26
	2" wc	4" wc	SP-ST Closes	D	AP-88	AP-41-88
	3" wc	6" wc	SP-ST Opens	D	AP-89	AP-41-89
1-30 PSIG. RANGE NO. 37	0.4 psig.	0.75 psig.	SP-DT	A	AP-153	AP-41-153
	0.5 psig.	1.5 psig.	SP-ST Opens	B	AP-2	AP-41-2
	1.0 psig.	1.5 psig.	SP-ST Closes	B	AP-3	AP-41-3
	1.25 psig.	1.75 psig.	SP-ST Opens	B&C	AP-36	AP-41-36
	1.25 psig.	1.75 psig.	SP-ST Closes	B&C	AP-26	AP-41-26
	3" wc	6" wc	SP-ST Closes	D	AP-88	AP-41-88
	4" wc	8" wc	SP-ST Opens	D	AP-89	AP-41-89
10-125 PSIG RANGE NO. 39	2 psig.	6 psig.	SP-DT	A	AP-153	AP-41-153
	3 psig.	8 psig.	SP-ST Opens	B	AP-2	AP-41-2
	4 psig.	8.5 psig.	SP-ST Closes	B	AP-3	AP-41-3
	4 psig.	10 psig.	SP-ST Opens	B&C	AP-36	AP-41-36
	4 psig.	10 psig.	SP-ST Closes	B&C	AP-26	AP-41-26
	.75 psig.	1.5 psig.	SP-ST Closes	D	AP-88	AP-41-88
	.75 psig.	1.5 psig.	SP-ST Opens	D	AP-89	AP-41-89

Litho in USA 5/88

SERIES AP PRESSURE SWITCHES WITH SNAP ACTION SWITCHES

INSTALLATION AND OPERATING INSTRUCTIONS

TYPES AP, APW, APWT, APH –With Suffix Numbers:
-7021-153 or -8021-153 -7041-153 or -8041-153
-7021-804 or -7041-804

OPERATION

A variation in control pressure causes the diaphragm to actuate the snap-action switch.

APPLICATION

TYPE AP, APH, APW, APWT with suffix numbers 7021-153 or 8021-153 are for use with mediums not injurious to steel, silver solder, Nylon/Buna N diaphragm.

TYPE AP, APH, APW, APWT with suffix numbers 7041-153 or 8041-153 are for use with mediums not injurious to 316 stainless steel and Teflon covered diaphram.

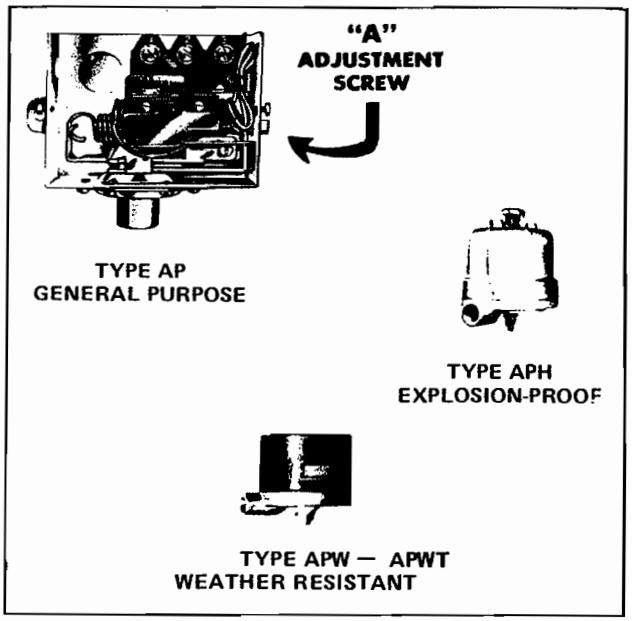
MOUNTING – MOUNT IN ANY POSITION

TYPE AP (General Purpose) can be installed on a panel or smooth surface using the two mounting ears or the 1/4" NPT bottom connection. **Do not mount by twisting the case, use a wrench on the square part of the 1/4" bottom pipe connection.**

TYPE APW–NEMA 3 (Weather-Resistant) 1/4" NPT female bottom connection.

TYPE APWT–NEMA 4 (Water-tight) 1/4" NPT female bottom connection.

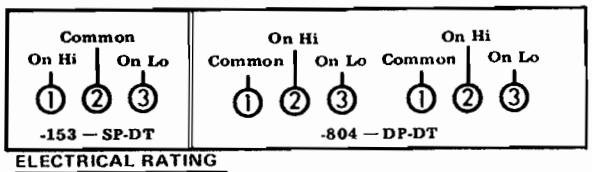
TYPE APH (Explosion-Proof) 1/4" NPT connection or use mounting bracket No. PP-135-95.



OPERATING RANGES – DIFFERENTIALS

Operating Ranges PSIG. Adjustable	Order By Range Number	MAX. Surge Press. PSIG	Approximate Switch Differential With Pointer Set At			
			-153		-804	
			LOW	HIGH	LOW	HIGH
10" Vac-50" wc	33	15	8"wc	10" wc	4.5" wc	5" wc
1-20 PSIG	36	60	0.5 psig	1.5 psig	.75 psig	1.5 psig
1-30 PSIG	37	60	0.75 psig	1.5 psig	.75 psig	1.5 psig
10-125 PSIG	39	160	3.0 psig	7.0 psig	1.75 psig	4 psig

ALL TYPES
SINGLE-POLE DOUBLE-THROW (-153) OR
DOUBLE-POLE DOUBLE-THROW (-804) OPERATION



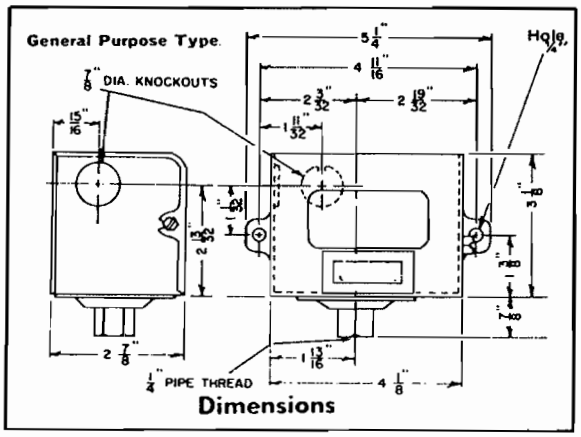
ELECTRICAL RATING

SERIES 7021-153 and 7041-153 – SPDT
15 Amp. max. 120V AC; 8 Amp. max. 240V AC
0.5 Amp. max. 120V DC; 0.25 Amp. 240V DC.
¾ Hp. 120V AC. 1 Hp. 240V AC

SERIES 8021-153 and 8041-153 – SPDT
15 Amp. 120V AC; 8 Amp. 240 V AC; 4 Amp. 480V AC
0.5 Amp. 120V DC; .25 Amp. 240V DC.
¾ Hp. 120V AC; 1½ Hp. 240V AC.
SERIES 7021-804 and 7041-804 (2 SPDT)
5 Amp. 120/240AC – 30V. DC Resistive

ADJUSTMENTS

Turn adjustment screw "A" (see illustration) until pointer on dial indicates desired operating pressure.



WIRING

Wire in accordance with the National Electrical Code and local regulations. Observe wiring diagram inside enclosure and details below for Type No. and electrical rating. Where control is connected directly into the load circuit it must be wired into hot side of line. **Do not overload.**

Do Not Oil Any Parts.

MERCOID DIVISION
DWYER INSTRUMENTS, INC.
P.O. Box 258
Michigan City, IN 46360 (USA)
PHONE 219-872-9141
FAX 219-872-9057
TELEX 25916

FR 88-700501-00

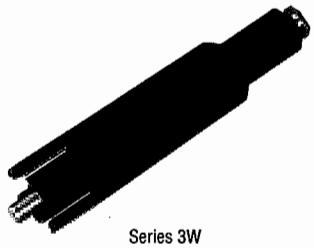
Series 3W – Wire Suspended Probes

- Metallic Bars
- Plastic Shield Protected
- Adaptable to Many Fittings
- Field Assembled

Series 3W probes, consisting of metallic bars within a protective plastic shield, are designed to be suspended above liquid with PVC-insulated wires. They are ideal for applications such as:

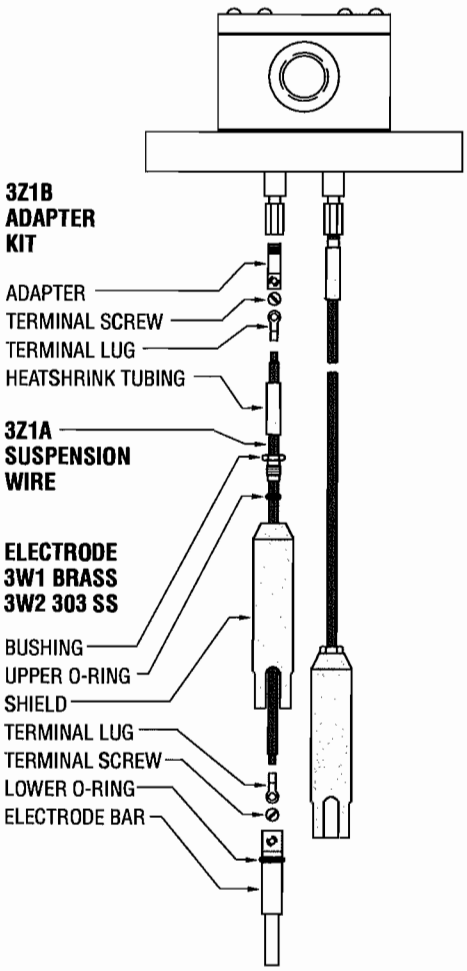
- Deep Wells
- Pump Control
- Waste Water
- Deep Tanks

7/8″ (2.22 cm) diameter x 3-3/4″ (9.52 cm) length. 3Z1A wire and 3Z1B adaptor kit required for use with 3E, 3F and 3N fittings.



Series 3W

Components Detail



How to Order

Select a 3W electrode, a 3Z1B adaptor and a length of 3Z1A suspension wire to form a complete suspended probe.

3W Electrodes

Probe Material	Part Number
Brass	**3W1**
316 Stainless Steel	**3W2**

3Z1B Adaptor Kit

For use with 3E, 3F and 3N fittings.
Part Number: 3Z1B

3Z1A Suspension Wire

Order in standard or custom length.

Length (Feet)	Part Number
500	**100325-500**
1000	**100325-1000**
5000	**7761782**
Custom	**3Z1A-XX** — Specify in one foot increments up to 5000 ft.

P/N 100537-1 Form 207
Rev C

Warrick® 3W1/3W2 Wire Suspended Electrodes
3Z1A Suspension Wire
Installation and Operation Bulletin

3Z1B Adapter Kit

The 3Z1B adapter kit must be used when the fitting has a 1/4"-20 threaded coupling.

Assemble as shown in the diagram.

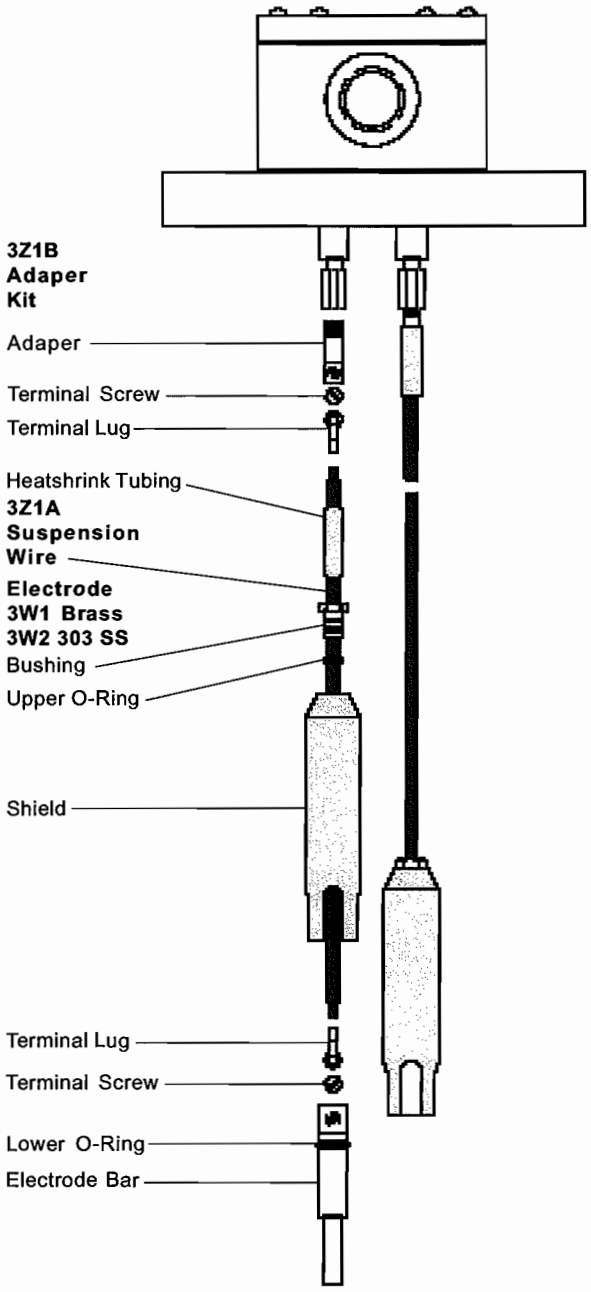
1. Slide heatshrink tubing over wire.
2. Strip insulation from wire (.25 in) and insert into terminal lug. Crimp terminal lug on wire to form electrical connection.
3. Thread adapter into 1/4"-20 coupling until hand tight plus 1-2 turns.
4. Screw terminal lug to electrode bar using terminal screw provided.
5. Slide shring tubing over assembly. Use hairdryer or heat gun to shrink tubing.

3W1/3W2 Wire Suspended Electrodes

The wire suspended electrode consists of seven parts. These are illustrated in the diagram. The lower O-ring and electrode bar are the only pre-assembled parts. Assembly is performed in the field prior to installation of the electrode in the well or tank.

Assemble as shown in the diagram.

1. Slip the bushing, upper O-ring and shield over the end of the suspension wire before the terminal lug is crimped onto the stripped end of the wire. Otherwise it will be necessary to pull the entire length of wire through those parts after the terminal lug has been fastened to the electrode bar.
2. Strip insulation from wire (.25 in) and insert into terminal lug. Crimp terminal lug on wire to form electrical connection.
3. Screw terminal lug to electrode bar using terminal screw provided.
4. Press the electrode bar, now attached to the suspension wire, into the shield. This is an interference fit and will require some pressure. Please note that the electrode bar will be flush with the end of the shield when fully seated.
5. Seat upper O-ring into shield and screw bushing into shield to seat.



Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580

anchor scientific inc.
Box 378, Long Lake, MN 55356 612-473-7115 FAX 612-473-6002

mini·float®
Form 2500-D

mini·float®

DESCRIPTION

Mini-floats are pilot duty devices designed for small diameter sumps and places where space is a determining factor in the selection of a level control device. Mini-floats control the function of motor load devices, such as contactors, motor starters, and power relays, to automatically cycle a pump or pumps. They can also be used for alarm signaling devices. Two Mini-Floats are needed for a one-pump operation; three for a two-pump operation.

SPECIFICATIONS

Cable	18-2 SJO W/A
Housing	Polypropylene
Clamp (Only on Type P models)	Adjustable 1"-4"
Temperature Rating	60° C.

MODELS

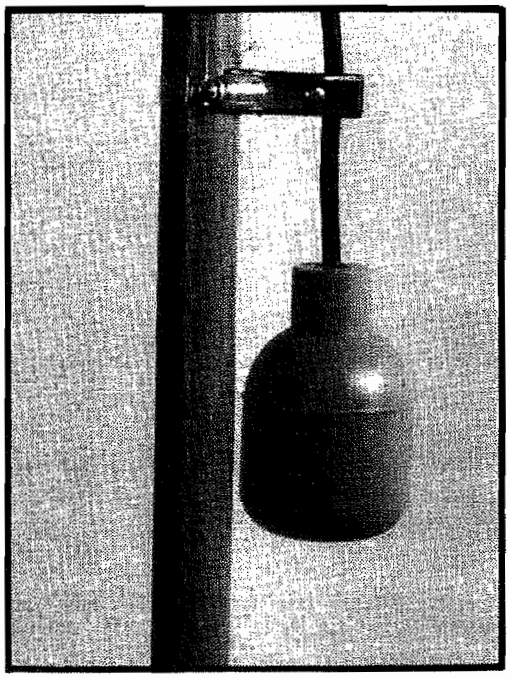
Mini-Floats are available in a combination of mounting styles, cable lengths, and circuit configurations. Mounting styles are shown at right: pipe mounted (Type P), and suspended (Type S). 10, 15, and 25-foot cable lengths are standard, but other lengths can be special ordered. Electrical configurations must be specificied; normally open, (NO), for pump out applications and normally closed, (NC), for pump in applications.

EXAMPLE:

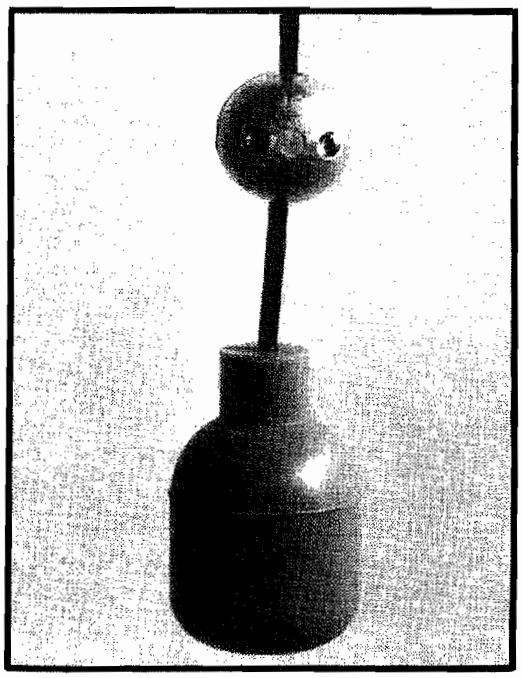
P	M	10	NO
Mounting Style	Mini-Float	Cable Length	Electrical Configuration

ELECTRICAL CONFIGURATION	CABLE LENGTH	SUSPENDED TYPE 'S' MODEL NO.	PIPE MOUNTED TYPE 'P' MODEL NO.
NORMALLY OPEN	10	S M 10 NO	P M 10 NO
	15	S M 15 NO	P M 15 NO
	20	S M 20 NO	P M 20 NO
	25	S M 25 NO	P M 25 NO
	30	S M 30 NO	P M 30 NO
NORMALLY CLOSED	10	S M 10 NC	P M 10 NC
	15	S M 15 NC	P M 15 NC
	20	S M 20 NC	P M 20 NC
	25	S M 25 NC	P M 25 NC
	30	S M 30 NC	P M 30 NC

MOUNTING STYLES

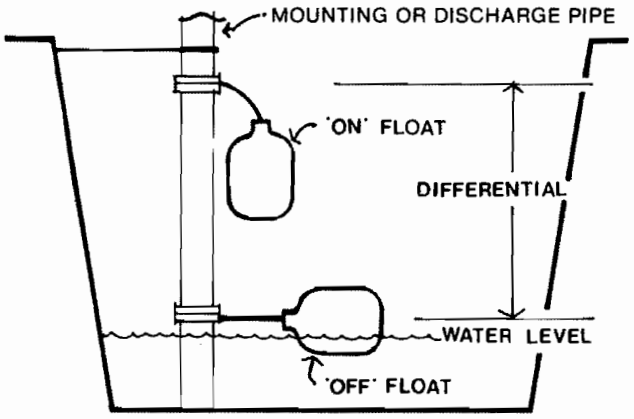


TYPE P - M



TYPE S - M

TYPICAL INSTALLATION



General Comments

1) Never work in the sump with the power on.

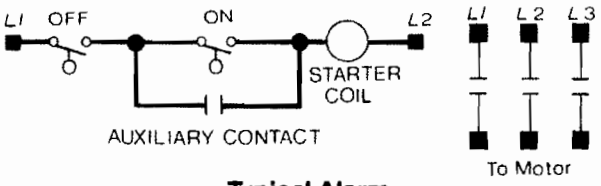
2) Attach the Type P Mini-Floats to the mounting pipe or the pump discharge pipe. The 'off' float should be below the 'on' float in a 'pump out' application.

3) Arrange the Mini-Floats so they do not tangle or hang up.

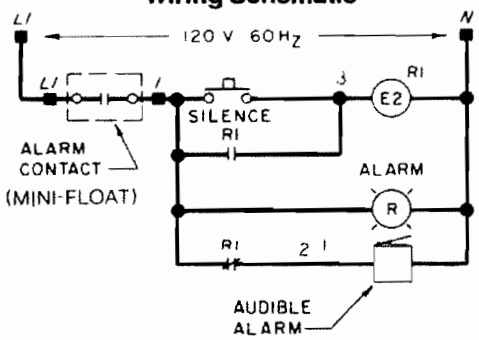
4) Thread the cable strap through the buckle with the ratchet pawl; cinch up tight; thread excess strapping through outer buckle slot.

5) Measuring the difference between mounting points gives the 'pump down' differential.

Typical Simplex Wiring Schematic



Typical Alarm Wiring Schematic



SPECIFICATIONS

Cable - 18-2 SJO W/A 34 × 41 strand. 90°C.
DIAMETER .30

Float - Polypropylene.

Clamp - Stainless Steel.

UL Listed — Ind. Con. Eq. 125 VA @ 115 VAC

Component Switch Rating — 4.5A @ 120V., Res. 2.2A @ 230V., Res.

Temperature Rating - 60 C.

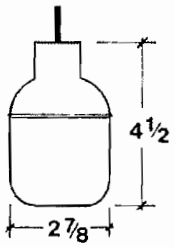
Normally Open - Blue Housing
Normally Closed - Red Housing

ELECTRICAL CONFIGURATION	CABLE LENGTH	SUSPENDED TYPE 'S' MODEL NO.	PIPE MOUNTED TYPE 'P' MODEL NO.
NORMALLY OPEN	10	S M 10 NO	P M 10 NO
	15	S M 15 NO	P M 15 NO
	20	S M 20 NO	P M 20 NO
	25	S M 25 NO	P M 25 NO
	30	S M 30 NO	P M 30 NO
NORMALLY CLOSED	10	S M 10 NC	P M 10 NC
	15	S M 15 NC	P M 15 NC
	20	S M 20 NC	P M 20 NC
	25	S M 25 NC	P M 25 NC
	30	S M 30 NC	P M 30 NC

SUBMITTAL APPROVAL

NAME

DATE



Float Dimensions

* Important Notes - Mini-floats are pilot duty devices. They cannot be used to directly power pump motors. Also, do not use Mini-Floats in gasoline or other combustibles. These devices can be used with intrinsically safe relays for some hazardous locations. See Sec. 500 of NEC.

This product contains mercury. Dispose of in accordance with Local, State and Federal Regulations so that mercury does not contaminate the environment.

DWN BY PD	DATE 7-17-80		anchor scientific inc. Industrial Park, Long Lake, Mn 55356 612-473-7115
CKD BY JTP	DATE 7 20-80		Typical Installation and specification data for Mini-Floats
APPD BY JTP	DATE 7-20		
PROJECT NAME	Mini-Float		DWG. NO. 2510-B
FACTORY ORDER NO.			

-Extraction and Treatment System Controls

1. CONTROLS DESCRIPTION

Scope

The controls were provided by CARBONAIR Environmental Systems, Inc. for the URS Corporation-Franklin Cleaners Site in Nassau City, NY. This section on controls is provided as a descriptive summary of the P & ID. This section can be used to determine the conditions which must be met for each item to operate.

General

- Any switch in the "HAND" position will operate the corresponding circuit under certain alarm conditions, not including motor temperature fault or circuit overload. The "HAND" position is for diagnostics or to clear alarms. The system should never be left unattended while any switch is in the "HAND" position.
- To reset an alarm, switch all switches to the "OFF" position. Clear the cause of the alarm condition. Then the press the "RESET" button. If the panel will not reset, then an alarm condition still exists.
- The alarm circuit logic will be provided to allow for automatic system restart (without manual intervention required for "false alarm" resetting) following power failure restoration.

Item	Required conditions
Well pump EW-1 in "AUTO"	On start-up, extraction well start safety must exist (Blower AUX contact & low air flow switch must be actuated) Extraction and Treatment System selector switch must be in "AUTO" Pressure blower must be running. Extraction well EW-1 low level alarm must NOT exist. Extraction well EW-1 high pressure alarm must NOT exist. Extraction well EW-2 low level alarm must NOT exist (if Well pump EW-2 is in "AUTO") Extraction well EW-2 high press. Alarm must NOT exist.(if Well pump EW-2 is in "AUTO") Air stripper sump high level alarm must NOT exist. Low air flow alarm must NOT exist. Pressure blower discharge high pressure alarm must NOT exist. Pressure blower suction high vacuum alarm must NOT exist. Wet well high-high level alarm must NOT exist. Valve vault sump high level alarm must NOT exist. The corresponding VFD must NOT have a fault. The corresponding circuit breaker must NOT be tripped.
Well pump EW-2 in "AUTO"	On start-up, extraction well start safety must exist (Blower AUX contact & low air flow switch must be actuated) Extraction and Treatment System selector switch must be in "AUTO" Pressure blower must be running. Extraction well EW-1 low level alarm must NOT exist. (if Well pump EW-1is in "AUTO") Extraction well EW-1 high pressure alarm must NOT exist. (if Well pump EW-1is in "AUTO") Extraction well EW-2 low level alarm must NOT exist Extraction well EW-2 high press. Alarm must NOT exist. Air stripper sump high level alarm must NOT exist. Extraction well safety must exist(Blower AUX contact & low air flow switch must be actuated) Low air flow alarm must NOT exist. Pressure blower discharge high pressure alarm must NOT exist. Pressure blower suction high vacuum alarm must NOT exist. Wet well high-high level alarm must NOT exist. Valve vault sump high level alarm must NOT exist. The corresponding VFD must NOT have a fault. The corresponding circuit breaker must NOT be tripped.

Item	Required conditions
Pressure blower in "AUTO"	Extraction and Treatment System selector switch must be in "AUTO" Pressure blower discharge high pressure alarm must NOT exist. Pressure blower suction high vacuum alarm must NOT exist. Pressure blower off delay must NOT be timed out due to the following alarms/conditions: Extraction and Treatment System selector switch moved to "OFF" position. Extraction well EW-1 low level alarm Extraction well EW-1 high pressure alarm Extraction well EW-2 low level alarm Extraction well EW-2 high pressure alarm Air stripper sump high level alarm Low air flow alarm Wet well high-high level alarm Valve vault sump high level alarm The corresponding circuit breaker or overload must NOT be tripped.
Pressure blower in "HAND"	Extraction and Treatment System selector switch must be in "AUTO" Pressure blower discharge high pressure alarm must NOT exist. Pressure blower suction high vacuum alarm must NOT exist. The corresponding circuit breaker or overload must NOT be tripped.

Alarm Description

Control device	Resultant conditions	Control panel indication
Extraction and Treatment System selector switch in "OFF" position	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Extraction and Treatment System selector switch in "OFF" position.
Well pump EW-1 VFD fault	(if Well pump EW-1 is in "AUTO" position) Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Well pump EW-1 fail pilot light illuminates.
Extraction well EW-1 low level switch	(if Well pump EW-1 is in "AUTO" position) Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Extraction well EW-1 low level alarm pilot light illuminates.
Extraction well EW-1 high pressure switch SET @ 40 psi	(if Well pump EW-1 is in "AUTO" position) Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Extraction well EW-1 high pressure alarm pilot light illuminates.
Well pump EW-2 VFD fault	(if Well pump EW-2 is in "AUTO" position) Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Well pump EW-2 fail pilot light illuminates.
Extraction well EW-2 low level switch	(if Well pump EW-2 is in "AUTO" position) Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Extraction well EW-2 low level alarm pilot light illuminates.
Extraction well EW-2 high pressure switch	(if Well pump EW-2 is in "AUTO" position) Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Extraction well EW-2 high pressure alarm pilot light illuminates.
Pressure blower overload tripped 50"	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower.	Pressure blower fail pilot light illuminates.

Pressure blower low air flow switch	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Low air flow pilot light illuminates.
Pressure blower high pressure switch 50"	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower.	Pressure blower high pressure alarm pilot light illuminates.
Pressure blower high vacuum switch SET	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower.	Pressure blower high vacuum alarm pilot light illuminates.
Air stripper sump high level switch	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Air stripper sump high level alarm pilot light illuminates.
Wet well high-high level switch	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Wet well high-high level alarm pilot light pilot light illuminates.
Valve vault sump high level switch	Shuts down Well pump EW-1 Shuts down Well pump EW-2 Shuts down Pressure blower after time delay.	Valve vault sump high level alarm pilot light illuminates.

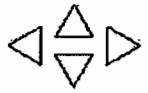
Procedure for changing Air Flow/Blower Off delays

Menu 3, M3:MONITOR

From the default screen, press MENU three times to arrive at the M3:MONITOR menu option.

The M3:MONITOR sub-menu contains the data monitor and the bit monitor. The data monitor allows you to examine the contents of memory registers or pointers to determine their contents. The default format is BCD/HEX, but the format can be changed to decimal by setting bit 8 of V7742. Please refer to the DL06 Memory Map for ranges.

Step 3.1



Step 3.2

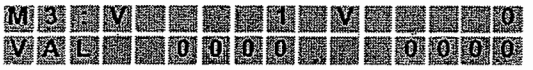
Data Monitor

Data type = V for V-memory or P for pointer. Press MENU to change data type, or press ENT to designate the register whose data you want to view or change.

Step 3.3

Step 3.4

Step 3.5



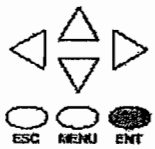
V-memory values

Use the right or left arrow key to move the cursor to the digit you want to change. Use the up or down arrow key to change the digit. The V-memory address is expressed as an octal number so you will not see 8's or 9's.

This screen allows you to view two adjacent V-memory locations in BCD format. The lower word is to the right. Pressing ENT makes it possible to change the value in the lower word. At this level of the menu hierarchy, you can also use the up and down arrow keys to scroll to other memory locations.

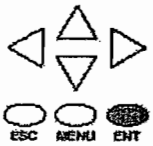
The data values on this screen will be four digits in length for BCD/HEX unless bit 8 of V7742 is set. Bit 8 of V7742 changes the data format to decimal (five digits).

Select the corresponding V-memory location
Air Flow delay V10000
Blower Off delay V10001

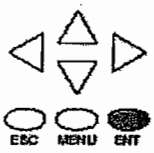


Step 1.1

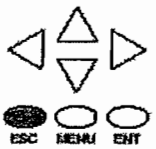
Use the right or left arrow key to move the cursor to the digit you want to change. Use the up or down arrow key to move to another digit. The V-memory value is expressed as a BCD number so you will see values (in the range: 0 - F) available for each digit. The data format can be changed to decimal by setting bit 8 of V7742.



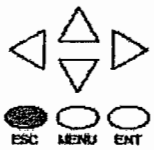
Step 1.1



Step 1.1



Returns to Step 1.1



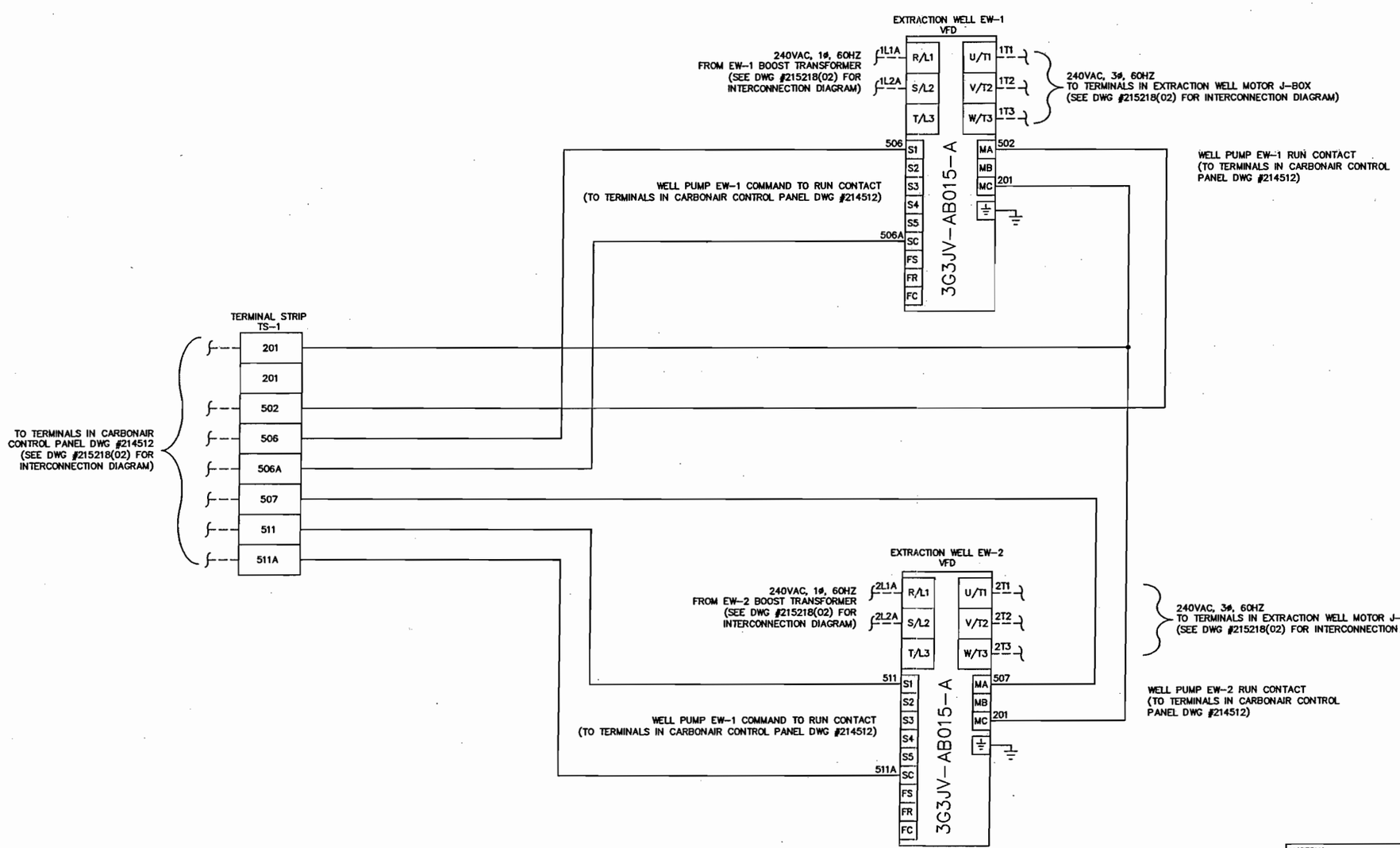
Push the ESC key five (5) times to return to the default screen.

Returns to default screen

VFD PANEL WIRING DIAGRAM

REVISIONS				
REV	ECO	DESCRIPTION	DATE	DRN
–		---	---	---
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH

NOTES ON VFD PANEL ENCLOSURE:
1. DIMENSIONS: 36"x30"x12.62"
2. RATED NEMA1



MATERIAL		APPROVAL	DATE
		DRFT AJH	10/25/02
		DIMSCALE 1	LTSCALE .5
TOLERANCES UNLESS NOTED OTHERWISE		D.L.	
DECIMAL .03	FRACTIONAL 1/32"	ANGLES 1°	PROJECT NO. 13703
THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC.		THIRD ANGLE PROJECTION	
		UNLESS OTHERWISE SPECIFIED: • DIMENSIONS ARE IN INCHES • DO NOT SCALE DRAWING	

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

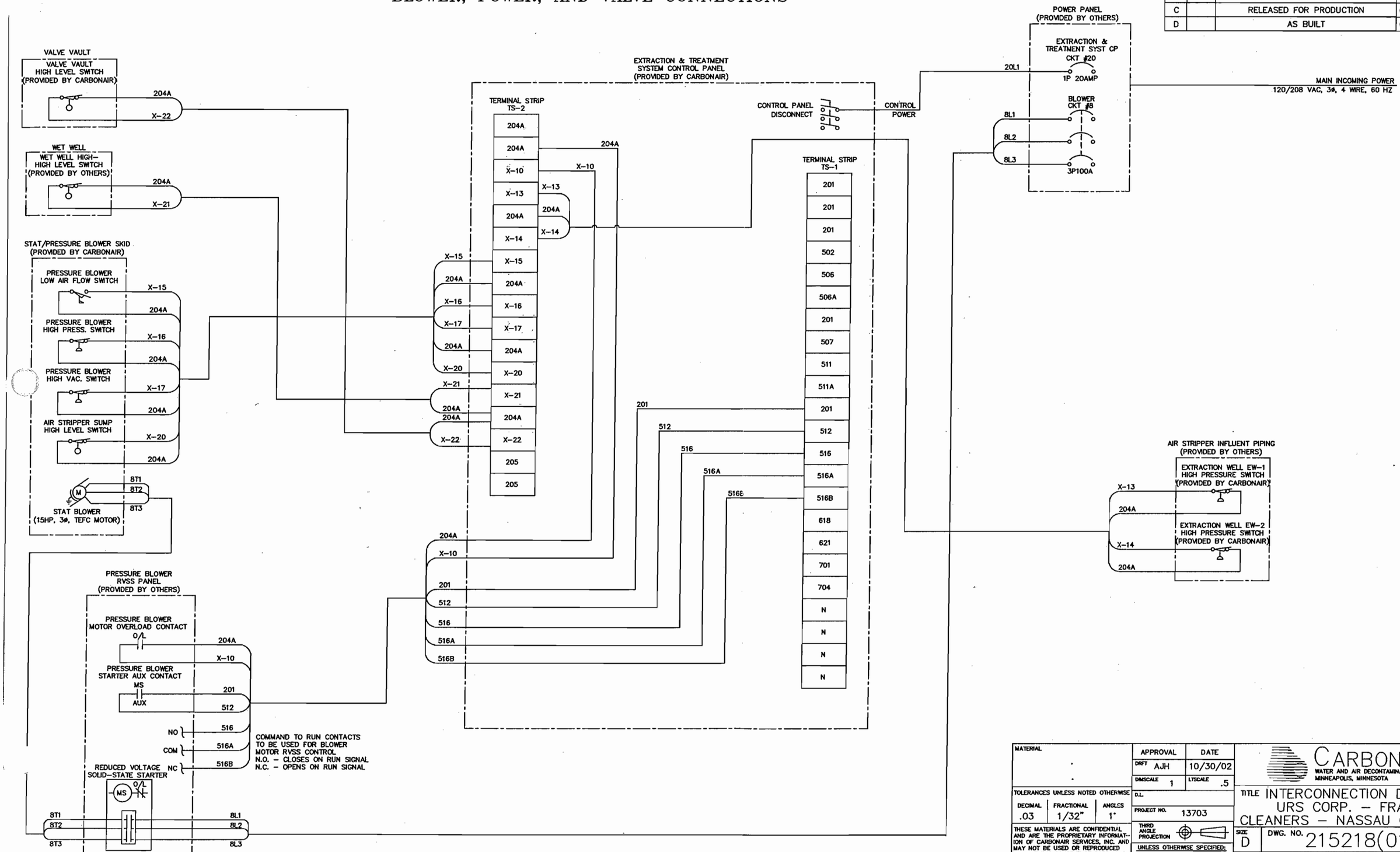
TITLE SCHEMATIC, VFD PANEL
URS CORP. – FRANKLIN
CLEANERS – NASSAU CITY, NY

SIZE	DWG. NO.	REV
D	215159	D

SCALE	EQUIP. NO.	SHEET
N/A	.	1 OF 1

INTERCONNECTION DIAGRAM #1
BLOWER, POWER, AND VALVE CONNECTIONS

REVISIONS				
REV	ECO	DESCRIPTION	DATE	DRN
–		---	---	---
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH



MATERIAL	APPROVAL	DATE
	DRFT AJH	10/30/02
	DIMSCALE 1	LTSCALE .5
TOLERANCES UNLESS NOTED OTHERWISE	D.L.	
DECIMAL .03 / FRACTIONAL 1/32" / ANGLES 1°	PROJECT NO. 13703	
	THIRD ANGLE PROJECTION	
	UNLESS OTHERWISE SPECIFIED: • DIMENSIONS ARE IN INCHES • DO NOT SCALE DRAWING	

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

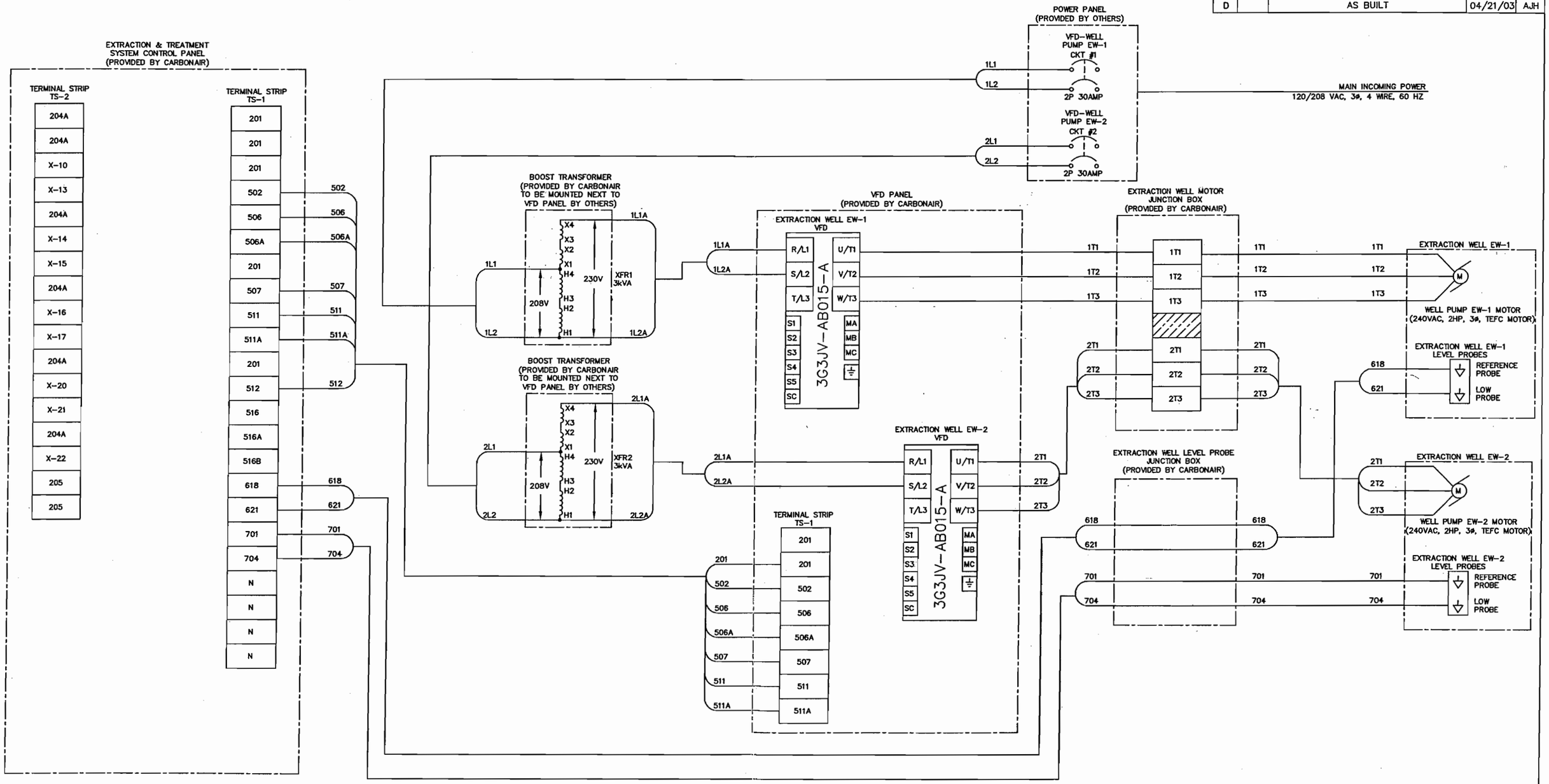
TITLE INTERCONNECTION DIAGRAM URS CORP. – FRANKLIN CLEANERS – NASSAU CITY, NY

SIZE D | DWG. NO. 215218(01) | REV D

SCALE N/A | EQUIP. NO. | SHEET 1 OF 2

INTERCONNECTION DIAGRAM #2
EXTRACTION WELL/VFD CONNECTIONS

REVISIONS				
REV	ECO	DESCRIPTION	DATE	DRN
–		---	---	---
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH



MATERIAL	APPROVAL	DATE
.	DRFT AJH	10/30/02
.	DIMSCALE 1	LTSCALE .5
TOLERANCES UNLESS NOTED OTHERWISE	D.L.	
DECIMAL .03 / FRACTIONAL 1/32" / ANGLES 1°	PROJECT NO. 13703	
THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC.	THIRD ANGLE PROJECTION	
	UNLESS OTHERWISE SPECIFIED: * DIMENSIONS ARE IN INCHES * DO NOT SCALE DRAWING	

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

TITLE INTERCONNECTION DIAGRAM
URS CORP. – FRANKLIN CLEANERS – NASSAU CITY, NY

SIZE	DWG. NO.	REV
D	215218(02)	D

SCALE N/A | EQUIP. NO. . | SHEET 2 OF 2

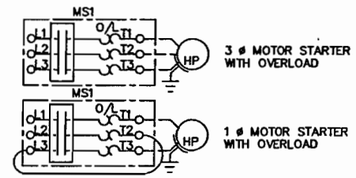
URS CORP. – FRANKLIN CLEANERS – NASSAU CITY, NY

REVISIONS				
REV	ECO	DESCRIPTION	DATE	DRN
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH

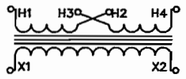
STANDARD LEGEND SYMBOLS

- TERMINAL IN PANEL
- FUSE BLOCK
- 1 POLE CIRCUIT BREAKER
- 2 POLE CIRCUIT BREAKER
- 3 POLE CIRCUIT BREAKER
- (CR) CONTROL RELAY COIL
- (TDR) CONTROL TIMER COIL
- (24 HR) 24 HOUR PIN TIMER
- (HM) MOTOR HOUR METER
- (CC) MOTOR CYCLE COUNTER
- FLOAT SWITCH CLOSES ON RISING LEVEL
- FLOAT SWITCH OPENS ON RISING LEVEL
- PRESSURE SWITCH CLOSES ON RISING PRESSURE
- PRESSURE SWITCH OPENS ON RISING PRESSURE
- TEMPERATURE SWITCH OPENS ON RISING TEMPERATURE
- TEMPERATURE SWITCH CLOSES ON RISING TEMPERATURE
- FLOW SWITCH CLOSES ON INCREASING FLOW
- NORMALLY OPEN RELAY CONTACT
- NORMALLY CLOSED RELAY CONTACT
- NORMALLY OPEN TIMER CONTACT
- NORMALLY CLOSED TIMER CONTACT
- FIELD WIRING
- NORMALLY OPEN PUSHBUTTON MOMENTARY
- NORMALLY CLOSED PUSHBUTTON MOMENTARY
- NORMALLY CLOSED EMERGENCY STOP PUSHBUTTON
- THREE POSITION H.O.A. SELECTOR SWITCH (ILLUMINATED ON NON-ILLUMINATED)
- SELECTOR SWITCH (ADDITIONAL CONTACTS MAY BE ADDED)

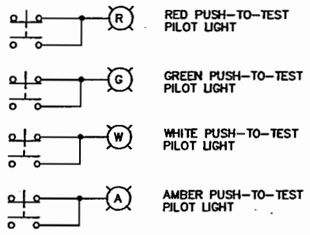
- DISTRIBUTION BLOCK
- SOLENOID VALVE
- WIRE CONTINUATION
- DISCONNECT



- (MS1) MOTOR STARTER COIL
- CK222 / 222 (CK) CONTACTOR / CONTACTOR COIL
- GROUND
- DUPLEX RECEPTACLE



TRANSFORMER



- (R) RED PILOT LIGHT
- (G) GREEN PILOT LIGHT
- (W) WHITE PILOT LIGHT
- (A) AMBER PILOT LIGHT

CONTROL PANEL WIRE COLOR CODING

BLACK	ALL UNGROUNDED CONTROL CIRCUIT CONDUCTORS OPERATING AT THE SUPPLY VOLTAGE
RED	UNGROUNDED AC CONTROL CIRCUITS OPERATING AT A VOLTAGE LESS THAN THE SUPPLY VOLTAGE
BLUE	UNGROUDED DC CONTROL CIRCUITS
YELLOW	UNGOUNDED CONTROL CIRCUITS OR OTHER WIRING, SUCH AS FOR CABINET LIGHTING, THAT REMAIN ENERGIZED WHEN THEN MAIN DISCONNECT IS IN THE "OFF" POSITION
WHITE OR NATURAL GRAY	GROUNDED AC CURRENT-CARRYING CONTROL CIRCUIT CONDUCTOR
WHITE WITH BLUE STRIPE	GROUNDED DC CURRENT-CARRYING CONTROL CIRCUIT CONDUCTOR
WHITE WITH YELLOW STRIPE	GOUNDED AC CONTROL CIRCUIT CURRENT-CARRYING CONDUCTOR THAT REMAINS ENERGIZED WHEN THE MAIN DISCONNECT IS IN THE "OFF" POSITION
LIGHT BLUE	INTRINSICALLY SAFE WIRING CONTROL CIRCUIT CONDUCTOR
GREEN	AC GROUND

NOTES

1. DRAWINGS NOT TO SCALE
2. NORMAL STATE, DEVICE ENERGIZED
3. WIRE NUMBER=TERMINAL NUMBER
4. ALL WIRING IS 16 AWG MTW UNLESS OTHERWISE NOTED
5. SHIELDED WIRING IS 20 AWG

MATERIAL: .	APPROVAL	DATE
	DRFT RLC	07/23/02
	DIMSCALE 1	LTSCALE .5
TOLERANCES UNLESS NOTED OTHERWISE: DECIMAL .03 / FRACTIONAL 1/32" / ANGLES 1°	D.L.	
	PROJECT NO. 13703	
THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC.	THIRD ANGLE PROJECTION	
	UNLESS OTHERWISE SPECIFIED: * DIMENSIONS ARE IN INCHES * DO NOT SCALE DRAWING	

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

TITLE: CONTROL PANEL SYMBOL LEGENDS & WIRE IDENTIFICATION

SIZE	DWG. NO.	REV
D	214512(01)	D

SCALE	EQUIP. NO.	SHEET
N/A	.	1 OF 7

MAIN INCOMING POWER
120/208 VAC, 3ø, 4 WIRE, 60 HZ

CONTROL PANEL POWER FED BY CKT#20 TREAT. SYS. CP POWER PANEL (FED BY OTHERS)

FROM NEUTRAL IN POWER PANEL (SUPPLIED BY OTHERS)

201 — DISC100 — 25 AMP NON-FUSED DISCONNECT SWITCH (INTERLOCKED TO INNER DOOR)

100 — SURGE SUPPRESSOR EDCO MCL120N25-2 — (Y) (O) (B) — 100 100A 100B

N

COL. 2
120 VAC

100 — FU201 5A (ATQR) — 201

204

205

201 — FU200 1A (AGC) — N

EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO	2	SS202	X-0	X0
WELL PUMP EW-1 SWITCH IN AUTO	3	SS203	X-1	X1
WELL PUMP EW-1 RUNNING CONTACT	4	CR502	X-2	X2
WELL PUMP EW-2 SWITCH IN AUTO	5	SS205	X-3	X3
	6			C1
WELL PUMP EW-2 RUNNING CONTACT	7	CR507	X-4	X4
PRESSURE BLOWER SWITCH IN HAND	8	SS208	X-5	X5
PRESSURE BLOWER SWITCH IN AUTO	9		X-6	X6
PRESSURE BLOWER RUNNING RELAY CONTACT	10	CR512	X-7	X7
	11			C2
PRESSURE BLOWER O/L CONTACT	12	MS1 O/L	X-10	X10
EXTRACTION WELL EW-1 LOW LEVEL PROBE	13	WLC711	X-11	X11
EXTRACTION WELL EW-2 LOW LEVEL PROBE	14	WLC717	X-12	X12
EXTRACTION WELL EW-1 HIGH PRESSURE SWITCH	15		X-13	X13
	16			C3
EXTRACTION WELL EW-2 HIGH PRESSURE SWITCH	17		X-14	X14
LOW AIR FLOW SWITCH	18		X-15	X15
PRESSURE BLOWER DISCHARGE HIGH PRESSURE SWITCH	19		X-16	X16
PRESSURE BLOWER SUCTION HIGH VACUUM SWITCH	20		X-17	X17
	21			C4
AIR STRIPPER SUMP HIGH LEVEL SWITCH	22		X-20	X20

SS202 — OX; SS203 — OX; CR502; SS205 — OX; CR507; SS208 — XOO; OOX; CR512; MS1 — O/L; WLC711; WLC717

PLC LCD INTERFACE

DIRECT LOGIC D0-06D

L	200 (18AWG)		
N	(18AWG)		
GND			
24V	204A — FU204 1A (AGC) — 204		24VDC POWER FOR DISCRETE PLC INPUTS
0V	205		
C0	200 (18AWG)		
Y0	Y-0 (18AWG)	207	WELL PUMP EW-1 CALL TO RUN CONTROL RELAY (506)
Y1	Y-1 (18AWG)	208	WELL PUMP EW-2 CALL TO RUN CONTROL RELAY (511)
Y2	Y-2 (18AWG)	209	PRESSURE BLOWER CALL TO RUN CONTROL RELAY (516,516)
Y3	Y-3 (18AWG)	210	WELL PUMP EW-1 FAIL CONTROL RELAY (601,602,602)
C1	200 (18AWG)		
Y4	Y-4 (18AWG)	212	WELL PUMP EW-2 FAIL CONTROL RELAY (603,604,604)
Y5	Y-5 (18AWG)	213	PRESSURE BLOWER FAIL CONTROL RELAY (605,606,606)
Y6	Y-6 (18AWG)	214	WELL EW-1 LOW LEVEL ALARM CONTROL RELAY (607,608,608)
Y7	Y-7 (18AWG)	215	WELL EW-1 HIGH PRESS. ALARM CONTROL RELAY (609,610,610)
C2	200 (18AWG)		
Y10	Y-10 (18AWG)	217	WELL EW-2 LOW LEVEL ALARM CONTROL RELAY (611,612,612)
Y11	Y-11 (18AWG)	218	WELL EW-2 HIGH PRESS. ALARM CONTROL RELAY (613,614,614)
Y12	Y-12 (18AWG)	219	LOW AIR FLOW ALARM CONTROL RELAY (615,616,616)
Y13	Y-13 (18AWG)	220	PRESSURE BLOWER HIGH PRESS. ALARM CONTROL RELAY (617,618,618)
C3	200 (18AWG)		
Y14	Y-14 (18AWG)	222	PRESSURE BLOWER HIGH VACUUM ALARM CONTROL RELAY (619,620,620)

200 — N

201 — 204

REVISIONS

REV	ECO	DESCRIPTION	DATE	
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH

MATERIAL .

TOLERANCES UNLESS NOTED OTHERWISE: DECIMAL .03 | FRACTIONAL 1/32" | ANGLES 1°

THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC.

APPROVAL	DATE
DRFT AJH	07/31/02
DWSCALE 1	LTSCALE .5
D.L.	
PROJECT NO. 13703	

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED:
* DIMENSIONS ARE IN INCHES
* DO NOT SCALE DRAWING

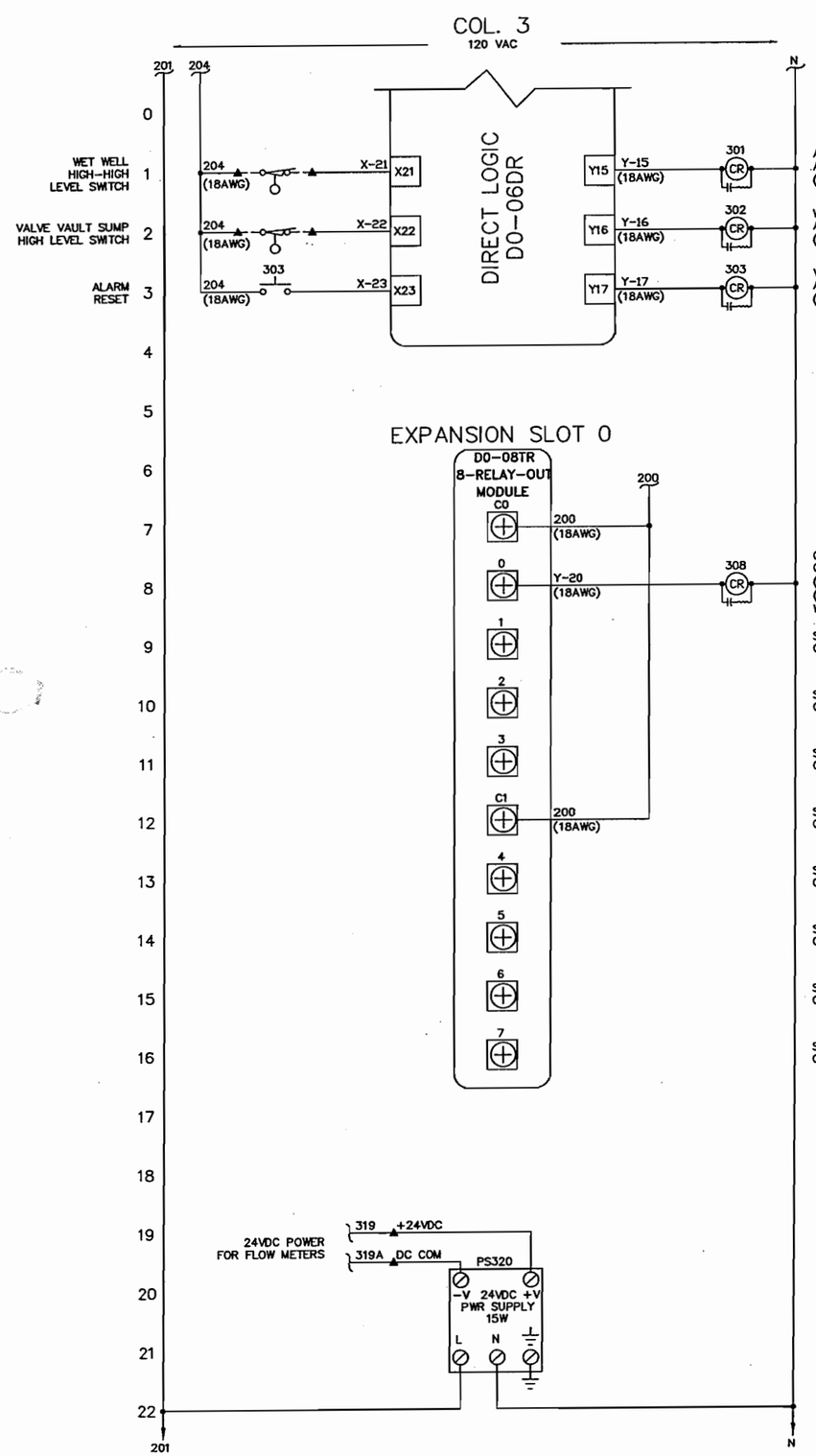
CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

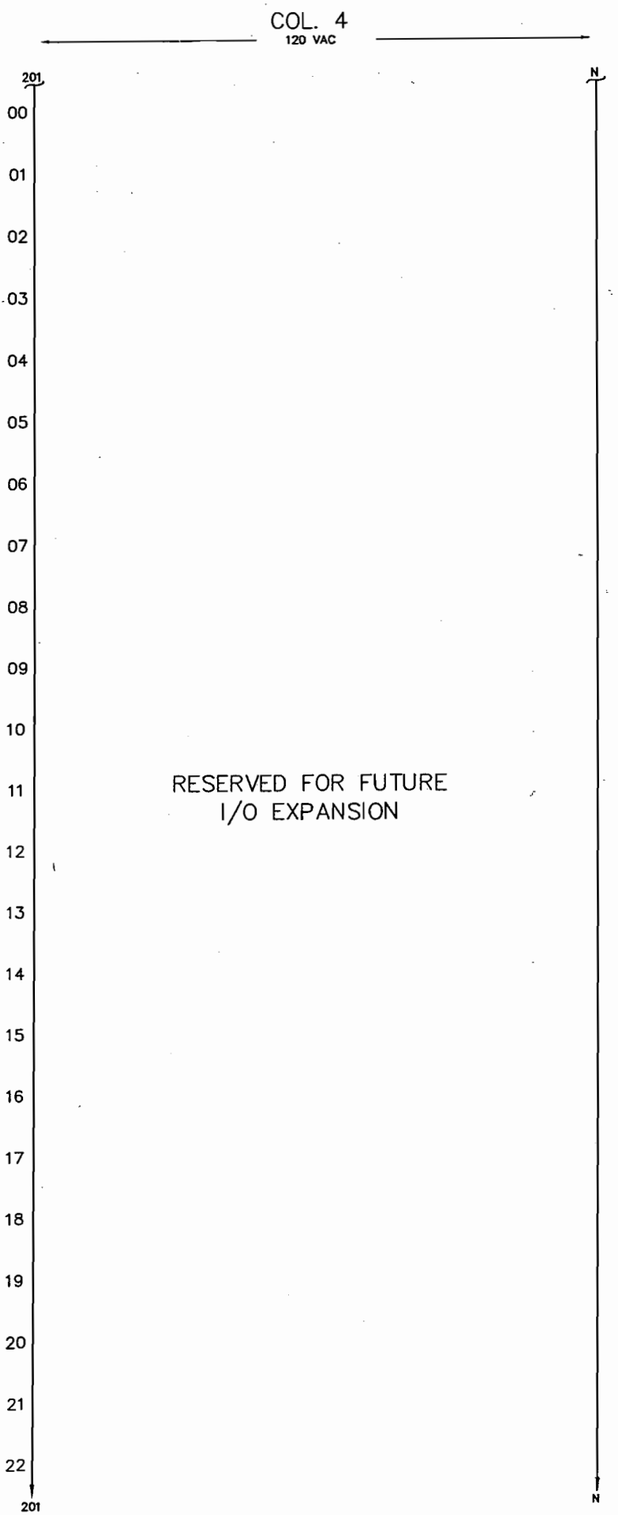
TITLE SCHEMATIC, CONTROL PANEL
URS CORP. – FRANKLIN CLEANERS – NASSAU CTY, NY

SIZE D | DWG. NO. 214512(02) | REV D

SCALE N/A | EQUIP. NO. . | SHEET 2 OF 7

REVISIONS				
REV	ECO	DESCRIPTION	DATE	
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH





MATERIAL	APPROVAL	DATE
.	DRFT AJH	07/31/02
.	DIMSCALE 1	LTSCALE .5
TOLERANCES UNLESS NOTED OTHERWISE	D.L.	
DECIMAL .03 / FRACTIONAL 1/32" / ANGLES 1°	PROJECT NO. 13703	
THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC.	THIRD ANGLE PROJECTION	
	UNLESS OTHERWISE SPECIFIED: • DIMENSIONS ARE IN INCHES • DO NOT SCALE DRAWING	

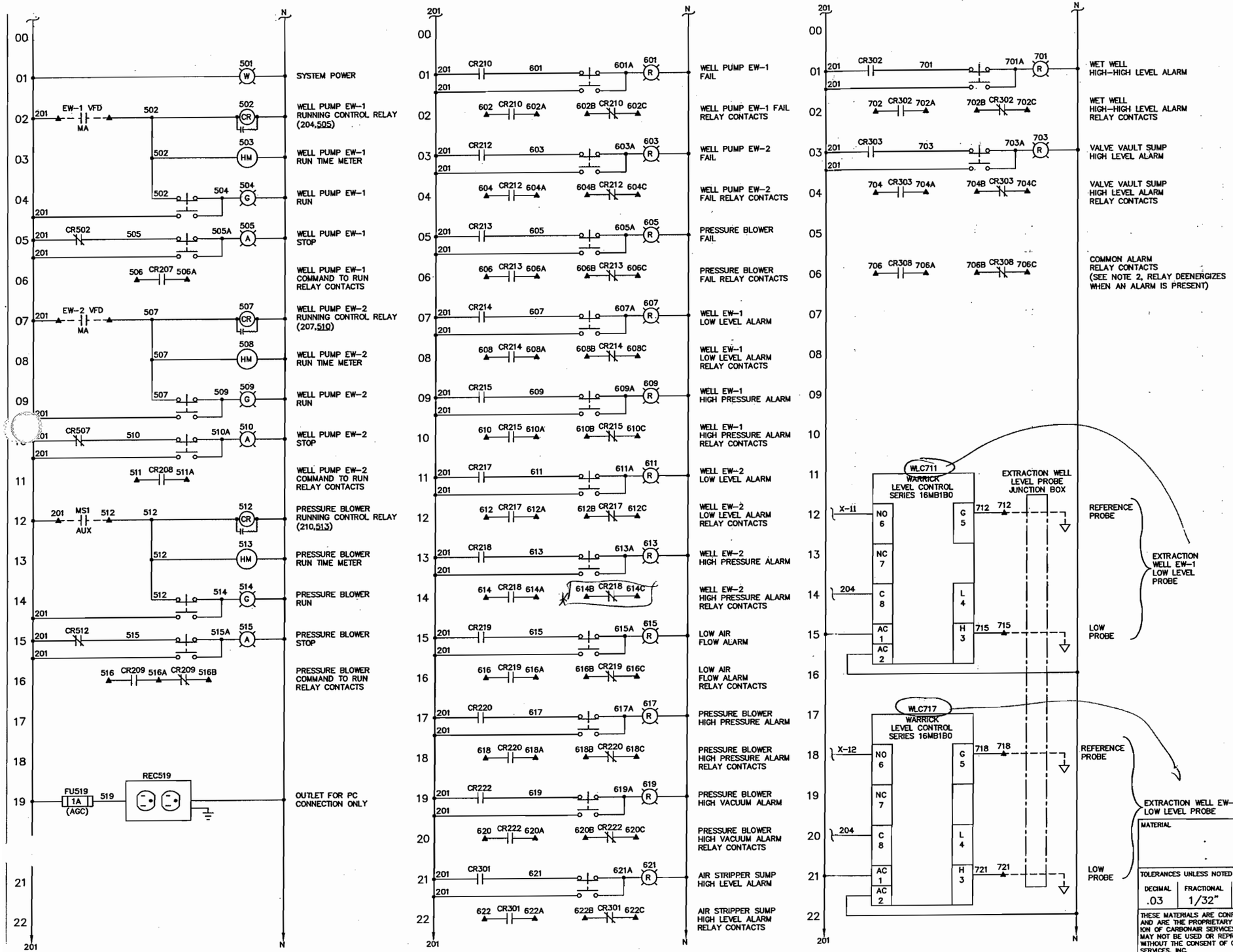
CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

TITLE SCHEMATIC, CONTROL PANEL
URS CORP. – FRANKLIN CLEANERS – NASSAU CITY, NY

SIZE	DWG. NO.	REV
D	214512(03)	D
SCALE N/A	EQUIP. NO. .	SHEET 3 OF 7

REVISIONS

REV	ECO	DESCRIPTION	DATE	
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH



MATERIAL	APPROVAL	DATE
.	DRFT AJH	07/31/02
.	DWGSCALE 1	LTSCALE .5

TOLERANCES UNLESS NOTED OTHERWISE: DECIMAL .03 | FRACTIONAL 1/32" | ANGLES 1°

D.L.

PROJECT NO. 13703

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED:
* DIMENSIONS ARE IN INCHES
* DO NOT SCALE DRAWING

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

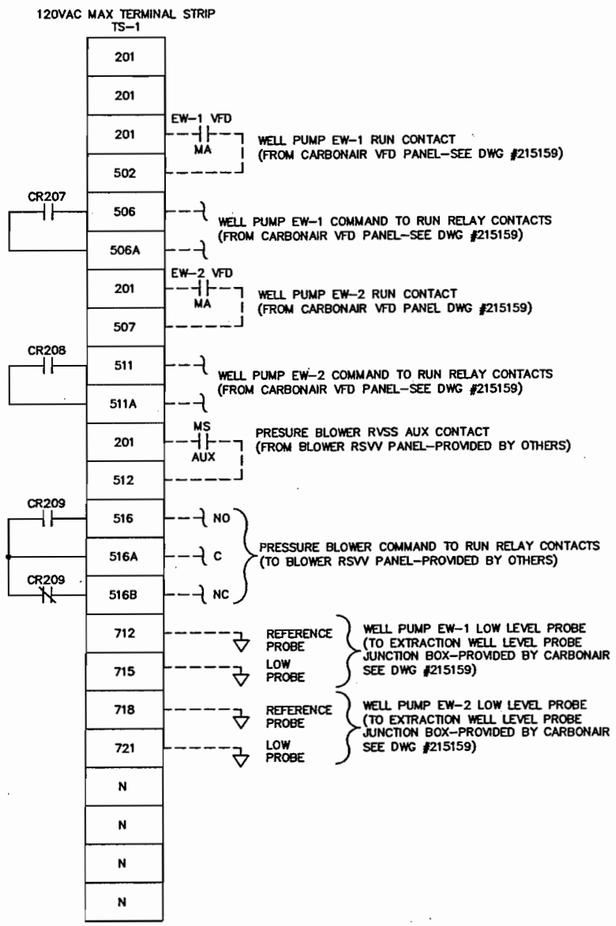
TITLE SCHEMATIC, CONTROL PANEL
URS CORP. – FRANKLIN CLEANERS – NASSAU CITY, NY

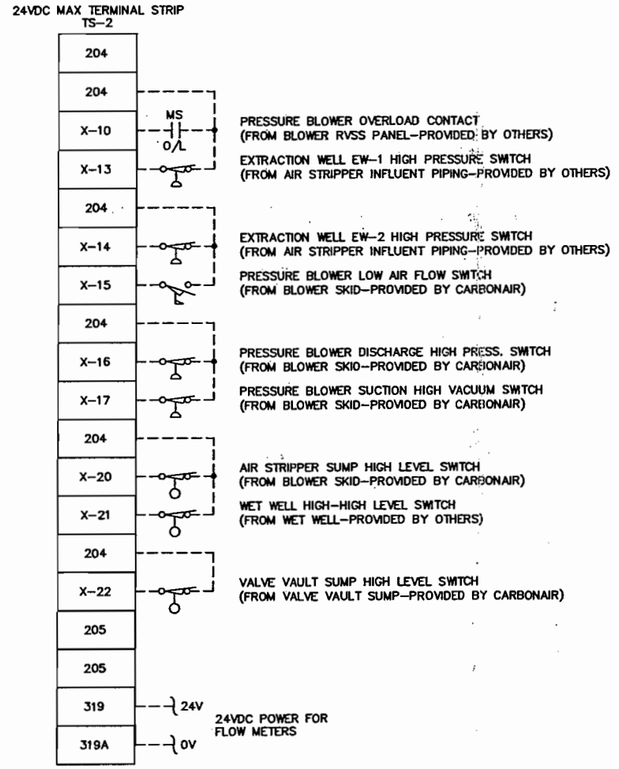
SIZE D | DWG. NO. 214512(04) | REV D

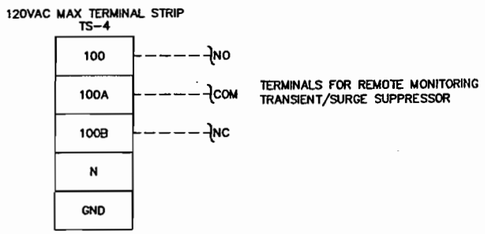
SCALE N/A | EQUIP. NO. . | SHEET 4 OF 7

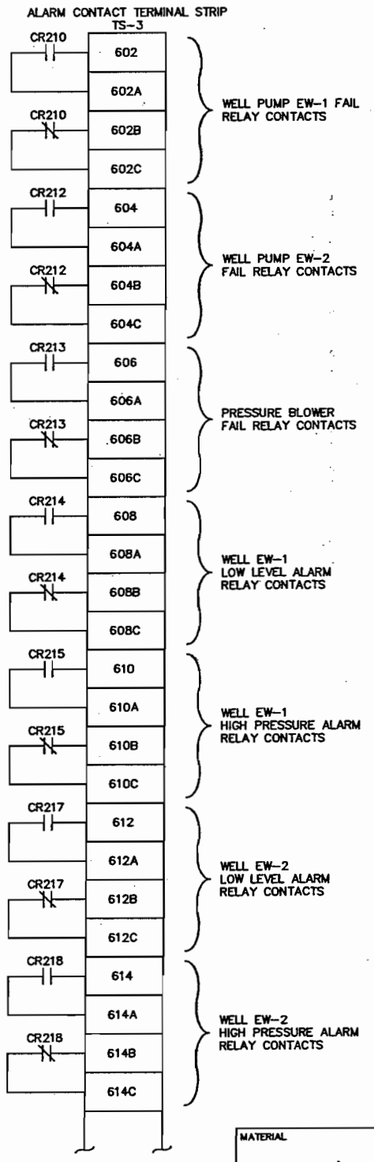
REVISIONS				
REV	ECO	DESCRIPTION	DATE	
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH

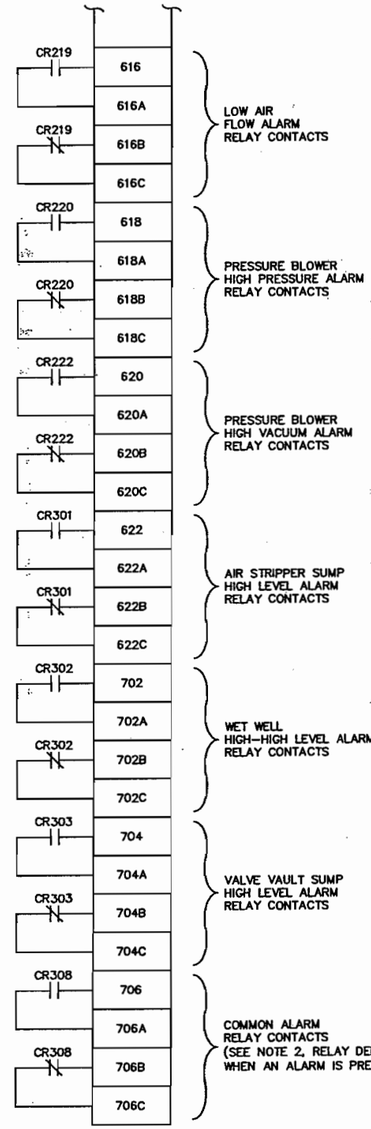
SEE CARBONAIR DWG #215218 FOR EXTERNAL INTERCONNECTION DIAGRAM











MATERIAL .	APPROVAL	DATE	CARBONAIR WATER AND AIR DECONTAMINATION MINNEAPOLIS, MINNESOTA ©2002
	DRFT AJH	07/31/02	
	DWSCALE 1	LTSCALE .5	
TOLERANCES UNLESS NOTED OTHERWISE: DECIMAL .03 FRACTIONAL 1/32" ANGLES 1°	D.L.		TITLE SCHEMATIC, CONTROL PANEL URS CORP. – FRANKLIN CLEANERS – NASSAU CITY, NY
	PROJECT NO. 13703		
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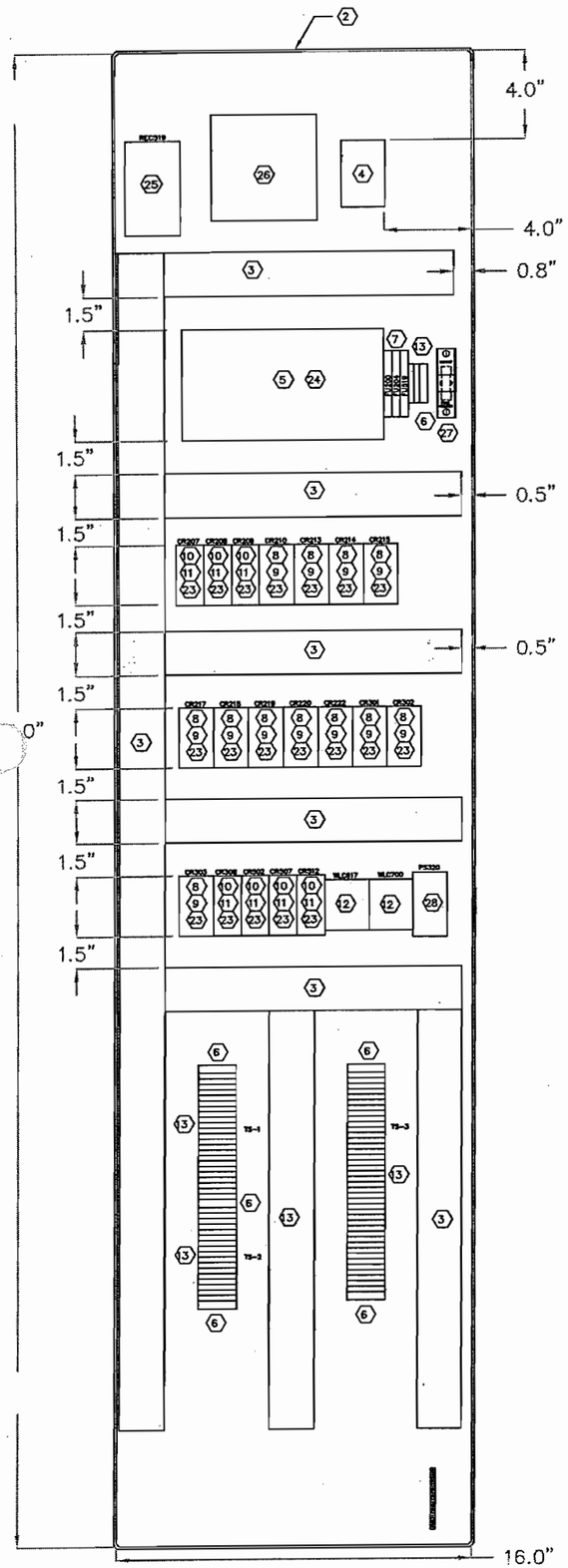
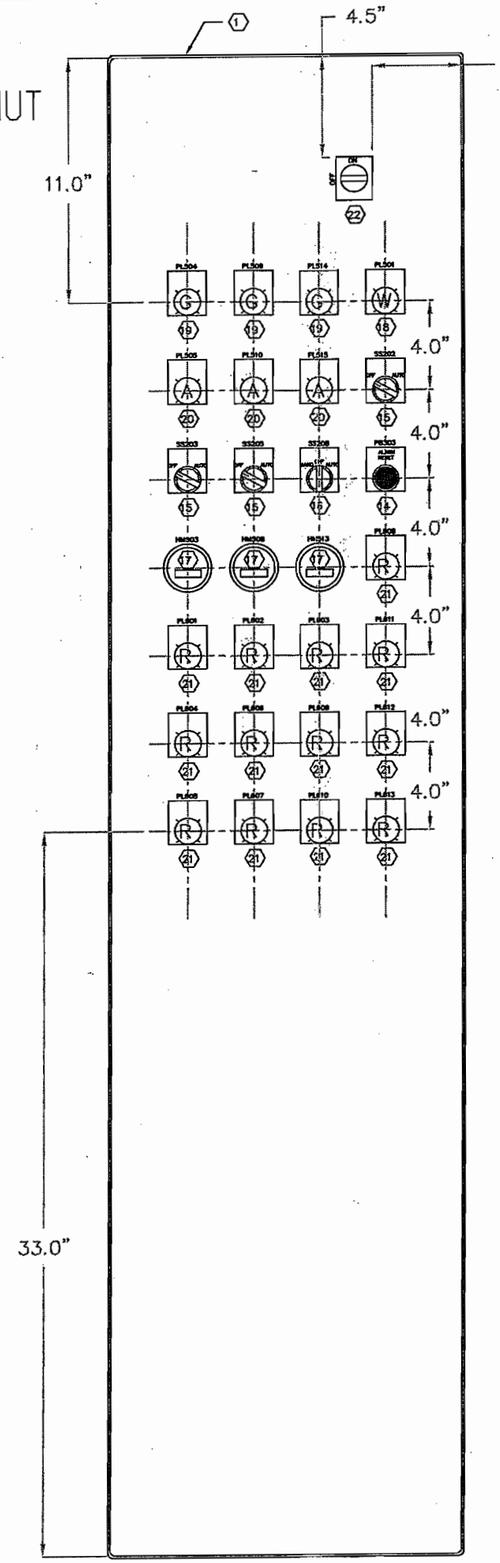
	UNLESS OTHERWISE SPECIFIED: • DIMENSIONS ARE IN INCHES • DO NOT SCALE DRAWING		SCALE N/A EQUIP. NO. . SHEET 5 OF 7

REVISIONS				
REV	ECO	DESCRIPTION	DATE	DRN
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		RELEASED FOR PRODUCTION	01/23/03	AJH
D		AS BUILT	04/21/03	AJH

CONTROL PANEL LAYOUT



ENCLOSURE DOOR LAYOUT



CONTROL ENCLOSURE NOTES:

1. DIMENSIONS: 72"H x 20"W x 16"D
2. FREE STANDING, RATED NEMA12
3. UL LISTED

EXTRACTION & TREATMENT CONTROL PANEL

NAMEPLATE SCHEDULE

IN OFF RUN FROM VFD MANUAL MODE

MATERIAL . .	APPROVAL	DATE
	DRFT AJH	08/08/02
	DMSCALE 1	LTSCALE 0.5
TOLERANCES UNLESS NOTED OTHERWISE	D.L. .	
DECIMAL .03 / FRACTIONAL 1/32" / ANGLES 1°	PROJECT NO. 13703	
THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC.	THIRD ANGLE PROJECTION	
	UNLESS OTHERWISE SPECIFIED: • DIMENSIONS ARE IN INCHES • DO NOT SCALE DRAWING	

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

TITLE CONTROL PANEL LAYOUT
PRELIMINARY
URS CORP–FRANKLIN CLEANERS

SIZE D | DWG. NO. 214512(06) | REV D

SCALE 0.5=3.5 | EQUIP. NO. . | SHEET 6 OF 7

REVISIONS				
REV	ECO	DESCRIPTION	DATE	DRN
A		RELEASED FOR SUBMITTAL	09/09/02	AJH
B		REVISED FOR SUBMITTAL	11/04/02	AJH
C		REVISED FOR RESUBMITTAL	01/23/03	AJH
D		AS BUILT	04/21/03	AJH

CONTROL PANEL BILL OF MATERIALS - PRELIMINARY

ITEM	REF	QTY	MANUFACTURER	MANUFACTURER	PART NUMBER
1	.	1	ENCLOSURE DOOR	LEHMAN	CUSTOM
2	.	1	SUB PANEL	LEHMAN	CUSTOM
3	.	13'	WIRE DUCT, WHITE, 2" x 2"	CRITCHLEY BETADUCT	2X2UPVC
4	DIS201	1	3 POLE DISCONNECT SWITCH	ABB	OT25E3
5	PLC200	1	PLC	AUTOMATION DIRECT	D0-06DR
6	.	5	TERMINAL END STOP	ENTRELEC	103002.26
7	FU200 FU204 FU519	5	FUSE HOLDER, AGC	ALLEN-BRADLEY	1492-H6
8	CR210	12	3 POLE RELAY	IDEC	RH3B-UL-AC120V
9	CR212 CR213 CR214 CR215 CR217 CR218 CR219 CR220 CR222 CR301 CR302 CR303		3 POLE RELAY BASE	IDEC	SH3B-05
10	CR207	7	2 POLE RELAY	IDEC	RH2B-UL-AC120V
11	CR208 CR209 CR308 CR502 CR507 CR512		2 POLE RELAY BASE	IDEC	SH2B-05
12	WLC711 WLC717	2	LEVEL CONTROLLER	WARRICK	16MB1B0

ITEM	REF	QTY	MANUFACTURER	MANUFACTURER	PART NUMBER
13	.	40	TERMINALS	PHOENIX CONTACT	UK5N
14	PB311	1	PUSH BUTTON, RED, N.O.	IDEC	HW1B-M1F10-R
15	SS202 SS203 SS205	3	SELECTOR SWITCH, 2 POSITION	IDEC	HW1S-2TF11
16	SS208	1	SELECTOR SWITCH, 3 POSITION	IDEC	HW1S-3TF20
17	HM503 HM507 HM511	3	HOUR METER	REDINGTON COUNTERS	711-0150
18	PL501	1	PILOT LIGHT, WHITE	IDEC	HW1L-M2F11QD-W-120
19	PL504 PL508 PL512	3	PILOT LIGHT, GREEN	IDEC	HW1L-M2F11QD-G-120
20	PL505 PL509 PL513	3	PILOT LIGHT, AMBER	IDEC	HW1L-M2F11QD-A-120
21	PL601 PL602 PL603 PL604 PL605 PL606 PL607 PL608 PL609 PL610 PL611 PL612 PL613	13	PILOT LIGHT, RED	IDEC	HW1L-M2F11QD-R-120
22	.	1	DISCONNECT OPERATOR	ABB	OHY2AJ
23	.	19	SURGE SUPPRESSOR	MALLORY	104MACQRL150
24	.	1	PLC, EXPANSION CARD	AUTOMATION DIRECT	D0-08TR
25	REC119	1	OUTLET	HUBBEL	CR015I
26	SUP102	1	SURGE SUPPRESSOR	EDCO	MCL120N25-2
27	FU201	1	FUSE HOLDER	GOULD SHAWMUT	30321R
28	PS320	1	POWER SUPPLY	IDEC	PS5R-B24

MATERIAL: .

TOLERANCES UNLESS NOTED OTHERWISE

DECIMAL	FRACTIONAL	ANGLES
.03	1/32"	1°

	APPROVAL	DATE
DRFT	AJH	08/08/02
DIMSCALE	1	LTSCALE 0.5
D.L.		
PROJECT NO.	13703	

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED:
* DIMENSIONS ARE IN INCHES
* DO NOT SCALE DRAWING

CARBONAIR
WATER AND AIR DECONTAMINATION
MINNEAPOLIS, MINNESOTA

TITLE CONTROL PANEL LAYOUT
BILL OF MATERIALS
URS CORP-FRANKLIN CLEANERS

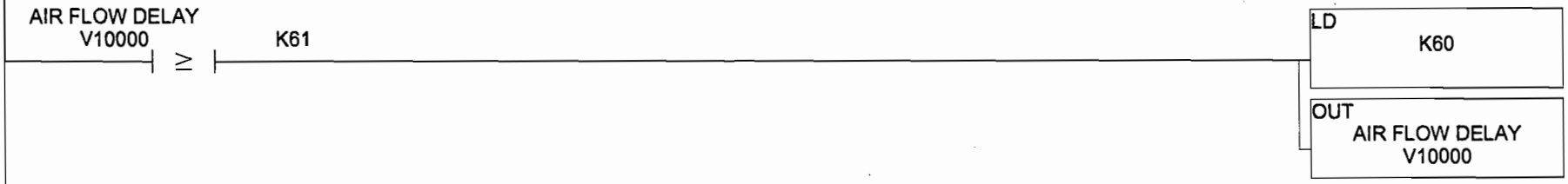
SIZE D | DWG. NO. 214512(07) | REV D

SCALE 0.5=3.5 | EQUIP. NO. . | SHEET 7 OF 7

Path: j:\137__\13703\10_controls\programs\13703.prj
Save Date: 11/21/03 14:33:12
Creation Date: 04/10/03 05:38:34
PLC Type: 06
Class ID: DirectLogic 06 Series
Link Name: 06 KSeq

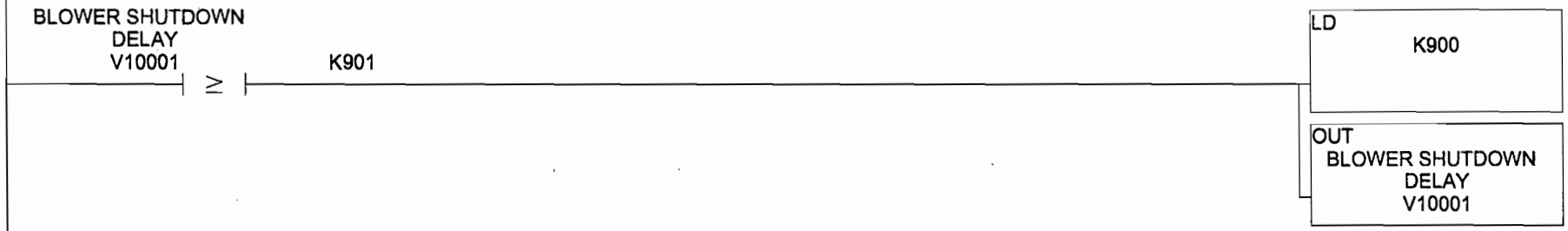
MAXIMUM DELAY FOR AIR FLOW IS 1 MINUTE (60 SECONDS)

1



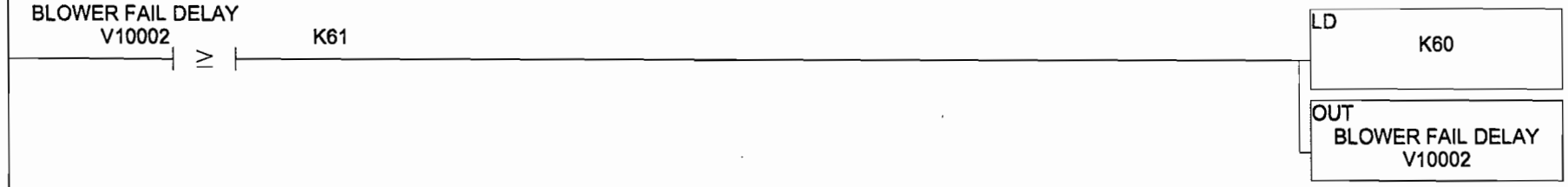
MAX DELAY FOR BLOWER IS 15 MINUTES (900 SECONDS)

2



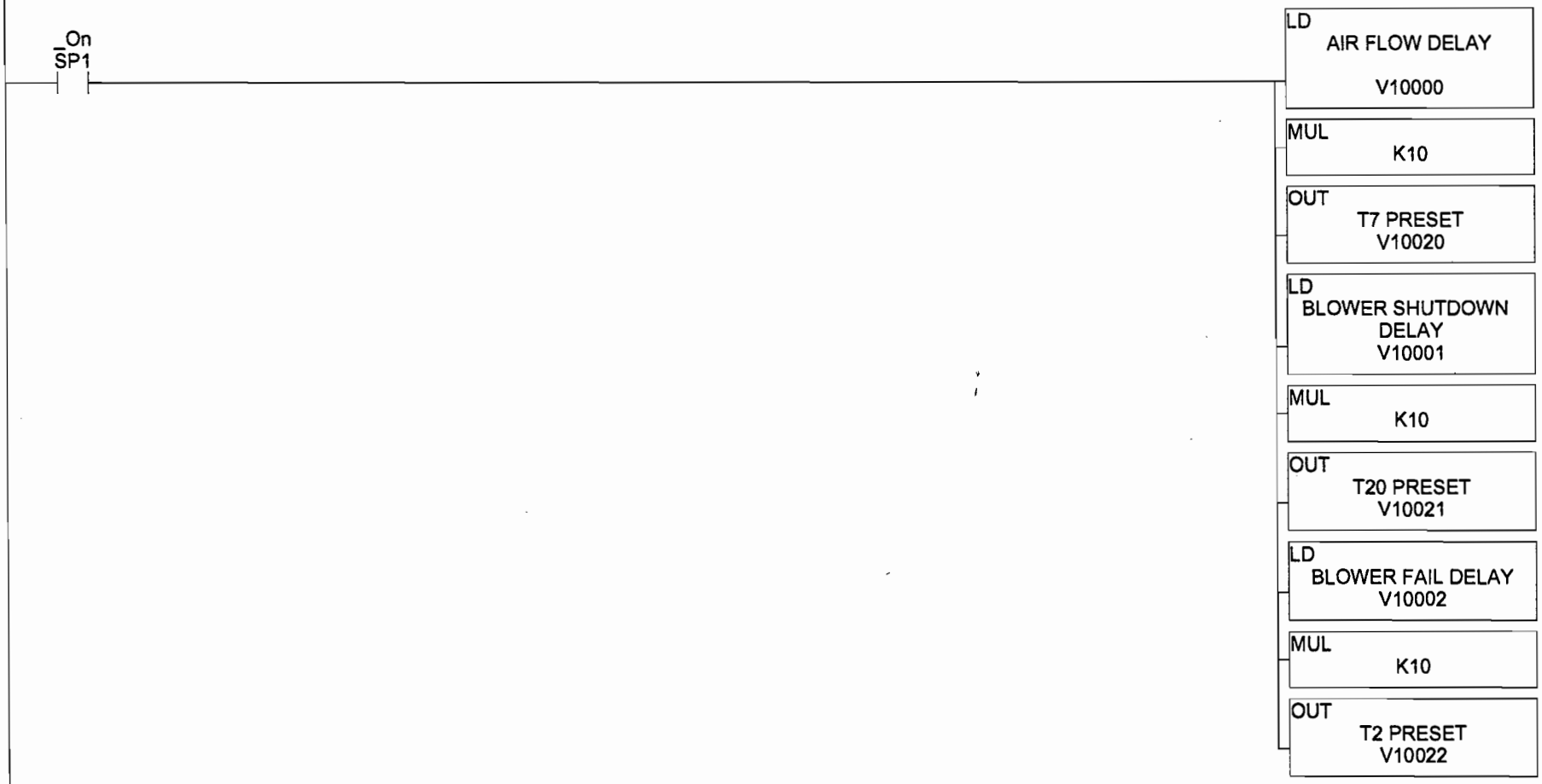
MAX DELAY FOR BLOWER FAIL TIMER IS 60 SECONDS

3



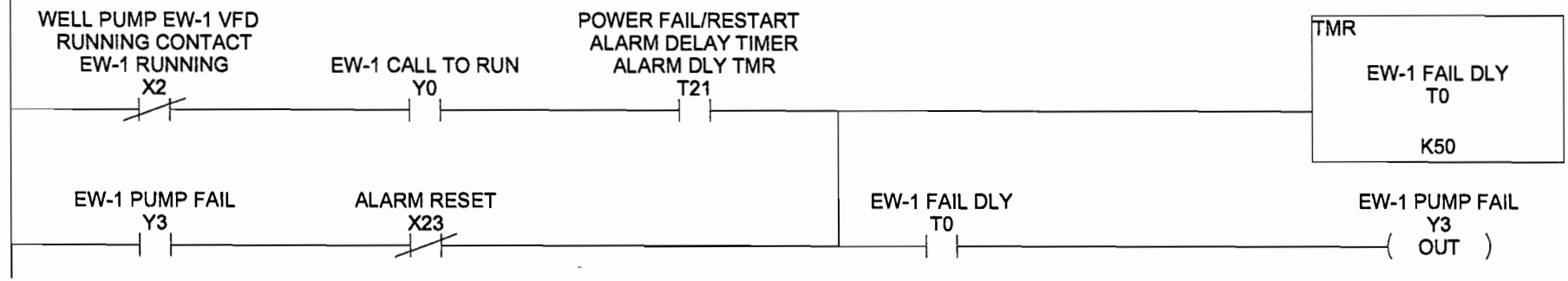
THIS RUNG GETS THE TIMER PRESET VALUES(IN TENTHS OF A SECOND) FROM THE DELAY VALUES(SECONDS)

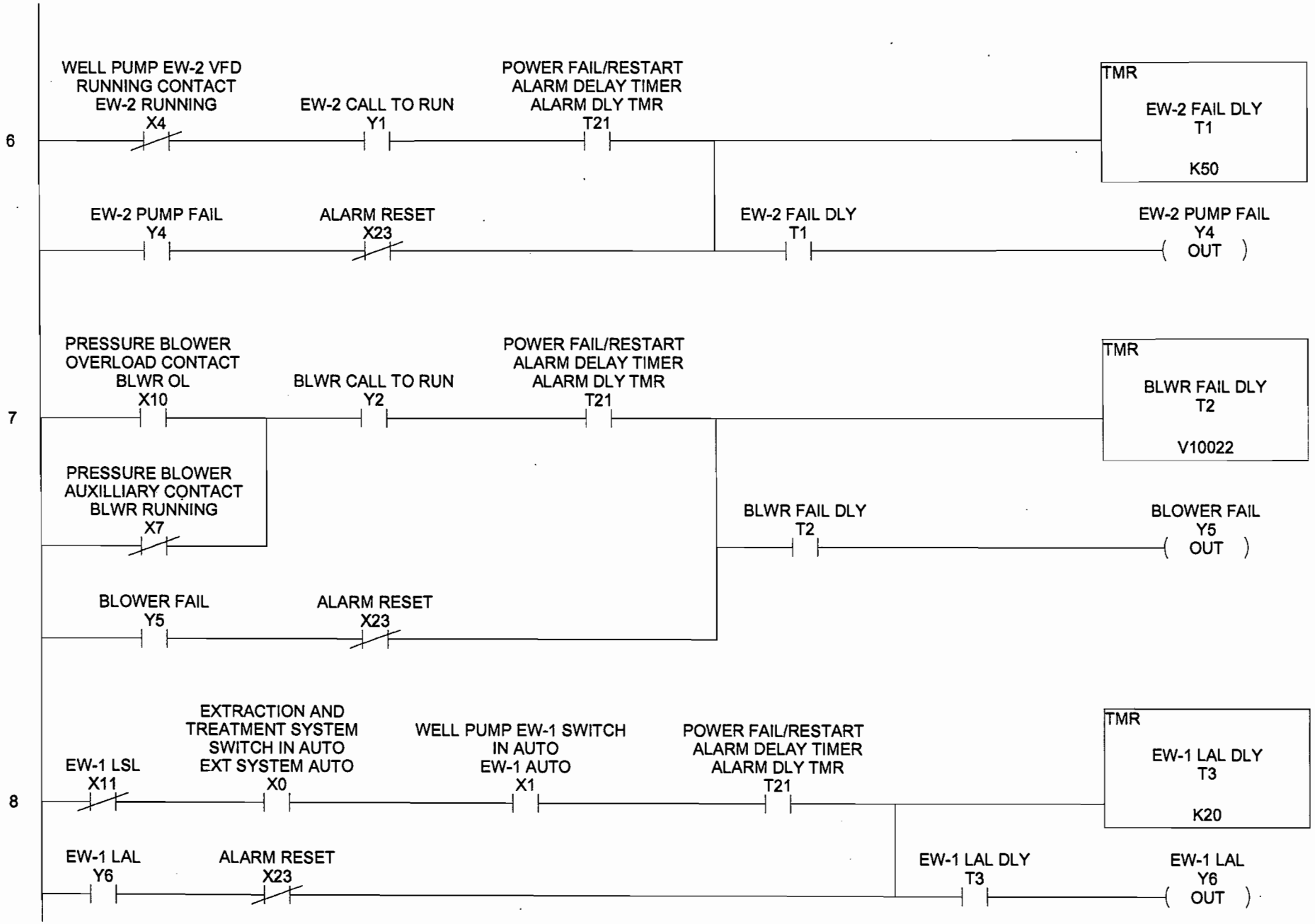
4

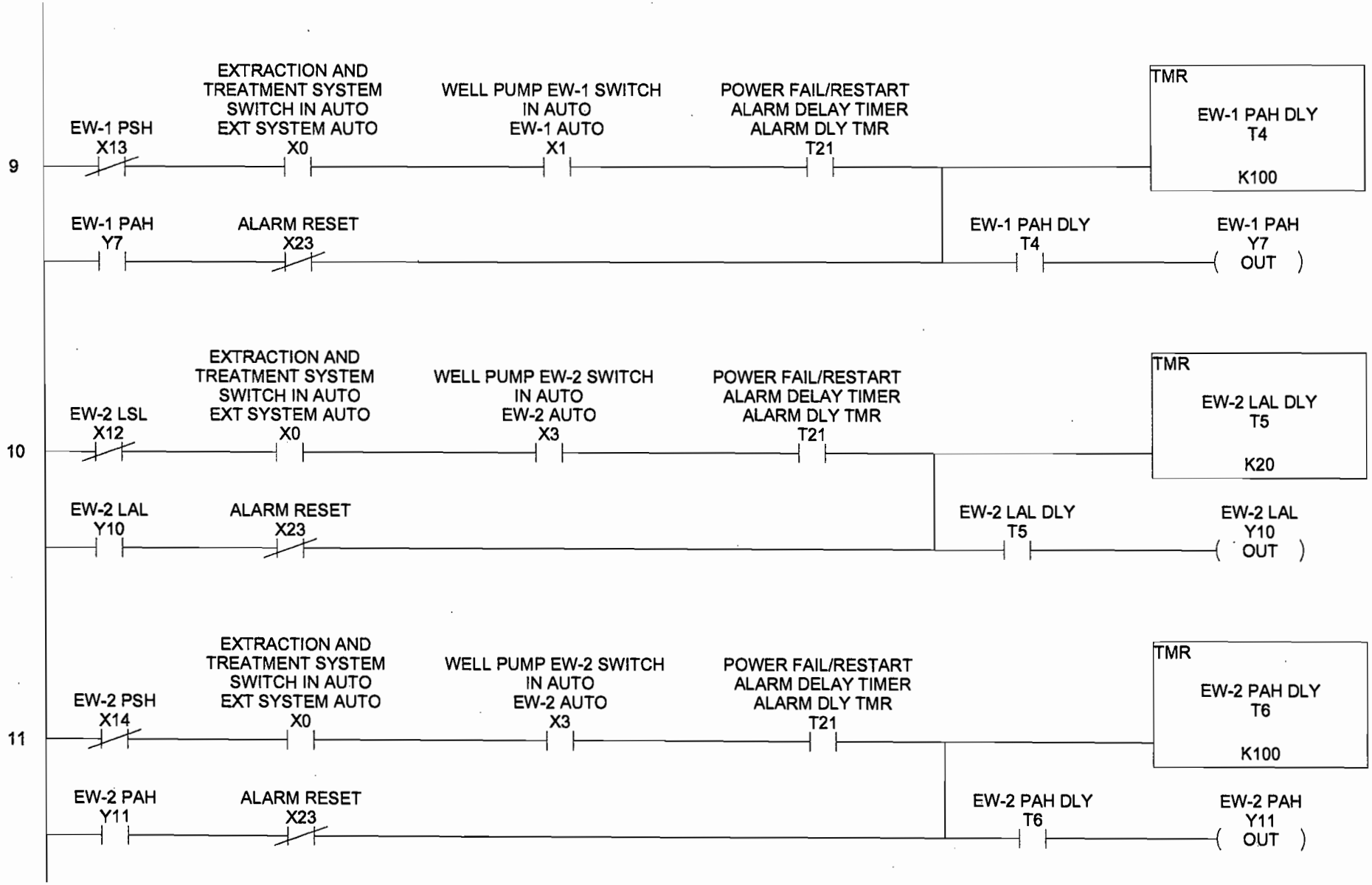


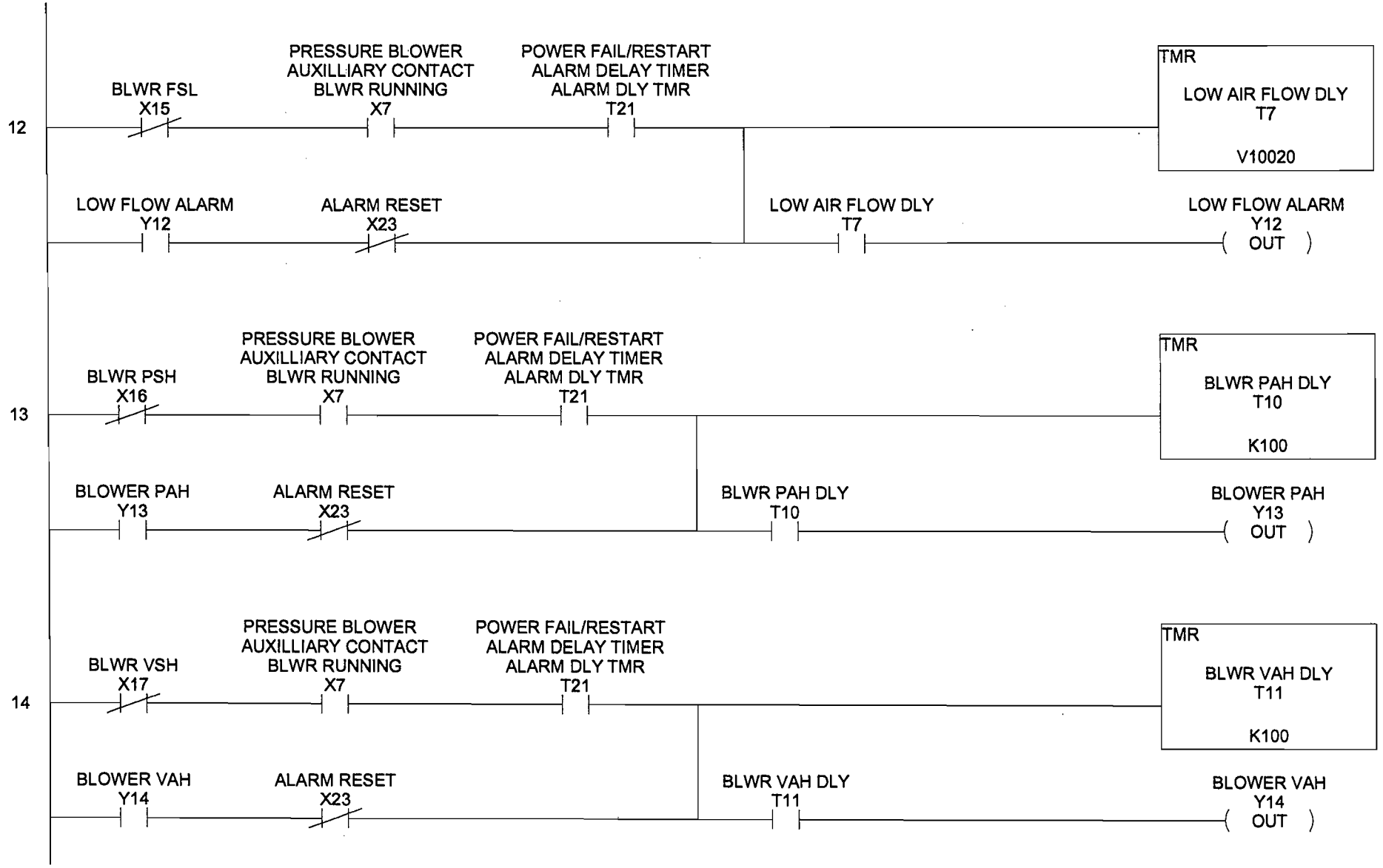
START OF ALARM LOGIC

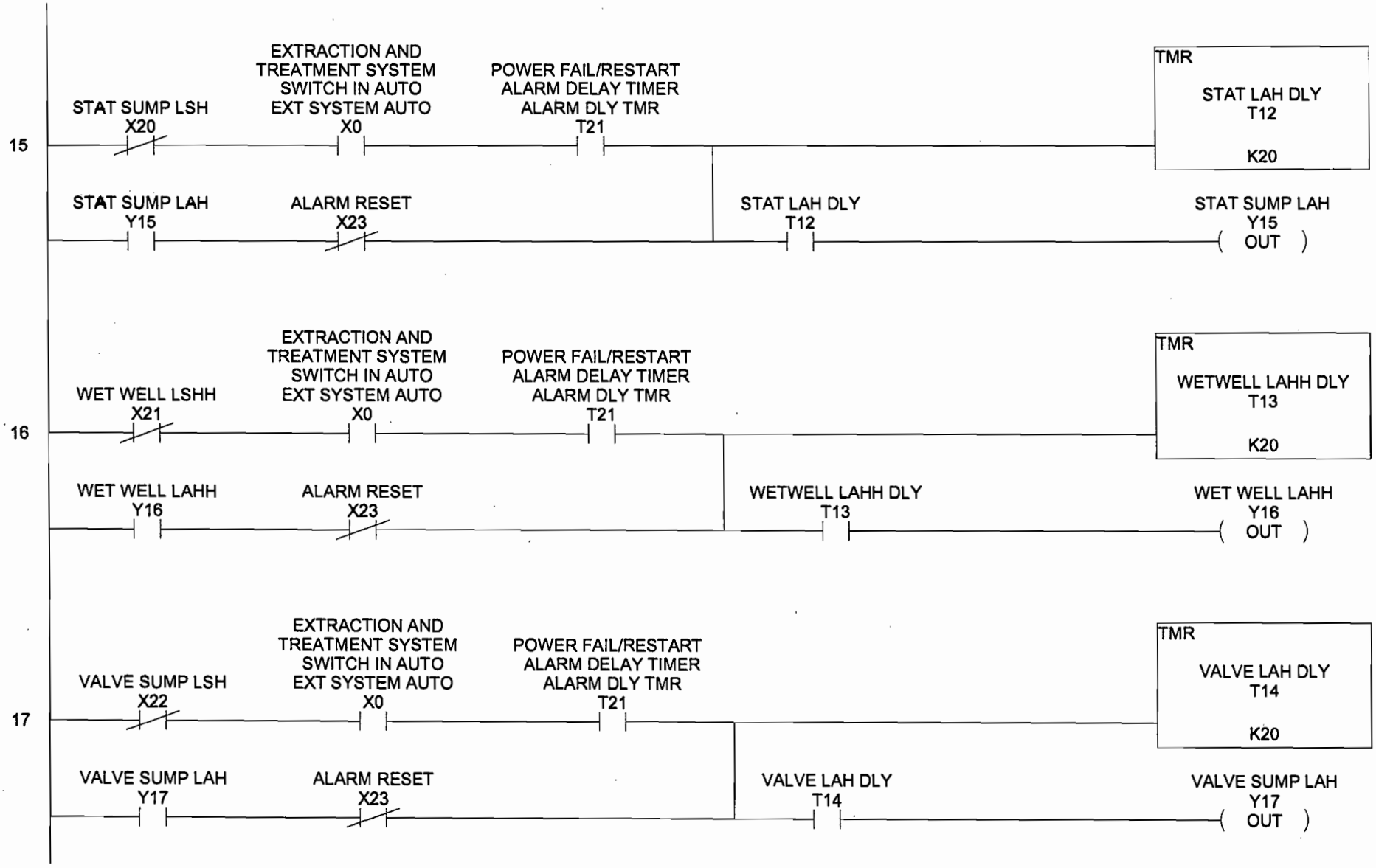
5

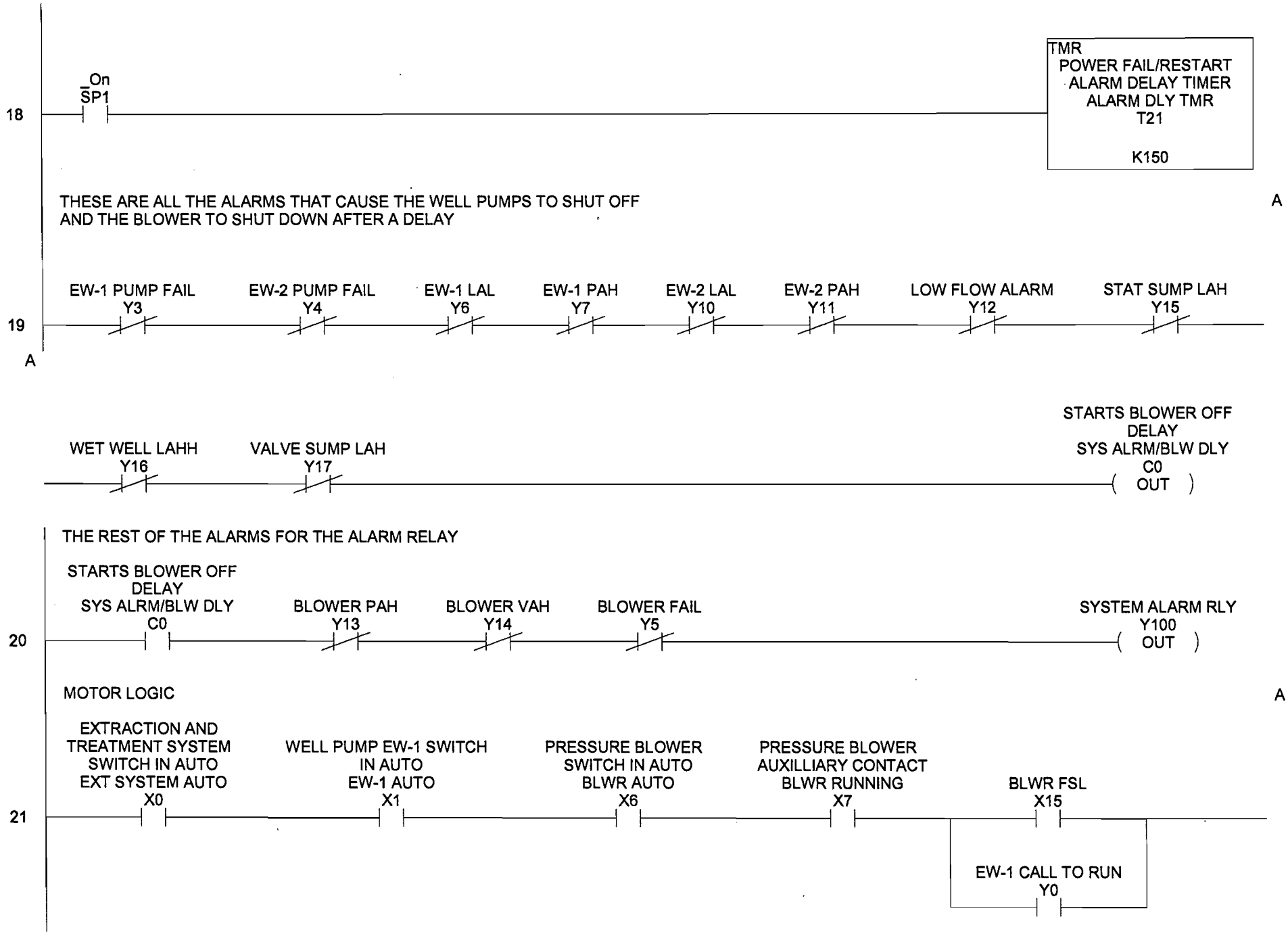



6
WELL PUMP EW-2 VFD RUNNING CONTACT EW-2 RUNNING X4
EW-2 CALL TO RUN Y1
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR T21
TMR EW-2 FAIL DLY T1 K50
EW-2 PUMP FAIL Y4
ALARM RESET X23
EW-2 FAIL DLY T1
EW-2 PUMP FAIL Y4 OUT
7
PRESSURE BLOWER OVERLOAD CONTACT BLWR OL X10
BLWR CALL TO RUN Y2
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR T21
TMR BLWR FAIL DLY T2 V10022
PRESSURE BLOWER AUXILLIARY CONTACT BLWR RUNNING X7
BLWR FAIL DLY T2
BLOWER FAIL Y5 OUT
BLOWER FAIL Y5
ALARM RESET X23
8
EW-1 LSL X11
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO X0
WELL PUMP EW-1 SWITCH IN AUTO EW-1 AUTO X1
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR T21
TMR EW-1 LAL DLY T3 K20
EW-1 LAL Y6
ALARM RESET X23
EW-1 LAL DLY T3
EW-1 LAL Y6 OUT

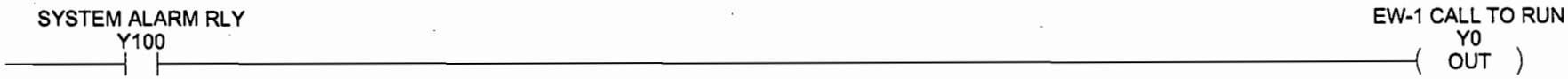

9
EW-1 PSH
X13
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
WELL PUMP EW-1 SWITCH IN AUTO EW-1 AUTO
X1
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR
T21
TMR
EW-1 PAH DLY
T4
K100
EW-1 PAH
Y7
ALARM RESET
X23
EW-1 PAH DLY
T4
EW-1 PAH
Y7
OUT
10
EW-2 LSL
X12
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
WELL PUMP EW-2 SWITCH IN AUTO EW-2 AUTO
X3
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR
T21
TMR
EW-2 LAL DLY
T5
K20
EW-2 LAL
Y10
ALARM RESET
X23
EW-2 LAL DLY
T5
EW-2 LAL
Y10
OUT
11
EW-2 PSH
X14
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
WELL PUMP EW-2 SWITCH IN AUTO EW-2 AUTO
X3
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR
T21
TMR
EW-2 PAH DLY
T6
K100
EW-2 PAH
Y11
ALARM RESET
X23
EW-2 PAH DLY
T6
EW-2 PAH
Y11
OUT


12
BLWR FSL
X15
PRESSURE BLOWER
AUXILLIARY CONTACT
BLWR RUNNING
X7
POWER FAIL/RESTART
ALARM DELAY TIMER
ALARM DLY TMR
T21
TMR
LOW AIR FLOW DLY
T7
V10020
LOW FLOW ALARM
Y12
ALARM RESET
X23
LOW AIR FLOW DLY
T7
LOW FLOW ALARM
Y12
OUT
13
BLWR PSH
X16
PRESSURE BLOWER
AUXILLIARY CONTACT
BLWR RUNNING
X7
POWER FAIL/RESTART
ALARM DELAY TIMER
ALARM DLY TMR
T21
TMR
BLWR PAH DLY
T10
K100
BLOWER PAH
Y13
ALARM RESET
X23
BLWR PAH DLY
T10
BLOWER PAH
Y13
OUT
14
BLWR VSH
X17
PRESSURE BLOWER
AUXILLIARY CONTACT
BLWR RUNNING
X7
POWER FAIL/RESTART
ALARM DELAY TIMER
ALARM DLY TMR
T21
TMR
BLWR VAH DLY
T11
K100
BLOWER VAH
Y14
ALARM RESET
X23
BLWR VAH DLY
T11
BLOWER VAH
Y14
OUT


15
STAT SUMP LSH
X20
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR
T21
TMR
STAT LAH DLY
T12
K20
STAT SUMP LAH
Y15
ALARM RESET
X23
STAT LAH DLY
T12
STAT SUMP LAH
Y15
OUT
16
WET WELL LSHH
X21
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR
T21
TMR
WETWELL LAHH DLY
T13
K20
WET WELL LAHH
Y16
ALARM RESET
X23
WETWELL LAHH DLY
T13
WET WELL LAHH
Y16
OUT
17
VALVE SUMP LSH
X22
EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
POWER FAIL/RESTART ALARM DELAY TIMER ALARM DLY TMR
T21
TMR
VALVE LAH DLY
T14
K20
VALVE SUMP LAH
Y17
ALARM RESET
X23
VALVE LAH DLY
T14
VALVE SUMP LAH
Y17
OUT

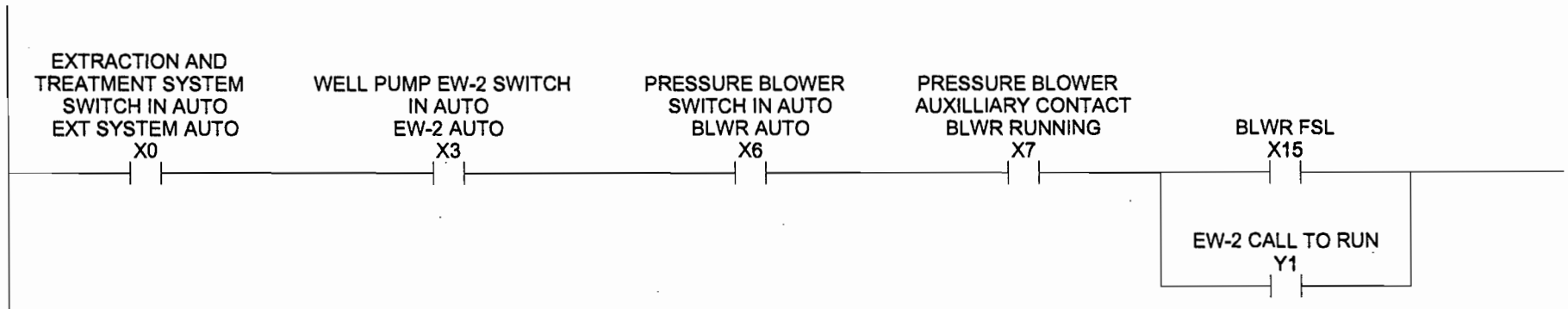

18
_On
SP1
TMR
POWER FAIL/RESTART
ALARM DELAY TIMER
ALARM DLY TMR
T21
K150
THESE ARE ALL THE ALARMS THAT CAUSE THE WELL PUMPS TO SHUT OFF
AND THE BLOWER TO SHUT DOWN AFTER A DELAY
A
19
EW-1 PUMP FAIL
Y3
EW-2 PUMP FAIL
Y4
EW-1 LAL
Y6
EW-1 PAH
Y7
EW-2 LAL
Y10
EW-2 PAH
Y11
LOW FLOW ALARM
Y12
STAT SUMP LAH
Y15
A
WET WELL LAHH
Y16
VALVE SUMP LAH
Y17
STARTS BLOWER OFF
DELAY
SYS ALRM/BLW DLY
C0
OUT
THE REST OF THE ALARMS FOR THE ALARM RELAY
20
STARTS BLOWER OFF
DELAY
SYS ALRM/BLW DLY
C0
BLOWER PAH
Y13
BLOWER VAH
Y14
BLOWER FAIL
Y5
SYSTEM ALARM RLY
Y100
OUT
MOTOR LOGIC
A
21
EXTRACTION AND
TREATMENT SYSTEM
SWITCH IN AUTO
EXT SYSTEM AUTO
X0
WELL PUMP EW-1 SWITCH
IN AUTO
EW-1 AUTO
X1
PRESSURE BLOWER
SWITCH IN AUTO
BLWR AUTO
X6
PRESSURE BLOWER
AUXILLIARY CONTACT
BLWR RUNNING
X7
BLWR FSL
X15
EW-1 CALL TO RUN
Y0

A

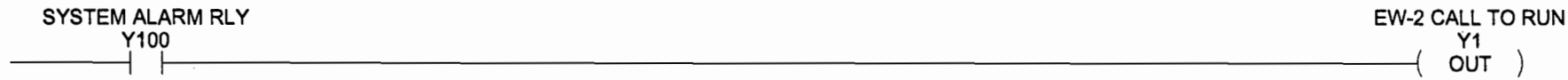

SYSTEM ALARM RLY
Y100
EW-1 CALL TO RUN
Y0
OUT

A

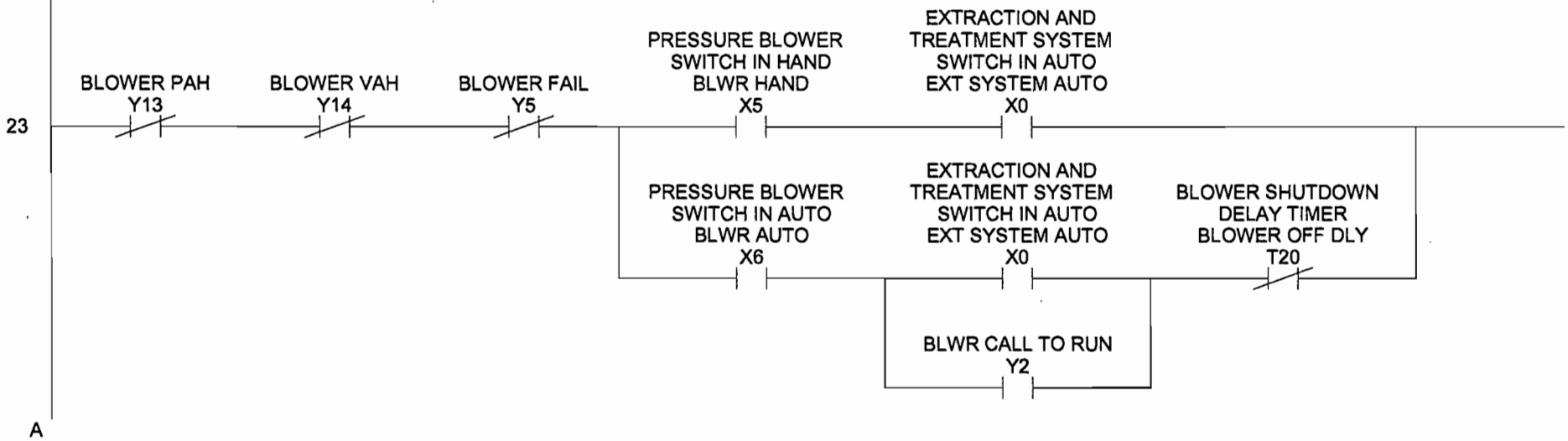
22


EXTRACTION AND TREATMENT SYSTEM SWITCH IN AUTO EXT SYSTEM AUTO
X0
WELL PUMP EW-2 SWITCH IN AUTO EW-2 AUTO
X3
PRESSURE BLOWER SWITCH IN AUTO BLWR AUTO
X6
PRESSURE BLOWER AUXILLIARY CONTACT BLWR RUNNING
X7
BLWR FSL
X15
EW-2 CALL TO RUN
Y1

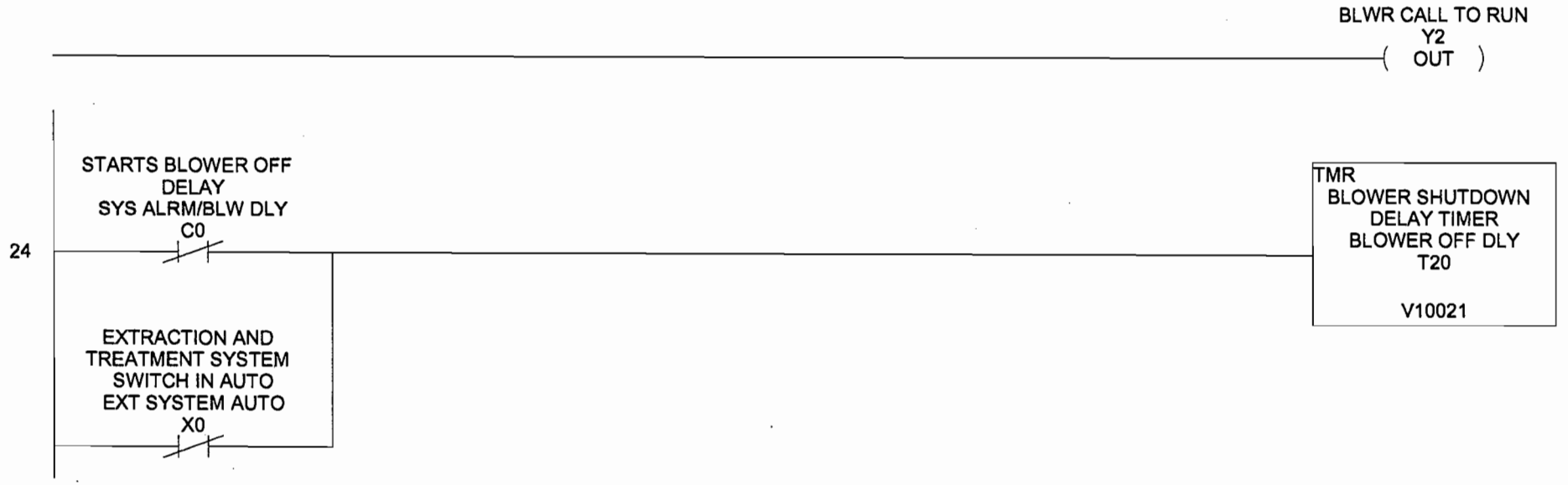
A

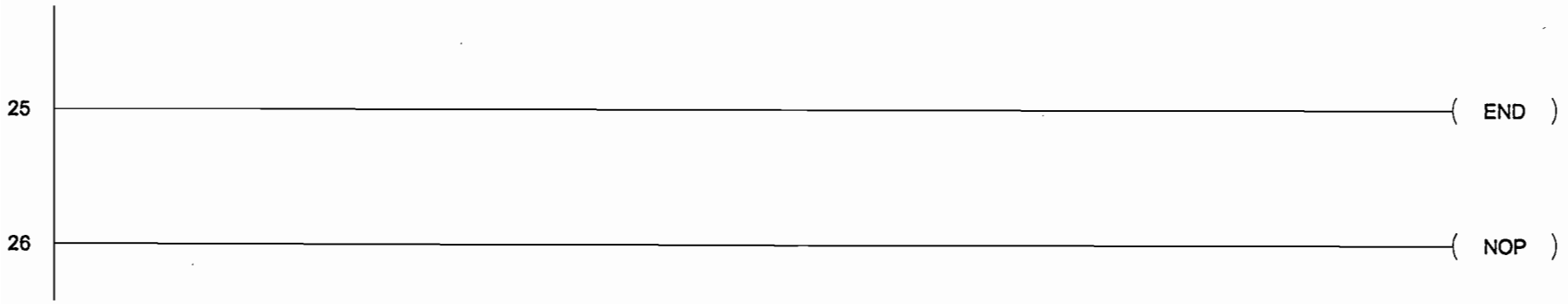

SYSTEM ALARM RLY
Y100
EW-2 CALL TO RUN
Y1
OUT

A


23
BLOWER PAH
Y13
BLOWER VAH
Y14
BLOWER FAIL
Y5
PRESSURE BLOWER
SWITCH IN HAND
BLWR HAND
X5
EXTRACTION AND
TREATMENT SYSTEM
SWITCH IN AUTO
EXT SYSTEM AUTO
X0
PRESSURE BLOWER
SWITCH IN AUTO
BLWR AUTO
X6
EXTRACTION AND
TREATMENT SYSTEM
SWITCH IN AUTO
EXT SYSTEM AUTO
X0
BLOWER SHUTDOWN
DELAY TIMER
BLOWER OFF DLY
T20
BLWR CALL TO RUN
Y2

A


BLWR CALL TO RUN
Y2
OUT
24
STARTS BLOWER OFF
DELAY
SYS ALRM/BLW DLY
C0
EXTRACTION AND
TREATMENT SYSTEM
SWITCH IN AUTO
EXT SYSTEM AUTO
X0
TMR
BLOWER SHUTDOWN
DELAY TIMER
BLOWER OFF DLY
T20
V10021


25
END
26
NOP

-Tetrasolv Model VF-1000

TetrasolvFiltration

Operation & Maintenance Manual

VFD • VFV • VF • VR SERIES

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

Tetrasolv Filtration Vapor Filters

CONTENTS

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***

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

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 (> 125° 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.

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

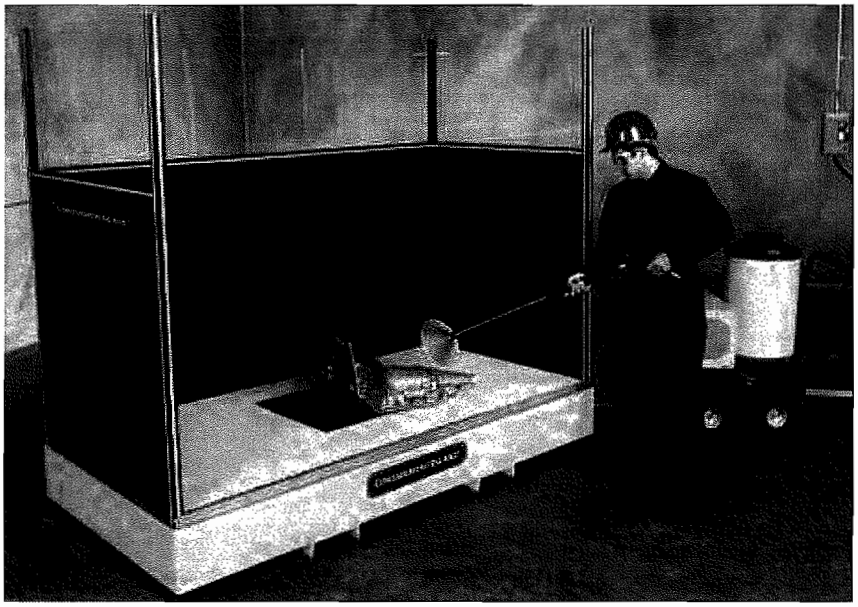
If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

Monitor the system closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

-Pressure Island CIE 4800 Containment Island
-Jenny Products Steam Jenny
-Grundfos Sink-paQ System
-Grundfos JPF-A, JPS-a, and JDF-A Jet Pumps
-Amtrol Well-X-Troll Tanks

Operator's Manual

Containment Island®



Models CIE 4800 and 8800

PRESSURE ISLAND®

THE NEXT GENERATION IN CLEANING™

Table of Contents

1. Introduction

Thank you for purchasing your Containment Island.

A Purpose

This manual covers the operation and maintenance of the CIE 4800. All information contained in this manual is based on the latest information available at the time of printing.

The CIE system is designed to operate with water or aqueous based solutions. Do not use other fluids without first contacting and receiving approval from Pressure Island. Operating the CIE system with solutions for which it was not designed will void the warranty.

B Scope

This manual applies to Containment Island (CIE 4800). If more detailed instructions are necessary, consult the manufacturer's documentation attached in Appendix A. For further information, contact Pressure Island Customer Service at (650) 780-7900 Ext. 222.

C Owner/User Responsibility

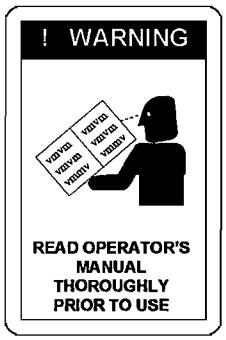
The owner and/or user must have an understanding of the manufacturer's operating instructions and warnings before using this Containment Island system. Warning information should be emphasized and understood. If the operator is not fluent in English, the manufacturer's instructions and warnings shall be read to and discussed with the operator in the operator's native language by the purchaser/owner, making sure that the operator comprehends its contents.

Owner and/or user must study and maintain for future reference the manufacturers' instructions.

This manual should be considered a permanent part of the machine and should remain with it if unit is resold.

When ordering parts, please specify model and serial number.

D Important Safety Instructions



WARNING: To reduce the risk of injury, read operating instructions carefully before using.

1. Read the owner's manual thoroughly. Failure to follow instructions could cause malfunction of the unit and result in death, serious bodily injury and/or property damage.
2. All installations must comply with local codes. Contact your electrician, plumber, utility company or the selling distributor for special details.

WARNING: Keep water spray away from electrical wiring or fatal electric shock may result.

3. To protect the operator from electrical shock, the machine must be electrically grounded. It is the responsibility of the owner to connect this machine to a UL grounded receptacle of proper voltage and amperage ratings. Do not spray water on or near electrical components. Always disconnect power before servicing.

4. Eye safety devices and foot protection must be worn when using this equipment.
5. Protect your CIE system from freezing.
6. Do not allow acids, caustic, or abrasive fluids to pass through the pump without obtaining approval of cleaning compound(s) from Pressure Island.
7. Do not allow CHILDREN to operate this equipment at any time. THIS MACHINE MUST BE ATTENDED DURING OPERATION.

8. The best insurance against an accident is precaution, and knowledge of the machine.

9. Do not operate this product when fatigued or under the influence of alcohol or drugs. Keep operating area clear of all persons.

10. Pressure Island will not be liable for any changes made to our standard units, or any components not purchased from Pressure Island.

11. Do not overreach or stand on unstable support. Keep good footing and balance at all times.

12. Follow the maintenance instructions specified in this manual.

13. When maintaining equipment or making repairs, disconnect from electrical source.

14. Any alterations or changes to the equipment and/or use of unauthorized chemicals will void all warranties.

2. Description of the Equipment

The Containment Island System consists of the following major components:

- Main Structure
- Electrical System
- Reservoir Filling System
- Circulating System
- Ozone Generating System
- Oil Skimmer
- Controls

A Main Structure

The main structure consists of a bolted frame, a polypropylene tub weldment, a three sided wall assembly (consisting of anodized aluminum posts and polypropylene/polycarbonate wall panels), tub cover and floor non-skid mat.

B Electrical System

The electrical system consists of the power cord with a 3 prong grounded plug, a 20 amp fuse, switches and other electrical components and associated wiring and connections. See Schematic Diagram No. 02-00138.

C Reservoir Filling System

The reservoir filling system consists of an inlet fitting, a solenoid shut-off valve, a float switch and associated plumbing.

D Circulating System

The circulating system consists of a diaphragm pump, a 150 and 50-micron filter assembly, a water outlet fitting and associated plumbing.

E Ozone Generating System

The ozone generating system consists of a recirculating pump, inlet strainer, venturi injector, ozone generator and associated plumbing.

F Oil Skimmer

The oil skimmer is an electrically driven belt and pulley system used to remove oil residue from the surface or the wash water.

G Controls

The control panel assembly contains three (3) ON/OFF switches: wash, ozone and oil skimmer. Each switch has a built-in light indicating the ON position.

- Wash Switch – Actuates the pumps providing water to the Pressure Washer inlet and filters.
- Ozone switch – Actuates the ozone generator and circulating pump.
- Oil skimmer switch – Actuates the oil skimmer.

3. Description of Operation

A Reservoir Fill (Inlet)

A hose is connected to the inlet fitting and is used to fill the reservoir. A solenoid valve, actuated by a float switch, shuts the water supply when the reservoir is full and is used to maintain the proper water level.

B Circulating Pump

The 150 and 50-micron filter assembly is connected to the outlet side of the diaphragm pump. The diaphragm-pump supplies filtered water to the wash pump.

C Pressure Washing or Steam Cleaning

The item(s) to be cleaned are placed on the floor of the Containment Island where they are pressure washed or steam cleaned. Wash water is contained within the walls and drains into the reservoir where it is filtered and recirculated to your pressure washer or steam cleaner.

D Ozone Generator

Ozone is injected into the wash water to prevent bacteria buildup and eliminate odors. A circulating pump draws water from the reservoir and pumps the water through a venturi injector. The venturi draws ozone from the generator and is injected into the water.

E Oil Skimmer

The oil skimmer is used to remove excess oily residue from the surface of the wash water. The oily water is expelled from the skimmer through the outlet tube into a suitable container (not included). Monitor the container while using the oil skimmer to prevent overflow because the oil skimmer removes some water.

Oil removal efficiency is increased when the water temperature is warm (such as when the unit has been operated) and when the water in the reservoir is quiescent. Therefore, the recommended time to use the oil skimmer is immediately after unit operation.

4. INSTALLATION INSTRUCTIONS

IMPORTANT

PLEASE READ INSTALLATION INSTRUCTIONS THOROUGHLY

Your **Containment Island** has been tested at the factory prior to shipment. The machine has been filled with water and all pumps and motors have been tested for proper operation.

A Installation

Your unit has been delivered on a pallet that has been custom designed to ensure that your unit arrives in perfect condition. Care must be exercised in removing the unit from the pallet. Once the unit has been lifted from the pallet, movement of the machine is accomplished with a pallet jack or forklift.

Requirements

- 110 volt, 1 phase AC power standard
- 20 amps
- a water source to provide water for the auto-fill function.

Be careful while installing your **Containment Island** unit!

1. Remove all banding and corner stops before taking it off the pallet
2. Use a forklift or pallet jack to move the Containment Island unit
3. Place the unit on **LEVEL FLOORING** with plenty of space to walk around it. Adjust the leveling feet to assure proper leveling.

B Assembly Procedure

See Wall Assembly Drawing No. 02-00143 for assembly and parts list.

C Wall Assembly Instructions

1. Install Wall Posts (Item 5) in each corner of the polypropylene tub. See Detail 1, 1A, and 1B. Detail 1B is a top view of the post resting in the corner of the tub. Insert the carriage bolts from the inside of the tub extending out through the yellow support bracket, leaving a small space between the square head of the carriage bolt and the tub flange (See Detail 1A). The nut and washers can then be loosely attached. Insert the posts by dropping the bottom of the post onto both of the carriage bolt heads. Each bolt must be lined up square in order to accept the vertical post (See Detail 1A). Once the posts are resting on the polypropylene surface, tighten the carriage bolt nuts. Repeat for all four posts.
2. Lower Back and Side Walls (Items 20 and 21). The bottom of each wall can be identified by the flat/non-routed edge. Each wall is 48" in height and ½ " thick, having each side and the top routed to expose a ¼" tab to be inserted into the wall posts and horizontal beams. **It is important to have the routed surface facing out. Refer to Detail 2.** Care should be taken when handling the walls, as the routed edges are subject to damage if mishandled.
3. Assemble the walls by lifting the bottom of each panel approximately half way up between two posts and inserting the routed edge into the open slots on the posts. Once routed edges are inside the extrusion posts gently lower the wall to rest on the tub surface. Repeat for all three walls.
4. Crossbeam Posts (Items 6 and 7) The back and side crossbeams are installed with two end bracket assemblies that will attach them to the vertical posts. Each bracket assembly consists of one black anodized aluminum bracket (Item 8), 4 black button head screws (Item 11) and 4 double nuts (Item 12). Assemble and install the brackets as shown in details 3 and 3A. Insert the screws through the bracket and loosely fasten onto the flat side of the double nut.

5. Insert two of the assembled brackets (one on each end) into the same open slot on the crossbeams as shown in Detail 3. If the screws are fastened too far into the double nuts they may need to be backed out in order to allow for insertion of the nuts into the slot of the extrusion. Insert the vertical double nuts on both of the brackets into the vertical posts. **Gently and evenly** lower the crossbeam between the two vertical posts until the lower wall routed edge is inserted into the bottom slot of the crossbeam. Push the two vertical posts toward each other in order to be sure that the lower wall and crossbeam are properly seated. Tighten screws on the brackets to fasten the crossbeam and vertical posts. Repeat for the remaining two walls.
6. Upper back and side walls (Items 22 and 23). Remove the protective coating from the walls. Slide each wall into the inside slots of the vertical posts. Install end caps (Item 10) on the vertical posts.

D Control Panel Assembly Instructions

5. Operating Instructions

- Plug the power cord into a grounded 110VAC receptacle (20 amp minimum).
- Attach a water hose to the Inlet fitting of the CIE.
- Attach the hose from the inlet connector of your pressure washer or steam cleaner to the Outlet fitting of the CIE.
- Place the wash switch in the ON position.
- Turn on the water and fill the reservoir. The autofill valve will shut off the water supply when the reservoir is full. Leave the water hose turned on during washer operation to maintain the proper reservoir fill level.
- Your pressure washer or steam cleaner is ready to operate.
- During the wash cycle, operate the Ozone Generator and circulating pump, as required, by actuating the Ozone switch. Ozone is injected into the wash water to prevent bacteria buildup and eliminate odors.

Caution

Monitor the ozone circulation pump outlet for excess foaming

- To remove excess oil residue from the wash water, place the Oil Skimmer switch in the ON position. For maximum efficiency, use the Oil Skimmer when the wash water in the reservoir is warm and the water in the reservoir is quiescent, such as immediately after operation and shut down. Monitor the container that catches the oily water to prevent overflow.
- To stop the wash cycle, place all switches in the OFF positions and turn off the inlet water hose.

6. Preventive Maintenance

In order for your CIE unit to perform according to the specifications the following maintenance should be performed.

Accessibility for Maintenance

- Access to the Motor Enclosure is through the motor enclosure cover.
- To access the main reservoir, raise the floor panel assembly.

A Process Water Reservoir

The water in the reservoir will need to be changed at the operators' discretion. Frequency will depend on how dirty the parts are and how often the machine is in operation. The polypropylene tub reservoir should be inspected regularly.

B Inlet Screen

There is a mesh inlet screen for the ozone pump and the circulation pump located in the reservoir. These inlet screens should be inspected and cleaned as necessary.

Operating the CIE unit at any time without the inlet screens will void the warranty.

C Oil Skimmer

The oil skimmer catch pan should be checked regularly.

7. TROUBLESHOOTING

Problem/Symptom	Possible Cause	Solution
Reservoir overflows	1. Power Cord disconnected 2. Main fuse failed 3. Defective float switch 4. Defective solenoid valve	1. Connect power cord 2. Replace fuse 3. Replace float switch 4. Replace solenoid valve
No water pressure at the outlet	1. No power to pump 2. Defective switch 3. Defective pump	1. Check power cord and main fuse 2. Replace switch 3. Repair or replace pump
Oil Skimmer does not operate	1. No power to the skimmer 2. Defective switch 3. Defective oil skimmer	1. Check power cord and main fuse 2. Replace switch 3. Repair or replace oil skimmer
Ozone generator does not turn on	1. No power to the unit 2. Defective switch 3. Defective unit`	1. Check power cord and main use 2. Replace switch 3. Repair or replace unit
Ozone generation system has no output flow	1. No power to the pump 2. Defective switch 3. Defective pump	1. Check power cord and main fuse 2. Replace switch 3. Repair or replace pump

NOTE: See Vendor Data, shipped with the unit, for Troubleshooting of Specific Components not covered above.

PRESSURE ISLAND®

THE NEXT GENERATION IN CLEANING™

An EZ Environmental Solutions Company

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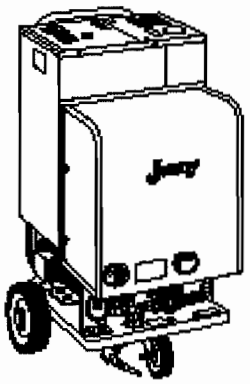
All Electric Machines

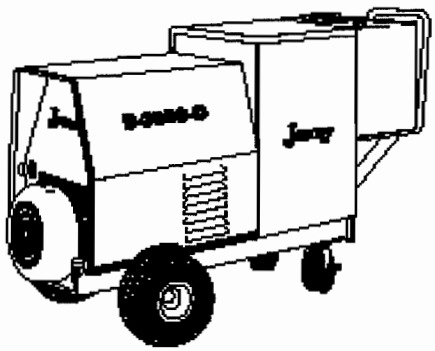
All Models

Jenny Products, Inc.
850 North Pleasant Ave.
Somerset, PA 15501
Ph: (814) 445-3400
Fax: (814) 445-2280

Owner's Manual

- Assembly & Start-up
- Operation
- Maintenance
- Cleaning Compounds & Mixing
- Trouble Shooting





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Thank you !

For ordering a **Jenny**®. Jenny has been manufacturing steam cleaners and pressure washers since 1927. We feel sure that each day you will appreciate more and more the savings in time and labor and the profit-making possibilities afforded by your new Jenny. Special attention has been given to every detail of engineering design, perfection of manufacturing methods, individual part inspection and thorough testing upon completion to assure the continuous trouble-free operation of your Jenny.

In short, your Jenny was designed and made by customer-minded workers. If you, for any reason, fail to find that our product serves as you believe it should, you will be doing yourself and us a favor by telling our Customer Representative, through our Distributor - or direct, just how our product has failed to please you. Over the years we have found that when troubles are reported by our customers, both of us profit. So please help us to serve you properly, which is our first desire.

Jenny Cleaning Compounds are made exclusively for use with Jenny and are the best, most economical and most effective cleaning agents you can employ. They have no gritty or insoluble matter which might damage the coils or pumping mechanism of your unit. They contain active chemicals and are highly concentrated for 100 per cent cleaning and maximum economy. Your Jenny Distributor will be pleased to supply your needs.

In the march of progress, engineering and design changes are inevitable, therefore, we reserve the right to vary our designs and/or specifications without implying that they need to be installed on previous models. If you have occasion to order parts or request information about your Jenny, be sure to give model and serial number.

You will find this booklet a valuable guide to the proper and safe operation and maintenance of your new Jenny. It is intended to be used by anyone using or maintaining the equipment. Follow the instructions carefully and you will assure yourself of the utmost in cleaning efficiency and economy.

How we clean...

There are four elements necessary for efficient cleaning no matter what method is used. They are:

1. WATER
2. CHEMICAL
3. HEAT
4. PRESSURE

Varying any one of these four elements will change the cleaning characteristics. Because of this, compensation can be made for deficiencies in any element. In other words, if you were to use a small amount of chemical, or a weak one, then by adding more heat or pressure effective cleaning could be attained. However, for any type of cleaning, there is always **one** *combination* of these elements which produces the best results from a standpoint of time required, thoroughness and cost.

Washing one's hands is an example of the four "elements of cleaning" at work. When hands are simply coated with a dried non-greasy deposit, water alone will wash it away. A high volume of free flowing water will speed the process because the impinging force loosens the dirt and the volume floats or flows it away.

When dirt contains an oil, or grease, a chemical must be used. In hand-washing the chemical is commonly referred to as soap. Because soap is an emulsifier, the hands can be cleaned, to some degree, using cold water. After the soap is applied, the hands are rubbed briskly together. The friction creates heat plus an abrasive action, which help to break down and loosen the dirt particles. Using hot free-flowing water will result in faster cleaning as the soap and heat will emulsify the dirt more effectively, while the impingement of the pressure loosens it and the volume carries it away.

Steam Cleaning Concept

Someone once thought that if cleaning efficiency increases in ratio to the temperature of water used, then steam would provide an excellent cleaning medium. They quickly learned, however, that steam being a wholly gasified liquid-lacking in mass or body-will not clean. Steam, for cleaning purposes, can be compared with air as used in sandblasting. Air in itself does not clean. It is only the carrying medium. The sand particles actually do the cleaning. When this fact became known, the next logical step was to blend water with the steam thus providing body for impingement and flushing action. But this, too, proved to be ineffective. The heat of this steam did tend to break down the dirt deposit, and the added water provided a moving force. But the end result was simply displaced dirt . . . dirt moved from one area to another. It was quite evident that another element was necessary if *thorough* cleaning was to be done.

A chemical was next added to provide an emulsifying agent. Now with water, steam and chemical, the dirt was emulsified, loosened and carried away.

THIS, IN ESSENCE, IS EXACTLY HOW A JENNY STEAM CLEANER OR PRESSURE WASHER OPERATES AND CLEANS. IT COMBINES, IN BALANCED COMBINATION, THE FOUR ELEMENTS NECESSARY FOR EFFECTIVE THOROUGH CLEANING . . . WATER, CHEMICAL, HEAT AND PRESSURE.

Pressure Washer Concept

The next logical step for Jenny was to find differing combinations of the four basic cleaning elements that were effective and performed a thorough cleaning job. It was clearly evident that changes in any one of the four elements of cleaning could be compensated for by changes in another element. From the varied attempts, it was clearly evident that a balance could be reached using a lower temperature or ambient temperature at a very high pressures and increased volumes of water. This conclusion brought forth the Hot Pressure Washers and Cold Pressure Washers.

How a Jenny Works...

It should be made clear at this point that a steam cleaner does not generate steam in the true sense of the word. The name of the machine is a gross misnomer. It is actually a CHEMICAL VAPOR SPRAY CLEANER!

The reason the name has persisted is because the vapor spray directed through a cleaning gun does resemble steam. Actually it consists of 85-90% solid water. The remaining steam is a by-product of creating pressure through heat. Because the name steam cleaner is synonymous with this type of cleaning device we will continue to refer to the machine as such.

At normal atmospheric pressures water heated in an open pan boils at 212° F. However, if the pan is covered, such as in the case of a pressure cooker, the water can be heated to temperatures above 212°F before boiling. Much the same happens in a Jenny Steam Cleaner . The heating coil located within the combustion chamber of a steam cleaner is subjected to intense heat. As cold water is pumped through the heating coil an orifice, or restriction, placed at the discharge end impedes its flow. As the water is heated it cannot expand, nor convert to steam, because of the "artificial atmosphere" created by the restriction. Because this condition exists the water reaches a temperature of 325°F., and yet remains in solid form. Once past the restriction the water does have a chance to partially vaporize and when finally escaping to atmosphere the temperature immediately drops to its atmospheric boiling point (212°F). As this happens the spray bursts into millions of tiny droplets of water having a great impingement force (The expansion of the water to Psteam can be up to 170 times).
Typically, the operating temperatures of pressure washers are far below a steam cleaner's 325 Degrees F running somewhere between ambient temperature and 180-200 Degrees F

depending on the type of pressure washer. Since these temperatures are below the boiling point of water, the water is incapable of producing pressure through elevated temperatures. Consequently, another method of producing pressure must be employed. High pressure and volume pumps are employed to achieve the desired pressures. The high pressure pumps are capable of producing incredible water pressures at very high flow rates. The pressures can reach upward of 5000 pounds per square inch (PSI) and the volumes can be as great as 10 gallons per minute (GPM).

Pressure Washers do not create steam at 325°F and subsequently do not achieve thier impingement forces the same way as do steam cleaners. Pressure washers achieve thier impingement force through the use of higher pressures and volumes since the temperatures produced do not cause a vapor expansion like a steam cleaner. Pressure washers make up this defficiency in temperature with the combination of increased pressures and volumes. The pressures can reach upward of 5000 pounds per square inch (PSI) and the volumes can be as great as 10 gallons per minute (GPM). This allows pressure washers to achieve similar cleaning results as steam cleaners since the inreased pressures and volumes will compensate for the temperature differences.

There are basically two types of pressure washers; Hot Pressure Washers and Cold Pressure Washers. The both work in a very similar manner with the only difference being the addition of heat.

Hot Pressure Washers function somewhat differently than Steam Cleaners although they both may have almost completely identical systems. Hot Pressure Washers do not create steam at 325°F and subsequently doe not achieve thier impingement force as the super heated water reaches the atmosphere as described above. However, the water is heated to approximately 160° to 200°F and the impingement force is attained from the very high pressure and volume generated by the pumping system. This allows Hot Pressure Washers to achieve very similar cleaning results as steam cleaners on many applications.

Cold Pressure Washers, as the name implies, use cold or ambient water temperatures in the cleaning process. With the lack of heat, we found that by using a larger volume of water at significantly increased pressures we could achieve similar cleaning results as many steam cleaners and hot pressure on applications where the cleaning was not grease or oil based. Unlike a steam cleaners which achieve thier impingement force from the 140-170 times expansion of super heated water hitting the atmosphere, cold pressure washers attain this force through shear pressure and an increased volume.

It must be noted at this time, that every type and style of pressure washer and steam cleaner has certain applications in which they will produce the best overall cleaning result based on the application, specified criteria, time required, cost, and thoroughness of the job. Not any one machine is the best overall at every application. There is continually a trade off of effective versus efficient cleaning.

This continual trade-off led to the idea of the Combination machine. Combination machines combine the cold pressure washer, hot pressure washer into the same unit, hence, the name Combination Machine. With these types of unit, you get the versatility of 3 cleaners in 1. As

easy as flipping a switch, the machine can go from a cold pressure washer to hot pressure washer. Change the tip in the gun and flip the machine selector switch, and the machine becomes a 325°F steam cleaner.

Jenny's Four Basic Systems...

A Jenny Steam Cleaner or Hot Pressure Washer has four basic systems. They are:

1. WATER
2. SOLUTION (chemical or "soap")
3. FUEL
4. ELECTRICAL

Through these four basic systems we combine the cleaning elements (water, chemical, heat and pressure) in a fully self-contained unit. These four systems will be described in more detail.

WATER SYSTEM
Water enters into the system through an inlet strainer into a float valve and into the float tank. The inlet strainer will filter out particles that are being carried in the water supply hose. The float valve and float tank provides the system with a 3" water break so that a backflow condition cannot arise, as well as, 1.5 gallons of reserve water to help with fluctuating water supply conditions. The float valve in the float tank helps maintain the proper water level in the float tank.

Water is drawn from the float tank, at a constant volume, through an outlet strainer by the pump where the pressure is increased dramatically. The pump is equipped with an accumulator, a device which absorbs hydraulic pulsations in the water system created by the actions of the pump. Because the unit is equipped with nozzle control, an unloader, a flow actuated valve, is also connected to the outlet of the pump. The unloader diverts the water from the pump back to the float tank when the cleaning gun is closed.

In Combination units, a panel-mounted selector valve is used on the output side of the pump to return a fixed volume of water back to the float tank. The volume of water "dumped" in this fashion is determined by an orifice placed in the return line and the amount the valve has been opened. The valve used to control this dumping is called the selector valve. In its closed position, it permits the full pumped volume of water to pass through the heating coil; when this valve is opened, a measured volume of water returns to the float tank, thus reducing the volume of water pumped through the heating coil which subsequently increases the temperature rise of the pumped water.

The discharge line from the pump connects to the inlet of the unloader valve which diverts the flow of water back to the float tank when the hand operated valve on the cleaning gun is closed. The water then flows (when the hand operated valve is in the open or on position) through a flow switch which controls the operation of the fuel solenoid and the solution solenoid. Just before the coil inlet there is a pressure relief valve which will protect the coil

and pump from a blocked cleaning gun and will provide an indication of restrictions which may be present in the coil. Water passes through the coil, where it is heated, and then into a fitting assembly which includes a fixed setting high temperature limit thermostat. This thermostat protects the system from being over heated. The hose and cleaning gun are attached to the coil outlet fitting assembly. The cleaning gun can be fitted with either a pressure wash tip or, in combination units, a steam nozzle and orifice assembly. The pressure tip and steam orifice restrict the flow of water through the system and cause the unit to operate at the correct pressure with the appropriate temperature rise. Because this unit is equipped with nozzle control, the cleaning gun handle is also a valve which will turn the cleaning spray on or off.

SOLUTION SYSTEM

The solution system for these units consists basically of a solution tank or a separate container, a solution metering valve, and often a solution solenoid valve. Solution, in a high pressure soap system, is either metered directly from the solution tank into the float tank using a gravity feed system, or is drawn from the tank or solution container by the pump. In some cases, a soap injector is used to draw soap into the system, however, this is achieved only under low pressure applications and usually requires a special soap tip. Regardless of the system being used, the soap is drawn through a metering valve so that the desired levels of solution concentration can be obtained.

ELECTRICAL SYSTEM

The electrical system for the all electric units has three primary functions. The first function is to operate the control circuitry; the second is to power the electric motor; and the third is to heat the water for steam or pressure cleaning. The control circuitry for the all of the all-electric units is 24VAC. The 24VAC is achieved through a control transformer which steps down the incoming 3 phase power from 230, 380, 460, or 575 volts and supplies the 24 volts. This isolates the sensitive controls from the incoming power line. The power coming from the control transformer passes through a fuse and into a normally open low water cut-off water switch. The switch will not actuate until the proper water line pressure is attained or will shut the unit down in case or a water pressure loss. This keeps the unit from running in case of either a no water condition or a low water condition. The switch is factory set to ensure that the machine will get the required water to operate properly and safely. Next in the electrical system is the motor switch controls a motor starter which starts and stops the motor as well as protects the motor from overheating. From this switch, the control circuit power is routed through the overload relays to ensure that the motor is not shutdown due to overload condition. This ensures that the motor is running before any other components in the system can operate. After the overload relay, the next component is the flow switch which controls the heating system and the soap system. The flow switch must see water passing through it in order to actuate either the soap or heating system. This is handled through a relay controlled by the flow switch. The relay allows the actuation of the heating system contactor and the soap system solenoid valve. The soap solenoid is opened when flow switch is activated. The amount of soap is controlled through a soap metering valve on the machine. The heating system is is controlled by both the flow switch and an On/Off switch located on the control panel. If both the flow switch and the heater on/off switch are actuated, then the heater contactor is engaged which powers up the heating coils. Some of the heating coils are controlled by a thermostat switch allowing the operator to adjust the overall temperature of the outlet water. Many of the machines systems and controls work in conjunction with one another to produce the desired cleaning results.

IMPORTANT!

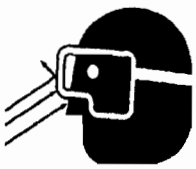
SAFETY AND HEALTH INSTRUCTIONS FOR SAFE USE

⚠DANGER

THIS PRODUCT CAN CAUSE SERIOUS INJURY OR DEATH IF NOT USED IN ACCORDANCE WITH THE FOLLOWING SAFETY INSTRUCTIONS. WE CAN NOT ANTICIPATE EVERY POSSIBLE CIRCUMSTANCE THAT MIGHT INVOLVE A POTENTIAL HAZARD. THE WARNINGS, CAUTIONS, DANGERS, AND SAFETY SUGGESTIONS ARE THEREFORE NOT ALL INCLUSIVE. AS THE OWNER YOU ARE RESPONSIBLE FOR THE SAFE OPERATION OF THIS EQUIPMENT. ALWAYS MAKE SURE THAT ANYONE USING THIS EQUIPMENT HAS READ THIS MANUAL AND FOLLOWS THE SAFETY WARNINGS TO HELP PREVENT THE POSSIBILITY OF PERSONAL INJURY TO THE OPERATOR OR ANYONE ELSE. IF ANY OPERATING PROCEDURE, INSTALLATION, MAINTENANCE, OR WORK METHOD NOT SPECIFICALLY RECOMMENDED IS USED, YOU MUST SATISFY YOURSELF THAT IT IS SAFE FOR YOU AND OTHER PERSONS. YOU MUST ALSO ENSURE THAT THE PRODUCT WILL NOT BE DAMAGED OR MADE UNSAFE BY THE PROCEDURE YOU CHOSE.

In the event that an injury does occur, please seek medical attention at once since the equipment may cause injuries that are not initially recognized.

1. Wear proper protective clothing and equipment.



Wear full eye protection (preferably a face shield) while operating this product. The pressurized spray from this unit can cause severe injury to the eyes. It also may contain irritating or caustic chemicals.

Wear proper protective equipment (eye protection or full face protection) while pouring chemicals into the holding tank. Follow the instructions on the chemical container or accompanying Material Safety Data Sheet (MSDS Sheet).

Wear protective clothing, gloves, and rubber boots that is made of material such as vinyl, rubber or PVC which will help protect the operator from not only water, but the type of cleaning compound(s) being used and the type of dirt/grease being removed from the surface being cleaned.

2. Use proper electrical power.

Connect unit to a dedicated circuit of the proper voltage, proper rated circuit breaker, and wired with the proper wire size and number of conductors.

Never modify, bend, or cut the electrical plug. Improper connection could result, causing damage, injury, or death of the equipment operator. If the plug must be replaced, use only one with the appropriate NEMA configuration for the current requirements of the unit.

This machine must be connected to a UL Listed Ground-Fault Circuit Interrupter (GFCI) in accordance with the National Electric Code (NEC) Article 422-4 - Ed-31, Except as provided for in NEC 90-4.

Do not modify or disconnect the electrical ground sensing circuit if connected. This unit is essential to help protect the operator from electrical shock.

This machine must be properly grounded to avoid fatal electrical shock in the event of an electrical malfunction. A ground connector screw should be fastened into the chassis to facilitate supplemental grounding as permitted by NEC 250-91.

Do not connect any other equipment to the electrical circuit serving this unit.

Do not replace a fuse or circuit breaker with one of a higher rating without being certain the wire size is adequate to handle the increased electrical load.

Keep all electrical connections dry and off of the ground.

Observe all local and national codes for the installation of this type of equipment.

If an extension cord is required, please use the following criteria for extension cord selection.

- 0 to 25 Feet - At least the same size wire.
- 25 to 50 Feet - At least one wire size larger.
- 50 to 75 Feet - At least two wire sizes larger.

If an extension cord of too small a wire size is used, the voltage drop will be high, and this will cause the motor to draw excessive current and overheat.

If there are any questions or problems with the electrical system being used please, do not hesitate in calling a local qualified electrician.

3. Do not spray people, animals, or any living thing.

The pressurized spray from this product can cause serious injury or death if sprayed at people, animals, or any living thing. This machine is capable of producing extremely high pressures and/or temperatures. The high temperature pressurized spray can cut exposed flesh like a knife. The spray can also cause severe irritation, cuts and/or burns. It can inject water and/or harmful chemicals into the skin, and this can cause serious injury or death. To prevent this from happening, always hold the cleaning gun securely in both hands at all times. Never point spray at people,animals, or any living thing.

Never put hands or fingers over the spray tip while in operation.

If an accident occurs and the spray appears to have penetrated the skin, even if the injury appears to be minor, seek medical care immediately. Do not treat as a simple cut. Be prepared to tell a physician what chemicals you are using.

For Treatment instructions, have your physician contact the nearest regional poison information center for more information.

4. Do not spray energized electrical equipment.

Electrical power must be removed from all equipment that is being sprayed. Electrical current from energized electrical equipment can travel up the stream of pressurized water and cause serious injury or death. Remove power and "lock out" the switch box that supplies power. For more details, please refer to U.S. Department of Labor, Occupational safety and Health Administration, Regulation 29 CFR 1910.147, Control of Hazardous Energy Source (lockout/tagout).

Do not permit the cleaning gun to come into contact with any energized electrical equipment. The cleaning gun is conductive and could pass electricity to the operator which may result in injury or death.

Always respect and remain alert to potential electrical hazards.

5. Do not use in flammable or combustible atmosphere.

This product is not intended for use in locations where fire or explosion hazards may exist due to the presence of flammable vapors, liquids or gases or combustible dusts or fibers.

Do not use this product to spray flammable or combustible chemicals.

Do not use this product to spray petroleum-based solvents or chemicals.

6. Unplug or disconnect unit before cleaning or servicing.

To help prevent the risk of injury or death as a result of shock or electrocution while this product is being cleaned, serviced, or repaired, electrical power must be removed. Unplug or disconnect the power cord or "lock out" the switch box that supplies power. For more details, please refer to U.S. Department of Labor, Occupational safety and Health Administration, Regulation 29 CFR 1910.147, Control of Hazardous Energy Source (lockout/tagout).

Do not touch plug with wet hands.

Only qualified personnel should attempt any electrical repairs or trouble shooting on the equipment. Serious injury or death could result from improper repairs and/or trouble shooting.

7. Do not let the pump or heater run without water flowing through the unit.

Never allow the machine and/or the heater to run with out water flowing through the unit or with an inadequate water supply. This may cause severe damage to the machine, operator and/or bystander.

8. Never attempt to clean or wash down the machine using its own spray gun.

Do not use the spray wand of the machine to clean or wash down the unit. The machine is water protected, but it is not water proof. The pressure and/or high temperature will increase the risk of electrical shock to the operator and/or bystander, as well as, damage to the machine.

9. Do not permit untrained personnel to maintain or make repairs on this unit.

Only qualified personnel should be permitted to make any type of repairs to this unit. Improper repairs may cause this unit to malfunction which could result in serious injury or death to the operator, repair person, or bystander.

10. Never modify or alter this unit.

For your own safety as well as others, never allow this unit to be altered or modified. Modifying or altering equipment to operate in a fashion other than its original design may cause serious injury or death.

Never exceed the factory pressure or temperature rating of the system. Be sure that all accessory equipment and system components meets or exceeds the pressure and temperature developed by the unit.

11. Do not operate this unit with any of the safety controls bypassed.

This unit was designed with safety in mind. Never allow anyone to bypass, modify, or alter any of the safety devices on this unit. If any of the safety devices appear to be disfunctional, do not operate the unit and immediately contact a qualified technician.

12. Risk of Asphyxiation.

The pressurized spray from this unit can cause particles as well as vapors to become airborne. Keep a safe distance from the vapors and airborne particles. Wear protective breathing apparatus. Use only in a well ventilated area.

Never use the equipment to spray toxic chemicals. The risk of inhalation or contact with the skin may result in injury or death.

13. Do not operate with protective covers or guard removed.

Operating this machine with the protective guards or covers removed could expose high speed moving components which could allow the operator or bystander to become entangled. Entanglement in this equipment may result in serious injury, amputation, or death.

14. Do not operate with any electrical panels or covers opened.

Operating this unit with any of the electrical panels or covers opened may expose high powered electrical connections and/or components which may come in contact with the operator or a bystander or be splashed or sprayed inadvertently. Contact with high powered electrical equipment either by person or water could result in serious injury or death.

15. Do not operate unit with damaged or worn hose, fittings, clamps, or spuds.

Always check the cleaning hose, by-pass hose, fittings, clamps, and spuds prior to operation. Replace all damaged or worn items with one which meet or exceed the specifications of the original equipment. The use of an improper hose, fitting, clamp, or spud may cause the hose, fitting, clamp, or spud to rupture which could result in serious injury or death.

Never attempt to stop or deflect a leak with any part of your body (including the use of a rag). The risk of injection is present.

16. Do not repair damaged hose or fittings.

Replace all damaged hoses and/or fittings with ones which meet or exceed the specifications of the original equipment.

Do not use the hose if cuts, leaks, abrasions, bulges, or coupling damage is evident.

Never remove any hose or fitting while the unit is on. The risk of fluid injection is present.

17. Do not route hose in a manner that will cause sharp bending, kinking, cutting, abrasion, or exterior damage.

18. Do not pull on the hose to move the unit, untangle knots, or any other excessive pulling stress.

19. Do not attempt field repairs on the hose or repairs through an unauthorized hydraulic repair shop.

The hose, couplings, and crimping specifications are specially designed and manufactured for use with steam cleaners and pressure washers and are different from standard hydraulic hose. Contact the nearest distributor for repair or replacement of the damaged hose.

20. Provide at least three (3) feet of clearance to adjacent construction.

21. Always release the system pressure from the cleaning gun and hose prior to service, storage, daily shutdown, and/or disconnecting the hose or gun from the unit.

Always release pressure from the cleaning gun and hose prior to service, storage, daily shutdown, and/or disconnecting the hose or gun from the unit. Pressure contained within the unit could be released unexpectedly and could cause injury.

22. Never leave an operating machine unattended.

Always shut off the machine and relieve the system pressure before leaving the unit. Never leave an operating machine unattended.

23. Never allow children or any unauthorized persons to operate the machine.

Allow only person trained in the use of the equipment to operate the unit. Never allow children or unauthorized personnel to operated the unit. Keep all persons at a safe distance when the machine is being operated.

24. Chemicals used for cleaning are dangerous.

The cleaning chemicals used in conjunction with steam cleaners and pressure washers can be very aggressive not only on the surface being cleaned, but on the operator or bystander. Proper care must be exercised when using cleaning chemicals.

Keep all chemicals out of the reach of children.

Proper safety precautions must be taken when handling, storing, and using chemicals.

Always have a clean supply of water available to wash off any chemicals that have come in contact with the skin and/or eyes.

If any contact occurs with the eyes, immediately flood the eyes with clean water for at least 15 minutes and seek medical attention at once.

If contact occurs with the skin, flood the affected area for 15 minutes with clean water. If irritation persists, seek immediate medical attention.

If chemicals are swallowed, follow the label product label directions and seek immediate medical attention.

For Treatment instructions, have your physician contact the nearest regional poison information center for more information.

Always read and understand the Material Safety Data Sheet (MSDS) on all chemicals before using them.

25. Use only Jenny Products repair parts and accessories.

To preserve the safety features that are built in to this product, use only Jenny Products repair parts and accessories.

This product must be periodically serviced in accordance with the instructions in this owner's manual.

Assembly & Initial Start-up Procedure

Your Jenny unit was tested at our factory as part of the manufacturing process. The machine will function as designed if properly assembled, set up, and operated.

1. Check the box for possible shipping damage.

   If extensive damage is apparent to the box, please notify the freight carrier immediately. Do not open the box. Wait for the freight carrier's inspector to be present before opening.

2. Open the shipping box and inspect for damage and missing components.

   You should find:

   1 - Jenny Cleaning Unit
   1 - Combination High Pressure/Steam Hose
   1 - Cleaning Gun Assembly (may be in 2 parts)
   1 - Instruction Manual and Warranty Card(s)
   1 - Spare parts bag (not included with all units)

   If any of these components are missing, please notify the distributor from whom the machine was purchased immediately.

   Inspect the unit carefully for any possible hidden damage. If the unit or any of the components are damaged, please notify the freight carrier immediately. Do not attempt to repair or use the unit or any of the components.

3. Record the machine model number, serial number, and specifications located on the machine chassis. Fill out the enclosed warranty card.

4. Remove the unit from the shipping pallet and place on a level surface.

   This can be accomplished by removing the two shipping bolts located on the chassis by the motor or engine and cutting steel banding located by the fuel and solution tanks.

5. Locate the cleaning machine in a safe work area.

   Place the cleaning machine as close to the work area as is possible safely. Leave a minimum of 3 feet clearance around the unit for work space.

Do not place the unit in such a manner where it may come into contact with its own spray. Electrical shock may result.

Do not locate near flammable or combustible liquids or operate in flammable or combustible atmosphere. A fire or explosion may result.

5 a. If the unit is equipped with a slow speed reciprocating duplex Jenny pump, fill the oil reservoir where the connecting rod and pump pistons meet. See ADDING OIL -- DUPLEX PUMP.

5 b. If the unit is equipped with a triplex ceramic piston pump, ensure that the oil level inside the pump is filled up to the center of the red dot on the oil sight gauge. See ADDING OIL -- TRIPLEX PUMP.

6. Attach one end of the combination hose to the cleaning gun assembly and the other end to the cleaning unit.

Tighten all connections securely. Use pipe dope or teflon tape to help seal the connections that require the use of a wrench.

Do not use a quick connector where the cleaning gun meets the hose. Risk of injection.

Do not use quick connectors on machines that produce steam. Steam temperatures reach up to 325 degrees F.

7. Mix Jenny cleaning compound as instructed on the label and fill the solution tank or separate container. See CLEANING COMPOUNDS AND MIXING.

If the unit requires a separate solution container, insert the siphon strainer located near the front panel of the unit into the solution container.

⚠CAUTION

Use only cleaning compounds that are compatible with steam cleaners or high pressure washers. The use of incompatible soaps may cause the machine to become clogged up and malfunction or reduce the life of the pump anddamage the machine's electric coils.

Do not use this unit to spray flammable or combustible chemicals.

Some chemicals used for cleaning are dangerous.

8. Connect the machine to an adequate cold water supply ensuring that the inlet water strainer is clean and free from debris.

A good rule of thumb to determine if the water supply is adequate, is that the free flowing water (straight out of the hose without restrictions) should be at least 1.50 times the

gallons per minute output of the machine. See SPECIFICATION SECTION for the exact gallonage of the machine.

NOTICE *If the water is being supplied by a well, make certain that the well produces enough water to keep up to the cleaning machine. This may have to be checked over a period of several hours.*

Use at least a 5/8 inch inside diameter water supply hose for any length of hose under 50 feet and 3/4 inch inside diameter for any length of hose over 50 feet.

NOTICE *If the pump is run with an inadequate water supply, the pump will cavitate. Cavitation causes the pump to operate loudly and vibrate and will cause damage to the pump.*

⚠WARNING *If required by local codes, a back flow preventer should be installed at the supply end of the hose.*

9. Check to be certain that all the control switches on the unit are in the **off** position and all hand operated valves are in the closed or off position. Connect the unit to the **correct electrical supply**.

The electrical specifications of the machine are located on the machine chassis and in the specifications section of this manual.

Connect unit to a dedicated circuit of the proper voltage, proper rated circuit breaker, and wired with the proper wire size and number of conductors.

Never modify, bend, or cut the electrical plug. Improper connection could result, causing damage, injury, or death of the equipment operator. If the plug must be replaced, use only one with the appropriate NEMA configuration for the current requirements of the unit.

This machine must be connected to a UL Listed Ground-Fault Circuit Interrupter (GFCI) in accordance with the National Electric Code (NEC) Article 422-4 - Ed-31, Except as provided for in NEC 90-4.

Do not modify or disconnect the electrical ground sensing circuit if connected. This unit is essential to help protect the operator from electrical shock.

This unit must be properly grounded to avoid fatal electrical shock in the event of an electrical malfunction. A ground connector screw should be fastened into the chassis to facilitate supplemental grounding as permitted by NEC 250-91.

Do not connect any other equipment to the electrical circuit serving this unit.

Do not replace a fuse or circuit breaker with one of a higher rating without being certain the wire size is adequate to handle the increased electrical load.

Keep all electrical connections dry and off of the ground.

Do not touch plug with wet hands.

Observe all local and national codes for the installation of this type of equipment.

If an extension cord is required, please use the following criteria for extension cord selection.

- 0 to 25 Feet - At least the same size wire.
- 25 to 50 Feet - At least one wire size larger.
- 50 to 75 Feet - At least two wire sizes larger.

If an extension cord of too small a wire size is used, the voltage drop will be high, and this will cause the motor to draw excessive current and overheat.

If there are any questions or problems with the electrical system being used, please do not hesitate in calling a local qualified electrician.

10. Review all Danger, Warning, and Caution information located in the Operator's Manual and on the machine.

11. Turn on the inlet water supply to fully open.

    The inlet water supply should not exceed 60 PSI and must be cold water.

    Do not use hot water as the inlet water supply. This unit is capable of producing hot water and/or steam from cold inlet water, and the use of hot water will create an over temperature condition.

12. With the unit off, remove the pressure wash tip or steam nozzle and orifice assembly from the end of the cleaning gun.

13. If the machine is a combination type unit, turn the volume selector valve to the high pressure setting (pressure wash).

14. Turn on the motor switch.

Do not operate with protective covers or guards removed.

Do not operate with any electrical panels or covers opened.

⚠DANGER **Do not operate with any of the safety controls bypassed.**

Do not permit untrained personnel to operate this unit.

⚠CAUTION **Never modify or alter this unit.**

15. Holding the gun securely with both hands, unlock the trigger safety lock, and press the trigger on the gun (nozzle control units only) to allow the water to flow. Let the pump run for 2-3 minutes after water starts flowing from the end of the gun to purge the system or any foreign matter. Check the machine, hose, and cleaning gun assembly for leaks.

⚠CAUTION If any leaks become apparent, disassemble the leaking parts and securely reseal the connection with pipe dope or teflon tape. Recheck the system for any other leaks.

Do not spray people, animals, or any living thing.

Do not spray energized electrical equipment.

16. Turn the motor or gasoline engine off, then release the gun handle.

17. With the unit off, install the desired tip into the end of the gun.

If any leaks became apparent, disassemble the leaking parts and securely reseal the connection with pipe dope or teflon tape. Recheck the system for any other leaks.

NOTICE *Steam Cleaners and Combination Units using the steam side will not come up to full operating pressure unit the unit has reached it operating temperature.*

1. Inspect the machine. It should be in good operating condition.

   If the machine does not appear to be in good operating condition, please contact a qualified repair or service person at once.

2. Inspect the cleaning gun, hoses, belts, clamps, and fittings. The hoses and belts should be free from cuts, abrasions, and any other kind of damage. The clamps and fittings should be tight and in good physical condition.

   If the hoses, belts, clamps, and fittings do not appear to be in good operating condition, please contact a qualified repair or service person at once.

Do not operate this unit with damaged or worn hose, fittings, clamps, or spuds.

3. If the combination hose has been disconnected, reconnect the combination hose to the cleaning unit.

   Tighten all connections securely. Use pipe dope or teflon tape to help seal the connections that require the use of a wrench.

   If the machine is supplied with a quick connector, attach the hose to the machine. Check the connector for a good sealed connection to make certain the hose does not blow off. See QUICK CONNECTOR

Do not use a quick connector where the cleaning gun meets the hose. Risk of injection.

Do not use quick connectors on machines that produce steam. Steam temperatures reach up to 325 degrees F.

4. Ensure that the oil level inside the pump is filled up to the center of the red dot on the oil sight gauge or within the line on the dip stick. If needed, add the correct amount of oil. See ADDING OIL -- TRIPLEX PUMP.

5. Check the amount of solution in the solution tank or solution container, and fill the solution tank or solution container if necessary. Mix Jenny cleaning compound as instructed on the label and fill the solution tank or separate container. See CLEANING COMPOUNDS AND MIXING.

   If the unit requires a separate solution container, insert the siphon strainer located near the front panel of the unit into the solution container.

Start-up Procedure

Do not use this unit to spray flammable or combustible chemicals.

⚠CAUTION Use only cleaning compounds that are compatible with steam cleaners or high pressure washers. The use of incompatible soaps may cause the machine to become clogged up and malfunction or reduce the life of the pump and machine.

Some chemicals used for cleaning are dangerous.

6. Connect the machine to an adequate cold water supply ensuring that the inlet water strainer is clean and free from debris.

   A good rule of thumb to determine if the water supply is adequate, is that the free flowing water (straight out of the supply hose without restrictions) should be at least 1.50 times the gallons per minute output of the machine. See SPECIFICATION SECTION for the exact gallonage of the machine.

NOTICE *If the water is being supplied by a well, make certain that the well produces enough water to keep up to the cleaning machine. This may have to be checked over a period of several hours.*

   Use at least a 5/8 inch inside diameter water supply hose for any length of hose under 50 feet and 3/4 inch inside diameter for any length of hose over 50 feet.

NOTICE *If the pump is run with an inadequate water supply, the pump will cavitate. Cavitation causes the pump to operate loudly and vibrate and will cause damage to the pump.*

⚠WARNING *If required by local codes, a back flow preventer should be installed at the supply end of the hose.*

7. Check to be certain that all the control switches on the unit are in the **off** position and all hand operated valves are in the **closed** or **off** position.

   The electrical specifications of the machine are located on the machine chassis.

Connect unit to a dedicated circuit of the proper voltage, proper rated circuit breaker, and wired with the proper wire size and number of conductors.

Never modify, bend, or cut the electrical plug. Improper connection could result, causing damage, injury, or death of the equipment operator. If the plug must be replaced, use only one with the appropriate NEMA configuration for the current requirements of the unit.

This machine must be connected to a UL Listed Ground-Fault Circuit Interrupter (GFCI) in accordance with the National Electric Code (NEC) Article 422-4 - Ed-

31, Except as provided for in NEC 90-4.

Do not modify or disconnect the electrical ground sensing circuit if connected. This unit is essential to help protect the operator from electrical shock.

This machine must be properly grounded to avoid fatal electrical shock in the event of an electrical malfunction. A ground connector screw should be fastened into the chassis to facilitate supplemental grounding as permitted by NEC 250-91.

Do not connect any other equipment to the electrical circuit serving this unit.

Do not replace a fuse or circuit breaker with one of a higher rating without being certain the wire size is adequate to handle the increased electrical load.

Keep all electrical connections dry and off of the ground.

Do not touch plug with wet hands.

Observe all local and national codes for the installation of this type of equipment.

If an extension cord is required, please use the following criteria for extension cord selection.

- 0 to 25 Feet - At least the same size wire.
- 25 to 50 Feet - At least one wire size larger.
- 50 to 75 Feet - At least two wire sizes larger.

If an extension cord of too small a wire size is used, the voltage drop will be high, and this will cause the motor to draw excessive current and overheat.

If there are any questions or problems with the electrical system being used please, do not hesitate in calling a local qualified electrician.

8. Review all Danger, Warning, and Caution information located in the Operator's Manual and on the machine.

9. Turn on the inlet water supply to fully open.

The inlet water supply should not exceed 60 PSI and ***must*** be cold water.

⚠WARNING Do not use hot water as the inlet water supply. This unit is capable of producing hot water and/or steam from cold inlet water, and the use of hot water will create an over temperature condition.

Start-up Procedure

10. Inspect the pressure wash tip or steam nozzle and orifice assembly to ensure that it is free from dirt and debris.

    If the pressure wash tip or steam nozzle and orifice assembly appears clogged, blocked, or dirty, immediately remove the tip and clean or replace. If it can not be cleaned, replace the tip with a tip with the same orifice size.

11. If the unit is a combination cleaner, insert the pressure wash tip or the steam nozzle to obtain the desired cleaning method and turn the volume selector to the proper setting.

12. Hold the gun securely with both hands, unlock the trigger gun safety lock, and squeeze the gun handle so that water flows from the end of the gun.

    If any leaks become apparent, stop the machine and disconnect it from any power source, disassemble the leaking parts and securely reseal the connection with pipe dope or teflon tape. Recheck the system for any other leaks.

Do not spray people, animals, or any living thing.

Do not spray energized electrical equipment.

13. Turn on the motor switch.

Do not operate with protective covers or guards removed.

Do not operate with any electrical panels or covers opened.

Do not operate with any of the safety controls bypassed.

Do not permit untrained personnel to operate this unit.

Never modify or alter this unit.

14. If heat is desired, turn on the heater switch after water flows from the gun.

15. Turn on the solution switch (if unit is so equipped) and adjust the solution metering valve for the desire solution flow.

1. Turn off the burner or heater switch and allow the unit to cool down.

Hold the gun in the open position until cool water (less than 100 degrees F) flows from the gun.

2. Flush the solution system or chemical injector with clean water. With the solution valve or injector knob fully open draw clean water through the solution system or injector for one minute.

Due to the corrosive nature or some compounds, do not allow solution to remain in the water system. It will take several minutes of water flowing through the system for the system to be purged of the cleaning solution.

Some chemicals used for cleaning are dangerous.

3. Turn off the motor.

If the machine is nozzle controlled, open the trigger gun to relieve the system pressure and lock the trigger gun safety lock. See GUN TRGGER SAFETY LOCK.

Do not spray people, animals, or any living thing.

4. Disconnect the unit from all electrical power.

If an extension cord was used, disconnect the extension cord from the electrical outlet and coil up the cord.

Do not touch plug with wet hands.

5. Remove the spray tip from the end of the cleaning gun. Inspect the spray tip to ensure that it is free from dirt and debris.

6. Turn off the water supply, and disconnect the garden hose from the cleaning machine.

7. Disconnect the combination hose from the machine if it is quick coupled, and coil the hose on the handle at the rear of the unit. See QUICK CONNECTOR.

Shutdown Procedure

8. Properly store and/or dispose of the unused cleaning compound.

NOTICE Please follow all federal, local, and state guidelines for the disposal of chemicals.

9. If appropriate, protect the unit from freezing. See the FREEZE PROTECTION.

⚠CAUTION *Do not store the Washer in unheated areas during cold weather. Severe damage may occur if water freezes in the Washer. If near or below freezing conditions cannot be avoided, the Washer must be protected from freezing.*

NOTICE *Cold air from outside can come down the flue and freeze the coil. The flue damper should be closed to prevent cold air from coming down the flue during the winter months.*

10. Inspect the machine. It should be in good operating condition.

    If the machine does not appear to be in good operating condition, please contact a qualified repair or service person at once.

    If the hoses, belts, clamps, and fittings do not appear to be in good operating condition, please contact a qualified repair or service person at once.

11. Place the machine is a protected area.

Ground Fault Circuit Interrupter

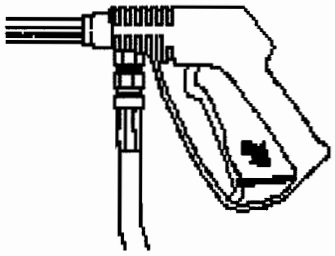
If the Jenny cleaning unit is a single phase unit, it will be equipped with a Ground Fault Circuit Interrupter. To ensure against electrical shock, test the device before each use. When the test button is pushed in, the indicator light should go off. Reactivate the device by pushing the reset button in. If the indicator light goes on, the device is ready for use.

⚠DANGER *Do not use the washer if the indicator light does not go on when reset or if the indicator light remains on when the test button is pushed in. This device does not guard against shock resulting from defects or faults in any wiring supplying power to the device, or from contact with both circuit conductors.*

Gun Trigger Safety Lock

The gun is equipped with a trigger safety lock to prevent accidental spraying.

To lock the gun trigger unfold the lever on the back of the trigger.



Always lock the trigger when not spraying.

Pop Off Valve

The pop off valve is a safety relief valve that will relieve system pressure when an over pressure condition occurs by "popping off." The valve is set at the factory during the testing of the machine for the correct relief pressure. If the valve pops off, then it is warning of a potential problem in the pressure side of the water system which needs to be corrected.

The valve can be adjusted by using an allen wrench. To increase the pressure where the valve pops off, turn the wrench clockwise, and to lower the setting, turn the wrench counter clockwise.

Hose Protector Plug - (fusible plug)

The hose protector plug is a safety device to alert the operator from an over temperature condition usually caused by and insufficient amount of water being pumped through the heating coil. The hose protector plug is screwed into the bottom of the fitting assembly at the outlet of the coil. This plug protects the combination hose and the operator from damage in case of superheated steam, by blowing out. When replacing, use a box wrench. Correct the cause of insufficient water to the heating coil before restarting unit.

⚠DANGER *Always point the hose protector plug toward the floor. When plug blows, the machine will release water through the opening.*

Quick Connector

To couple the quick connector, pull back the sleeve on the hose end and push hose end on to the outlet fitting. Release the sleeve and make sure it is fully forward. Check to see if the coupling is secure.

Do not use quick connectors on machines that produce steam. Steam temperatures reach up to 325 degrees F.

If the coupling is not secure, it may blow apart when the cleaning machine is started.

Never decouple the quick coupler when the machine is running.

Always release the pressure in the system before decoupling.

Do not use a quick connector where the cleaning gun meets the hose. Risk of injection.

To decouple, turn the burner off and allow cold water to flow out the end of the gun for several minutes to cool the machine down. Turn the machine off then pull the trigger on the gun to release the pressure in the system. Pull back the sleeve on the hose end and pull hose end off the outlet fitting.

Ventilation Requirements

Determine if ventilation is required in the installation of the gas fired Jenny.

Ventilation will be required of the equipment if any room that has a volume of less that 50 cubic feet per 1000 BTU/Hour (this ratio may be different for your area, please contact the proper Federal, State, and Local agencies to determine the proper requirements) of all fuel burning equipment used within the room. To determine the volume of the room, multiply the length by the width by the height. To determine the BTU/Hour, add up all the BTU/Hour ratings of every fuel burning device contained within the room.

Sample:

Room Size 50' Long x 25' Wide x 10' High
Total Volume of the Room = 12,500 Cubic Feet

3 Jenny Machines -	1.) 200+	@	150,000 BTU/HR
	2.) 760-C	@	350,000 BTU/HR
	3.) 2000-C	@	328,000 BTU/HR
	Total BTU/HR		828,000 BTU/HR

The ratio desired is $\frac{50 \text{ Cubic Feet}}{1000 \text{ BTU/HR}}$

In the example above $\frac{12{,}500 \text{ Cubic Feet}}{328{,}000 \text{ BTU/HR}} = \frac{38.11 \text{ Cubic Feet}}{1{,}000 \text{ BTU/HR}}$

From the example, it can be seen that the 38 Cubic Feet/BTU/HR is much less than the 50 Cubic Feet/BTU/HR. This means that the fumes will have to be vented outside of the building.

If ventilation is required, the installation must be made by licensed qualified, competent technician experience in making such installations. It must also fulfill the National Fire Protection Agency Standards for the installation of this type of this equipment, as well as, any other applicable federal, state, and local codes.

Hard Water

Hard water can cause the build up of deposits within the water system of the Jenny unit to happen very quickly. This will require frequent deliming of the water system and will eventually cause the destruction of the unit. Although the frequency of deliming that must be done to the unit is directly proportional to the amount of use the unit receives, if you feel that the deposit build up occurs too quickly, have the water supply checked. If the water supply exceeds 8 grains of hardness, then a water softener should be installed. This will lengthen the life of the Jenny cleaning unit and maintain the machines overall efficiency.

Deliming Instructions

How to Tell When a Heating Coil is Restricted

A heating coil may become restricted or clogged over time due to undisolved mineral deposits and solids contained in the water or due to the chemicals being used. Not all cleaning chemicals are designed to be used with pressure washers and steam cleaners.

The deposits in the coil and outlet are the result of the effect of heat on undisolved solids in the water used. These deposits settle on the inner wall of the coil and will restrict the flow of water through the coil and eventually may completely clog the coil. These deposits must be removed, periodically, to prevent the coil from becoming completely clogged or restricted.

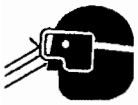
Some of the symptoms to look for are: slow heating, inadequate temperature rise, loss of pressure at the end of the gun, or excessive pressure on the inlet (cold water) side of the coil. This excessive pressure causes the coil drain and relief valve to trickle water at normal operating pressure. If you notice any of these symptoms, DELIME AT ONCE WITH **JENNY COIL CONDITIONER.**

Deliming Safety Warnings

Jenny No. 80 Coil Conditioner is a highly corrosive blended acid designed to remove lime and other water deposits from the water system of your cleaning unit. Follow the instructions on the chemical container or accompanying Material Safety Data Sheet (MSDS Sheet).

Wear proper protective equipment (eye protection or full face protection) while using Jenny No. 80 Coil Conditioner.

Wear protective clothing, gloves, and rubber boots that is made of material that is resistant to acids.



Use a vapor respirator when using this product. Perform the deliming operation in a well ventilated area.

Proper safety precautions must be taken when handling, storing, and using this chemical.

Keep all chemicals out of the reach of children.

Always have a clean supply of water available to wash off any chemicals that have come in contact with the skin and/or eyes.

If any contact occurs with the eyes, immediately flood the eyes with clean water for at least 15 minutes and seek medical attention at once.

If contact occurs with the skin, flood the affected area for 15 minutes with clean water. If irritation persists, seek immediate medical attention.

If chemicals are swallowed, follow the label product label directions and seek immediate medical attention.

For Treatment instructions, have your physician contact the nearest regional poison information center for more information.

Always read and understand the Material Safety Data Sheet (MSDS) on all chemicals before using them.

Deliming Instructions

1. Disconnect the unit from all electrical power.

2. Bypass the low water cut-off switch, if one is installed on the unit.

3. Obtain an acid resistant five gallon container.

4. Remove the pressure wash tip and/or steam orifice from the gun and place both of them into container. If the unit is a combination unit, turn the volume selector to pressure wash.

5. Turn on the motor and run the Jenny unit with both the solution and burner switches off until water flowing from the end of the gun is free from compound (no longer feels "slippery"). If this procedure is not followed, the cleaning compound will neutralize the acid in the Jenny No. 80 Coil Conditioner and make it ineffective.

6. Turn off the water to the unit at the source.

7. Disconnect the pump inlet hose from the float tank at the float tank.

8. Attach a strainer to the end of the hose and insert the end of the hose into the acid resistant container.

9. Place the outlet end of the cleaning gun into the acid resistant container with the nozzle open and the gun held securely. This will allow the Jenny No. 80 Coil Conditioner to recirculate through the machine.

10. Put one (1) gallon of water into the acid resistant container.

11. Start the Jenny unit with the burner switch and solution switch and/or valve closed in the off or closed position.

⚠WARNING HOLD COIL CONDITIONER CONTAINER WITH TWO HANDS. DO NOT SQUEEZE **ALWAYS ADD ACID TO WATER - NEVER WATER TO ACID.** IF WATER IS ADDED TO A HIGH CONCENTRATION OF ACID, A VIOLENT REACTION WILL TAKE PLACE WHICH MAY SPLASH ACID OUT OF CONTAINER AND CAUSE SERIOUS BURNS, INJURY OR DEATH.

12. Slowly pour two quarts of Jenny Coil Conditioner into the acid resistant five gallon container.

13. When the water/conditioner solution starts to circulate, it will fizz actively in the five gallon container. After the fizzing slows down (indicating that the solution is becoming neutralized by the contaminants in the coil) allow the solution to circulate through the unit for 2 minutes, then, FOLLOWING THE WARNING ABOVE, add the remainder of Jenny No. 80 Coil Conditioner.

14. Circulate the Jenny No. 80 Coil Conditioner for 7 minutes, or if coil was extremely limed, up to 10 minutes. Keep the coil conditioner lukewarm by occasionally turning the burner on and off. Turn the fuel on only long enough for the spraying gun barrel to feel warm, NOT HOT.

⚠DANGER **Do not allow the unit to steam or get very hot. A chemicals ability to react, in most cases, increases with temperature.**

15. For exceptionally heavy deposits in the coil, discard the weakened coil conditioner and repeat steps 10 through 14.

16. Turn off the Jenny unit. Disconnect the unit from the electrical power source. Restore low water cut off switch, if installed, to proper operation by reversing the procedure in step 2.

17. Clean the float tank and the strainer. Reconnect the pump inlet hose to the float tank. Turn on the water supply at the source and connect the unit to the electrical power source and start unit (the burner switch and solution switch and/or valve in the off or closed position).

18. Flush the coils by pumping clear water through the Jenny unit for about five minutes. This will allow any dislodged but undisolved scale to be discharged through cleaning gun opening.

19. Fill the solution tank with Jenny Cleaning Compound (mixed in correct strength). Open the solution metering valve to its maximum setting. Turn on the burner and solution switch and/or valve and run the Jenny at full operating pressure for five minutes to neutralize any remaining coil conditioner inside the pump and coil. THIS STEP IS VERY IMPORTANT!

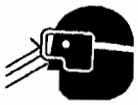
Freeze Protection

The water and solution system of your Jenny cleaning machine are both susceptible to freezing. As water freezes, the forming ice crystals expand. When this expansion occurs, the ice produces an incredible amount of force that is capable of ruinning pumps, high pressure fittings, hydraulic hoses, valves, coils, and any other parts in the water or solution system of the machine.

For this reason, it is strongly reccommended that the following steps be taken anytime the unit is going to be stored for any prolonged length of time or exposed to below freezing temperatures.

Anti-Freeze Safety Warnings

Anti-freeze is a chemical that inhibits water from freezing, overheating, and provides protection from rust and corrosion. Follow the instructions on the chemical container or accompanying Material Safety Data Sheet (MSDS Sheet).



Wear proper protective equipment (eye protection or full face protection and gloves) while using Anti-Freeze.

Proper safety precautions must be taken when handling, storing, and using Anti-Freeze.

Keep all chemicals out of the reach of children.

Always have a clean supply of water available to wash off any chemicals that have come in contact with the skin and/or eyes.

If any contact occurs with the eyes, immediately flood the eyes with clean water for at least 15 minutes and seek medical attention at once.

If contact occurs with the skin, flood the affected area for 15 minutes with clean water. If irritation persists, seek immediate medical attention.

If chemicals are swallowed, follow the product label directions and seek immediate medical attention.

For Treatment instructions, have your physician contact the nearest regional poison information center for more information.

Always read and understand the Material Safety Data Sheet (MSDS) on all chemicals before using them.

Freeze Protection Instructions

1. Turn the machine off.
2. Remove the pressure wash tip and/or steam nozzle and orifice from the gun. If the unit is a combination unit, turn the selector switch to pressure wash.
3. Insert the solution siphon into the anti-freeze container and open the solution metering valve. Turn on or start the the machine long enough to fill the solution system with anti-freeze, then turn the machine off and close the solution metering valve.
4. Disconnect the unit from all electrical power if the machine is electrically operated.
5. Bypass the low water cut-off switch, if one is installed on the unit.
6. Reconnect power to the unit if the machine is electrically powered.
7. Turn off the water to the unit at the source and allow the pump to empty the float tank.
8. Fill the float tank with approximately 1.5 gallons of a 75% anti-freeze 25% water solution.
9. Turn on the motor and run the Jenny unit with both the solution and burner in the off or closed position until the anti-freeze and water solution flows from the end of the gun while continuing to add the anti-freeze water solution to the float tank as needed.

⚠DANGER **Do not allow the unit to steam or get very hot. A chemicals ability to react, in most cases, increases with temperature.**

10. Open and close the trigger gun to allow the anti-freeze and water solution to circulated through the unloader and bypass lines.

11. If the machine is a combination type (steam cleaner and pressure washer in the same unit), switch modes to allow the anti-freeze and water solution to circulate through the bypass line.

12. After these steps have been completed, allow the pump to emptly the float tank.

13. Turn off the Jenny unit. Disconnect the unit from the electrical power source. Restore low water cut off switch, if installed, to proper operation by reversing the procedure in steps 5 and 6.

14. Remove the hose from the end of the float tank and blow air through the entire water system, until air comes out of the end of the gun.

15. Reconnect the hose to the float tank.

Adding Oil

Oil can be added to the high pressure triplex ceramic plunger pump by removing the red oil plug/ dipstick (marked oil) located on the top of the pump crankcase (please see the exploded view of the pump to find the exact location of the red oil plug/dipstick). The red oil plug/dipstick has two lines on it that give the high and low limits of the oil level that must be maintained within the crankcase to keep the pump properly lubricated. If oil must be added, please add the oil slowly and frequently check the level using the oil plug/dipstick. Use only Special Jenny Synthetic Oil.

Changing Oil

The oil can be changed by first using a suction gun to remove the old oil from the pump crankcase, or by removing the lower oil plug located on the lower back crankcase cover. Care should be taken to ensure that the oil is not allowed to spill all over the Jenny unit. Once the oil has been drained, then follow the steps for adding oil to the high pressure triplex ceramic plunger pump. Please follow the maintenance instructions for service intervals.

Adding and Changing Engine Oil

Please follow the engine manufacturer's guidelines and instructions for adding and changing the oil. Only use the type and weight recomended by the manufacturer. Please follow the maintenance instructions for service intervals.

Your units cleaning ability is based not only on its performance specifications-pressure, volume and temperature, but also on the selection and proper use of cleaning compounds.

Even the best cleaning compound applied in too strong or too weak a concentration will be ineffective, and may even damage the item being cleaned. The wrong type of cleaning compound can damage the unit.

Normally, cleaning compounds are diluted when placed into the solution container, and are further diluted when mixed with the water flowing through the unit.

⚠DANGER

Never use flammable cleaning solvents or compounds in this unit. Fire or explosion causing injury or death may result.

Do not spray toxic chemicals. Risk of inhalation or contact with skin which may result in injury or death.

Compound dilution rates are often given by manufacturers in terms of ratios. A typical recommendation for Jenny APL or HDL cleaning compounds is 1:125; 1 part compound for every 125 parts of water out of the cleaning gun.

For example, the CPW 1020 has a maximum solution feed rate of 74 oz. per minute and a total output of 2.0 GPM (256 oz. per minute). By using this information and the cleaning compounds manufacturer's recommendations, it is possible to calculate the appropriate compound dilution.

To simplify mixing, use the following formula to determine water to compound dilution when compound recommends a 1:125 dilution ratio:

The simplified formula to figure this out is as follows:

$$\frac{(\text{GPM machine})\times(\text{Dilution Ratio})\times(128\text{oz/gal})\times(128\text{oz/gal})}{(\text{Solution Feed Rate oz./min.})} = \text{Oz Added to 1 gal. of water}$$

In the example above:

$$\frac{(2.0\text{GPM})\times(1/125)\times(128)\times(128)}{(74\ \text{Oz/Min})} = \text{Oz}$$

Oz.=3.54 Oz./Gal. or Approximately 4 Oz./Gal.

Therefore, the soap container or tank will have 4 oz. of soap mixed with every gallon of water put into the container.

Use these compound dilutions as a starting dilution for your application.

⚠CAUTION

Use only Cleaning Compounds that are compatible with high pressure washers. Using a laundry-type soap may clog the injector.

Cleaning Compounds and Mixing

APPLICATION	CHEMICAL DRUM KITS				CONCENTRATED POWDERS						LIQUID CHEMICAL		
	APC	HDC	TW	XDD	AP	CWD	HD	SHSC	CW	CC	SW	GRL	MGRL
1. Auto Motor Cleaning	●	■	●	★	×	×	●	★	×	×	✓	×	×
2. Car Washing	■	×	★	×	★	★	★	×	×	×	✓	×	×
3. Truck Washing	■	★	★	×	■	■	★	×	×	×	✓	×	×
4. Off Road Eqpt. Washing	●	■	■	★	●	●	■	★	×	×	✓	×	×
5. Off Road Eqpt. Motor Cleaning	●	■	●	★	×	●	●	★	×	×	✓	×	×
6. Glass & Tile Cleaning	★	×	★	×	×	★	×	×	×	×	✓	×	×
7. Aluminum & Soft Metals	★	×	★	×	■	■	★	×	★	×	✓	×	×
8. Washing By Hand	★	★	★	×	★	★	★	×	×	×	✓	×	×
9. Cleaning Painted Surfaces	★	×	★	×	★	★	×	×	●	×	✓	×	×
10. Pre Soak For Cold Pressure Washing	■	★	■	×	■	■	★	×	×	×	✓	×	×
11. Floor Cleaning	■	★	■	×	●	■	★	×	×	×	✓	×	×
12. Mining Equipment	●	■	●	★	●	■	■	★	×	×	✓	×	×
13. Stripping Oil Base Paint	×	×	×	×	×	×	×	×	×	×	✓	●	●
14. Chrome Cleaning	★	★	★	×	■	★	★	×	×	×	✓	×	×
15. Casting Cleaning	●	■	●	★	●	●	■	★	★	×	✓	×	×
16. Aluminum Siding Washing	■	★	★	×	●	■	★	×	×	×	✓	×	×
17. Graffiti Removal	×	×	×	×	×	×	×	×	×	×	×	★	■
18. Gaffiti Removal from Masonry	×	×	×	×	×	×	×	×	×	×	×	×	★
19. Stainless Steel Filter Cleaning	■	★	★	★	■	■	★	★	★	×	✓	×	×
20. Tractor Cleaning	■	★	■	★	■	●	■	★	×	×	✓	×	×
21. Lawn Mower Cleaning	■	★	■	★	■	★	★	★	×	×	✓	×	×
22. White Wall Tires	×	×	×	★	×	●	●	×	×	×	✓	×	×
ADDITIONAL INFORMATION													
Indoor Use	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Outdoor Use	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
USDA Accepted For Use In Meat & Poultry Process	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Water Softener Added To Compound	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Available In 5, 55 Gallons	✓	✓	✓	✓							✓	✓	✓
Available In 40 Containers					✓	✓	✓	✓	✓	✓			

Key: ★ Best Compound for this Application ■ Good Performance ● Acceptable Cleaning × Not Recommended ✓ Application

These items should be checked **daily** before operation of unit begins:

1. Water supply, water supply hose,and connections.
2. Solution supply container for adequate supply.
3. Water pump oil level.
4. Check for proper operation of all controls.

NOTE: Water pump oil change should be made after the first 50 hrs, then at regular intervals of every 100 hrs under normal operating conditions. The number of operating hours allowed between oil changes will be affected by conditions such as high ambient temperature, high humidity, and severity of use. You must change the oil more frequently under these conditions. **Never** operate this unit on an incline over 15 degrees maximum to ensure optimum lubrication to the water pump.

When the water pump requires oil to be added, use only Special Jenny Synthetic oil and fill until the level is between the two lines on the dipstick or to the center of the oil sight glass. (Do Not overfill)

5. Pressure tip for wear or obstruction.
6. Hose damage or hose being kinked.
7. Electrical supply and connections.
8. Reset on the GFIC drop cord, if applicable.
9. Ensure that there is access to the main shut-off switch.
10. Look for any other obvious problems.

These items should be checked **weekly**:

1. Inlet hose washer strainer for contaminates.
2. Filter screen in float tank that may be clogged or restricted.
3. Drop cord for any damage.
4. Hose wear or damage.
5. Gun handle damage or leaking.

These items should be checked **monthly**:

1. Belt tension and condition of water pump belts.
2. Pulley set screws or bushing retainer bolts on water pump and motor pulley.
3. Water leaks from any fittings or hoses.
4. Clean any accumulated debris out of the float tank.
5. Overall condition of unit .

Maintenance

These items should be checked **yearly**:

1. Check precharge in the accumulator for the proper working pressure. Recharge as necessary using only nitrogen.
2. Remove piston from pressure or flow switch and check for mineral deposits. Replace if necessary
3. Replace any belts that are worn or frayed with original equipment parts for best results.
4. If required at the time, change the oil in the water pump.

NOTE: Also refer to the note under item 4 in daily checks.

5. Solution container and solution system should be cleaned out to insure a proper working system.
6. Replace all worn or damaged hose with new original equipment.
7. Check and replace drain relief valve if needed.
8. A check on the heating coil for back pressure will help you to determine if the coil may be restricted.

NOTE: Mineral deposits in the coil and coil outlet fittings assembly are the result of the affects of heat on undissolved solids in the water used. These deposits must be periodically removed to prevent the coil from being clogged.

9. A new pressure tip should be installed depending on usage, heavy usage may require you to change the pressure tip more frequently.

Routine Maintenance can normally be accomplished by most Jenny owners. After consulting with the Troubleshooting section of this manual, and your unit needs service or the repair that seems to be beyond your capability, contact the distributor from whom you purchased the unit.

If your distributor is unable to assist you or supply repair parts needed, refer to the manufacturers representative listing in the back of this manual. Your manufacturers representative will be able to provide technical assistance and parts ordering information.

If your unit does not operate properly you should determine the following information prior to calling for help.

The units model number, serial number and date of purchase located on the chassis.

The water output (volume) of the unit. Run discharge into a bucket with the pressure tip removed. Measure the volume of water in five minutes, divide by five to determine the actual GPM output.

The size of the pressure tip installed in the unit, The number is stamped on the tip.

Please reference the Trouble Shooting section of this manual.

This information will assist in isolating problems with your unit.

OWNER'S RECORD

JENNY MODEL NO. _____ SERIAL NO. _____

PURCHASED FROM:
NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

DATE OF PURCHASE _____

Troubleshooting

Symptom	Cause	Remedy
The Pressure and/or the Delivery Drops	Worn Packing Seals	Replace Packing Seals
	Broken Valve Spring	Replace Spring
	Belt Slippage	Tighten or Replace Belt
	Worn, Damaged or Incorrect Nozzle	Replace with Correct New Nozzle
	Fouled Discharge Valve	Clean Valve Assembly
	Fouled Inlet Strainer	Clean Strainer
	Worn or Damaged Hose	Repair/Replace Hose
	Worn or Plugged Relief Valve on Pump	Clean, Reset, and Replace Worn Parts
	Cavitation	Check Suction Lines on Inlet of Pump for Restrictions or Loose Connections
	Unloader	Check Unloader for Proper Operation
	Selector switch set on Steam Phase	Change switch to Pressure Phase
Water in Crankcase	High Humidity	Reduce oil Change Interval
	Worn Seals	Replace Seals
Noisy Operation	Worn Bearings	Replace Bearings, Refill Crankcase Oil with Recommended Lubricant
	Cavitation	Check Inlet Lines for Restrictions and/or Proper Sizing or Loose Connections
Rough/Pulsating Operation with Pressure Drop	Worn Packing	Replace Packing
	Inlet Restriction	Check System for Stoppage, Air Leaks, Correctly Sized Inlet Plumbing to Pump
	Accumulator Pressure	Recharge/Replace Accumulator
	Unloader	Check Unloader for Proper Operation
	Cavitation	Check Inlet Lines for Restrictions and/or Proper Sizing or Loose Connections
Pressure Rises & Falls (Cycling)	Debris in Unloader	Clean Float Tank, Repair or Replace Unloader
	Incorrect Nozzle	Replace with Correct New Nozzle
Pump Pressure as Rated, Pressure Drop at Gun	Restricted Discharge Plumbing	Resize Discharge Plumbing to Flow Rate of Pump
Excessive Leakage	Worn Plungers	Replace Plungers
	Worn Packing/Seals	Replace Packing Seals
	Excessive Vacuum	Reduce Suction Vacuum
	Cracked Plungers	Replace Plungers
	Inlet Pressure too High	Reduce Inlet Pressure
High Crankcase Temperature	Wrong Grade of Oil	Use Recommended Pump Oil from Manufacturer
	Improper Amount of Oil in Crankcase	Adjust Oil Level to Proper Amount (Do not overfill)

Symptom	Cause	Remedy
Cleaning Spray too Hot/Fuse Plug Blows/Over Temperature Switch Shuts Off	Inadequate water supply Note: If water is being supplied from a well be certain the water flow is adequate for the gallonage required to run this unit.	Increase Water Supply
	3/4" Hose Connector Screen obstructed	Clean or Replace Screen
	Float Tank Screen obstructed (Remove and clean)	Clean Float Tank/Clear Obstruction
	Connections from the Float Tank to the Pump loose. Note: If the connections between the Float Tank and the Pump are loose, air is being drawn into the water intake line, (even though the water is not leaking) therefore reducing water flow.	Tighten Connections
	Pump Drive Belt loose or slipping	Tighten Pump Belt
	Water Pump defective or Pump Check Valves worn	Replace Check Valves
	Coil partially blocked or Limed Up	Delime/Replace Coil
	Motor running too slow due to low voltage or frequency	Call Qualified Electrician
	Unloader leaking into bypass (full flow of water not going through coil)	Repair/Replace Unloader
	Pressure Tip in the end of the Gun partially blocked	Clean Pressure Tip
	Inadequate Pump Flow	See Trouble Shooting section for Pump Malfunction
	Pressure or Flow Switch not shutting off heat	Replace pressure/flow switch
Coil Relief Valve Leaks	Relief Valve has dirt on the seat	Clean/Replace Valve Seat
	Relief Valve not adjusted properly	Adjust Relief Valve
	Pressure Tip is clogged	Clean Pressure Tip
	Coil is liming up	Delime Coil with Jenny Coil Conditioner
	Inside lining of Hose separating and causing restriction	Replace Hose
	Coil plugged up	Replace Coil
	Hose crushed (ran over by vehicle)	Replace Hose
	Incorrect Pressure Tip installed	Replace Pressure Tip, See Specification Section for Correct Size
		Clean Pressure Tip
Cleaning Spray Pressure Excessive	Pressure Tip Partially Obstructed	Clean Pressure Tip
	Incorrect Pressure Tip Installed	Replace Pressure Tip, See Specification Section for Correct Size
	Restricted Coil (Coil Liming Up)	Delime Coil with Jenny Coil Conditioner
	Unloader adjusted incorrectly	Adjust unloader to manufacturer's specfications.
Motor Overload Kicks Motor Off	Low supply line voltage	Call Qualified Electrician
	Motor Double Phasing (Three Phase units Only)	Call Qualified Electrician
	Extension cord too long and/or inadequate wire size for length of cord being used	Replace Extension Cord with One of Greater Wire Gauge Size
	Loose connection to unit (extension cord, etc.)	Replace/Repair Connection

Troubleshooting

Symptom	Cause	Remedy
	Excessive back pressure in water system and Drain Relief Valve is disabled	Lower Back Pressure/Replace Drain Relief Valve
	Water Pump low on oil or out of oil causing Pump to seize/bind	Replace Pump
	Bad or worn Bearing in Motor	Replace Motor
	Motor Winding Damaged or Burned Out	Replace Motor
	Incorrect Pressure Wash Tip installed (too small)	Replace with New Correct Pressure Tip
Pressure Fluctuates	Loose Water Pump Belt	Tighten Pump Belt
	Unit is drawing in air on inlet side of Water Pump	Tighten Inlet Water Connections
	Check Valves in Water Pump may be worn	Replace Check Valves
	Worn Packing Seals (see Pump Trouble Shooting section)	Replace Seals
Fusible Plug Blows	Inadequate water supply to Unit (supply hose kinked, etc.)	Increase Water Supply
	Water Pump Check Valves worn or stuck	Replace Check Valves
	Drain Relief Valve leaking	Adjust/Replace Drain Relief Valve
	Float Tank Strainer Clogged Note: Debris in the Float Tank will settle at the bottom of tank until unit is started, it will then be drawn to Float Tank Outlet Screen causing inadequate water supply.	Clean/Replace Strainer
	Coil is liming up reducing adequate flow of water.	Delime Coil
Pressure Rises Suddenly	Partially or Fully Clogged Pressure Tip	Clean or Replace Nozzle
Spray Stops Suddenly at Cleaning Gun	Fusible Plug Blown	Replace Fusible Plug and See Fusible Plug Section
	Electric Heating Coil Restricted	Delime Heating Coil
	Drain Relief Valve Leaking	See Coil Relief Valve Section
Water Float Tank Overflows	Float Ball is Defective	Replace Float Ball
	Float Valve will not Shut Off	Adjust or Replace Float Valve
	Solution Solenoid will not Shut Off	Clean or Replace Solution Solenoid
Cleaning Solution not feeding from tank	Solution Tank Empty	Fill Solution Tank
	Solution Tank or Line Clogged	Clean Tank and Replace Solution Lines
Motor Runs, Unit Not Heating Water	Heater Switch Turned Off	Turn Switch On
	Defective Heater Switch	Replace Heater Switch
	Flow Switch Stuck	Replace Flow Switch
	Heater Contactor Defective	Replace Heater Contactor
	OverTemperature Switch Defective	Replace Over Temperature Switch
Unit Heating, but not to Desired Temperature	Thermostat Turn Down Too Low	Adjust Thermostat
	Modulating Contactor Defective	Replace Modulating Contactor
	Thermostat Defective	Replace Thermostat
	Electric Heating Coil Defective	Replace Defective Heating Coil

LIMITEDWARRANTY

Products manufactured by (GRUNDFOS) GRUNDFOS PUMPS CORPORATION are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS' manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

GRUNDFOS®

Leaders in Pump Technology

Grundfos Pumps Corporation • 3131 N. Business Park Avenue • Fresno, CA 93727
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ISO 9001 CERTIFIED

L-SE-TL-014	05/98
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Sink-paQ
System

Installation and Operating Instructions

Please leave these instructions with the pump for future reference.

GRUNDFOS®

Leaders in Pump Technology

SAFETY WARNING

Electrical Work

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Shock Hazard

A faulty motor or wiring can cause electrical shock that could be fatal, whether touched directly or conducted through standing water. For this reason, proper grounding of the pump to the power supply's grounding terminal is required for safe installation and operation.

In all installations, the above-ground metal plumbing should be connected to the power supply ground as described in Article 250-80 of the National Electrical Code.

Pre-Installation Checklist

1. Check the Condition of the Pump

The basin your pump came in is specially designed around your pump during production to prevent damage. As a precaution, look at the pump and examine it for any damage that may have occurred during shipping. Examine any other parts of the shipment as well for any visible damage.

IMPORTANT

Remove check valve from basin, and all tape from discharge pipe, vent hole, and float switch.

Make certain that the FLOAT SWITCH is on the *opposite* side of the INLET.

The vertical float switch is preset at the factory. Check to see that the vertical float switch moves up and down freely and does not hang up. The vertical float should be on the opposite side of the inlet for proper operation.

2. Verify Electrical Requirements

Verification of the electrical supply should be made to be certain the voltage, phase and frequency match that of the pump motor. The proper operating voltage and other electrical information can be found on the motor nameplate. These motors are designed to run on ±10% of the nameplate-rated voltage. Wiring connection diagrams can be found on the plates attached to the motor. **If voltage variations are larger than ±10%, do not operate the pump.**

Installation

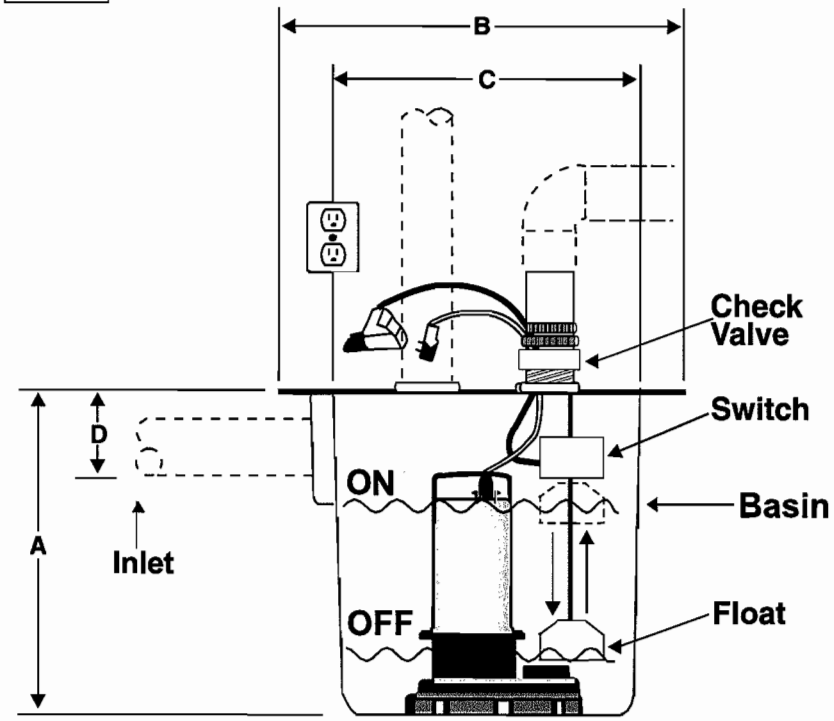
Refer to Figure 1 below for typical installation. Sump bottom must be solid and basin must be level. If installed outdoors and subject to freezing, provision must be made to protect the pump.

Install the check valve, on the discharge pipe to prevent backflow. Note the valve manufacturer's installation recommendations. Install an adequately sized gate valve on the discharge side of the check valve for plumbing maintenance.

Install a 1-1/2" vent pipe, to vent gases and odors to the atmosphere and a 1-1/2" inlet pipe.

Before placing cover on basin, cycle system with water to assure proper operation.

Figure 1



MAXIMUM DIMENSIONS				
HP	A	B	C	D
1/3	15	16.5	12	4

Note: Dimensions are approximate.

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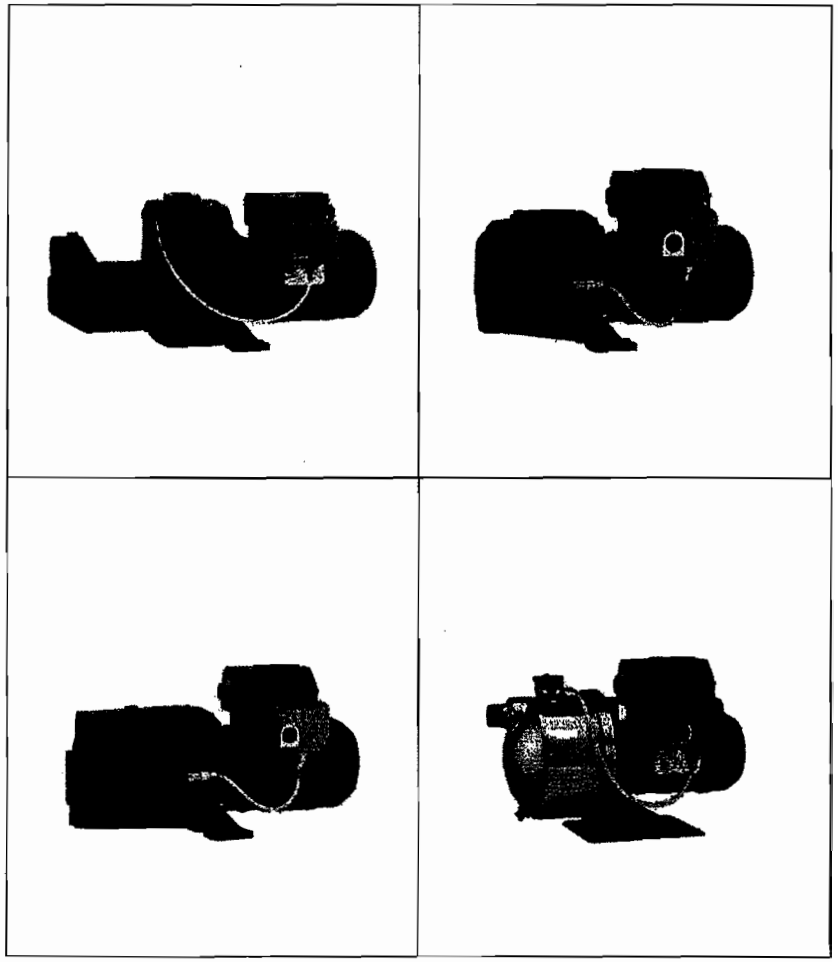
GRUNDFOS

02/01 cod.0013.517.01

JPF-A, JPS-A, JDF-A

(GB) **Installation and Operating Manual**

(F) **Notice d'installation et d'entretien**



GRUNDFOS

1. GENERAL

Read this documentation carefully before installation. Installation and functioning must comply with the safety regulations in the country in which the product is installed. The entire operation must be carried out in a workmanlike manner.
Failure to comply with the safety regulations not only causes risk to personal safety and damage to the equipment, but invalidates every right to assistance under guarantee.

2. APPLICATIONS

JPF 2-A, JPF 3-A, JPF 4-A, JPF 5-A, JPF 7-A, JPF 41-A, JPS 2-A, JPS 4-A: Self-priming centrifugal jet pumps with excellent suction capacity, even when gas is present in the water. Particularly suitable for water supply uses and for pressurization in the home. Suitable for small farming applications, market gardens, gardening, emergencies in the home and industrial utilities.
JDF 2-A, JDF 4-A: Self-priming centrifugal pumps for suction at depths of as many as 98,4 ft with ejector to be fitted in 4" wells or larger. Used for supplying water to farm houses and in small farming applications.

3. PUMPED FLUIDS

The machine has been designed and built for pumping water, free from explosive substances and solid particles or fibres, with a density of 61,31 lb/ft^3 and a kinematic viscosity of 1,0764×10^{-5} ft^2/s, and chemically non-aggressive liquids.

4. TECHNICAL DATA AND RANGE OF USE

- **Supply voltage:** 1 X 115V 60Hz / 1 X 230V 60Hz — see electrical data plate
- **Absorbed power:** see electrical data plate
- **Delivery:** 0,26 g.p.m to 32 g.p.m
- **Head up:** to 200 ft
- **Pumped liquid:** clean, free from solid bodies or abrasive substances, non-aggressive.
- **Protection class:** F
- **Line fuses AM class:**

Model	Line fuses(Amps) 1x115V 60Hz	1x230V 60Hz
JPF 2-A, JPF 3-A	8	4
JPS 2-A	8	6
JDF 2-A	12	6
JPF 4-A, JDF 4-A	12	6
JPS 4-A, JPF 41-A	16	8
JPF 5-A	--	10
JPF 7-A	--	20

Maximun operating pressure:	87 psi	JPF 2-A, JPF 3-A, JPF 4-A, JPF 41-A, JDF 2-A, JDF 4-A
	109 psi	JPF 5-A, JPF 7-A
	116 psi	JPS 2-A, JPS 4-A

Liquid temperature range:	32 ÷ +95°F:	JPF 2-A, JPF 3-A, JPF 4-A, JPF 41-A, JPS 2-A, JPS 4-A,
	32 ÷ +104°F:	JPF 5-A, JPF 7-A , JDF 2-A, JDF 4-A

- **Storage temperature:** 14°F to +104°F
- **Relative humidity of the air:** MAX. 95%
- **Pumps construction in conformity with standards:** CAN/CSA – C22.2 No. 108 – M89
  CAN/CSA – C22.2 No. 108 – M89
  CSA Std C22.2 No 77 - 95

5. MANAGEMENT

5.1 Storage

All the pumps must be stored indoors, in a dry, vibration-free and dust-free environment, possibly with constant air humidity. They are supplied in their original packaging and must remain there until the time of installation. If this is not possible, the intake and discharge ports must be accurately closed.

5.2 Transport

Avoid subjecting the products to needless jolts or collisions.
To lift and transport the unit, use lifting equipment and the pallet supplied standard (if applicable).

5.3 Weights

The adhesive label on the package indicates the total weight of the pump.

6. WARNINGS

6.1 Skilled technical personnel

It is advisable that installation be carried out by skilled personnel in possession of the technical qualifications required by the specific legislation in force.

The term **skilled personnel** means persons whose training, experience and instruction, as well as their knowledge of the respective standards and requirements for accident prevention and working conditions, have been approved by the person in charge of plant safety, authorizing them to perform all the necessary activities, during which they are able to recognize and avoid all dangers.

6.2 Safety

Use is allowed only if the electric system is in possession of safety precautions in accordance with the regulations in force in the country where the product is installed.

6.3 Checking motor shaft rotatiou

Before installing the pump you must check that the rotating parts turn freely. For this purpose remove the fan cover (13) from its seat in the motor end cover (11). Insert a screwdriver in the notch on the motor shaft from the ventilation side. If there is a blockage, turn the screwdriver, tapping it gently with a hammer. **Fig.A**

6.4 Responsibility

The Manufacturer does not vouch for correct operation of the pumps if they are tampered with or modified, ruu outside the recommended work range or in contrast with the other instructions given in this manual.
The Manufacturer declines all responsibility for possible errors in this instructions manual, if due to misprints or errors in copying. The company reserves the right to make any modifications to products that it may consider necessary or useful, without affecting the essential characteristics.

7. INSTALLATION

7.1 The pump must be fitted in a well ventilated place, protected from unfavourable weather conditions and with an environment temperature not exceeding 104°F. Fig.B

7.2 A firm anchoring of the pump to the bearing surface favours the absorption of any vibrations caused by pump operation. **Fig. C**

7.3 Ensure that the metal pipes do not exert undue strain on the apertures, thus preventing deformations or breakages. **Fig. C**

7.4 **It is always good practice to place the pump as close as possible to the liquid to be pumped.** The pump must be installed only in horizontal position. The internal diameters of the pipes must never be smaller than that of the mouth of the pump. It is advisable to fit a foot valve on suction. **Fig. D** For suction depths of over 13 ft or with long horizontal stretches it is advisable to use an intake hose with a diameter larger than that of the intake aperture of the pump. To prevent the formation of air pockets, the intake hose must slope slightly upwards towards the pump. **Fig. D**

7.5 If the intake pipe is made of rubber or flexible material, always check that it is of the reinforced type to avoid throttling due to suction.

8. ELECTRICAL CONNECTION

Caution! always follow the safety regulations.

Please follow the wiring diagrams inside the pressure box.

8.1 **All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.**

Ensure that the mains voltage is the same as the value shown on the motor plate. A faulty motor or winding can cause electrical shock that could be fatal, whether touched directly or conducted through standing water. For this reason, proper grounding of the pump to the power supply's grounding terminal is required for safe installations, the above-ground metal plumbing should be connected to the power supply as a ground as described in Article 250-80 of the National Electrical Code or Section 26-954 of the Canadian.

8.2 In fixed installations, International Safety Standards require the use of isolating switches with a fuse-carrier base.

8.3 Single-phase motors are provided with built-in thermal overload protection with automatic reset, and may be connected directly to the mains.

9. STARTING UP

9.1

Do not start the pump unless it has been completely filled with fluid.

Before starting up, check that the pump is properly primed; fill it completely with clean water by means of the hole provided after having removed the filler cap on the pump body. This ensures that the mechanical seal is well lubricated and that the pump immediately starts to work regularly. (**Fig. F**). **Dry operation causes irreparable damage to the mechanical seal.** The filling cap must then be screwed back on carefully.

10. PRECAUTIONS

10.1 The pump should not be started more than 20 times in one hour so as not to subject the motor to excessive thermal shock.

10.2 **DANGER OF FROST:** When the pump remains inactive for a long time at temperatures of less than 32°F, the pump body must be completely emptied through the drain cap (26) **Fig. H**, to prevent possible cracking of the hydraulic components. This operation is advisable even in the event of prolonged inactivity at normal temperature.

10.3 When starting after long periods of inactivity, the starting-up operations listed above must be repeated.

11. MAINTENANCE AND CLEANING

In normal operation, the pump does not require any specific maintenance. However, it may be necessary to clean the hydraulic parts when a decrease in performance is observed. **The pump must not be dismantled unless by skilled personnel in possession of the qualifications required by the regulations in force.** In any case, all repairs and maintenance jobs must be carried out only after having disconnected the pump from the power mains.

12. MODIFICATIONS AND SPARE PARTS

Any modification not authorized beforehand relieves the manufacturer of all responsibility. All the spare parts used in repairs must be original ones and the accessories must be approved by the manufacturer so as to be able to guarantee maximum safety of the machines and systems in which they may be fitted.

12.1 **Removal and replacement of the supply cable**

Before starting, ensure that the pump is not connected to the power network

Unscrew the screw from the cover of the pressure switch using a screwdriver and remove the cover. Remove the yellow-green lead, slackening the earth screw, the blue lead and the brown lead from the respective terminals at the side, slackening the screws on the terminals. Remove the cable blocking terminal, slackening the respective screws, and slip off the cable which is now disconnected.

When replacing the power cable, a cable of the same type must be used and with the same terminals, proceeding as for disassembly in inverse order.

ATTENTION:

For power cables with a plug, fit a device for disconnecting the power network (e.g. a magnetothermal switch) with separation contacts of at least 0,12". for each pole.

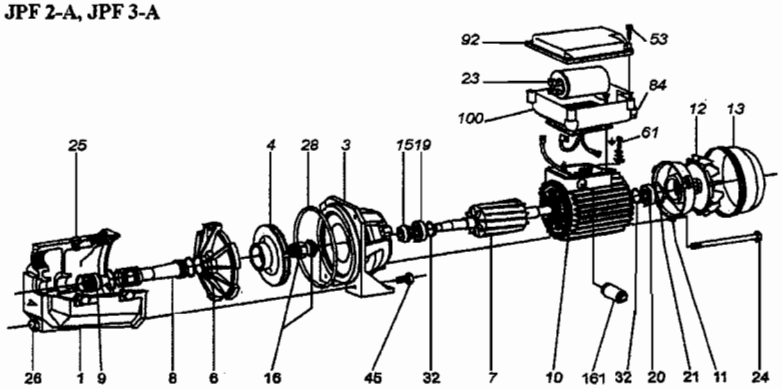
13. INSTRUCTIONS FOR ADJUSTING THE PRESSURE SWITCH

1. Establish the minimun desired pressure value (leaving the pump).
2. Set the storage tank preloading pressure 2,9 psi less than the minimun pressure level.
3. Calibrate it following the indications given below inside the pressure box.

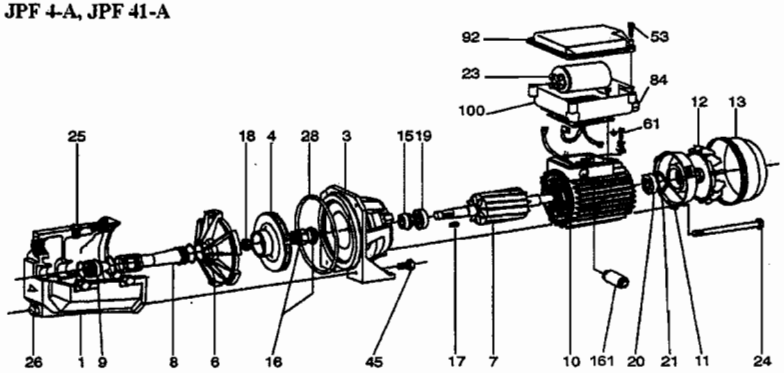
14. TROUBLESHOOTING

FAULT	CHECKS (possible cause)	REMEDY
1. The motor does not start and makes no noise	A. Check the electric connections. B. Check that the motor is live. C. Check the protection fuses. D. Check that the pressure switch is live. E. Ensure that the tank preloading pressure is not higher than the minimun value of the pressure switch.	 C. If they are burnt-out, change them. N.B. If the fault is repeated immediately this means that the motor is short circuiting. E. Set the preloading pressure 2,9 bar below the minimun value of the pressure switch.
2. The motor does not start but makes noise.	A. Ensure that the mains voltage is the same as the value on the plate. B. Ensure that the connections have been made correctly. C. Check that all the phases are present on the terminal board. (3~) D. Look for possible blockages in the pump or motor. E. Check the condition of the capacitor.	 B. Correct any errors. C. If not, restore the missing phase. D. Remove the blockage. E. Replace the capacitor.
3. The motor turns with difficulty.	A. Check the voltage which may be insufficient. B. Check whether any moving parts are scraping against fixed parts.	 B. Eliminate the cause of the scraping.
4. The pump does not deliver.	A. The pump has not been primed correctly. B. The diameter of the intake pipe is insufficient. C. Blocked foot valve.	 B. Replace the pipe with a larger diameter one. C. Clean the foot valve.
5. The pump does not prime.	A.The intake pipe or the foot valve is taking in air. B.The downward slope of the intake pipe favours the formation of air pockets.	A. Correct the problem and prime again. B. Correct the inclination of the intake pipe.
6. The pump supplies insufficient flow.	A. Blocked foot valve. B. The impeller is worn or blocked. C. The diameter of the intake pipe is insufficient.	A. Clean the foot valve. B. Remove the obstructions or replace the worn parts. C. Replace the pipe with one with a larger diameter.
7. The pump vibrates and operates noisily.	A. Check that the pump and the pipes are firmly anchored. B. There is cavitation in the pump, that is the demand for water is higher than it is able to pump. C. The pump is running above its plate characteristics.	A. Fix the loose parts more carefully. B. Reduce the intake height or check for load losses. C. It may be useful to limit the flow at delivery.
8. The motor does noy stop when the demand for water has ceased.	A. Ensure that the value at which the pressure switch is set to stop the motor is not higher than the pressure than the pump can generate (suction + delivery) B. Check that the pressure switch contacts move freely.	A. Set the pressure switch at a lower pressure. B. Otherwise change the pressure switch.
9. The pressure switch, starting and stopping frequently during normal water delivery.	A. Check the setting of the pressure switch which witt certainly be too low. B. Check that the diaphragm of the expansion chamber (if used) is unbroken.	A. Increase the setting values of the pressure switch until the problem is overcome. Do not forget to reset the minimun intervention pressure. B. Otherwise remove the fault.

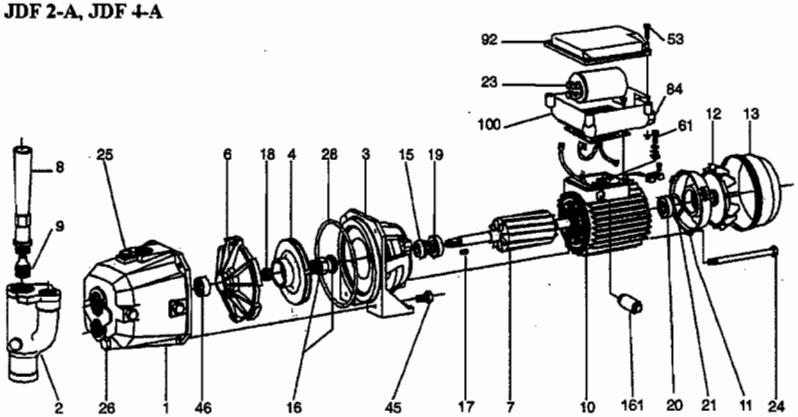
JPF 2-A, JPF 3-A



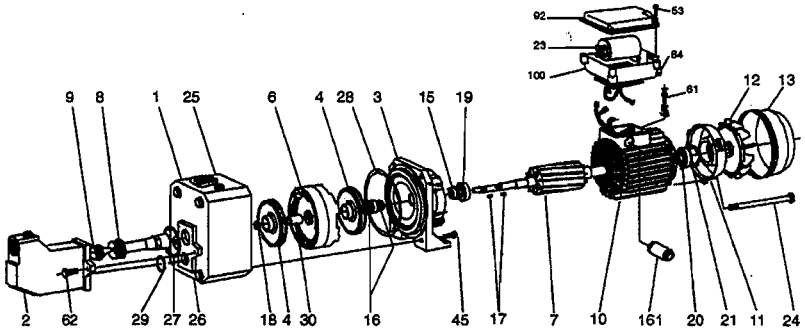
JPF 4-A, JPF 41-A



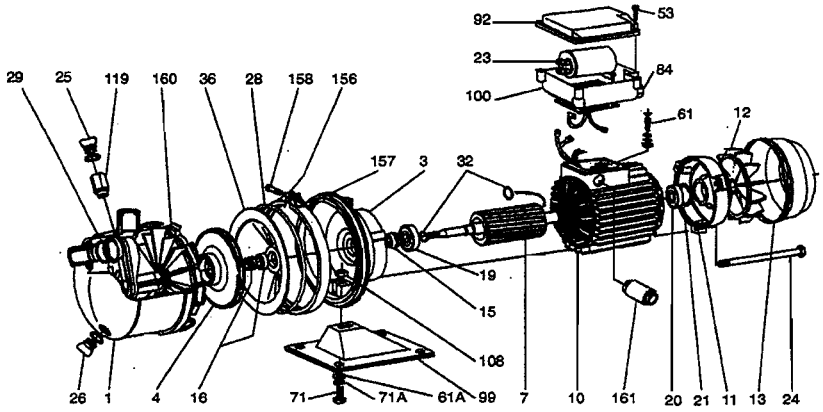
JDF 2-A, JDF 4-A



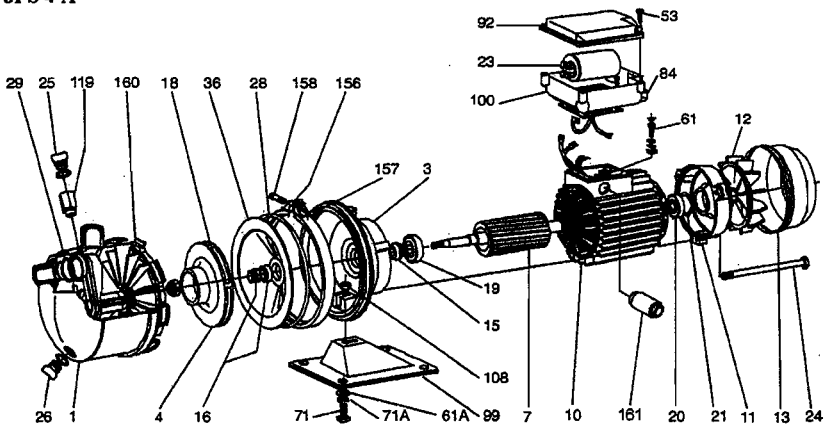
JPF 5-A



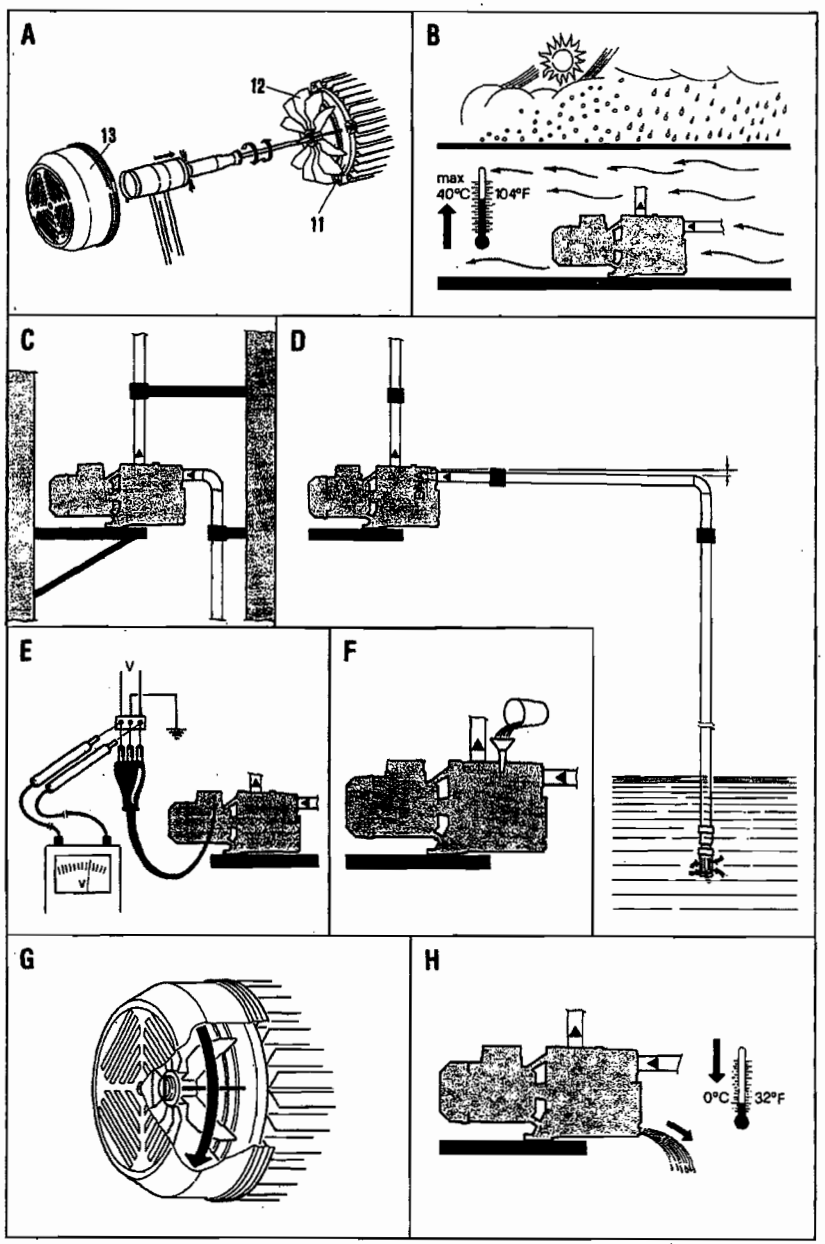
JPS 2-A



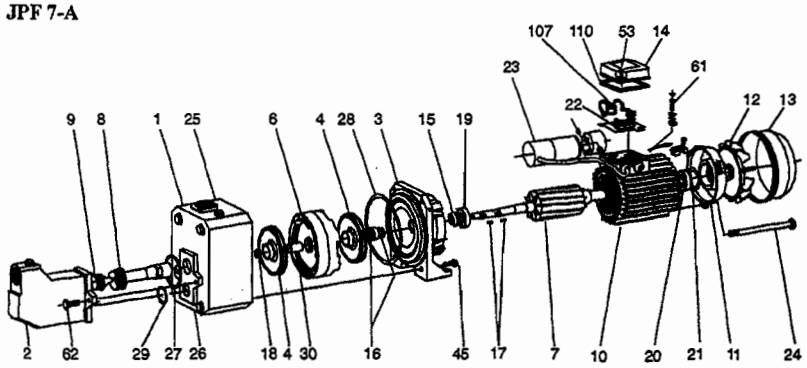
JPS 4-A



ENGLISH



JPF 7-A



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To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS' or an authorised service station centre for instructions. Any defective product to be returned to GRUNDFOS or a service station centre must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorisation must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations exclusions may not apply to you. This warrant gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Product used of applied in Canada is subject to Grundfos Canada Inc's standard warranty policy. All product intended for export is subject to the warranty policy, rules, laws and regulations of the local country or region.

AMTROL INC.
1400 Division Road
W. Warwick, Rhode Island 02893
(401) 884-6300

WELL-X-TROL® INSTALLATION INSTRUCTIONS

ATTACHING ACCEPTANCE FITTINGS:

SKIRTLESS MODELS WX-101, 102, 103 and 200
In-line Models WX-101, 102, and 103 are conventionally installed directly in the main water supply line with a 3/4" connection. For Model WX-200, a 1" fitting is used.

SKIRTED MODELS WX-201 thru WX-350
Skirted Models WX-201 thru WX-302 are equipped with an elbow for connection to the system. The WX-201 thru WX-203 has a 1" elbow; The WX-205 thru WX-302 has a 1 1/4" elbow. The WX-350 has a 1 1/4" tee for straight through piping.

PROPER WELL-X-TROL LOCATION
The WELL-X-TROL should be installed as close as possible to the pressure switch. This will reduce the adverse effects of added friction loss and differences in elevation between WELL-X-TROL and/or water supply main and switch.

ADJUSTING WELL-X-TROL PRECHARGE TO SYSTEM REQUIREMENTS
WELL-XTROLS are shipped with a standard precharge of 20 psi for Models WX-101 and WX-102, 30 psi for Models WX-103 thru WX-203, and 38 PSI for Models WX-205, WX-250, WX-251, WX-302, and WX-350. This precharge should be adjusted, when not attached to the system, as follows:

1. Remove protective air valve cap and using a suitable pressure gauge, check precharge pressure. (Tank should be at room temperature and empty of water.)
2. Release or add air as necessary to make precharge pressure 1-2 psi below the pressure switch pump cut-in setting. **NOTE:** Pressure switch setting may be out-of-adjustment, i.e., if labeled "30/50", it may be actually 28 or 29 to 48 to 49. See "Fine Tuning Procedure", below, for correcting this situation. Do not adjust WELL-X-TROL precharge for this variation.
3. Replace protective air valve cap and seal with the air valve label provided. (See Figure 1) This will enable you to determine if valve has been tampered with on possible future service calls.

When the WELL-X-TROL is installed in the system, system pressure must be reduced to exhaust the tank of acceptance water before precharging. Once this has been done, follow above steps 1-3.

SYSTEM CONNECTION
1. Locate WELL-X-TROL in final desired location.
2. Level as necessary.
3. Connect to pump supply line with same size pipe as from pump. Eliminate unnecessary friction loss.
4. All Piping should be in accordance with prevailing local codes and standards.

FINE TUNING PROCEDURES (see chart)
Many times actual pressure switch settings will vary from the standard pressure range indicated. These variations could cause a momentary lag of water delivery as the pressure switch is not "tuned" to the WELL-X-TROL's precharge pressure.

TO "FINE TUNE", FOLLOW THESE STEPS:

1. Fill the system and WELL-X-TROL until pump cuts off.
2. Open one or more fixtures to drain WELL-X-TROL.
3. If there is a momentary pause in the water flow from the time the WELL-X-TROL is emptied and the pump starts, adjust pump switch cut-in setting upward (clockwise) slightly. (Refer to Adjustment Instructions by switch manufacturer).

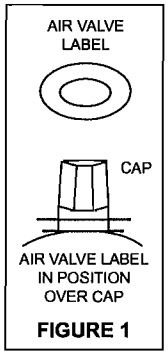


FIGURE 1

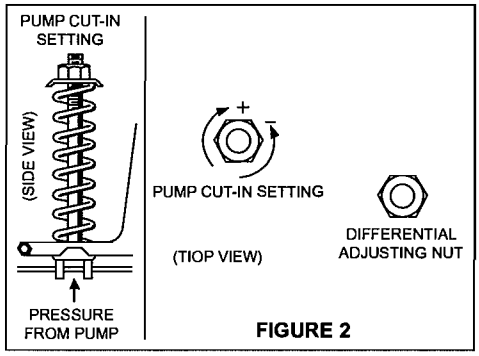


FIGURE 2

4. Close fixtures and refill WELL-X-TROL to pump cut-off. Check time to fill.
5. Open fixtures and see if pause in water is eliminated at pump cut-in. If not, continue adjusting pressure switch.

REPLACING GALVANIZED OR EPOXY LINED TANKS WITH WELL-X-TROL
Many times ad defective steel tank must be replaced with a WELL-X-TROL to provide Effective System Protection, (ESP).

It is a simple procedure and the line drawing should be followed for correct connection to the system. Because the WELL-X-TROL is precharged with air, it will always occupy less space for equal amounts of pressurized water than a galvanized or epoxy lined steel tank.

It is recommended that a relief valve be installed at the WELL-X-TROL connection to ensure system protection.

Also BE SURE to plug the air port on a jet pump, as air is no longer required to be supplied to the tank.

RECOMMENDED PIPE SIZE FOR PUMP FLOWS	
PIPE SIZE	FLOW GPM
3/4	10
1	16
1 1/4	30
1 1/2	40

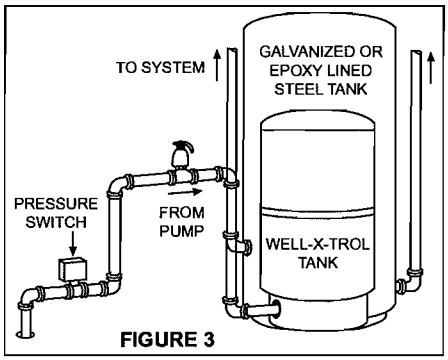
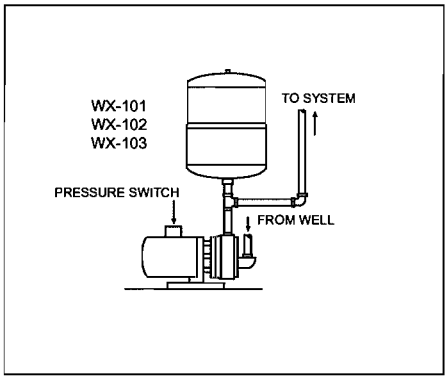


FIGURE 3

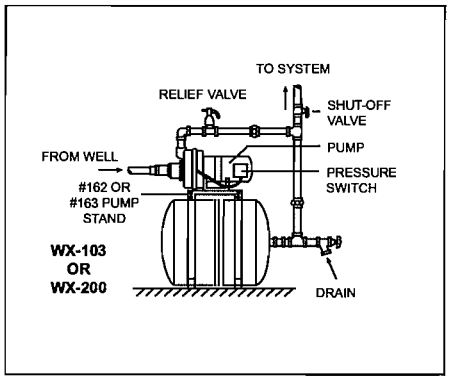
PART #: 9015A290
MC #: 4385 (11/97)

RECOMMENDED INSTALLATIONS

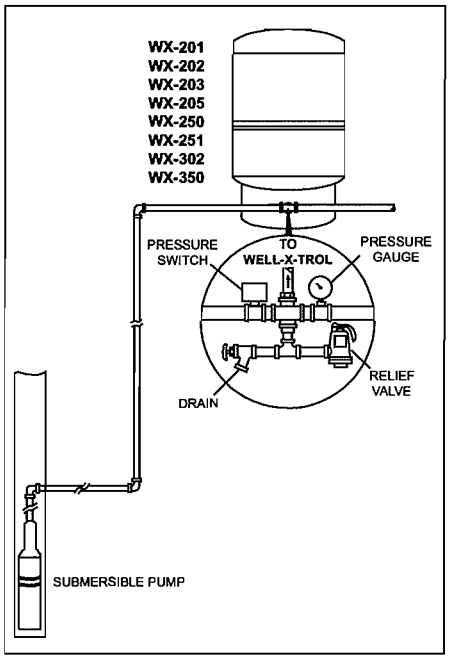
WX-100 Series WELL-X-TROL with tank mounted at jet pump.



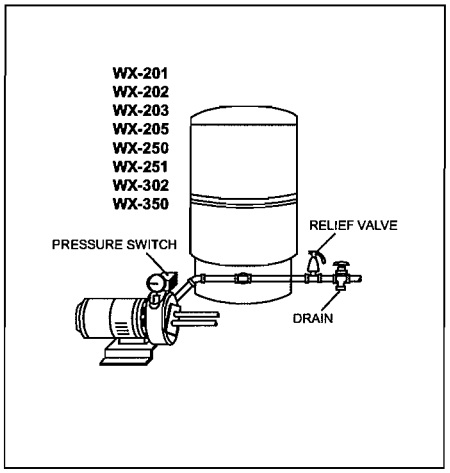
WX-103 or WX-200 with #162 pump stand. WX-200 with #163 pump stand mounting jet pump.



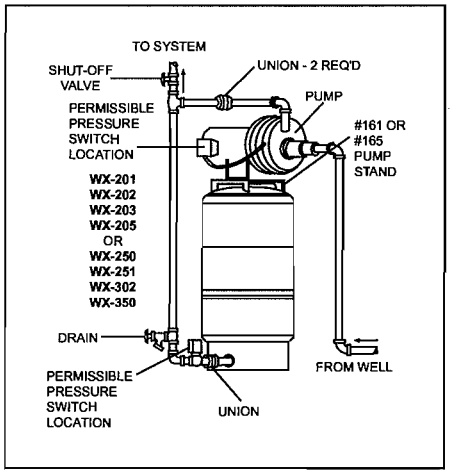
WX-201 through WX-350 WELL-X-TROL installed on-line using submersible pump.



WX-201 through WX-350 WELL-X-TROL installed on-line with jet pump.



WX-201 through WX-203 WELL-X-TROL using #161 pump stand. WX-205 through WX-350 using #165 pump stand. Shallow well jet pump mounted on tank.



WELL-X-TROL BY AMTROL

LIMITED WARRANTY

RESIDENTIAL MODELS WX-101 THROUGH WX-350 INCLUDING ALL OPTIONS.

AMTROL Inc. warrants to the original purchaser its Well-X-Trol® Pre-pressurized Diaphragm Well Tank is of the kind and quality set forth in written specification and is free from defects in materials and workmanship under normal use and service when used in the manner for which the Well-X-Trol was designed and intended. AMTROL, as its sole and exclusive obligation under this warranty, will repair or replace at its option a Well-X-Trol or part thereof without charge in case of a defect, malfunction or failure to conform to this warranty within five (5) years from the date of manufacture. AMTROL will not however, accept or otherwise be liable for any claims for labor costs incurred by the consumer in removing or reinstalling a Well-X-Trol and/or part thereof. This warranty does not apply if the defect is due to failure to use the Well-X-Trol tank for its intended purpose, the result of accident, abuse, misuse, or unauthorized alteration, or because the Well-X-Trol Tank was not installed and maintained in accordance with the printed instructions which accompanied it. IN NO EVENT SHALL AMTROL, INC. BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES. Some states do not allow the exclusion or limitation of incidental, special or consequential damages, so the above limitation or exclusion may not apply to you.

THE WARRANTIES SET FORTH HEREIN ARE IN LIEU OF ANY AND ALL OTHER EXPRESSED WARRANTIES. ANY IMPLIED WARRANTIES OF MERCHANTIBILTY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL BE LIMITED IN DURATION TO THE 5-YEAR PERIOD OF THIS LIMITED WARRANTY. Some states do not allow limitations on how long an implied warranty last, so the above limitation may not apply to you.

In order to obtain service under this warranty, the consumer must contact the installer or dealer where the unit was purchased. The installer or dealer must contact the distributor who will then contact AMTROL and AMTROL may require the defective Well-X-Trol Tank to be returned to AMTROL (freight prepaid) to process the warranty claim. Defective tanks covered under this warranty will be replaced or repaired at the factory, and returned to the distributor (freight prepaid). In replacing or repairing parts or products, AMTROL reserves the right to make such changes in the details of design construction, arrangement, or materials as shall in its judgement constitute an improvement over former practice.

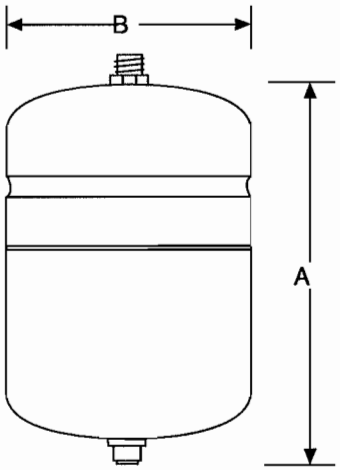
This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

AMTROL INC. 1400 Division Road • W. Warwick, RI 02893 • 401-884-6300

AMTROL INC.

WELL-X-TROL®

Pre-pressurized diaphragm-type well tanks
WX-100, 200 and 300 SERIES

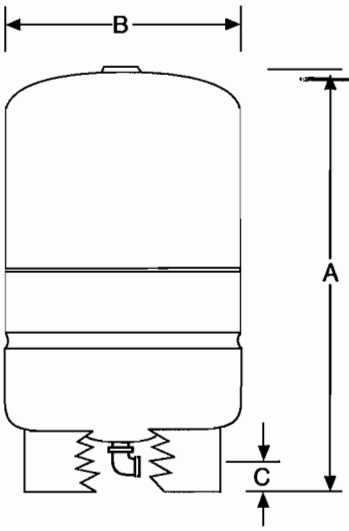


In-Line Models

Model No.	Tank Vol. Lit.	Tank Vol. Gal	Max. Accept. Factor	A Height mm	A Height ins.	B Diameter mm	B Diameter ins.	Sys. Conn.[1] ins.	Factory Pre-charge PSIG	Working Pressure PSIG[2]	Ship Wt. kg	Ship Wt. lbs.
WX-101	8	2.0	0.45	321	12⅝	203	8	¾	18	100	2.3	5
WX-102	17	4.4	0.55	381	15	279	11	¾	18	100	4.0	9
WX-103	33	7.6	0.42	629	22¼	279	11	¾	28	100	7.0	15
WX-104	39	10.3	1.00	451	17¾	390	15⅜	1	28	100	9.0	20
WX-200	53	14.0	0.81	559	22	390	15⅜	1	38	100	10.0	22

[1] **System Connection:** Steel. [2] 100 PSIG is 689.5 kPa
[1] **System Connection:** Steel. Copper Lined Steel Fitting

Stand Models



Model No.	Tank Vol. Lit.	Tank Vol. Gal	Max. Accept. Factor	A Height mm	A Height ins.	B Diameter mm	B Diameter ins.	C Conn. ins.	Sys. Conn.[3] ins.	Factory Pre-charge PSIG	Working Pressure PSIG[2]	Ship Wt. kg	Ship Wt. lbs.
WX-104-S	39	10.3	1.00	489	19¼	390	15⅜	1 13/16	1	38	125	10.5	23
WX-201	53	14.0	0.81	606	23⅞	390	15⅜	1 13/16	1	38	125	11.4	25
WX-202	76	20.0	0.57	803	31⅝	390	15⅜	1 13/16	1	38	125	15.0	33
WX-202XL	98.4	26.0	0.44	971.5	38¼	390.5	15⅜	1 13/16	1	38	125	16.3	36
WX-203	121	32.0	0.35	1181	46½	390	15⅜	1 13/16	1	38	125	20.0	43
WX-205	129	34.0	1.00	752	29⅝	559	22	2 3/16	1¼	38	125	28.0	61
WX-250	167	44.0	0.77	914	36	559	22	2 3/16	1¼	38	125	31.0	69
WX-251	235	62.0	0.55	1187	46¾	559	22	2 3/16	1¼	38	125	41.0	92
WX-255	306.6	81.0	0.41	1432	56⅜	558.8	22	2 3/16	1¼	38	125	10.0	22
WX-302	326	86.0	0.54	1200	47¼	660	26	2 3/16	1¼	38	125	56.0	123
WX-350	450	119.0	0.39	1572	61⅞	660	26	2 3/16	1¼	38	125	75.0	166

[2] 100 PSIG is 689.5 kPa, 125 PSIG is 862 kPa (Stainless Steel Elbow).
[3] **System Connection:** Steel. Air Stem Stainless Steel.

Max. Operating Conditions

Operating Temperature	200° F (93° C)

Specifications

Description	Standard Construction
Shell	Steel
Diaphragm	Heavy Duty Butyl
Liner	Virgin Polypropylene
Coating	Blue Enamel[4]

[4] Unless TUF-KOTE is specified.
All dimensions are approximate.

NSF
ANSI/NSF 61

Job Name _____

Location _____

_____

_____

Engineer _____

Contractor _____

Contractor P.O. No. _____

Sales Representative _____

Model No. Ordered _____

Pump Cut-In _____ PSI Pump Cut-Out _____ PSI

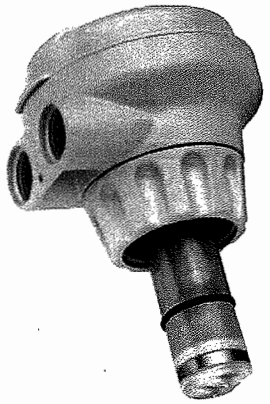
Pump GPM _____

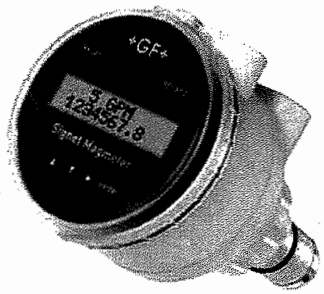
*Submittal data sheets can **ONLY** be ordered as a "Submittal Data Sheet Pack", using **MC# 4400**. They are not available to order on an individual basis, however each data sheet is available on the Amtrol Web Site and can be downloaded and printed for use as needed.*

-Signet 515/2536 Rotor-X Flow Sensor
-Signet 8550 Flow Transmitters

Signet 2551 Magmeter Flow Sensor

Available in a variety of wetted materials and ideal for pipe sizes up to DN900 (36 in.)





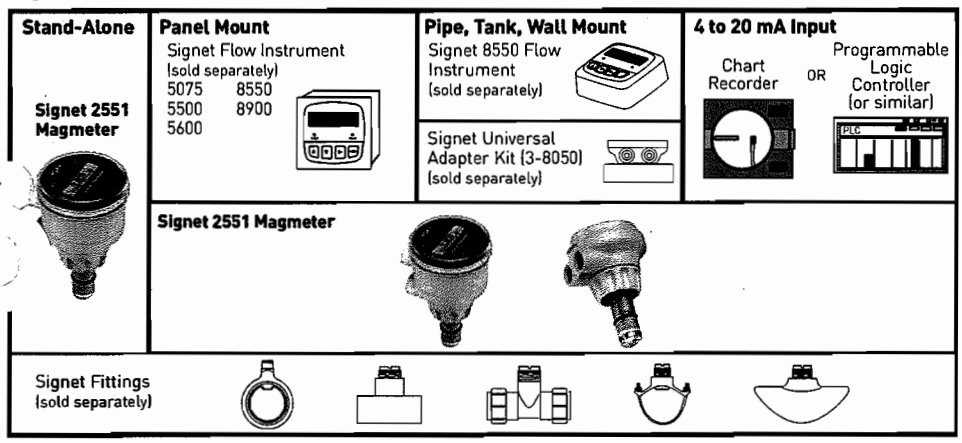
Description

The Signet 2551 Magmeter is an insertion style magnetic flow sensor that features no moving parts. The patented* sensor design is available in corrosion-resistant materials to provide long-term reliability with minimal maintenance costs. Material options include PP with stainless steel, PVDF with stainless steel, PVDF with Hastelloy-C, or PVDF with Titanium. Utilizing the comprehensive line of Signet installation fittings, sensor alignment and insertion depth is automatic. These versatile, simple-to-install sensors deliver accurate flow measurement over a wide dynamic range in pipe sizes ranging from DN15 to DN900 (½ to 36 inches), satisfying the requirements of many diverse applications.

Signet 2551 Magmeters offer many output options of frequency/digital (S³L) or 4 to 20 mA which are available on both the blind and display versions. The frequency or digital (S³L) sensor output can be used with Signet's extensive line of flow instruments while the 4 to 20 mA output can be used for a direct input to PLCs, chart recorders, etc. Both the 4 to 20 mA output and digital (S³L) sensor interface is available for long distance signal transmission. An additional benefit is the empty pipe detection which features a zero flow output when the sensors are not completely wetted. Also, the frequency output is bi-directional while the 4 to 20 mA output can be set for uni- or bi-directional flow using the display or the 3-0250 USB to Digital (S³L) Configuration/ Diagnostic setup tool which connects to PCs for programming capabilities.

In addition the display version of the 2551 Magmeter is available with relays and features permanent and resettable totalizer values which can be stored and seen on the display. Also, the display contains multi-languages with English, Spanish, German, French, Italian and Portuguese menu options.

System Overview



Features

- **Test certificate included for -X0, -X1**
- **Patented Magmeter technology**
- **No moving parts**
- **Bi-directional flow**
- **Empty pipe detection**
- **Installs into pipe sizes DN15 to DN900 (0.5 to 36 in.)**
- **Operating range 0.05 to 10 m/s (0.15 to 33 ft/s)**
- **Accurate measurement even in dirty liquids**
- **Blind 4 to 20 mA, digital/frequency, relay output**
- **No pressure drop**
- **Corrosion resistant materials; PP or PVDF with SS, Hastelloy-C, or Titanium**
- **Multi-language display menu available**

Applications

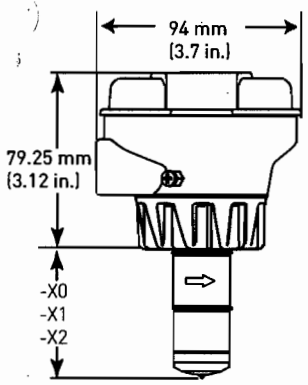
- **Chemical Processing**
- **Water and Waste Water Monitoring**
- **Metal Recovery and Landfill Leachate**
- **Commercial Pools, Spas, and Aquariums**
- **HVAC**
- **Irrigation**
- **Scrubber Control**
- **Neutralization Systems**
- **Industrial Water Distribution**

CE cULus LISTED MEASURING EQUIPMENT 77CJ

* U.S. Patent No: 7,055,396 B1

Dimensions

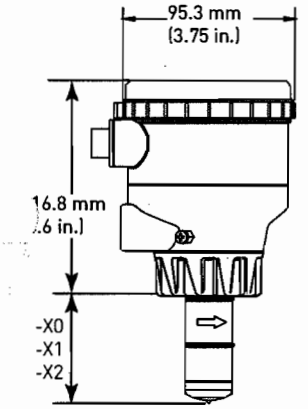
Blind Version



Pipe Range
1/2 to 4 in. -X0 = 58 mm (2.3 in.)
5 to 8 in. -X1 = 91 mm (3.6 in.)
10 to 12 in. -X2 = 167 mm (6.6 in.)

X = Sensor Body P, T, V, or W

Display Version



Pipe Range
1/2 to 4 in. -X0 = 58 mm (2.3 in.)
5 to 8 in. -X1 = 91 mm (3.6 in.)
10 to 12 in. -X2 = 167 mm (6.6 in.)

X = Sensor Body P, T, V, or W

Specifications

General

Operating Range:
0.05 to 10 m/s (0.15 to 33 ft/s)
Pipe Size Range: DN15 to DN900 (½ in. to 36 in.)
Linearity: ±1% reading plus 0.01 m/s (0.033 ft/s)
Repeatability: ±0.5% of reading @ 25 °C (77 °F)
Minimum Conductivity: 20 µS/cm

Wetted Materials

Sensor body/Electrodes and Grounding ring:
- -P0, -P1, -P2: PP/316L SS
- -T0, -T1, -T2: PVDF/Titanium
- -V0, -V1, -V2: PVDF/Hastelloy-C
- -W0, -W1, -W2: PVDF/316L SS

O-rings:
- FPM (standard)
- EPR (EPDM), FFPM (optional)

Case: PBT
Display Window: Polyamide
Protection Rating: NEMA 4X/IP65

Electrical

Power Requirements
- 4 to 20 mA: 24 VDC ±10%, regulated, 22.1 mA max.
- Frequency: 5 to 24 VDC ±10%, regulated, 15 mA max.
- Digital (S³L): 5 to 6.5 VDC, 15 mA max.
- Auxiliary (only required for units with relays): 9 to 24 VDC, 0.4 A max

Reverse polarity and short circuit protected

Current output (4 to 20 mA):
- Loop Accuracy: 32 µA max. error (25 °C @ 24 VDC)
- Isolation: Low voltage < 48 VAC/DC from electrodes and auxiliary power
- Maximum Cable: 300 m (1000 ft)
- Error condition: 22.1 mA
- Max. Loop Resistance: 300 Ω
- Compatible with PLC, PC or similar equipment
- 4 to 20 mA load needed

Frequency Output:
- Output Modes: Freq., or Mirror Relay (display version only)
- Max. Pull-up Voltage: 30 VDC
- Max. Current Sink: 50 mA, current limited
- Maximum Cable: 300 m (1000 ft)
- Compatible with Signet Model 5075, 5500, 5600, 8550, 8900

Digital (S³L) Output:
- Serial ASCII, TTL level 9600 bps
- Compatible with Model Signet 8900 controller

Relay Specifications

- #1, #2 Type: Mechanical SPDT
  Rating: 5 A @ 30 VDC max., 5 A @ 250 VDC max.
- #3 Type: Solid State
  Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Hysteresis:
User adjustable for exiting alarm condition
Alarm On 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 Closed

Display

Characters: 2 x 16
Contrast: User-set in four levels
Backlighting (only on relay versions):
Requires external 9-24 VDC, 0.4 mA max.

Max. Temperature/Pressure Rating

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)

Maximum Operating Pressure:
10.3 bar @ 25 °C (150 psi @ 77 °F)
1.4 bar @ 85 °C (20 psi @ 185 °F)

See Temperature and Pressure Graphs for more information

Standards and Approvals

- CE
- UL, CUL (for display versions with relays)
- NEMA 4X / IP65 Enclosure (with cap installed)
- U.S. Patent No. 7,055,396 B1

Ordering Information

Sensor Part No.					
3-2551					
	Sensor Body (Transducer) and Electrodes/Grounding Ring Materials - Choose One				
	-P	Polypropylene and 316L SS			
	-T	PVDF and Titanium			
	-V	PVDF and Hastelloy-C			
	-W	PVDF and 316L SS			
		Pipe Size - Choose One			
		0	DN15 to DN100 (½ to 4 in.)		
		1	DN125 to DN200 (5 to 8 in.)		
		2	DN250 to DN900 (10 to 36 in.)		
			Display Options - Choose One		
			-1	No Display	
			-2	With Display, two SPDT relays, one solid state relay	
			-4	With Display	
				Output Options - Choose One	
				1	Frequency, Digital (S^3L), programmable open collector; for use with any Signet Flow Instrument or the 8900 Multi-Parameter Controller**
				2	4 to 20 mA output; for use with PLC, PC or similar equipment
3-2551	-P	0	-2	2	**Example Part Number**

**This option is a programmable open collector output that is available with display versions only.

Application Tips

- Note minimum process liquid conductivity requirement is 20 µs/cm
- Install sensor using standard Signet installation fittings for best results
- Sensor is capable of retrofitting into existing 515 and 2536 fittings.

Mfr. Part No.	Code
3-2551-P0-11	**159 001 105**
3-2551-P0-12	**159 001 110**
3-2551-P0-21	**159 001 267**
3-2551-P0-22	**159 001 273**
3-2551-P0-41	**159 001 261**
3-2551-P0-42	**159 001 279**
3-2551-P1-11	**159 001 106**
3-2551-P1-12	**159 001 111**
3-2551-P1-21	**159 001 268**
3-2551-P1-22	**159 001 274**
3-2551-P1-41	**159 001 262**
3-2551-P1-42	**159 001 280**
3-2551-P2-11	**159 001 107**
3-2551-P2-12	**159 001 112**
3-2551-P2-21	**159 001 435**
3-2551-P2-22	**159 001 438**
3-2551-P2-41	**159 001 432**
3-2551-P2-42	**159 001 441**
3-2551-T0-11	**159 001 108**
3-2551-T0-12	**159 001 113**
3-2551-T0-21	**159 001 436**
3-2551-T0-22	**159 001 439**
3-2551-T0-41	**159 001 433**
3-2551-T0-42	**159 001 442**
3-2551-T1-11	**159 001 109**
3-2551-T1-12	**159 001 114**
3-2551-T1-21	**159 001 437**
3-2551-T1-22	**159 001 440**
3-2551-T1-41	**159 001 434**
3-2551-T1-42	**159 001 443**
3-2551-T2-11	**159 001 448**
3-2551-T2-12	**159 001 449**
3-2551-T2-21	**159 001 454**
3-2551-T2-22	**159 001 455**
3-2551-T2-41	**159 001 460**
3-2551-T2-42	**159 001 461**

Mfr. Part No.	Code
3-2551-V0-11	**159 001 257**
3-2551-V0-12	**159 001 259**
3-2551-V0-21	**159 001 269**
3-2551-V0-22	**159 001 275**
3-2551-V0-41	**159 001 263**
3-2551-V0-42	**159 001 281**
3-2551-V1-11	**159 001 258**
3-2551-V1-12	**159 001 260**
3-2551-V1-21	**159 001 270**
3-2551-V1-22	**159 001 276**
3-2551-V1-41	**159 001 264**
3-2551-V1-42	**159 001 282**
3-2551-V2-11	**159 001 450**
3-2551-V2-12	**159 001 451**
3-2551-V2-21	**159 001 456**
3-2551-V2-22	**159 001 457**
3-2551-V2-41	**159 001 462**
3-2551-V2-42	**159 001 463**
3-2551-W0-11	**150 001 230**
3-2551-W0-12	**159 001 231**
3-2551-W0-21	**159 001 271**
3-2551-W0-22	**159 001 277**
3-2551-W0-41	**159 001 265**
3-2551-W0-42	**159 001 283**
3-2551-W1-11	**159 001 232**
3-2551-W1-12	**159 001 233**
3-2551-W1-21	**159 001 272**
3-2551-W1-22	**159 001 278**
3-2551-W1-41	**159 001 266**
3-2551-W1-42	**159 001 284**
3-2551-W2-11	**159 001 452**
3-2551-W2-12	**159 001 453**
3-2551-W2-21	**159 001 458**
3-2551-W2-22	**159 001 459**
3-2551-W2-41	**159 001 464**
3-2551-W2-42	**159 001 465**

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
O-Rings		
1220-0021	**198 801 186**	O-ring, FPM (2 required per sensor)
1224-0021	**198 820 006**	O-ring, EPR (EPDM) (2 required per sensor)
1228-0021	**198 820 007**	O-ring, FFPM (2 required per sensor)
Replacement Transducers		
3-2551-P0	**159 001 211**	PP/316L SS, DN15 to DN100 (½ to 4 in.) pipe
3-2551-P1	**159 001 212**	PP/316L SS, DN125 to DN200 (5 to 8 in.) pipe
3-2551-P2	**159 001 444**	PP/316L SS, DN250 to DN900 (10 to 36 in.) pipe
3-2551-T0	**159 001 213**	PVDF/Titanium, DN15 to DN100 (½ to 4 in.) pipe
3-2551-T1	**159 001 214**	PVDF/Titanium, DN125 to DN200 (5 to 8 in.) pipe
3-2551-T2	**159 000 445**	PVDF/Titanium, DN250 to DN900 (10 to 36 in.) pipe
3-2551-V0	**159 001 376**	PVDF/Hastelloy-C, DN15 to DN100 (½ to 4 in.) pipe
3-2551-V1	**159 001 377**	PVDF/Hastelloy-C, DN125 to DN200 (5 to 8 in.) pipe
3-2551-V2	**159 000 446**	PVDF/Hastelloy-C, DN250 to DN900 (10 to 36 in.) pipe
3-2551-W0	**159 001 234**	PVDF/316L SS, DN15 to DN100 (½ to 4 in.) pipe
3-2551-W1	**159 001 235**	PVDF/316L SS, DN125 to DN200 (5 to 8 in.) pipe
3-2551-W2	**159 001 447**	PVDF/316L SS, DN250 to DN900 (10 to 36 in.) pipe
Replacement Electronics Module		
3-2551-11	**159 001 215**	Magmeter electronics, frequency or digital (S^3L) output
3-2551-12	**159 001 216**	Magmeter electronics, 4 to 20 mA output
3-2551-21	**159 001 372**	Magmeter display electronics, frequency or digital (S^3L) output, with relays
3-2551-22	**159 001 373**	Magmeter display electronics, 4 to 20 mA output w/relays
3-2551-41	**159 001 374**	Magmeter display electronics, frequency or digital (S^3L) output
3-2551-42	**159 001 375**	Magmeter display electronics, 4 to 20 mA output
Other		
P31536	**198 840 201**	Sensor plug, Polypropylene
7300-7524	**159 000 687**	24 VDC power supply 7.5W, 300 mA
7300-1524	**159 000 688**	24 VDC power supply 15W, 600 mA
7300-3024	**159 000 689**	24 VDC power supply 30W, 1.3 A
7300-5024	**159 000 690**	24 VDC power supply 50W, 2.1 A
7300-1024	**159 000 691**	24 VDC power supply 100W, 4.2 A
3-8551.521	**159 001 378**	Clear plastic cap for display
1222-0042	**159 001 379**	O-ring for clear plastic cap, EPR (EPDM)
3-0250	**159 001 538**	USB to digital (S^3L) Configuration/Diagnostic tool

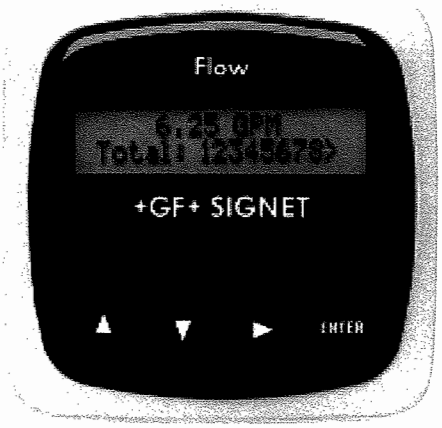
Please refer to Wiring, Installation, and Accessories sections for more information.

3-2551.099 Rev A (01/10)

3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057 • www.gfsignet.com • e-mail: signet.ps@georgfischer.com

+GF+ SIGNET 8550 Flow Transmitters

3-8550-X (Field)



3-8550-XP (Panel)

Features

- **Permanent & resettable totalizers**
- **Scaleable outputs**
- **Relay options**
- **Mounting versatility**
- **2 x 16 character dot matrix LCD**
- **NEMA 4X enclosure with self-healing window**
- **Large pushbuttons**
- **Numbered terminals**
- **Output simulation for complete system testing**

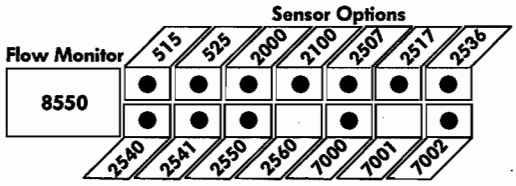
Application

- **Flow control and monitoring**
- **Filtration or softener regeneration**
- **Effluent totalization**
- **Pump protection**
- **Feed pump pulsing**
- **Ratio control**
- **Water distribution**
- **Leak detection**

Description

+GF+ SIGNET 8550 Flow Transmitters are advanced instruments that convert the signal from all +GF+ SIGNET flow sensors into a 4 to 20 mA signal for long distance transmission. Configuration flexibility is maximized with single or dual input/output, two optional relays for process control, two packaging options for integral/pipe mount or panel installation, and scalability for virtually any flow range or engineering unit. State-of-the-art electronic design ensures long-term reliability, signal stability, and simple user setup and operation.

Options

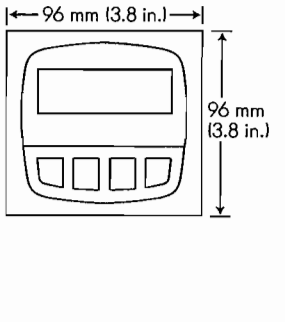


Technical Features

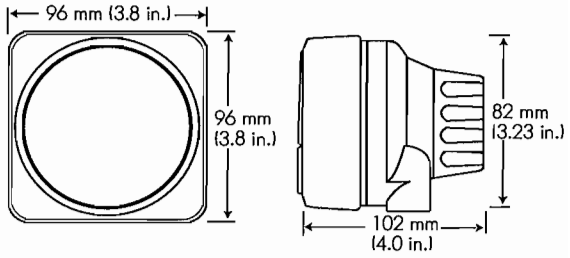
Mounting Version	Part No.	Wire Power	Sensor Input	4 to 20 mA Output	Open Collector/ Relay
Field 	3-8550-1	2/4 non-powered and powered sensors	1	1	1 O.C. Hi, Lo, Pulse Freq or Off
	3-8550-2	4 non-powered and powered sensors	1	1	2 Relays Hi, Lo, Pulse or Off
	3-8550-3	2/4 non-powered and powered sensors	2	2 Sensor 1, Sensor 2 or delta Flow	2 O.C.'s Hi, Lo, Pulse Freq or Off
Panel → 	3-8550-1P	2/4 non-powered and powered sensors	1	1	1 O.C. Hi, Lo, Pulse Freq or Off
	3-8550-2P	4 non-powered and powered sensors	1	1	2 Relays Hi, Lo, Pulse or Off
	3-8550-3P	2/4 non-powered and powered sensors	2	2 Sensor 1, Sensor 2 or delta Flow	2 O.C.'s Hi, Lo, Pulse Freq or Off

Dimensions

Panel Mount



Integral/Universal Mount

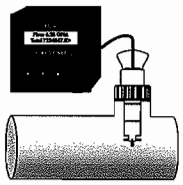


Installation

The transmitter is available in a panel mount or a field version. The field version is mounted to the sensor using the integral mount kit (3-8051) or you may select the universal mount kit (3-8050) to mount the transmitter on a surface near the sensor.

1. Panel Mount

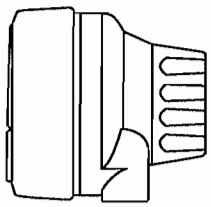
3-8550-XP



All panel mount transmitters (3-8550-XP) include a mounting bracket and gasket for a NEMA 4X watertight panel installation. Panel mount transmitters fit into a standard 1/4 DIN panel cutout.

2. Integral Mount

3-8051 Kit

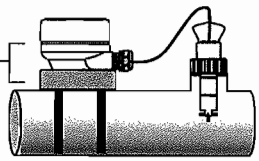


The Integral Mount Kit (3-8051) can be ordered separately and includes a conduit base, locking ring, and integral adapter for mounting the transmitter directly onto a sensor.

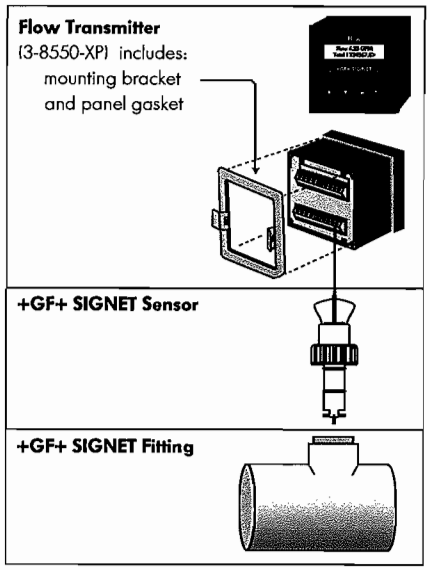
3. Universal Mount

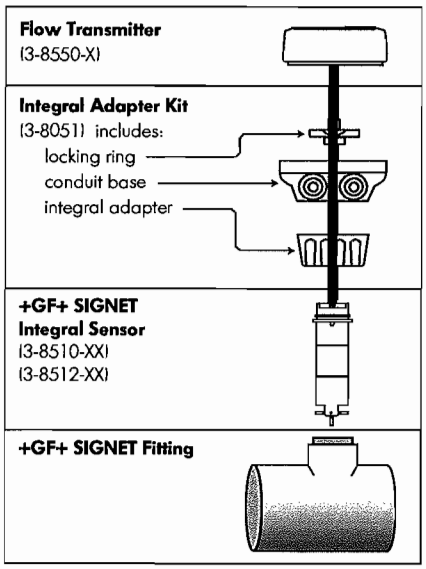
3-8550-X Transmitter

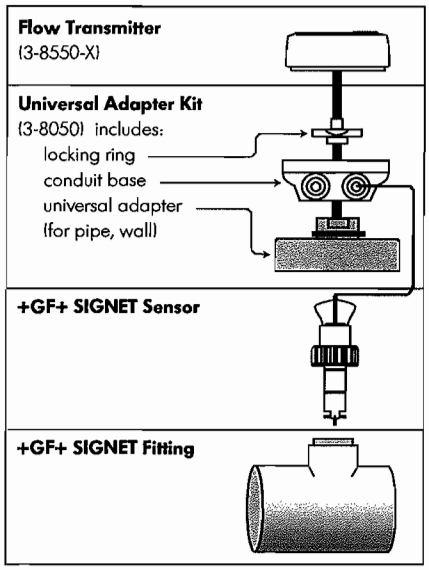
3-8050 Kit



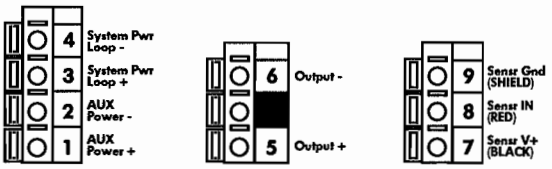
The Universal Mount Kit (3-8050) can be ordered separately and includes a conduit base, locking ring, and universal adapter for mounting the transmitter on a pipe, wall, or other stationary surface.



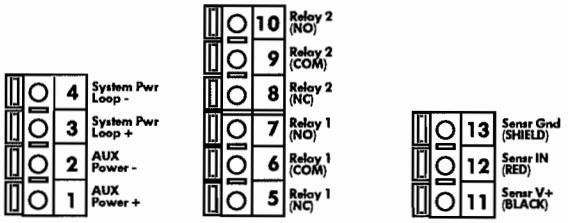




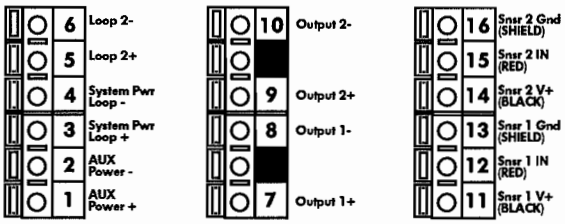
Rear Terminal View



Terminal 8550-1



Terminal 8550-2



Terminal 8550-3

Note: The terminal blocks are not labeled on the back of the unit. An adhesive label is supplied with terminal descriptions to serve as a remote terminal display.

Technical Data

General

Compatibility:
+GF+ SIGNET Flow Sensors with frequency outputs (all except 2560 and 7001)
Accuracy: ± 0.5% of reading @ 25°C
Enclosure:
- Rating: NEMA 4X/IP65 front
- Case: PBT
- Panel Case Gasket: Neoprene
- Window: Polyurethane coated polycarbonate
- Keypad: Sealed 4-key silicone rubber
- Shipping Weight: 0.325kg (0.8 lbs.)

Display:
- Alphanumeric 2 x 16 LCD
- Update rate: 1 second
- Contrast: User selectable, 5 levels

Environmental

Operating temperature:
-10 to 70°C (14 to 158°F)
Storage temperature:
-15 to 80°C (5 to 176°F)
Relative humidity:
0 to 95%, non-condensing

Standards and Approvals

- CSA, CE, UL listed
- Manufactured under ISO 9001 and ISO 14001
- NEMA 4X and IP65

Electrical

Power:
- 12 to 24 VDC ±10%, regulated
  (-1) 61 mA max.; (-2) 200 mA max.; (-3) 122 mA max.

Sensor Input:
- Range: 0.5 to 1500 Hz
- Sensor power:
  2-wire: 1.5 mA @ 5 VDC ± 1%
  3 or 4 wire: 20 mA @ 5 VDC ± 1%
- Optically isolated from current loop
- Short circuit protected

Current output:
- 4 to 20 mA, isolated, fully adjustable and reversible
- Max loop impedance:
  50Ω max. @ 12 V,
  325Ω max. @ 18 V,
  600Ω max. @ 24 V
- Update rate: 100 ms
- Accuracy: ±0.03 mA

Relay output:
- Mechanical SPDT contacts: Hi, Lo, Pulse, Off
- Maximum voltage rating: 5 A @ 30 VDC, 5 A @ 250 VAC resistive load
- Hysteresis: User selectable
- Max 300 pulses/min.

Open-collector output: Hi, Lo, Pulse, Off
- Open-collector, optically isolated,
  50 mA max. sink, 30 VDC max.
  pull-up voltage.
- Max 300 pulses/min.
- Hysteresis: User selectable

Ordering Information

Mfr. Part No.	Code	Description
3-8550-1	159 000 047	Flow transmitter, Field mount
3-8550-1P	159 000 048	Flow transmitter, Panel mount
3-8550-2	159 000 049	Flow transmitter, Field mount with relays
3-8550-2P	159 000 050	Flow transmitter, Panel mount with relays
3-8550-3	159 000 051	Flow transmitter, Field mount with dual input/output
3-8550-3P	159 000 052	Flow transmitter, Panel mount with dual input/output

Accessories

Mfr. Part No.	Code	Description
3-8050	159 000 184	Universal mounting kit
3-8050.395	159 000 186	Transmitter NEMA 4X cover
3-8051	159 000 187	Flow Integral Mnt NPT
3-8052	159 000 188	3/4 in. Integral Mounting Kit
3-8050.396	159 000 617	RC Filter kit (for relay use)
3-8050.392	159 000 640	Model 200 retro-fit adapter
3-0000.596	159 000 641	Heavy duty wall mount bracket
3-5000.598	198 840 225	Surface Mount Bracket
3-9000.392	159 000 368	Liquid tight connector kit for rear cover (includes 3 connectors)
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 piece)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG13.5 (1 piece)

Engineering Specifications

- The transmitter shall meet appropriate CE, CSA & UL standards.
- The transmitter shall be manufactured under ISO 9001 and ISO 14001 certified processes.
- The transmitter shall be field or panel mountable.
- The transmitter shall have flow rate and dual totalization capability.
- The display units shall be fully scaleable.
- The device shall meet NEMA 4X and IP65 standards.
- The operating voltage shall be 12 to 24 VDC.
- The transmitter shall have a 4 to 20 mA output with an open collector output, 5 to 30 VDC or a 4 to 20 mA output with 2 relays, or dual 4 to 20 mA output with dual open collector with delta capability.
- The transmitter shall have simulate capability.
- The transmitter shall be +GF+ SIGNET 8550 Flow Transmitter.

+GF+ SIGNET
8550-1 Flow Transmitter

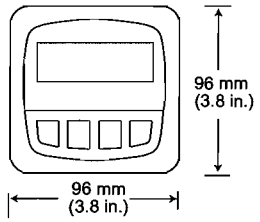
3-8550.090-1 G-4/03 English

WARNING!
- Remove power to unit before wiring input and output connections.
- Follow instructions carefully to avoid personal injury.

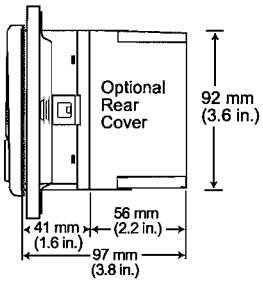
Contents

1. Specifications

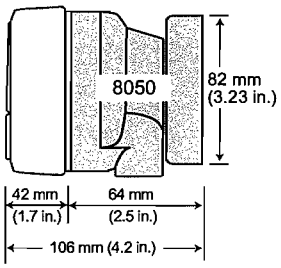
Dimensions



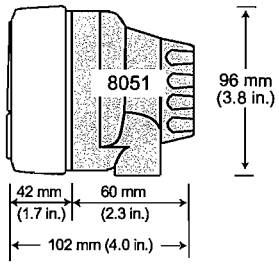
FRONT VIEW
Field Mount &
Panel Mount



SIDE VIEW
Panel Mount



SIDE VIEW
Field Mount w/
8050 Universal base



SIDE VIEW
Field Mount w/
8051 Integral kit

General
Compatibility: +GF+ SIGNET Flow Sensors (w/freq out)

Enclosure:
- Rating: NEMA 4X/IP65 front
- Case: PBT
- Panel case gasket: Neoprene
- Window: Polyurethane coated polycarbonate
- Keypad: Sealed 4-key silicone rubber
- Weight: Approx. 325g (12 oz.)

Display:
- Alphanumeric 2 x 16 LCD
- Update rate: 1 second
- Contrast: User selected, 5 levels
- Display accuracy: ±0.5% of reading @ 25°C
- Thermal sensitivity shift: ±0.005% of reading per °C

Electrical
- Power: 12 to 24 VDC ±10%, regulated, 61 mA max current

Sensor Input:
- Range: 0.5 to 1500 Hz
- Sensor power: 2-wire: 1.5 mA @ 5 VDC ± 1%
  3 or 4 wire: 20 mA @ 5 VDC ± 1%
- Optically isolated from current loop
- Short circuit protected

Current output:
- 4 to 20 mA, isolated, fully adjustable and reversible
- Max loop impedance: 50 Ω max. @ 12 V
  325 Ω max. @ 18 V
  600 Ω max. @ 24V
- Update rate: 100 ms
- Accuracy: ±0.03 mA

Open-collector output, optically isolated:
- 50 mA max. sink, 30 VDC maximum pull-up voltage.
- Programmable for:
  - High or Low setpoint with adjustable hysteresis
  - Pulse operation (max rate: 300 pulses/min).

Environmental
- Operating temperature: -10 to 70°C (14 to 158°F)
- Storage temperature: -15 to 80°C (5 to 176°F)
- Relative humidity: 0 to 95%, non-condensing
- Maximum altitude: 2000 m (6562 ft)
- Insulation category: II
- Pollution degree: 2

Standards and Approvals
- CSA, CE, UL listed
- Immunity: EN50082-2
- Emissions: EN55011 Class B
- Manufactured under ISO 9001 and ISO 14001

2. Installation
ProcessPro transmitters are available in two styles: panel mount and field mount. The panel mount is supplied with the necessary hardware to install the transmitter. This manual includes complete panel mounting instructions.
Field mounting requires one of two separate mounting kits. The 3-8051 integral kit joins the sensor and instrument together into a single package. The 3-8050 Universal kit enables the transmitter to be installed virtually anywhere.
Detailed instructions for integral mounting or other field installation options are included with the 3-8051 Integral kit or the 3-8050 Universal kit.

2.1 Panel Installation

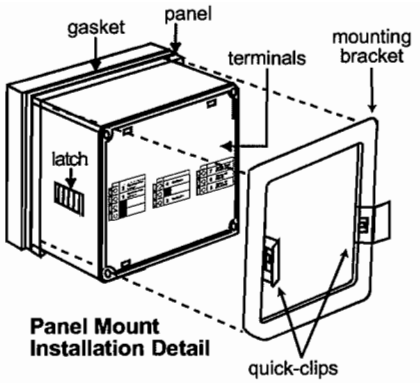
1. The panel mount transmitter is designed for installation using a 1/4 DIN Punch. For manual panel cutout, an adhesive template is provided as an installation guide. Recommended clearance on all sides between instruments is 1 inch.

2. Place gasket on instrument, and install in panel.

3. Slide mounting bracket over back of instrument until quick-clips snap into latches on side of instrument.

4. To remove, secure instrument temporarily with tape from front or grip from rear of instrument. DO NOT RELEASE.

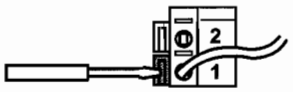
Press quick-clips outward and remove.



Panel Mount Installation Detail

3. Electrical Connections

Caution: Failure to fully open terminal jaws before removing wire may permanently damage instrument.



Wiring Procedure

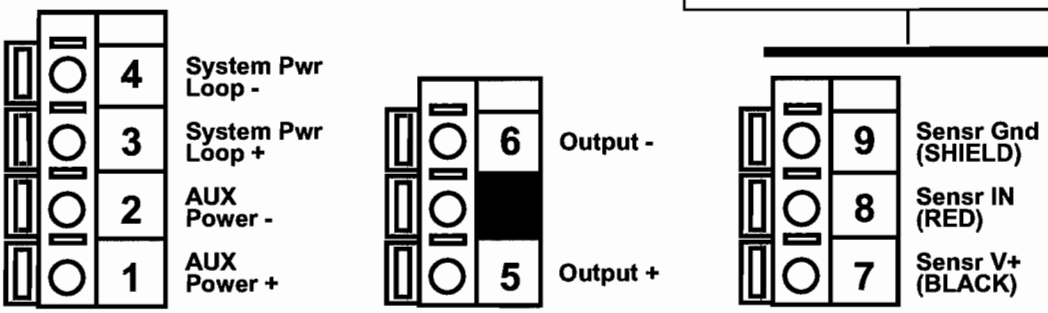
1. Remove 0.5 - 0.625 in. (13-16 mm) of insulation from wire end.
2. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
3. Insert exposed (non-insulated) wire end in terminal hole until it bottoms out.
4. Release orange terminal lever to secure wire in place. Gently pull on each wire to ensure a good connection.

Wiring Removal Procedure

1. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
2. When fully open, remove wire from terminal.

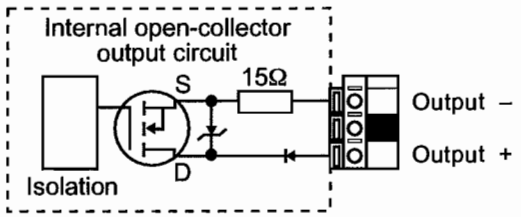
Terminals 3 and 4: Loop Power
12-24 VDC ±10% system power and current loop output.
Max. loop impedance:
50 Ω max. @ 12 V
325 Ω max. @ 18 V
600 Ω max. @ 24 V

Terminals 7-9: Flow sensor input



Terminals 1 and 2: AUXILIARY power
Used only if the flow sensor requires more than 1.5 mA current. For Signet sensors this is limited to the following products:

- 2000
- 2507
- 2530
- 2535
- 2540 if mfg. prior to Jan 1999
- 7002 Vortex sensor

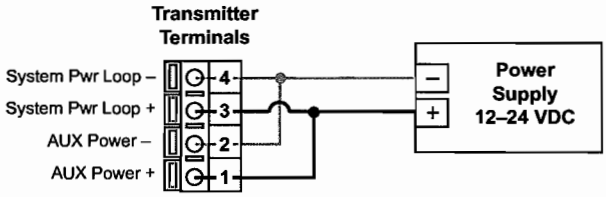


Terminals 5 and 6: Open-collector Output
A transistor output, programmable (see CALIBRATE menu) as:

- High or Low setpoint with adjustable hysteresis
- Volumetric pulse
- Frequency based on flow rate
- May be disabled (Off) if not used.

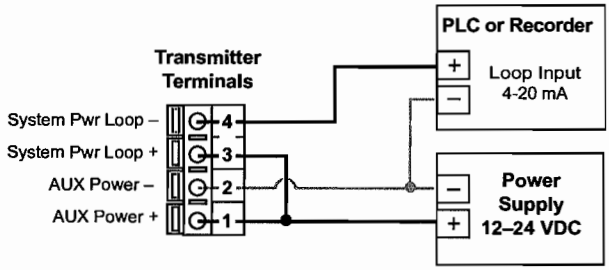
3.1 System Power/Loop Connections

Stand-alone application, no current loop used



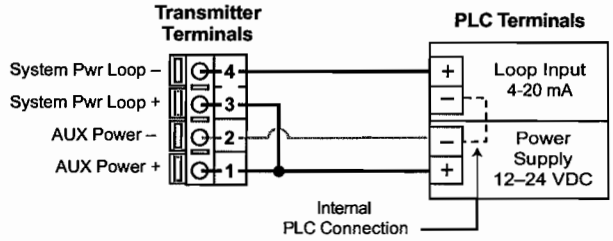
* See AUX POWER Note

Connection to a PLC/Recorder, separate supply



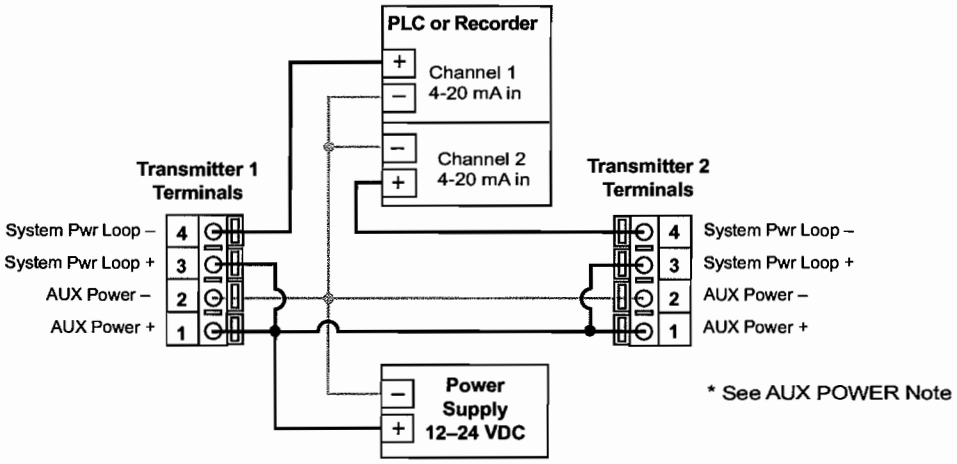
* See AUX POWER Note

Connection to a PLC with built-in power supply



* See AUX POWER Note

Example: Two transmitters connected to PLC/Recorder with separate power supply



* See AUX POWER Note

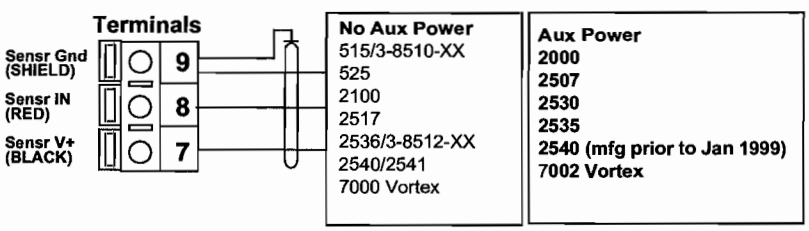
Auxiliary Power note:
AUXILIARY power is used only if the flow sensor requires more than 1.5 mA current.
For Signet sensors this is limited to the following products:

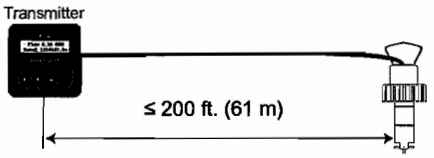
- 2000, 2507, 2530, 2535, 2540 if mfg. prior to Jan 1999, 7002 Vortex sensor

3.2 Sensor Input Connections

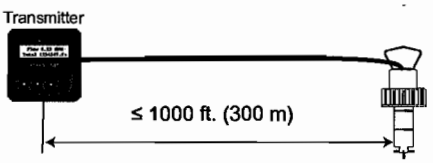
Wiring Tips:

- Do not route sensor cable in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing sensor cable in grounded metal conduit will help prevent electrical noise and mechanical damage.
- Seal cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal. Splice double wires outside the terminal.





Maximum cable length is 200 ft. for 515/8510-XX, 525 , 2517 and any sinusoidal flow signal.



Maximum cable length is 1000 ft. for 2536/ 8512-XX, 2540/2541, vortex, and any open collector flow signal.

3.3 Open Collector Output

The Open collector output can be used as a switch that responds when the flow rate moves above or below a setpoint, or it can be used to generate a pulse that is relative to the flow volume or to the flow rate.

- **Low**

Output triggers when the flow rate is less than the setpoint. The output will relax when the flow rate moves above the setpoint plus the hysteresis value.

- **High**

Output triggers when the flow rate is greater than the setpoint. The output will relax when the flow rate drops below the setpoint plus the hysteresis value.

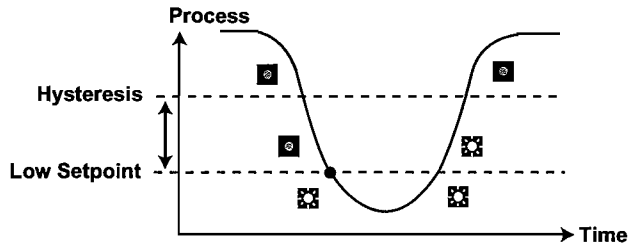
- **Frequency**

Output is a pulse stream that is based on the input flow sensor signal. Set for 1 (input frequency = output frequency). Set for even numbers (2, 4, 6, 8 . . . . 254 maximum) to scale output frequency.

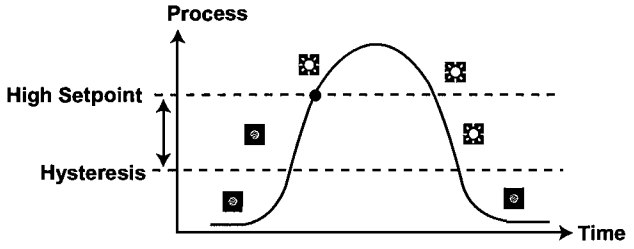
- **Pulse**

Output is a pulse based on the volume of fluid that passes the sensor. Set any value from 0.0001 to 99999.

The output may be disabled (Off) if not used.

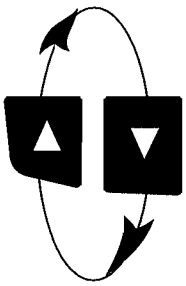


Relay energized
Relay relaxed



VIEW menu

- During normal operation, the ProcessPro displays the VIEW menu.
- When using the CALIBRATE or OPTIONS menus, the ProcessPro will return to the VIEW menu if no activity occurs for 10 minutes.
- To select the item you want displayed, press the UP or DOWN arrow keys. The items will scroll in a continuous loop. Changing the display selection does not interrupt system operations.
- No key code is necessary to change display selection.
- Output settings cannot be edited from the VIEW menu.



View Menu

Display	Description
0.0 GPM Total: 12345678 >	Monitor the flow rate and the resettable totalizer. Press the RIGHT ARROW key to reset the totalizer. If the Reset is locked, you will need to enter the Key Code first. Lock or Unlock the totalizer in the OPTIONS menu. This is the permanent View display.

All of the displays below are temporary. After ten minutes the display will return to the permanent display.

Perm: 12345678 Gallons	Monitor the Permanent Totalizer value.
Loop Output: 12.00 mA	Monitor the 4-20 mA Loop output.
Last CAL: 06-30-01	Monitor date for scheduled maintenance or date of last calibration. (See description in Calibrate Menu.)

ProcessPro Editing Procedure:

Step 1. Press and hold ENTER key:

- 2 seconds to select the CALIBRATE menu
- 5 seconds to select the OPTIONS menu.

Step 2. The Key Code is UP-UP-UP-DOWN keys in sequence.

- After entering the Key Code, the display will show the first item in the selected menu.

Step 3. Scroll menu with UP or DOWN arrow keys.

Step 4. Press RIGHT ARROW key to select menu item to be edited.

- The first display element will begin flashing.

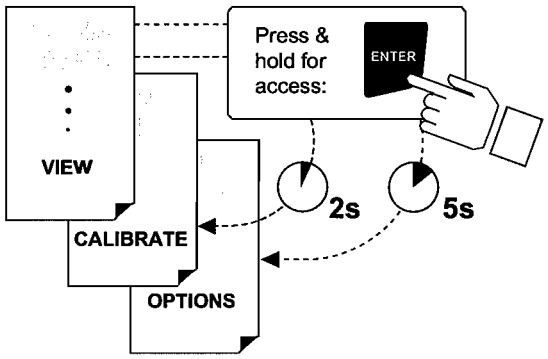
Step 5. Press UP or DOWN keys to edit the flashing element.

- RIGHT ARROW key advances the flashing element.

Step 6. Press ENTER key to save the new setting and return to Step 3.

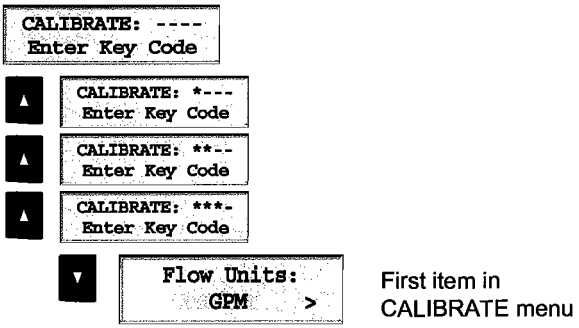
Notes on Step 1:

- The View Menu is normally displayed.
- The CALIBRATE and OPTIONS menus require a KEY CODE.



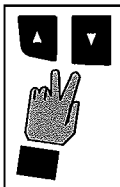
Notes on Step 2:

If no key is pressed for 5 minutes while display is showing "Enter Key Code", the display will return to the VIEW menu.



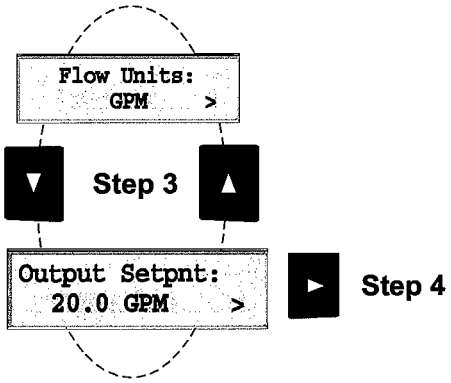
Notes on Steps 3 and 4:

- Refer to pages 6 and 7 for complete listing of menu items and their use.
- From the Step 3 display, pressing the UP and DOWN keys simultaneously will return the display to the VIEW menu.
- If no key is pressed for 10 minutes, display will also return to the VIEW menu.



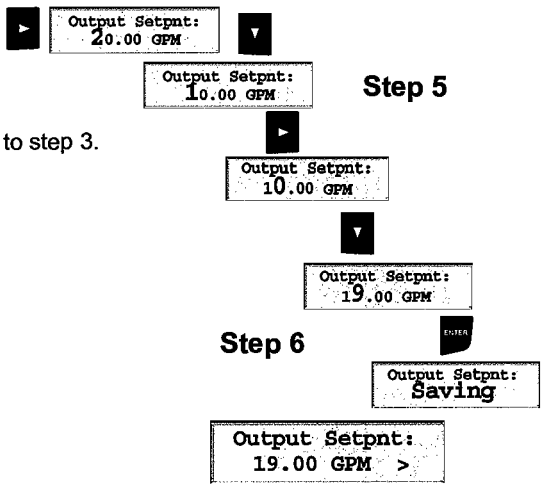
Step 3: Finished Editing?

Press the UP and DOWN keys simultaneously after saving the last setting to return to normal operation.



Notes on Steps 5 and 6:

- All output functions remain active during editing.
- Only the flashing element can be edited.
- RIGHT ARROW key advances the flashing element in a continuous loop.
- Edited value is effective immediately after pressing ENTER key.
- If no key is pressed for 10 minutes unit will restore the last saved value and return to step 3.
- Step 6 (pressing ENTER key) always returns you to Step 3.
- Repeat steps 3-6 until all editing is completed.



Step 5: Made an Error?

Press the UP and DOWN keys simultaneously while any element is flashing. This will recall the last saved value of the item being edited and return you to Step 3.

Calibrate Menu

Display (Factory settings shown)	Description
Flow Units: GPM >	The first three characters set the Flow Rate units of measure. They have no effect on calculations. They may be any alpha or numeric character, upper or lower case. The last character sets the Flow rate Timebase. Select S (seconds), M (minutes), H (hours) or D (days).
Flow K-Factor: 60 >	This setting tells the transmitter how to convert the input frequency from the flow sensor into a flow rate. The K-factor is unique to the sensor model and to the pipe size and schedule. Refer to data in the sensor manual for the correct value. Limits: 0.0001 to 99999. (The K-factor cannot be set to 0)
Total Units: Gallons >	This setting identifies the Totalizer units. It has no effect on any calculation. It serves as a label only. Each character can be any alpha or numeric selection, upper or lower case.
Total K-Factor 60 >	This setting tells the transmitter how to convert the input frequency from the flow sensor into a volumetric total. It also is used as the basis for the Open Collector pulse mode. The setting is usually the same as the Flow K-factor, or different by x10 or x100. Limits: 0.0001 to 99999. (The K-factor cannot be set to 0)
Loop Range: GPM 000.00 → 100.00 >	Select the minimum and maximum values for the 4-20 mA Current loop output. The 8550 will allow any values from 0.0000 to 99999.
Output Mode: Low >	Select the desired mode of operation for the Open Collector output. Options available are High, Low, volumetric Pulse, or Frequency. The signal may be disabled (Off) if not used.
Output Setpnt: 10.0 GPM >	In Low or High Mode, the Open Collector output will be activated when the Flow rate reaches this value. Be sure to modify this setting if you change the Flow Units.
Output Hys: 5.0 GPM >	The Open Collector output will be deactivated at Setpoint ± Hysteresis, depending on High or Low Setpoint selection. (See details on page 4.)
Output Volume: 100.00 Gallons >	In Pulse mode, the Open collector output will generate one pulse when this volume of flow passes the sensor. The measurement is based on the Total K-factor. The 8550 will allow any value from 0.0001 to 99999.
Output PlsWdth: 0.1 Seconds >	In Pulse mode, this setting defines the duration of the Open Collector output pulse. The 8550 allows any value from 0.1 seconds to 999.9 seconds.
Output Freq.: Divide by 1 >	In Frequency mode, the Open Collector output will simulate the sensor frequency, divided by this setting. Set for 1 (input frequency = output frequency). Set for even numbers (2, 4, 6, 8 . . . 254 maximum) to scale output frequency.
Last CAL: 6-30-01	Use this "note pad" to record important dates, such as annual recertification or scheduled maintenance.

Options Menu

Display (Factory settings shown)	Description
Contrast: 3 >	Adjust the LCD contrast for best viewing. A setting of 1 is lower contrast, 5 is higher. Select lower contrast if the display is in warmer ambient surroundings.
Flow Decimal *****. >	Set the decimal to the best resolution for your application. The display will automatically scale up to this restriction. Select *****., ****.*, ***.**, **.*** or *.****
Total Decimal ******.** >	Set the totalizer decimal to the best resolution for your application. Select ********., *******.*, or ******.**
Averaging: Off >	OFF provides the quickest output response to changes in flow. LOW averaging = 4 seconds, HIGH averaging = 8 seconds of input signal. Longer averaging produces more stable display and output response.
Total Reset: Lock Off >	Lock Off : No key code required to reset the resettable totalizer. Lock On : The Key Code must be entered to reset the resettable totalizer.
Loop Adjust: 4.00 mA > Loop Adjust: 20.00 mA >	Adjust the minimum and maximum current output. The display value represents the precise current output. Adjustment limits: • 3.80 mA < 4.00 mA > 5.00 mA • 19.00 mA < 20.00 mA > 21.00 mA Use this setting to match the system output to any external device.
Output Active: Low >	Active HIGH: This setting is used to turn a device (pump, valve) ON at the setpoint. Active LOW: This setting is used to turn a device OFF at the setpoint.
Test Loop: >	Press UP or DOWN keys to manually order any output current value from 3.6 mA to 21.00 mA to test current loop output.
Test Output: >	Press UP or DOWN keys to manually toggle the state of open collector output.

Troubleshooting

Display Condition	Possible Causes	Suggested Solutions
"- - - - -"	Flow rate exceeds display capability	• Increase Flow units time base • Move flow decimal one place to the right
"Pulse Overrun"	• Open Collector pulse rate exceeds maximum of 300 pulses per minute. • Pulse width set too wide.	• Increase Pulse volume setting • Decrease pulse width setting. • Reduce system flow rate
"Value must be more than 0"	K-factors cannot be set to 0.	Enter K-factor from 0.0001 to 99999
Open Collector is always activated	• Hysteresis value too large • Defective transmitter	• Change the hysteresis value • Replace transmitter

Ordering Information

Mfr. Part No.	Code	Description
3-8550-1	159 000 047	Flow transmitter, Field mount
3-8550-1P	159 000 048	Flow transmitter, Panel mount
3-8550-2	159 000 049	Flow transmitter, Field mount with relays
3-8550-2P	159 000 050	Flow transmitter, Panel mount with relays
3-8550-3	159 000 051	Flow transmitter, Field mount with dual input/output
3-8550-3P	159 000 052	Flow transmitter, Panel mount with dual input/output

Accessories

Mfr. Part No.	Code	Description
3-8050	159 000 184	Universal mounting kit
3-8051	159 000 187	Flow Integral Mnt NPT
3-8050.395	159 000 186	Splashproof rear cover
3-8050.396	159 000 617	RC Filter kit (for relay use)
3-0000.596	159 000 641	Heavy duty wall mount bracket
3-5000.598	198 840 225	Surface Mount Bracket
3-5000.399	198 840 224	5 x 5 inch adapter plate for +GF+ SIGNET retrofit
3-9000.392	159 000 368	Liquid tight connector kit for rear cover (includes 3 connectors)
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 piece)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG13.5 (1 piece)
7300-7524	159 000 687	24 VDC Power Supply 7.5 W, 300mA
7300-1524	159 000 688	24 VDC Power Supply 15 W, 600mA
7300-3024	159 000 689	24 VDC Power Supply 30 W, 1.3 A
7300-5024	159 000 690	24 VDC Power Supply 50 W, 2.1 A
7300-1024	159 000 691	24 VDC Power Supply 100 W, 4.2 A

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3-8550.090-1 (G-4/03) English

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-AMCO Water Metering Systems for Potable Cold Water Meters
-Controls and Meters Model R/T

AMCO Water Metering Systems Inc
1100 SW 38th Avenue
Ocala, FL 34473
Telephone (352) 732-4670
Fax (352) 368-1950

MTR-INS-018/01-03

January 2003

AMCO Water Metering Systems For Potable Cold Water Meters
Installation/Start-up Instructions

INTRODUCTION

All AMCO water meters have been manufactured with current technology in accordance with applicable AWWA standards. Water passes through a measuring chamber driving an oscillating piston or rotor, the movements of which are transferred by appropriate gearing and magnetic drive to a standard direct reading sealed register. If the meter has been ordered with visual remote (RMR), electronic remote (EMR) or InsideR™ transmitter, refer to the following documents for additional instructions:

1. Remote Meter Read (RMR) — RMR-INS-022
2. Encoder Electronic Meter Read (EMR) — EMR-INS-026
3. InsideR™ — INS-INSIDE-RF

TESTING FOR METER ACCURACY

All AMCO water meters have been flow tested before shipment. Should further accuracy tests be necessary, the requirements of Table 5-3 of the AWWA Manual M-6 should be followed. Before testing, thoroughly flush the meter to eliminate all air from the test bench system. In the case of turbine and compound meters, water should pass through as much straight pipe as possible before entering the meter, or install a turbulence canceling strainer ahead of the meter. Turbines and compound meters tested in series must have straight pipe between meters for absolute accuracy testing.

GENERAL INSTALLATION INSTRUCTIONS FOR ALL AMCO WATER METERS

(1) Install meters in a service line which has been flushed free of foreign material.
(2) Install meters in horizontal or inclined pipe work.
(3) Install meters with the flow direction arrow pointing downstream, i.e. towards the utility customer's facility being served by the meter.
(4) Thoroughly tighten all meter couplings or companion flange bolts.

POSITIVE DISPLACEMENT AND TURBINE METER START-UP

A meter's measuring device can be damaged if subjected to full flow conditions prior to expelling all the air from the pipeline.

(5) With all valves closed, open a downstream faucet or other fixture that will demand water from the water main.

(6) Gradually open the upstream valve to allow water to pass through the meter.
(7) Observe that the register's sweep hand is turning clockwise in response to the water throughput.
(8) Observe that the lowest value totalizer wheel advances one (1) number for each complete turn of the sweep hand.
(9) When all the air has been expelled from the pipeline, close the downstream faucet or fixture.
(10) Check all connections to detect leaks.
(11) Observe the low flow detector to identify downstream piping leaks.

COMPOUND METER START-UP

At start-up, the changeover valve is closed, diverting water through the bypass meter. When 6.5 psi differential exists across the valve, with at least 13 psi pressure downstream, the valve will open allowing water flow through the main line turbine meter; however, water will continue to be measured by the bypass meter.

(12) With all valves closed, open slightly a downstream faucet or other fixture that will demand water from the water main.
(13) Gradually open the upstream valve causing water to flow through the bypass meter, and allowing the downstream piping to build up to at least 13 psi.
(14) Increase the rate of flow until the turbine meter register begins to measure water.
(15) Observe that both meters are now measuring water.
(16) Reduce the rate of flow until the turbine meter register stops measuring water.
(17) Observe that the bypass meter will continue to measure water.
(18) Close the downstream valve or faucet, and check all connections to detect leaks.
(19) Observe the low flow detector to identify downstream piping leaks.

MAXIMIZING TURBINE AND COMPOUND METER ACCURACY AND REVENUE

Unlike positive displacement meters, horizontal turbines of all types can be adversely affected by upstream turbulence. Good metering practices suggest that you consider a length of straight pipe upstream, or the installation of AMCO's Z-Plate turbulence-canceling strainer to maximize accuracy and revenue, as well as to protect the meter from foreign matter and debris.

FIRE HYDRANT METER START-UP

It is recommended that a gate valve or fire hydrant valve be installed downstream to control flows from AMCO's hydrant meter. After coupling the meter to the hydrant outlet,

(20) Open slightly the downstream valve.
(21) Slowly pressurize the meter by opening the fire hydrant's main valve.
(22) After all the air has been expelled from the hydrant meter, close the downstream gate valve.

(23) Open the fire hydrant's main valve as needed.
(24) Control flows from the downstream valve, always opening it slowly to avoid overspeeding on start-ups.

WARNINGS AND CAUTIONS

POSITIVE DISPLACEMENT METERS

At your request, these meters may have a non-return valve installed in the inlet port. This valve will not allow pressures caused by thermal expansion to pass to the water system's side of the meter. Take particular care that the meter is installed with the direction of flow as indicated by the arrow cast in the meter case. Check your local codes for pressure relief requirements. AMCO Water Metering Systems Inc. assumes no responsibility for damages.

At your request, these meters may have a plastic main case. Plastic meter cases will not conduct electricity. Check your local codes for grounding requirements. AMCO Water Metering Systems assumes no responsibility for the electrical grounding of its water meters.

At your request, these meters may have a frost protection device. Take particular care to install these meters in a location where water damage will not occur if the frost device releases or functions. AMCO Water Metering Systems assumes no responsibility for damages.

FIRE HYDRANT METERS

This meter has a restrictor plate installed in the outlet port. A restrictor plate will suppress the flow capacity of the meter and protect it from overspeeding when water throughput flows to atmosphere. Take particular care to install and start-up the meter as recommended above. AMCO Water Metering Systems assumes no responsibility for damages.

At your request, this meter may have a check valve installed in place of the restrictor plate. This valve will not allow pressures caused by reverse flow conditions to pass to the water system's side of the meter. Take particular care that the meter is installed with the direction of flow indicated by the arrow cast in the meter case. Check your local codes for pressure relief requirements. AMCO Water Metering Systems assumes no responsibility for damages.

APPLICATION. These meters are for use in the measurement of potable cold water up to 120 degrees F and working pressures up to 150 psi.

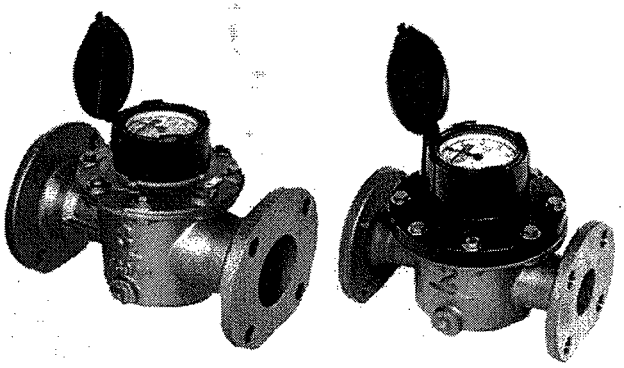
PERFORMANCE DATA				DIMENSIONS			
Model	**Size**	**Flow Range**	**Recommended Continuous Flow**	**Length**	**Width**	**Height (Lid Closed)**	**Weight**
C700	5/8" x 1/2"	1/8 – 20	15	7 1/2	4	5 1/2	3 1/2
	5/8" x 3/4"	1/8 – 20	15	7 1/2	4	5 1/2	3 1/2
	3/4" x 3/4"S	1/4 – 30	15	7 1/2	3 7/8	6 3/16	4 3/5
	3/4"x3/4"	1/4 – 30	15	9	3 7/8	6 3/16	4 4/5
	3/4"x1"	1/4 – 30	15	9	3 7/8	6 3/16	4 4/5
	1"	1/2 – 50	25	10 3/4	6 15/16	6 5/8	10 1/5
	1 1/2"	1 1/2 – 100	50	12 5/8 or 13	7 1/2 or 8 1/2	8 7/8	21 7/10 or 23 7/10
	2"	2 – 160	80	15 1/4 or 17	8 3/4	8 1/8	36 7/10 or 38 7/10
T3000	1 1/2"	3 – 200	160	10	7 3/8	7 3/4	19 1/2 or 20
	2"	3 – 200	160	10	7 3/8	7 3/4	21 1/2 or 22
	3"	4 – 750	600	11 7/8	7 3/8	11 7/8	33 3/8
	4"	7 – 1250	1000	14	9	10 3/4	51 1/2
	6"	15 – 2500	2000	18	11	13 3/8	90
	8"	25 – 3500	2800	20	13 7/16	16 1/16	168
	10"	55 – 5500	3200	17 3/4	16 1/8	18 15/16	246
	12"	95 – 7000	4300	19 3/4	19 1/16	20 3/8	278
C3000	2"	1/4 – 160	100	17	12 9/16	8	34
	3"	1/4 – 650	325	17	13 1/4	9 7/16	55 1/4
	4"	1/4 – 1150	575	20	14 1/8	10 7/8	67 1/8
	6"	3/4 – 2500	1560	24	17 9/16	8 1/8	145
	8"	1 1/2 – 3000	1875	34 or 34 1/2	20 1/2	16	227 or 285
H3200	3"	5 – 400	300	14 3/8	7 3/8	8 13/16	17 1/4

Specification Sheet

Industrial Turbine Meters

Model T3000 Bronze, Magnetic Drive, Flanged Ends

Sizes: 1 1/2", 2" and 3"



T3000CB T3000CP

Description

Operation. T3000 Turbine Meters are designed for installation where occasional low and moderate to high sustained flows are demanded. Water passes through the meter without a change in flow direction, driving a helix rotor in direct proportion to the quantity of water passing through the meter. Rotor revolutions are transferred to a register by appropriate reduction gearing and a magnetic drive.

Compliance to Standards. The T3000 Turbine Meter complies with all performance and material requirements of the American Water Works Association Standard C701, Class II In-Line (High-Velocity) Type, as most recently revised.

Installation. The meter must be installed in a clean pipeline, free from any foreign materials. Install the meter with direction of flow as indicated by the arrow cast in the meter case. The meter may be installed in horizontal, inclined or vertical lines. It is recommended that a plate strainer be used to protect the measuring element and help reduce the effects of turbulence. The installer should consider a bypass pipe with gate valves for use during maintenance and a downstream test tee for future field testing.

Application. T3000 meters are for use in POTABLE COLD WATER up to 120°F (50°C) and working pressures up to 150 psi. The meter will perform with accuracy registration of 100% ± 1 1/2% within the normal flows*. Both pressure loss and accuracy tests are made before shipment. No adjustments need be made before installation.

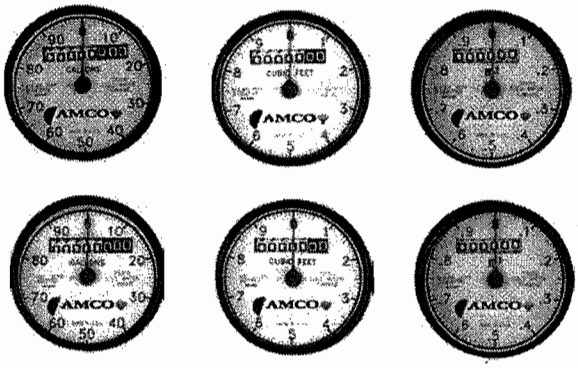
Construction. The meter consists of a main case, a measuring element, a case cover and a magnetically driven register assembly. The main case is cast in bronze with raised characters showing model, size and direction of flow. The case has a throated inlet. A case dowel pin is inserted for locating the cover plate. The measuring element assembly consists of the rotor, straightening vanes, accuracy regulator, spindles and gears, filters and undergear assembly. The measuring element is attached to the

Specifications

Performance	**1 1/2"**	**2"**	**3"**
95%-101% Accuracy GPM	3	3	4
*98.5%-101.5% Accuracy GPM	4-200	4-200	5-750
Continuous Flow GPM	160	160	600
Maximum Flow GPM	200	200	750
Operating Pressure psi	150	150	150
Operating Temperature °F	120	120	120
Sweep Hand Registers			
US Gallons	100	100	100
Cubic Feet	10	10	10
Cubic Meters	1	1	1
Imperial Gallons	100	100	100
Capacity of Register			
US Gallons (millions)	100	100	100
Cubic Feet (millions)	10	10	10
Cubic Meters (millions)	1	1	1
Imperial Gallons (millions)	100	100	100
Register Type	Permanently sealed direct reading register.		
Materials			
Main Case	Bronze		
Top Cover Plate	Bronze or Polymer		
Body O-Ring	Neoprene Rubber		
Case Bolts	Stainless Steel		
Measuring Element	Polyphenylene Oxide		
Rotor	Polypropylene		
Rotor Bushings	PTFE Compound		
Rotor Thrust Bearing	Ceramic Jewel		
Rotor Spindle	Tungsten Carbide		
Undergearing	Polyacetal Resin		
Register Lens	Tempered Glass		
Register Housing and Lid	Polymer or Bronze		
Register Can	90% Copper Alloy		

side of the cover with four stainless steel screws and washers, one insert of which is placed eccentrically in the cover. The internal regulator assembly is interconnected with an external regulator shaft located on top of the cover. This allows meter calibration without depressurizing the test bench or meter service. The regulator is protected by a tamperproof device. The main case and cover are assembled with an O-ring gasket and stainless steel bolts. The register assembly is secured to the main case with a slotted screw and is hinged over the inlet throat. However, the register can be rotated and locked in any 360 degree position therein.

Register. The register is contained within a 90% copper seamless can which is oven cured at 150°F for 90 minutes to eliminate condensation. The 1/4" true tempered glass lens is secured in an "L" shaped gasket, then roll sealed to produce a permanent sealed design. To assure easy reading, the totalizer wheels are large and color coded. The applicable size, model, registration, part number and date code are printed on the calibrated dial face. Moving clockwise during operation, the extra thin sweep hand does not interfere with meter reading, and the flow indicator will detect plumbing leaks.



Magnetic Drive. The magnetic drive design eliminates miscoupling associated with right angle drives. Torque is absorbed in the undergear assembly below the driving magnet. As a result, the driving magnet is turning slowly at all flows, assuring magnetic coupling with the register assembly. The undergearing is protected by an appropriately filtered encasement.

Connections. All sizes are available with 4-bolt round flanged end connections. The 1 1/2" and 2" meters are also available with 2-bolt oval flanged-end connections. Both flanged connections conform to ANSI B16.1 cast-iron pipe flange, Class 125. Both bronze and cast-iron companion flanges are available. The companion flanges are faced, drilled and tapped with ANSI B2.1 internal taper pipe thread and conform to ANSI B16.1 cast-iron pipe flange, Class 125.

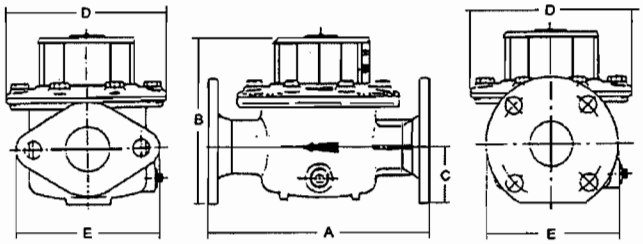
Maintenance. The measuring element with integral straightening vanes can be removed, repaired or replaced without removing the main case from the service line. Blank cover plates are available for use during repair. Pretested and calibrated measuring elements with cover plates and registers are available for exchange or purchase. In addition, AMCO Water Metering Systems Inc. maintains a fully equipped and staffed repair facility in Ocala, Florida.

Pulsers. See Specification Sheet #LRP/HRP-T3000.
LRP (2-wire) Reed Switch, 4 Watt (50V AC/DC Max.)
HRP (3-wire) Slotted Disc, 6-15 VDC
Both units require power from an external source.

Dimensions and Net Weights

Meter Size	Dimensions (Inches) A	B	C	D	E	Weight (lbs.)
1 1/2" Oval	10	7 3/4	2 7/16	7 3/8	5 5/8	19 1/2
1 1/2" Round	10	7 3/4	2 7/16	7 3/8	5 1/16	20
2" Oval	10	7 3/4	2 7/16	7 3/8	6 1/8	21 1/2
2" Round	10	7 7/8	2 9/16	7 3/8	6 1/16	22
3"	11 7/8	9 3/8	3 13/16	7 3/8	7 1/2	33 3/8

Note: Add ¾" to overall height with polymer top plate (1½" - 3")



The company's policy is one of continuous product improvement and the right is reserved to modify the specifications contained herein without notice.

IND-T3-BZ-11223/02-03

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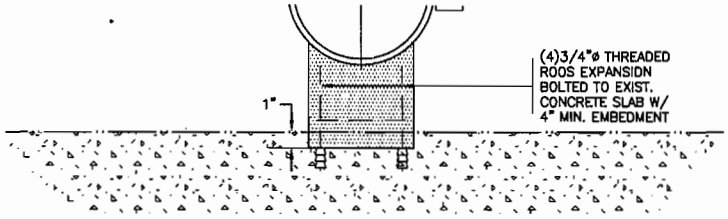
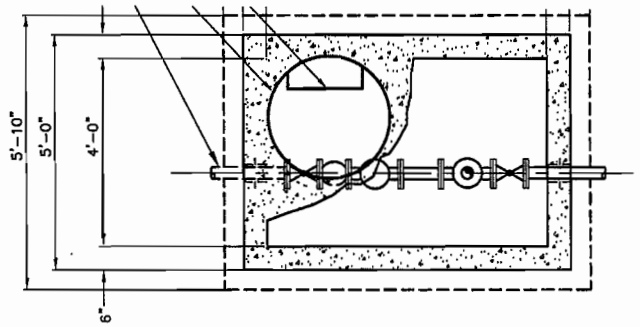
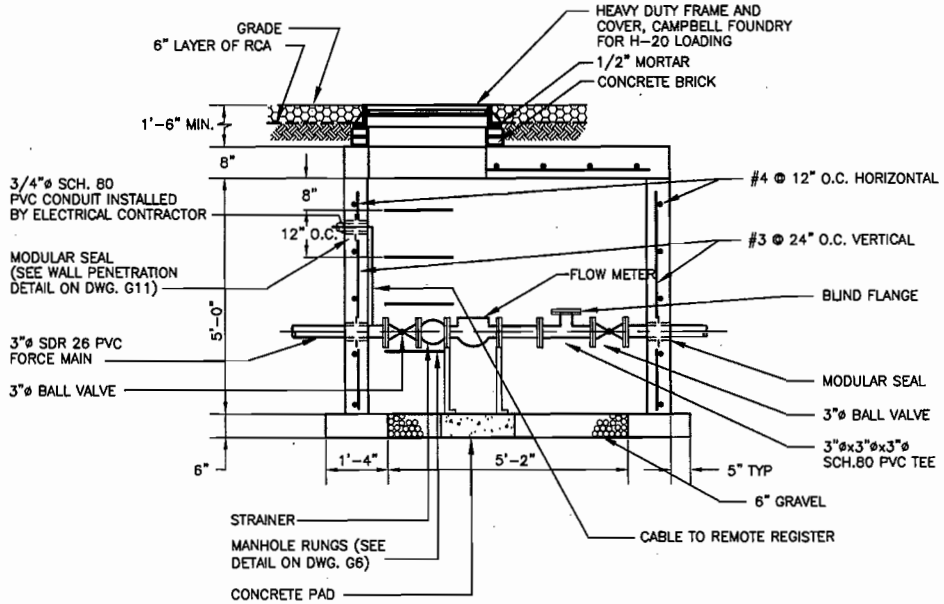


CHECK VALVE SUPPORT DETAIL
N.T.S



FLOW METER VAULT PLAN (WITHOUT MANHOLE COVER)
SCALE: 1/2"=1'-0"



FLOW METER VAULT SECTION
SCALE: 1/2"=1'-0"

INSTALLATION &

OPERATION MANUAL

FOR THE

MODEL R / T

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MODEL R / T INSTALLATION & OPERATION MANUAL

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MODEL R / T INSTALLATION & OPERATION MANUAL

1.0 INTRODUCTION

The **Model R/T** is a miniature electronic **Rate and Total** indicator. It has a large, easy-to-read LCD display. The display is back-lighted for easy viewing at night or in dark areas. It is designed to operate directly on DC voltage, but has a matching AC power supply which attaches directly to the rear of the unit. It is compact and lightweight. Even with the matching power supply attached, the **Model R/T** fits in the small non-corrosive box which is normally supplied by Controls & Meters, Inc. The **Model R/T** is programmable and capable of many functions. Calibration is done by programming, using the two facepanel buttons. This manual will concentrate on the basic functions needed to display a simple Rate and Total.

2.0 POWER & HOOK-UPS

The **Model R/T** is easy to hook up to power. It operates directly on 12 Volts DC, (with an operating range of 9 - 28 Volts DC). The matching AC power supply provides 12 VDC and operates on 115 Volts AC (switchable to 230 Volts AC). To access the **Model R/T** rear electrical connections, loosen the four screws on the non-corrosive box and remove the cover.

If the **Model R/T** is used without the AC power supply, the DC Voltage connects to the terminals labeled "**COMMON**" and "**V+**" (see Figure 1). When the AC power supply is used, it attaches directly to these same two terminals (see Figure 2). The AC power attaches to the terminals below the 115/230 Volt switch (see Figure 3).

CAUTION: Before hooking up AC power to the 12 volt power supply, make sure the 115/230 VAC switch is set to display the correct voltage value.

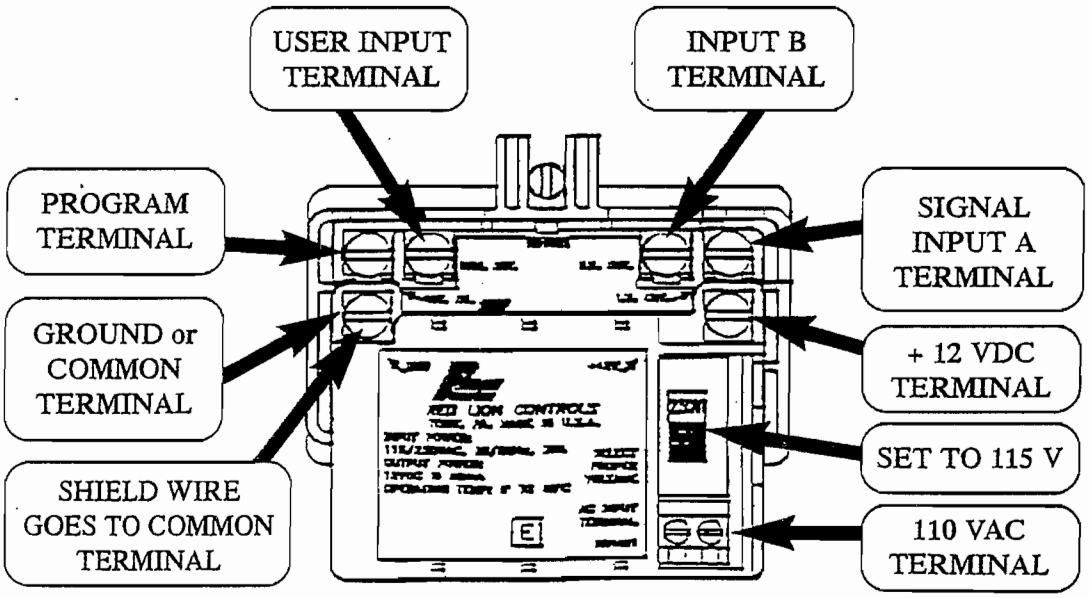

Figure 1. **Model R/T** (with matching power supply) Rear Electrical Connections.

R/T INSTALLATION CONFIGURATION

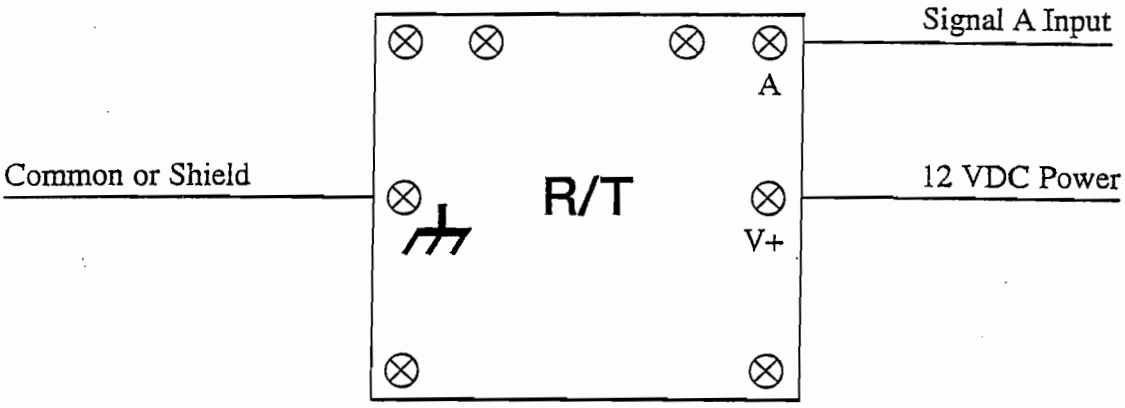

Fig. 2. Model R/T Wiring Diagram for ... Electronic 3-Wire Configuration

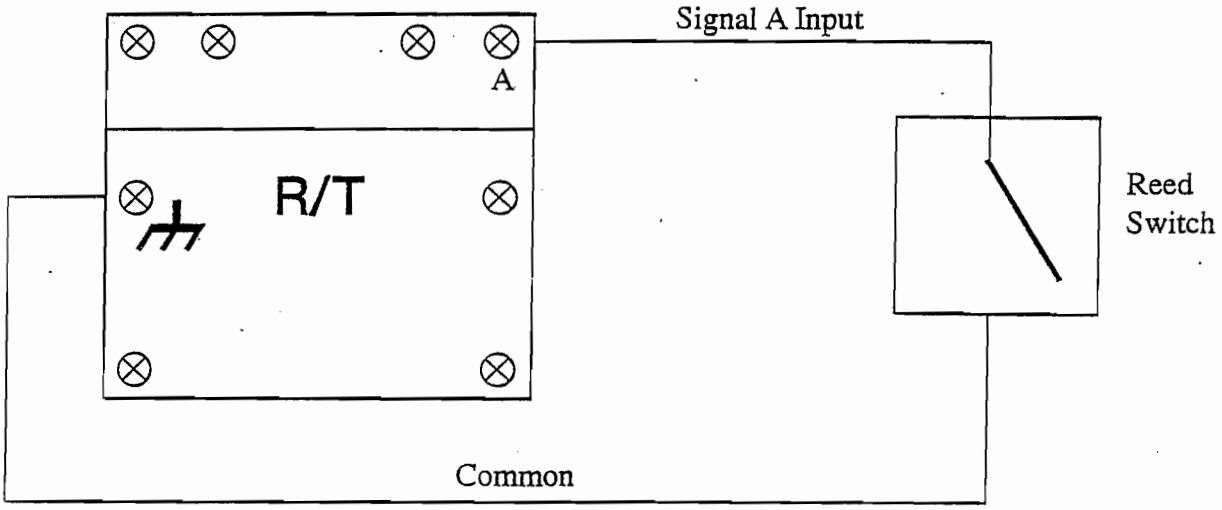

Fig. 3. Model R/T Wiring Diagram for ... Electronic 2-Wire Reed Switch Configuration

3.0 READY-TO-USE

THE MODEL R/T WILL USUALLY COME TO YOU READY-TO-USE. THE CALIBRATION REQUIRED FOR YOUR APPLICATION WILL NORMALLY BE DONE FOR YOU BY CONTROLS & METERS, INC., BASED ON YOUR ORDER INFORMATION. Should any changes be necessary, the following sections of this manual will guide you through the calibration procedures.

4.0 BASIC OPERATION

After power up, the **Model R/T** briefly flashes a screen message, then comes to rest on either a Rate or Total display. (The Rate display can be distinguished from the Total, by the letter "R" on the left side of the screen.) Both Rate and Total can be alternately displayed. The two facepanel buttons can manually control the screen. The Select (**SEL**) button switches the screen to the alternate display. Likewise, the Reset (**RST**) button switches the Total display back to zero.

However, the **Model R/T** screen is also controlled by the program. The program can set the screen to alternate displays automatically (see Table 1, Item 14.0). Or the screen can be locked onto either of the displays by disabling the **SEL** button (see Table 1, Item 2.0). Also the Totalizer can be changed to Non-Resettable by disabling the **RST** button (see Table 1, Item 3.0).

5.0 CALIBRATION PROCEDURES

Calibration of the **Model R/T** is done by Program selections and by Signal testing. Programming requires several Menu selection choices and direct entry of calibration values. These choices and entries are done entirely by use of the two face-panel buttons, Select (**SEL**) and Reset (**RST**). These programming selections determine both the display values and the display format of the screen. Signal testing checks and confirms the accuracy of both the display values and the display format.

5.1 PROGRAM ENTRY & EXIT

The **Model R/T** can only be calibrated in the Program Mode. To enter the program, connect a jumper wire from the "**PROGRAM**" terminal to the "**COMMON**" terminal on the rear of the unit (see Figure 1). When the matching power supply is attached, the "**COMMON**" terminal is labelled "**GND**" (see Figure 3).

To exit and save the program, disconnect the jumper wire between "**PROGRAM**" terminal and the "**COMMON**" (or "**GND**") terminal. It will be automatically saved. To escape the program without saving, disconnect the power to the **Model R/T** first, before removing the jumper wire. The program changes will be lost.

5.2 PROGRAM HELP

The **Model R/T CALIBRATION PROGRAM GUIDE** (Table 1) is a handy, easy-to-use reference guide. This programming guide, like a detailed "road map", can help the operator quickly identify where they are, what to do and where to go next. It can help explain how and why the various steps are related. And when programming is done, it can record their specific program settings for future reference and help.

The **Model R/T CALIBRATION PROGRAM GUIDE** (Table 1) is divided into four sections (by boxed lines) to identify the relationships between the various steps. The four boxed sections are: **1) General Setup; 2) Totalizer Setup; 3) Rate Setup;** and, **4) External Setup.** In addition, the portions of these sections that do not always appear, have been shaded to show how the menu sequence may be different.

5.3 PROGRAM OPERATION

Upon entering the Program Mode, the display screen flashes between the **Menu Items Screen** and the **Program Settings Screen** (see Table 1). The facepanel buttons, Select (**SEL**) and Reset (**RST**), provide access to the **Menu Items** and the **Program Settings.** These buttons perform various functions in the Program Mode.

The **Menu Items Screen** can be scrolled through by pressing the **SEL** button once for each Menu Item. Slowly scrolling through the list allows each Menu Item to flash its associated Program Setting. Quickly scrolling through the list displays the Menu Items without flashing the Program Settings (until the scrolling stops).

The **Program Settings Screen** can be entered by pressing the **RST** button after selecting the Menu Item needed. This screen does not flash, but waits for the operator to make a decision. In this screen, the options available to the operator are: 1) to select a calibration setting; or, 2) to directly enter a calibration value.

When the choice is a calibration setting, the display will be a non-flashing word or number. Press the **RST** button to step through the list. When the right setting appears, leave it on the **Program Settings Screen** and return to the **Menu Items Screen** by pressing the **SEL** button. The screen moves to the next Menu Item.

When the choice is calibration value, the display has a number with a flashing digit. Each press of the **RST** button increments the flashing digit once. To select the next digit, press the **SEL** button once. Repeat this process until the value is correct. Then leave the **Program Settings Screen** and return to the **Menu Items Screen** by pressing and holding the **SEL** button. The screen moves to the next Menu Item.

Table 1. Model R/T CALIBRATION PROGRAM GUIDE

TO PROGRAM: Connect Jumper wire from PROGRAM Terminal to GROUND Terminal.
TO EXIT & SAVE: Disconnect Jumper wire between PROGRAM and GROUND Terminals.
TO EXIT & DON'T SAVE: Disconnect Power from Model R/T before removing Jumper.

Item No.	MENU ITEMS SCREEN	DEFAULT PROGRAM SCREENS	ACTUAL PROGRAM SETTINGS	MENU - ITEM DESCRIPTIONS
1.0	**INP A - b**	**cnt ud**		Count MODES
2.0	**dSPSEL**	**YES**		Select (SEL) Button Enable
3.0	**rSt Enb**	**YES**		Reset (RST) Button Enable
4.0	**tot dP**	**0 (Note 1)**		Counter A Dec. Pt. Position
5.0	**SCLFAC (scalefactor)**	**01.0000**		Counter A Scale Factor = 1/ K (1/ K-Factor limited to 4 dec.)
6.0	**btot dP**	**0 (Note 1)**		Counter B Dec. Pt. Position
7.0	**bSCLFAC**	**01.0000**		Counter B Scale Factor = 1/ K
8.0	**rAtE Enb**	**YES**		Rate Indicator Function Enable
9.0	**rAtE dP**	**0 (Note 2)**		Rate Display Dec. Pt. Position
10.0	**rAtE dSP (max. rate)**	**001000**		Rate Display Volume (Units) (Full-Scale Flow Rate Value)
11.0	**rAtE INP (max. freq.)**	**01000.0 (see Note 3)**		Rate Input Frequency (Herz) (Full-Scale Signal Input Value)
12.0	**Lo - Udt (min. time)**	**01.0 (see Note 4)**		Lo-Update Time (.1 - 99.9 sec) (Rate Display Refresh Time)
13.0	**Hi - Udt (max. time)**	**01.0 (see Note 5)**		Hi-Update Time (.1 - 99.9 sec) (Rate Display Buffer Time)
14.0	**dSPScroL**	**NO**		Display Scroll (Rate / Total)
15.0	**USEr INP**	**rESEt**		User Input (Terminal on Rear)
16.0	**USEr Asg**	**totAL**		User Input Assignment
17.0	**FACt SEt**	**(skip this)**	Do Not Use This	Factory Settings (defaults)

NOTICE: ITEM #'s 6.0, 7.0, & 16.0 (above) are not shown with every setting option.
Note 1: Counter Dec. Pt. position **is highly interactive with SCLFAC** Dec. Pt. position.
Note 2: Rate Dec. Pt. position **ONLY affects rAtE dSP,** not SCLFAC or rAtE INP.
Note 3: Rate Input Freq.value **is ALWAYS limited to ONE Decimal Pt.** position. For higher rate resolution, inflate both rAtE dSP and rAtE INP by x10, or x100.
Note 4: Lo-Udt is the min. time BETWEEN screen updates for Rate Screen refresh.
Note 5: Hi-Udt is the max. time DELAY for the next signal pulse, before showing ZERO.

6.0 CALIBRATION PROGRAMMING

The **Model R/T** calibration is accomplished by entering the Program Mode (see section 5.1) and by following the rules of program operation (see section 5.3). The remainder of this manual explains the **Totalizer Setup** and the **Rate Setup** sections (see section 5.2) of the **CALIBRATION PROGRAM GUIDE** (Table 1). To learn how to determine specific calibration setup choices, the operator must be familiar with the **DECIMAL POINT FACTORS & DISPLAYS** (Table 2) and the **SCALE FACTORS & DPF MULTIPLIERS** (Table 3). Also, the calibration formulas and examples that follow will help solve these setup choices.

6.1 RATE & TOTAL CALIBRATION FORMAT

The **Model R/T** display format is primarily determined by the choice of the Decimal Point Factors for the Rate indicator and for the Totalizer. The decimal point selections for Rate and Total are independent of each other, but the selection process and choices are identical. In each case, there are six decimal point locations available (see Table 2). The customer may specify a format, but may have to accept a modified result to gain resolution accuracy. The display format has a direct bearing on the calibration factor. If a display format is used that yields unacceptable results, simply modify the format AND redo the calibration factors.

Table 2. Model R/T DECIMAL POINT FACTORS & DISPLAYS

Decimal Point Position (DPP) Display Option Number	Decimal Point Position (DPP) Number of Decimal Places	Decimal Point Position (DPP) Visual Display Format	Decimal Point Factor (DPF) Multiplier Number
1	0	0	(x 1)
2	1	0.0	(x 10)
3	2	0.00	(x 100)
4	3	0.000	(x 1000)
5	4	0.0000	(x 10000)
6	5	0.00000	(x 100000)

This table shows the six decimal point positions (DPP) available on the Model R/T. The choices are the same for the Totalizer and the Rate indicator. The factory default is no decimal points. A typical application commonly needs at least one decimal point. The Decimal Point Factor (DPF) is needed for the calibration factor calculations.

Table 3. Model R/T SCALE FACTORS & DPF MULTIPLIERS

DPP Program Display Option Number	DPP Number of Decimal Places	Calibration Example: K-FACTOR (pulses/gal.)	Decimal Point Factor (DPF) Multiplier	SCALE FACTOR Calculated Value (1/K) x (DPF) = xx.XXXXxxxxxx	SCALE FACTOR Entry Value (limit of 4) xx.XXXX
1	0	14,873.0 ppg	(x 1)	00.0000 6723593	00.0001
2	1	14,873.0 ppg	(x 10)	00.0006 7235930	00.0007
3	2	14,873.0 ppg	(x 100)	00.0067 2359308	00.0067
4	3	14,873.0 ppg	(x 1000)	00.0672 3593088	00.0672
5	4	14,873.0 ppg	(x 10000)	00.6723 5930881	00.6724
6	5	14,873.0 ppg	(x 100000)	06.7235 9308814	06.7236

This table shows an example of a given K-factor and the effect that each of the six decimal point positions (DPP) have on the Scale Factor. It can also help the operator choose what Decimal Point Factor (DPF) must be used to get accurate resolution from the meter's K-factor. The Scale Factor is limited to a four decimal place entry.

6.2 TOTALIZER CALIBRATION FACTORS

The **Model R/T** calibration factor for the Totalizer is called the Scale Factor, **SCLFAC** (see Table 1, Item 5.0). Calculating the Scale Factor requires the K-factor of the meter and the Decimal Point Factor (**DPF**) multiplier of the **Model R/T** display format. The K-factor is determined by the meter manufacturer. The **DPF** multiplier is determined by the decimal point location chosen for the display (see Tables 2 and 3).

The calibration formula for the Scale Factor is:

SCLFAC = (1 / K-factor) x DPF

The Scale Factor entry is limited to four decimal places (xx.XXXX). This is the basic problem that results in the resolution accuracy and often requires modification of the display format. A large K-factor becomes a very small decimal when inverted by the **SCLFAC** formula. For example: **DPF** = 1; **K** = 4,195 ppg; **SCLFAC** = 0.000238379. This number would have to be entered into the **Model R/T** as **SCLFAC** = 0.0002. The only way to restore the meter resolution is to adjust the **DPF** which also moves the decimal point.

6.3 RATE CALIBRATION FACTORS

The **Model R/T** main calibration factors for the Rate indicator are the Rate Display value and the Rate Input value. The values for these two factors must be determined at a specific rate. But they work together with the **Model R/T** to provide the correct display at any rate. It is important that these values be entered into the program carefully, with the same number of decimal places as chosen for the Rate Display format (see section 6.1).

The Rate Display (**rAtE dSP**) factor is a flow rate value which the **Model R/T** will output to the Rate Display screen when it receives a specific frequency input from the meter. The value chosen for the Rate Display factor can be virtually any number. Normally, the value chosen is the maximum flow rate of the metering application (Full Scale Flow).

The Rate Input (**rAtE INP**) factor is the frequency value which the **Model R/T** will receive from meter at the same specified flow rate value chosen for the Rate Display factor. This frequency value must be calculated using the K-factor and the flow rate chosen for the Rate Display factor. The K-factor is determined by the meter manufacturer. The K-factor used here for the Rate calculations should be the same one used for the Totalizer calculations.

The calibration formula for the Rate Input Frequency is:

Frequency (Hz) = K-factor x (Rate Display Flow Rate per Minute / 60)

6.4 MISCELLANEOUS RATE CALIBRATIONS

The **Model R/T** has several rate calibration options that control the Rate Display screen. The Rate Enable option (**rAtE Enb**) controls the entire Rate Display function. Normally it will be left "on" (**YES**) to provide both Rate and Total. If it is "off" (**NO**), the Rate Display will be disabled. And, in the Program Mode, the other Rate programming functions (Table 1, Items 9.0 - 14.0) will not be shown on the **Menu Items Screen** (see Table 1, Item 8.0).

The Hi-Update Time and Lo-Update Time options control the Rate screen buffer times. The Hi-Update Time (**Hi-Udt**) prevents the Rate screen from dropping to zero unless the timegap between pulses is greater than the setting. The Lo-Update Time (**Lo-Udt**) prevents the Rate screen from refreshing at a rate greater than the setting. Both of these options can be set from 00.1 to 99.9 seconds. The factory default is 1.0 second for each. These times may have to be adjusted to each customers needs (see Table 1, Items 13.0 & 12.0).

The Display Scroll option (**dSPScroL**) allows the display screen to alternate Rate and Total. Only, pausing on each display about 4 seconds. In this mode the SEL button can still toggle the screens, but it can not hold a screen. This option is more distracting than useful for most customers (see Table 1, Item 14.0).

7.0 CALIBRATION EXAMPLE

A customer has **a Model R/T** that he wants to program with a turbine meter. The meter produces 14,873.0 pulses per gallon (ppg). His maximum flow rate will be 5.0 gallons per minute (gpm). His two basic needs are the calibration factors for the totalizer first and then the rate.

To calibrate the totalizer he needs to answer two questions. The first thing he needs to do is decide how many decimal places to display in his totalizer. The second thing that he needs to know is his Scale Factor.

The customer thinks that he only wants to show whole numbers in his total, but he still wants very high resolution accuracy. After looking at **Table 2**, he decides that he wants his Decimal Point Factor multiplier (DPF) to be "times one" (x 1). Now he needs to calculate his Scale Factor. The formula he needs is SCLFAC = (1 / K-factor) x DPF. His DPF = (x 1); his K factor = 14,873.0; and his SCLFAC = 0.000067235. Looking at **Table 3**, he discovers that he can only enter 4 decimal places (0.0001).

Now he has a problem because this Scale Factor does not work. His meter resolution accuracy is nearly gone. In order to make this Scale Factor work, he must change his DPF. He calculates all the options and must decide which one meets his needs (see **Table 3**). Display Option # 1 meets his desire to show only whole numbers, but it will not work. Display Option # 6 meets his desire for high resolution accuracy, but it requires five decimal places. He decides that he can live with the accuracy of Display Option # 3. His Scale Factor will be entered as 0.0067 and his totalizer will only show two decimal places. He knows he can change this at a later time.

Now he can calibrate his rate, but he must know three things. First, he must chose how to set up his display. He does not have to use the same number of decimal of places on his rate, that he chose to use on his total. But, he decides that two decimal places on his rate will be alright. Next, he needs to enter the rate display. He decides to use his maximum flow rate which is 5 gpm. Since he has chosen to display two decimal places, he must enter his rate as 5.00 gpm.

Finally, he must calculate his rate input frequency. The formula is rate frequency = K-factor x (Maximum gpm / 60). K = 14,873.0 ppg; Maximum gpm = 5. His rate frequency is 1239.416667. Since he has chosen to display two decimal places for his rate, he must enter his frequency as 1239.42 Hz. Notice that his frequency is so large that he can not display three decimal places. In this case, he is limited to a maximum of two decimal places

-Grundfos KP 150, 250, 350 and AP 12 Sump and Utility Pumps

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To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

MANUFACTURER WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE. EXCEPT AS EXPRESSLY HEREIN PROVIDED THE GOODS ARE SOLD "AS IS", THE ENTIRE RISK AS TO QUALITY AND FITNESS FOR A PARTICULAR PURPOSE, AND PERFORMANCE OF THE GOODS IS WITH THE BUYER, AND SHOULD THE GOODS PROVE DEFECTIVE FOLLOWING THEIR PURCHASE, THE BUYER AND NOT THE MANUFACTURER, DISTRIBUTOR, OR RETAILER ASSUMES THE ENTIRE RISK OF ALL NECESSARY SERVICING OR REPAIR.

Some jurisdictions do not allow the exclusion or limitation of implied warranties of merchantability and fitness for a particular purpose, of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last or require you to pay certain expenses as set forth above. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

The telephone number of our service and repair facilities central directory, from which you can obtain the locations of our service and repair facilities is, 1-800-333-1366.

GRUNDFOS®

Leaders in Pump Technology

GRUNDFOS PUMPS CORPORATION • 3131 Business Park Avenue • Fresno, CA • 93727
Customer Support Centers: Allentown, PA • Fresno, CA
(800) 333-1366 • FAX (800) 333-1363
Canada: Oakville, Ontario • **Mexico:** Apodaca, N.L.

LKP-TL-001 Rev.3/00
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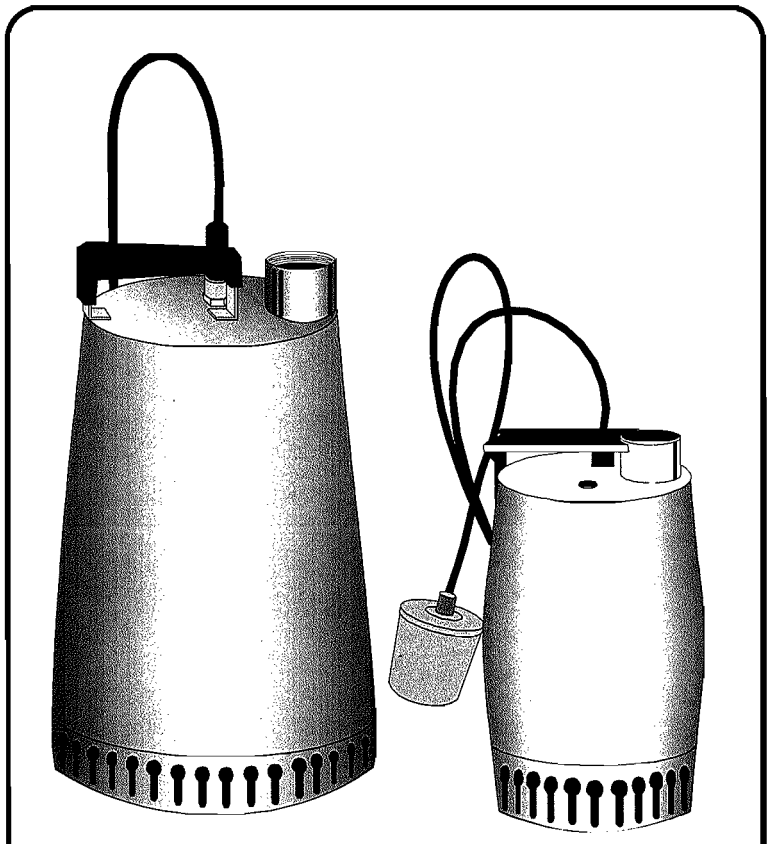
"The AP & KP"

Sump and Utility Pumps
Models KP 150 · 250 · 350
AP 12

Installation and Operating Instructions



Please leave these instructions with the owner for future reference

GRUNDFOS®

"Leaders in Pump Technology"

Notes

Safety Warning

WARNING:
Risk of electric shock — This pump has not been investigated for use in swimming pool areas.
The safe operation of this pump requires that it be grounded in accordance with National Electric Code and local governing codes and regulations.

Technical Specifications

Motor Protection:	Built-in thermal overload protection
Discharge Port:	KP 1 1/4" NPT AP 1 1/2" NPT
Noise Level:	Less than 65 dB(A), measured in accordance with ISO 3743.
Installation Depth:	Min: Water level above strainer inlet Max: 33 feet below liquid level
Storage Temperature:	Min -5°F

Pre-Installation Checklist

1. Check the Condition of the Pump

Examine the pump carefully to make sure no damage has occurred during shipment. "The AP, KP" pump should remain in its shipping carton until it is ready to be installed. This carton is especially designed to protect it from damage. During unpacking and prior to installation, care should be taken to ensure the pump is not dropped or mishandled.

2. Electrical Requirements

The operating voltage and other electrical data are marked on the motor label. Make sure that the motor is suitable for the electrical supply on which it will be used. All electrical cords must be of an adequate size to prevent any drop in the supply voltage. All "AP/KP" models have built-in thermal overload motor protection which resets automatically. "AP/KP" models are supplied complete with a power cord. When fitted, the automatic float switch is connected between the pump power cord and the power supply.
Wiring of the pump should be in accordance with NEC regulations for permanent or temporary installations, whichever is applicable.

3. Pumped Liquid Requirements

The operating limits of "The KP & AP" pumps include:

Liquid Temperature:	**Min**	**Max**
KP 150, 250 & 350	32°F	122°F
AP 12	32°F	131°F

At intervals of at least 30 minutes, a liquid temperature of up to 158°F is allowed for short periods (2 minutes).

Pre-Installation Checklist

4. Is the Application Correct for This Pump ?

SUITABLE APPLICATIONS

"The AP/KP" pumps are single-stage submersible pumps suitable for pumping waste water. The pump is capable of pumping water which contains solids up to 3/8"(KP),7/16"(AP) in diameter. The pump is suitable for:

- Drainage of basements or buildings prone to flooding,
- Pumping of waste water from washing machines, sinks, baths, showers, etc., up to the sewer level.
- Dewatering of sites or excavations or the pumping of water for fountains.
- Pumping in draining wells
- Emptying swimming pools, ponds, tanks, or fountains (***except when there are persons in the water***).

UNSUITABLE APPLICATIONS

The pump ***IS NOT*** suitable for pumping:

- Sewage
- Liquids containing long fibers
- Liquids containing solid particles larger than 3/8"(KP),7/16"(AP) in diameter.
- Flammable liquids (oil, gasoline, etc.)
- Aggressive liquids

Note: If the pump has been used for very dirty or chlorinated water it should be flushed thoroughly with clean water after use.

5. Read this Guide Thoroughly

Even if you are very familiar with the installation of this pump, a quick glance through the remaining sections of this guide may help you avoid a potential problem.

Installation and Operation

Handling the Pump

It is recommended that a cable be secured to the pump handle to make it easier to remove the pump.

Do not lower or lift the pump by means of the electric cord.

Electrical Connection

The electrical connection should be carried out in accordance with local regulations and following the National Electrical Code. The pump should be grounded. The operating voltage and frequency are marked on the nameplate.

"THE AP/KP" pumps have built-in thermal overload protection and require no additional motor protection. If the motor is overloaded, it will stop automatically. When it has cooled to normal temperature it will start automatically.

Maintenance

AP Kits

Description	Product No.
Impeller AP12	96422174
Cord w/nut 10'	96023909
Cord w/nut 25'	96023910
Shaft Seal & Oil Kit NBR	96010604
Shaft Seal Kit AP12,35,50 NBR	96427804
Shaft Seal Kit AP12,35,50 FKM	96426650

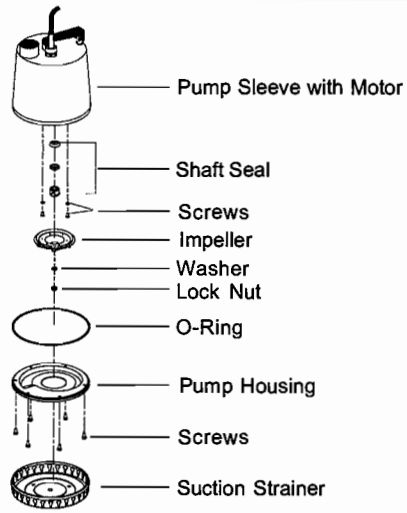


Fig. 2 AP 12

Troubleshooting

Problem	*Cause*
1. Motor does not start	a) Supply failure. b) Pump switched off by float switch. c) Fuses are blown. d) Thermal relay has cut out the electricity supply to the motor (see Electrical Connection — pg.2). e) Check cable for defects.
2. Thermal relay trips out after short time of operation.	a) Temperature of pumped liquid higher than stated under "Pumped Liquid Requirements" on pg.1. b) Pump partly blocked by particles (see "Cleaning the Pumps" — pg.5). c) Pump mechanically locked (see "Cleaning the Pumps" — pg.5). d) Check volts and amperage. e) Check cable for defects.
3. Pump runs but gives insufficient water.	a) Strainer partly blocked by particles. b) Pump partly blocked by particles (see "Cleaning the Pumps"). c) Discharge pipe partly blocked. Check the check valve, if fitted. d) Check the wear plate and the impeller for wear (see "Cleaning the Pumps").
4. Pump runs but gives no water.	a) Strainer blocked by particles. b) Pump partly blocked by particles (see "Operation and Maintenance"). c) Discharge pipe partly blocked. Check the check valve, if fitted. d) Liquid level is too low. During starting, the liquid level must be above the strainer. e) The float switch cable length is set too long

Non-Return Check Valve Recommended

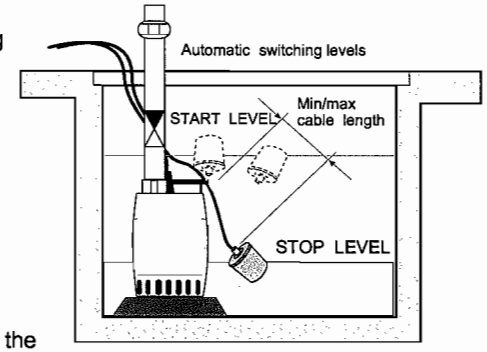
Whenever the pump is installed in a permanent installation with a float switch, a non-return check valve must be fitted in the discharge pipe or hose.

Adjusting the Float Switch

The float switch can automatically turn the pump on and off. Switching adjustment is possible by repositioning the float switch in the handle of the pump. The free cable length must always be:

KP 150, 250 & 350
- At least 2 1/2 inches
- No more than 6 inches

AP 12
- At least 4 inches
- No more than 14 inches

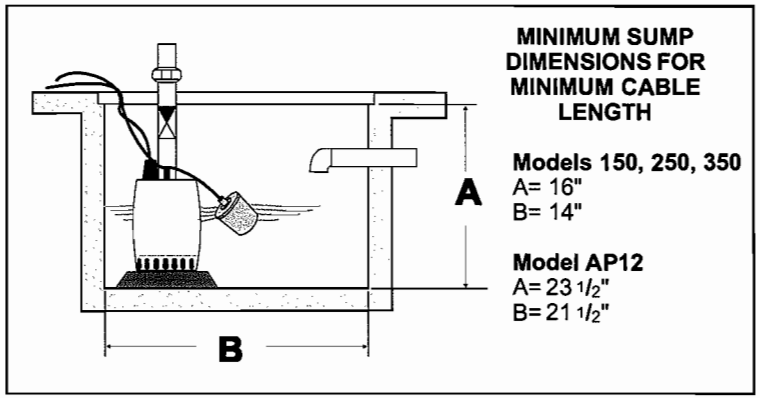


Minimum drain depth (manual operation) 1/2"

For manual operation, unplug both the pump and floatswitch from the115V outlet. Plug the 115V plug on the pump into the outlet.

Basin Requirements

When the pump is installed in a permanent installation with a float switch, and the cable length is set to the minimum length as listed above, the minimum dimensions of the well should be as shown below. Furthermore, the well should be dimensioned according to the relation between the water flow to the well and the pump capacity.



MINIMUM SUMP DIMENSIONS FOR MINIMUM CABLE LENGTH

Models 150, 250, 350
A= 16"
B= 14"

Model AP12
A= 23 1/2"
B= 21 1/2"

Starting "The AP/KP"

Before starting the pump, check:
- Whether the pump is submerged in liquid. During normal operation, the strainer of the pump must be below the surface of the liquid.
- Whether the pump is positioned on a base so that the strainer is not blocked by silt, mud or similar materials.
- Whether the pipe/hose connection is tight.
- Whether the discharge pipe is open (bend of hose, etc).
- Whether the pump is connected to the electric supply in accordance with the instructions.
- Check the float switch for free movement.

Then:
- Switch on and check to make sure the pump operates properly, that water is being pumped, and the pump operates through the control sequence.
- The float switch will allow the pump to pump down to a level of approximately 4". To pump out below this level secure the switch in the manual position. See Adjusting the Float Switch.

Regular Maintenance

Under normal operating conditions, **"The AP/KP" is maintenance free.** It is always advisable to flush the pump after each use, particularly if it has been pumping liquids containing particles that may settle in the pump.

Cleaning the Pump

If the pump does not deliver a sufficient quantity of water because of sediment, dismantle and clean the pump. To dismantle the pump:

1. Disconnect the electrical supply. Allow the pump to drain.
2. **KP 150, 250 & 350** — *(Refer to Fig.1 Pg.6)* Carefully loosen the suction strainer by inserting a screwdriver in the recess between the outer casing and the strainer and pressing it hard. Repeat until the strainer is free and can be removed.
   AP 12 — *(Refer to Fig.2 Pg.7)* Carefully loosen the strainer by inserting a screwdriver through one of the holes of the strainer and press it downwards (towards bottom). Repeat the procedure until the strainer is free and can be removed.
3. Remove the suction strainer, clean, and refit it. Connect the electricity supply and start the pump.

If the pump still doesn't deliver sufficient water, then:

4. Disconnect the electricity supply.
5. **KP 150, 250 & 350** — *(Refer to Fig.1 Pg.6)* Turn the pump housing 90° counter-clockwise using a screwdriver. Pull off the housing. Clean and flush the pump with water to remove possible impurities between the motor and the outer casing. Clean the impeller by spraying it with a hose. Check to make sure the impeller can rotate freely. If not:
   a. Hold the impeller in place with a screwdriver while loosening and removing the nut on the motor shaft (13mm).
   b. Clean the impeller and around the shaft.

Maintenance

Check the impeller, the housing, and the gasket. Assemble the pump in reverse order of dismantling. When doing so, check to make sure the sealing part of the housing is positioned correctly. Moisten the gasket with water to facilitate the fitting.

6. **AP 12** — (*Refer to Fig.2*) Unscrew the six screws close to the edge of the pump sleeve and lift the pump housing out of the pump sleeve. Clean the pump housing, the pump, and the impeller. Check to make sure the impeller can rotate freely. If not:
   a. Hold the impeller in place with a screwdriver while loosening and removing the nut on the motor shaft (13mm).
   b. Clean the impeller and around the shaft.
      Check the impeller and around the shaft. If the impeller is worn or defective, install a new one. Assemble the pump in reverse order of dismantling. Do so by:
   c. Fit the impeller with the washer and nut. Make sure the impeller engages with the shaft.
   d. Position the O-ring in the pump sleeve and lower the pump into the intermediate chamber.
   e. Fit the six screws with gaskets in the pump housing and tighten securely.

KP Kits

Description	Product No.
KP150 Impeller Kit	015783
KP250 Impeller Kit	015784
KP350 Impeller Kit	015786
(Kit incl. Impeller, nut, and gasket)	
Replacement Cord 10'	016728

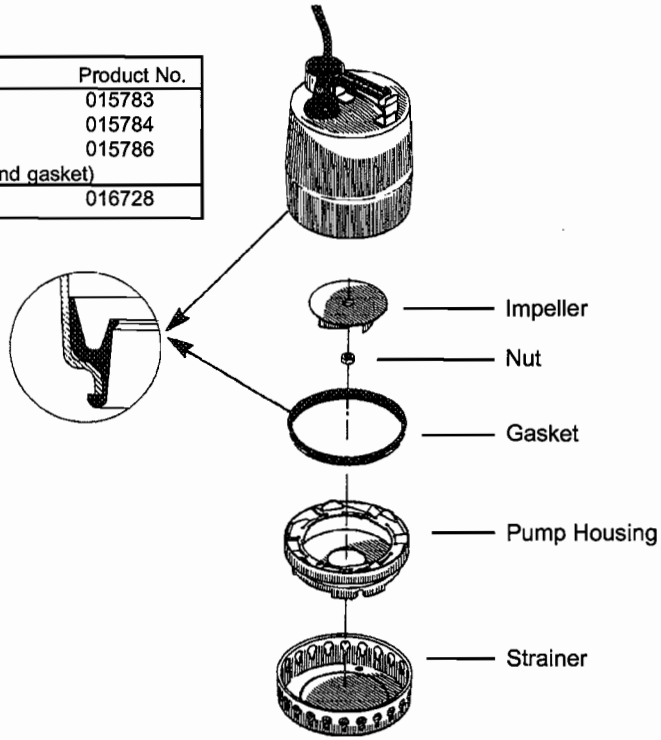
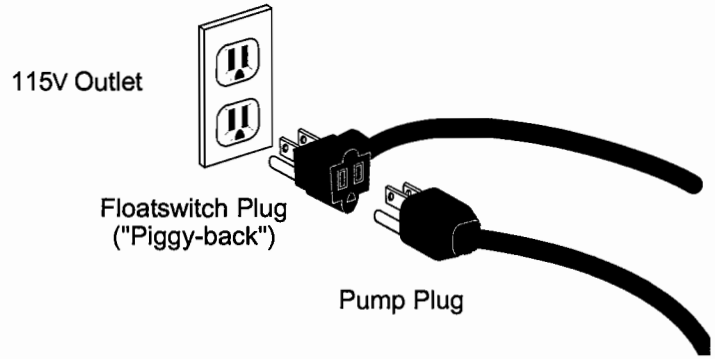


Fig. 1 KP 150, 250 & 350

Installation and Operation

When connecting the pump for manual operation, the 115V plug is inserted into a 115V outlet. If a floatswitch is included for automatic operation it will be of the "Piggy-back" design. Plug the 115V plug on the floatswitch into the 115v outlet then plug the 115V plug from the pump into the floatswitch plug. Suitable for use with GFI, ground fault interuptor.

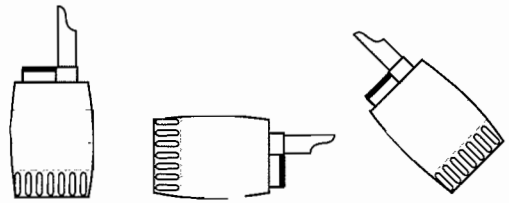


Pump Location and Positioning

Before positioning the pump, make sure that the strainer will not be blocked or partly blocked by silt, mud, or similar materials. This can be avoided by positioning the pump on bricks or a concrete pad, or by letting the pump hang from the discharge pipe or a cable 2-4 inches above the bottom.

"The AP & KP" can be used in the following positions:

When used in the horizontal position, the pump must be completely covered by liquid, and discharge port at the highest position on the pump (as shown).



Pipe Connection

Steel or rigid plastic pipe can be screwed directly into the 1 1/4" inch NPT for KP, 1 1/2" inch NPT for AP12 pump discharge port. For permanent installation, a union fitting at a convenient point is recommended to facilitate ease of removal for cleaning and servicing. A few other recommendations:

- For portable or temporary installations, plastic discharge pipe can be used in conjunction with a suitable screwed/hose connector.
- Removal of the pump should be by a cable secured to the pump handle and not by the discharge pipework.
- Screwed threads should be sealed using Teflon® tape.

-Greenheck CW/CWB Centrifugal Sidewall Exhaust Fans
-Greenheck WD-323 Backdraft Damper

READ AND SAVE THESE INSTRUCTIONS

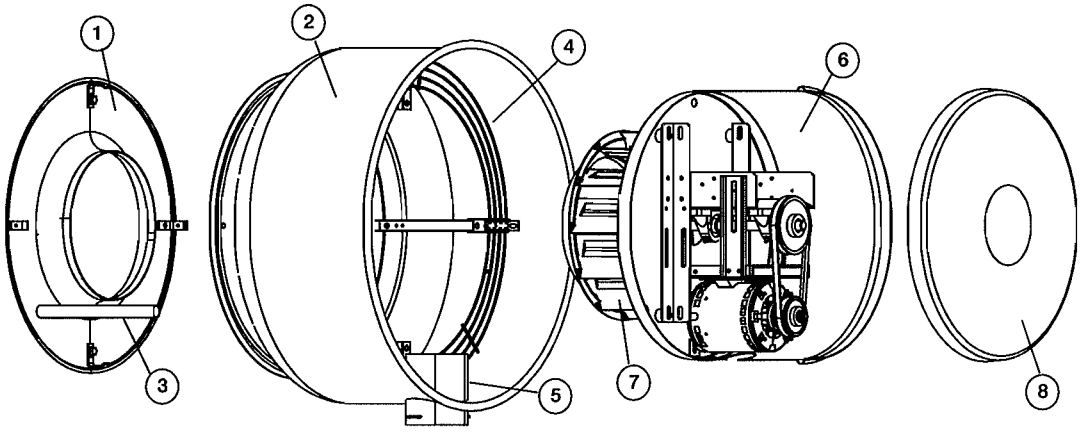
PN 457691

GREENHECK
The Solution Company.

Models CW/CWB
Centrifugal Sidewall
Exhaust Fans

Installation, Operation and Maintenance Manual

Component Identification



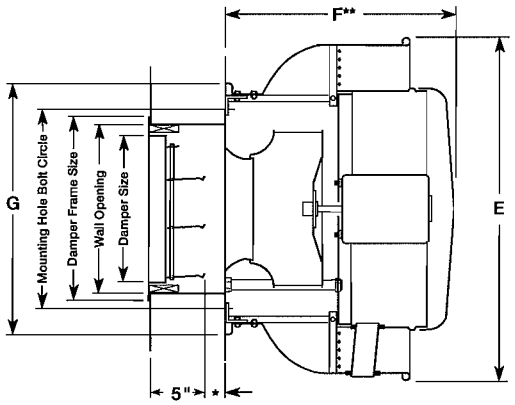
1 MOUNTING PLATE
2 WINDBAND
3 ELECTRICAL CHASE
4 BIRDSCREEN
5 BREATHER TUBE
6 MOTOR COMPARTMENT
7 WHEEL
8 COVER

Dimensional Data

CW - Direct Drive

Model	E	F**	G	Wall Opening	Damper Size	Damper Frame Size	Mtg. Bolt Circle
CW-060,065,070,075	18 3/8	13 1/2	14 3/4	8 1/2 x 8 1/2	8x8	10x10	11 3/4
CW-080,085,090 CW-095	21	13 3/8 15 1/4	17 7/8	10 1/2 x 10 1/2	10x10	12x12	15
CW-098,101,121,131	24 7/8	23 3/4	19 3/4	12 1/2 x 12 1/2	12x12	14x14	16 7/8
CW-141,161	28 7/8	24 3/4	22 1/8	15 1/2 x 15 1/2	15x15	17x17	19 3/8

*NOTE: 2 inches minimum, 8 inches when motorized option is required
**May vary depending on motor size

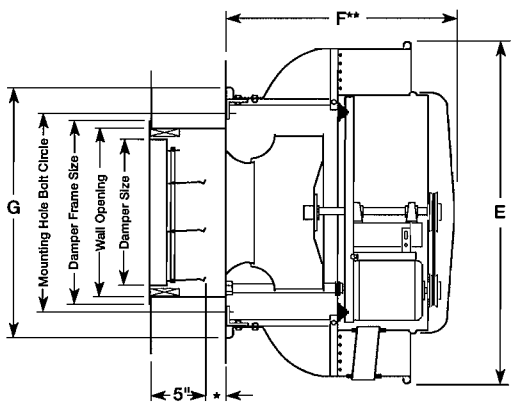


CWB - Belt Drive

Model	E	F**	G	Wall Opening	Damper Size	Damper Frame Size	Mtg. Bolt Circle
CWB-098,101,101HP,121,131	24 7/8	23 3/4	19 3/4	12 1/2 x 12 1/2	12x12	14x14	16 7/8
CWB-141,141HP,161,161HP	28 7/8	24 3/4	22 1/8	15 1/2 x 15 1/2	15x15	17x17	19 3/8
CWB-180,180HP,200,200HP	35 3/8	28 5/8	27 3/4	17 1/2 x 17 1/2	17 x17	19x19	25
CWB-220,220HP,240,240HP	42 25/32	33 7/8	31 1/4	20 1/2 x 20 1/2	20x20	22x22	28 3/8
CWB-300,300HP	50	36	38 3/8	25 1/2 x 25 1/2	25 x25	27x27	35 27/32

*NOTE: 2 inches minimum
7 inches when motorized option is required

**May vary depending on motor size



Installation

Upon receiving unit, check for any damage and report it immediately to the shipper. Also check to see that all accessory items are accounted for.

These fans exhaust directly away from the building, therefore their location and placement should be analyzed. Proximity to nearby buildings and people must be considered.

Access to the motor compartment is accomplished by removing the screws from the cover. The cover can then be removed and placed on a flat surface in an area protected from strong winds.

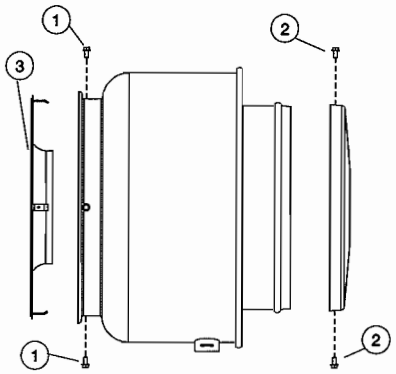
The motor's amperage and voltage rating must be checked for compatibility to the supply voltage prior to final electrical connection. For NFPA - restaurant applications, the electrical supply must enter the motor compartment through the breather tube. For other non-flammable applications the electrical supply can be routed through the conduit chase between the curb cap and the bottom of the motor compartment. ***Consult local code authorities for your specific requirements.***

IMPORTANT: UL/cUL 762 Installations are for Restaurant Applications.

CWB (all) and CW (A, B, and C motor RPMs) are the only fans approved for this installation. All must include the suffix "G".

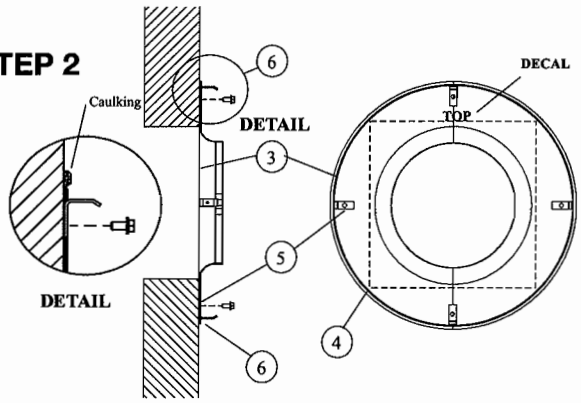
All fans must be installed per NFPA 96 and meet all local code requirements. In addition, the maximum operating temperature at the fan must not exceed 375 degrees F.

STEP 1



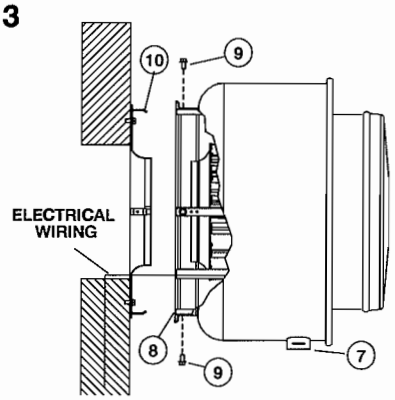
Remove mounting plate from unit by removing the fasteners shown above marked by (1). Remove motor compartment cover by removing fasteners marked by (2).

STEP 2



Locate the mounting plate (3) at the desired position and check to avoid unit clearance problems. Cut the wall opening (4) as shown based upon dimensions obtained from the Dimensional Data Section. Locate top of mounting plate (decal) and attach to the wall construction. The fasteners must pass through the holes provided in the mounting angle clips (5) on the mounting plate (3). For uneven surfaces, shims may be required. Sealant or caulking should be applied in the groove (6) formed by the mounting plate and the wall to prevent moisture leakage into the building.

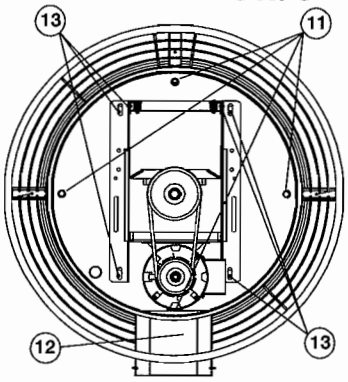
STEP 3

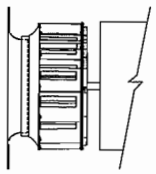


Once the mounting plate has been attached to the wall, the unit can be installed. The unit should be aligned with the breather tube (7) pointing down. The electrical chase should be guided through the hole in the motor compartment. The horizontal support channels (8) should slide over the mounting angle clips (10) on the mounting plate until the holes in the windband and clips are aligned. Replace fasteners (9) and tighten. Wiring now can be done. Consult local code authorities for your specific requirements.

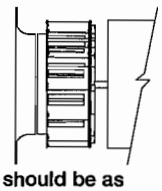
STEP 4

CW/CWB Models 098 - 300





CW Models 060-095



During shipping, wheel position may shift. Alignment should be as shown above (centered in the inlet) and can be accomplished by loosening the fasteners (11) located in the motor compartment. For belt drive units, additional vertical alignment can be accomplished by loosening the four fasteners on the drive frame support angles, and the 2 fasteners that hold the L-brackets to the support angles on top (13). Also, horizontal alignment can be made by loosening the bearings from the bearing plate.

Removal of the entire power pack (motor, drives and wheel) for maintenance or cleaning can be accomplished by removing the breather tube (12) and fasteners (11).

Pre-Starting Checks

Check all fasteners for tightness. The wheel should rotate freely and be aligned as shown in Fig. 1. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment, and realignment may be necessary. Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame. Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position.

WHEEL OVERLAP DIMENSIONS

MODEL	G	H
060-095	-	3/32 in.
098-161	1/4 in.	-
180-300	1/2 in.	-

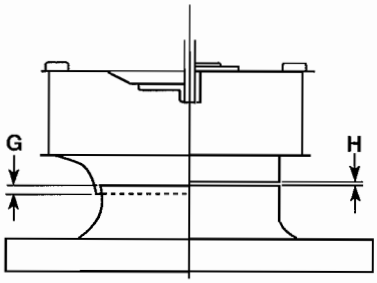


Fig. 1

WHEEL ROTATION

All CW/CWB fans have a clockwise wheel rotation when viewed from top of fan.

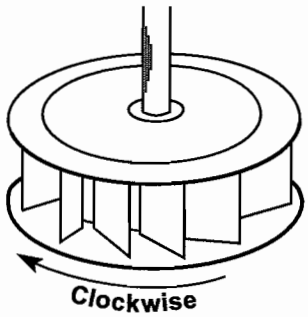


Fig. 2

Direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout. Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should be clockwise as shown in Fig. 2 and correspond to the rotation decal on the unit.

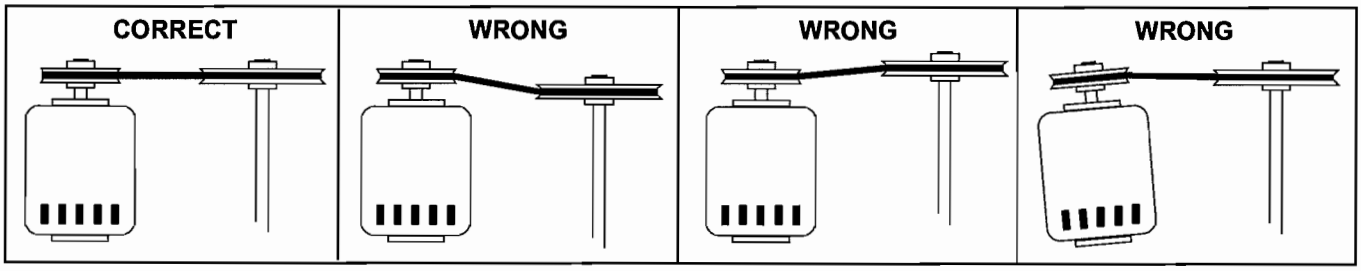
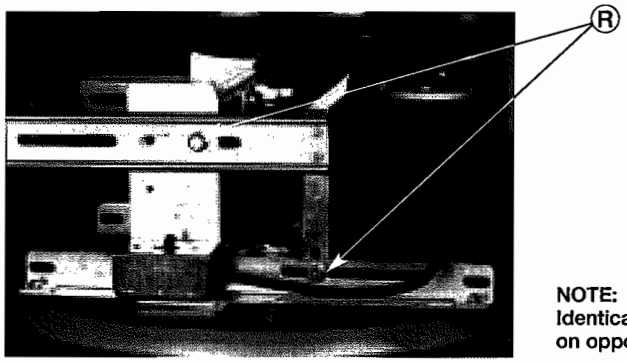


Fig. 3

If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss. (See Fig. 3)

For all CWB units belt tension can be adjusted by loosening four fasteners (marked "R") on the drive frame. The motor plate slides on the slotted adjusting arms and drive frame angles in the same manner (see Fig. 4). Belt tension should be adjusted to allow 1/64" of deflection per inch of belt span. For example, a 15" belt span should have 15/64" (or about 1/4") of deflection with moderate thumb pressure at mid-point between pulleys. (See Fig. 5). Overtightening will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.



NOTE:
Identical fasteners on opposing side

Fig. 4

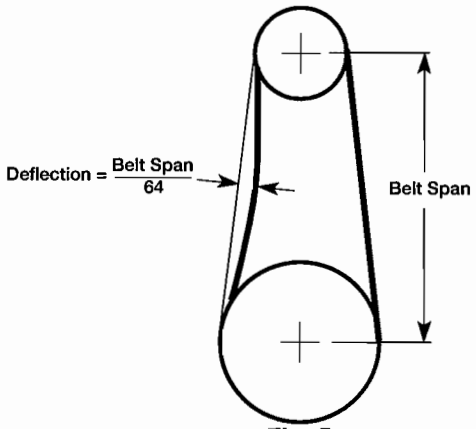


Fig. 5

The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in speed represents a substantial increase in the horsepower required by a unit. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

MAINTENANCE

Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit. Matched belts should always be used on units with multigroove pulleys. For belt replacement, loosen the tensioning device far enough to allow removal of the belt by hand. Do not force belts on or off. This may cause cords to break, leading to premature belt failure. Once installed, adjust belts as shown in "Pre-Starting Checks."

Shaft bearings can be classified in two groups: relubricating and non-relubricating. All bearings on standard Model CWB fans are factory lubricated and require no further lubrication under normal use (between -20°F and 180°F in a relatively clean environment). Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent overpacking or contamination. Grease fittings should be wiped clean. The unit should be in operation while lubricating. Extreme care should be used around moving parts. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease is recommended.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated and should not be lubricated further. Motors supplied with grease fittings should be greased in accordance with manufacturers' recommendations. Where motor temperatures do not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

The unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off, etc.).

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

A proper maintenance program will help these units deliver years of dependable service.

TROUBLESHOOTING

PROBLEM	CAUSE	CORRECTIVE ACTION
REDUCED AIRFLOW	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, etc.
	Unit running backwards	Correct as shown in Fig. 2
	Excessive dirt buildup on wheels	Clean wheel
	Improper wheel alignment	Center wheel on inlets
EXCESSIVE NOISE OR VIBRATION	Bad bearings	Replace
	Belts too tight or too loose	Refer to Fig. 5 and adjust tension
	Wheel improperly aligned and rubbing	Center wheel on inlets. See Fig. 1
	Loose drive or motor pulleys	Align and tighten. See "Pre-Starting Checks"
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance
	Unbalance of wheel caused by excessive dirt and grease buildup	Remove buildup

NOTE: Before taking any corrective action, make certain unit is not capable of operation during repairs.

Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at our option when retumed to our factory, transportation prepaid.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171
www.greenheck.com

GREENHECK
DAMPERS AND LOUVERS

Special Purpose
BACKDRAFT DAMPER
WD-323
For Use With Models CW & CWB Centrifugal Sidewall Exhaust Fans

Application and Design

The WD-323 series is a vertically mounted backdraft damper that is designed for use with Models CW & CWB centrifugal sidewall exhaust fans to allow horizontal airflow and prevent reverse airflow. The damper is opened by air pressure differential and gravity and closed by springs. Optional motor pack converts to motorized operation.

Standard Construction

Frame: 0.063 in. extruded aluminum.

Blades: 0.025 in. roll formed aluminum.

Axles: 3/16 in. diameter plated steel, full length.

Bearings: Synthetic sleeve type.

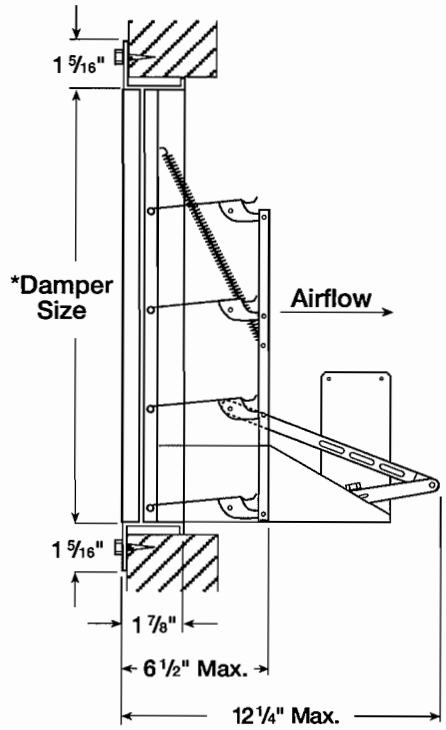
Linkage: 0.064 in. aluminum tie bar.
Spring assisted to close blades.

Blade Seals: Vinyl .

Sizes Available: 8 in. x 8 in.
10 in. x 10 in.
12 in. x 12 in.
15 in. x 15 in.
17 in. x 17 in.
20 in. x 20 in.
25 in. x 25 in.

Options (at additional cost)

- WD-323 Motor Packs (24v, 115v, 208/230v, or 440v)
- End Switch Kit: Model #851038



* W & H dimensions furnished approximately 1/8 in. under size. W is always parallel to damper blades.

Quantity	Size		
	W Width	H Height	

Project Location

Contractor Design Specifier

-Provided by Electrical Contractor

-Provided by Electrical Contractor

-Franklin Electric Overload Protection 4-inch Three-Phase Submersible Motors

TOLL-FREE HELP FROM A FRIEND

1-800-348-2420

1-260-827-5102 FAX

Phone Franklin's toll-free SUBMERSIBLE SERVICE HOTLINE for answers to your installation questions on submersible pump motors. When you call, a Franklin expert will offer assistance in troubleshooting submersible systems and provide immediate answers to your motor application questions. Technical support is also available online. Visit our website at:

www.franklin-electric.com

Franklin Electric
Bluffton, Indiana 46714

156370101 7.02

OVERLOAD PROTECTION

4-INCH THREE-PHASE SUBMERSIBLE MOTORS

NOTICE: WARRANTY ON THREE PHASE SUBMERSIBLE MOTORS IS VOID UNLESS SUBTROL-PLUS® OR AMBIENT COMPENSATED QUICK TRIP PROTECTION IS USED IN ALL THREE LINES.

The characteristics of submersible motors are different than standard motors, and special overload protection is required. Either Subtrol-Plus® or other overload protection approved by Franklin Electric must be used with this motor. For a list of approved overload relays, please refer to Franklin Electric's Application-Installation-Maintenance (AIM) Manual or website (www.franklin-electric.com), or call the Submersible Service Hotline at 800.348.2420. Fixed heater selections for some overload relays common to North America are listed below, along with instructions for the use of fully adjustable overload relays.

Fixed Heater Overload Relays

Heater selections are tabulated below for use in the following components:

Allen-Bradley Bulletin 505, 509, 520, 540, 570 starters.
Furnas Class 14,17,18, 36, 37, 87,88 and 89 starters.
General Electric Type CR124 relays (using Type CR 123 heaters).

Some of these relays offer additional adjustment. That adjustment should be set no higher than 100% unless necessary to stop nuisance tripping, and only when measured amps in all lines are below nameplate maximum.

Fully Adjustable Overload Relays

Relay adjustment should be set at the SET amps in the tables. Only if tripping occurs with amps in all lines measured to be within nameplate maximum amps should the setting be increased, not to exceed the MAX value shown.

Franklin Electric

50 Hertz 4" Motors

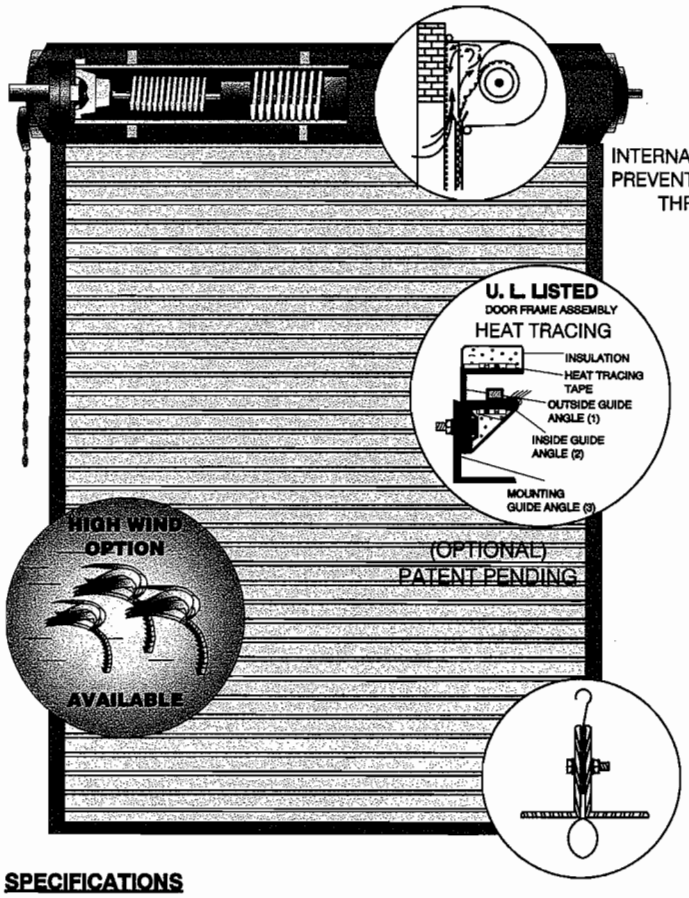
kW	HP	Volts	Fully Adjustable Relays	
			Set	Max.
.37	1/2	220	1.7	1.8
		380-415	1.0	1.1
.55	3/4	220	2.4	2.6
		380-415	1.4	1.5
0.75	1	220	3.3	3.5
		380-415	1.9	2.0
1.1	1 1/2	220	4.4	4.7
		380-415	2.8	3.0
1.5	2	220	6.4	6.9
		380-415	3.7	4.0
2.2	3	220	9.7	10.4
		380-415	5.6	6.0
3	4	220	11.5	12.4
		380-415	6.8	7.3
3.7	5	220	14.4	15.5
		380-415	8.4	9.0
4	5 1/2	220	15.8	17.0
		380-415	9.7	10.4
5.5	7 1/2	220	21.2	22.8
		380-415	12.1	13.0
7.5	10	380-400	17.4	18.7

For more information about overload protection or other submersible motor issues, contact the Franklin Electric Submersible Service Hotline at **800.348.2420**, or visit our website at **www.franklin-electric.com**.

60 Hertz 4" Motors

HP	Volts	Nema Starter Size	Heaters for Overload Relays			Fully Adjustable Relays	
			Furnas	Allen Bradley	G.E.	Set	Max.
1/2	200	00	K31	J16	L380A	3.2	3.4
	230	00	K28	J14	L343A	2.7	2.9
	380	00	K22	J9	L211A	1.7	1.8
	460	00	-	J8	L174A	1.4	1.5
	575	00	-	J6	-	1.2	1.3
3/4	200	00	K34	J19	L51CA	4.1	4.4
	230	00	K32	J17	L420A	3.5	3.8
	380	00	K27	J13	L282A	2.3	2.5
	460	00	K23	J10	L211A	1.8	1.9
	575	00	K21	J8	L193A	1.5	1.6
1	200	00	K37	J21	L618A	5.0	5.4
	230	00	K36	J19	L561A	4.4	4.7
	380	00	K28	J14	L310A	2.6	2.8
	460	00	K26	J12	L282A	2.2	2.4
	575	00	K23	J10	L211A	1.8	1.9
1 1/2	200	00	K42	J23	L750A	6.3	6.8
	230	00	K39	J21	L680A	5.5	5.9
	380	00	K32	J17	L420A	3.3	3.6
	460	00	K29	J15	L343A	2.8	3.0
	575	00	K26	J12	L282A	2.2	2.4
2	200	0	K50	J26	L111B	8.6	9.3
	230	0	K49	J25	L910A	7.5	8.1
	380	0	K36	J20	L561A	4.6	4.9
	460	00	K33	J18	L463A	3.8	4.1
	575	00	K29	J15	L380A	3.0	3.2
3	200	0	K55	J29	L147B	11.6	12.5
	230	0	K52	J28	L122B	10.1	10.9
	380	0	K41	J23	L750A	6.1	6.6
	460	0	K37	J21	L618A	5.1	5.5
	575	0	K34	J19	L510A	4.1	4.4
5	200	1	K62	J34	L241B	19.1	20.5
	230	1	K61	J33	L199B	16.6	17.8
	380	0	K52	J28	L122B	10.0	10.8
	460	0	K49	J26	L100B	8.3	8.9
	575	0	K42	J23	L825A	6.6	7.1
7 1/2	200	1	K68	J38	L332B	28.4	30.5
	230	1	K67	J37	L293B	24.6	26.4
	380	1	K58	J32	L181B	14.9	16.0
	460	1	K55	J30	L147B	12.3	13.2
	575	1	K52	J28	L122B	9.9	10.6
10	380	1	K62	J34	L241B	19.5	20.9
	460	1	K60	J32	L199B	16.1	17.3
	575	1	K56	J30	L165B	12.9	13.8

-Alpine Roll-up Door

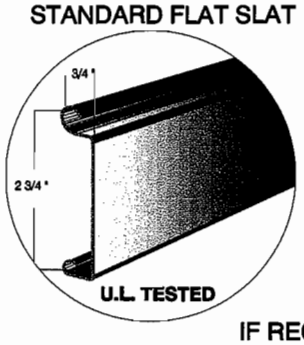


WIND-TITE™

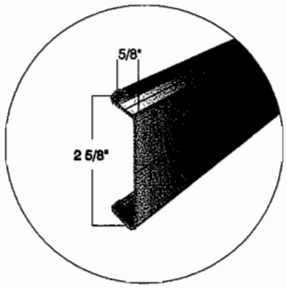
FULL WEATHER SEALED DOOR

STANDARD FLAT SLAT IS UPGRADEABLE
TO INSUL-SOUND OR INSUL-VAPOR

STANDARD FLAT SLAT



OPTION 1



IF REQUIRED
CUSTOM DESIGNED WINDLOAD SPECIFICATIONS
WINDLOAD AND STRESS ANALYSIS CALCULATIONS
WILL BE SUPPLIED TO ARCHITECTS
AND ENGINEERS UPON WRITTEN REQUEST

PIPE SHAFT
Solid shaft, minimum thickness 1 1/4" for 4" pipe, 1 1/2" for 6" pipe, 1 3/4" for 8" - 1018 cold rolled round

BRACKETS
Steel plate not less than 3/16" thick. Ball bearings at rotating support points. Bolted to wall mounting angle supports counterbalance assembly and forms end enclosures. (Optional) Stop Lock Bearing : to prevent door from free falling in the event drive operation fails.

HOOD Hexagon (Square or Round OPTIONAL)
#24 ga. galvanized steel (Equip with neoprene air baffle). Formed to fit contour of brackets. 3/8" thick intermediate supports as required to prevent excessive sag. Optional phosphate or baked enamel painted.

FASCIA GALVANIZED (OPTIONAL)
Useful where areas behind hoods are open. (especially applicable to pre-engineered buildings).

OPERATION
Push-up, hand chain, hand-crank, or motor operation. (for optional features see motor operators section in this catalog)

LOCKING
Equip doors for locking by padlock from coil side. (Padlocks by others) Slidelocks, pinlocks and LOC-TITE optional.

FINISH
Slats are prepared with a minimum galvanizing of G-60 (interior) and G-90 (exterior). The hoods are galvanized. Other exposed ferrous surfaces prime painted.

GALVANIZING (OPTION)
To be applied to guides, brackets, pipe shafts and gears in addition to Standard Specifications. Apply under conditions of extreme or unusual atmospheric contamination (in accordance with ASTM: A525)

SPECIFICATIONS

GENERAL
Furnish rolling service doors as manufactured by Alpine Overhead Doors,Inc.

CURTAIN
Flat Slats: Roll form galvanized steel or optional stainless steel, flat sections. Gauges from 22ga. 20ga. 18 ga. (Optional phosphate or baked enamel painted)

GALVANIZED ENDLOCKS
Cast endlocks/windlocks riveted to the ends of the slats, with 1/4" rivets. (furnish windlocks as required by design windload). Endlock/Windlocks are available in brass material as an option, which prevents sparking.

BOTTOM BAR
Two galvanized steel angles equipped with vinyl weatherstrip which extends into guides. Standard galvanized ASTM {A525).

GUIDES
Guides are designed using a minimum of 3/16" steel angles and satisfy windload specifications. (Equip with vinyl weather seals).

COUNTERBALANCE ASSEMBLY
Steel pipe barrel of a size capable of carrying a curtain load with a maximum deflection of 0.03" per ft. of door width. Heat treated helical torsion springs encased in a steel pipe and designed to include an overload factor of 25% to ensure minimum effort to operate. Sealed and prelubricated ball bearing at rotating support points. Charge wheel for applying spring torque and for future adjustment. Stainless steel or hot dipped galvanized pipe assembly is available.
Optional: High Cycle Springs designed to satisfy up to 100,000 cycles.

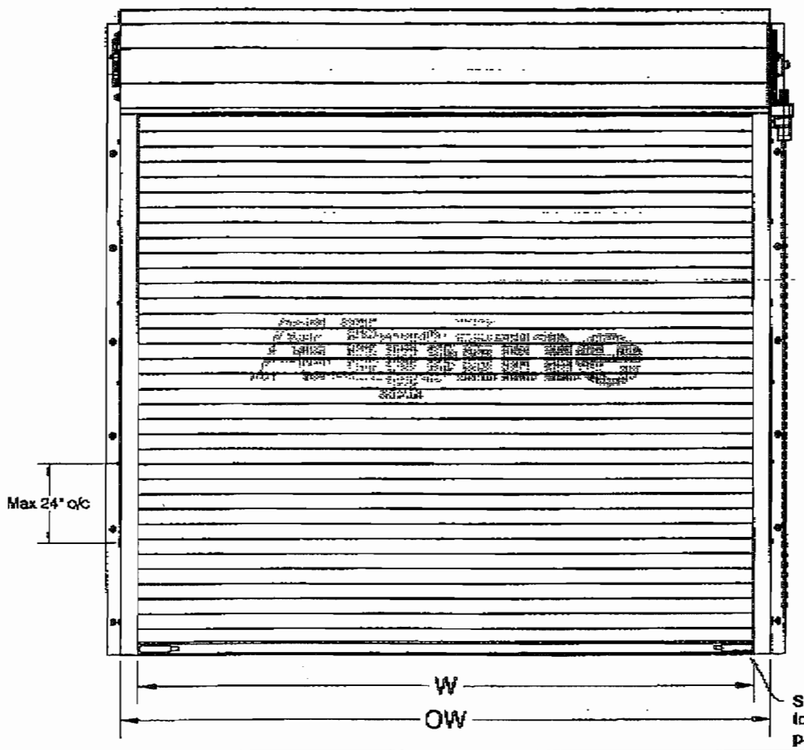
PROJECT: Franklin Cleaners - Garden City, NY

CONTRACT# / P.O.#: NYSDEC# D004264

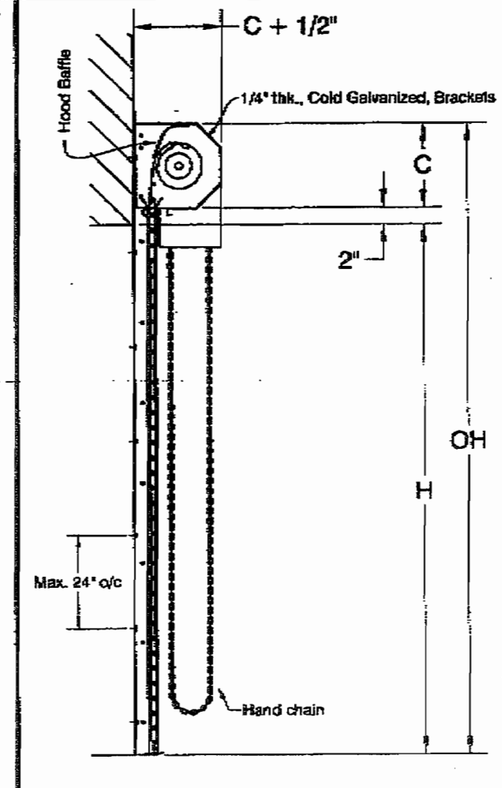
FILE NAME: fs1\sys1:\dwg\insul\vibra\00936.dwg

DRAWING#: 00936 - 1 of 1

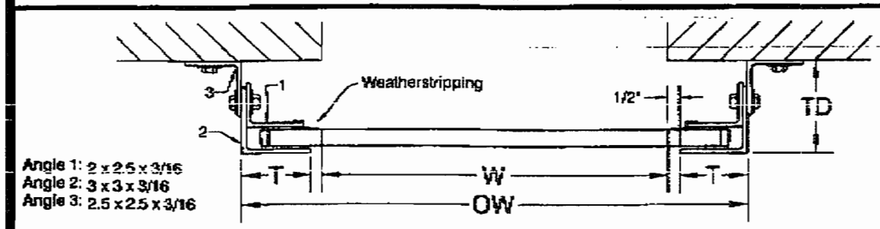
Door is shown right hand drive, left hand is opposite.



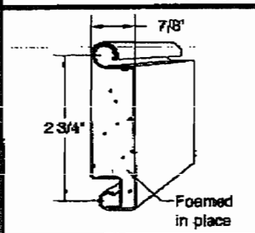
COIL SIDE ELEVATION



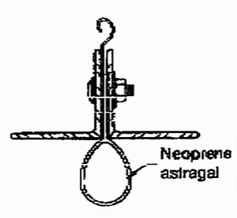
VERTICAL SECTION



GUIDE SECTION



CURTAIN



BOTTOM BAR

QTY.	MK	CLEAR OPENING W OPENING WIDTH	CLEAR OPENING H OPENING HEIGHT	OVERALL SIZE OW OVERALL WIDTH	OVERALL SIZE OH OVERALL HEIGHT	C BRACKET	T GUIDES	TD GUIDE DEPTH	OPERATION	DRIVE SIDE
1		10'-0"	8'-0"	10'-7"	9'-8"	18"	3"	4 1/2"	Hand Chain	Right Hand

PLEASE CHECK APPROPRIATE BOX, SIGN AND RETURN TO ALPINE.

☑ APPROVED (O.K. to Fabricate) ☐ RESUBMIT

☐ APPROVED AS NOTED ☐ DISAPPROVED

COMPANY NAME Dean Bjorgos TITLE VP

SIGNATURE

PRINT NAME ROBERT Bjorgos DATE 6/18/03

NOTES:

1. Alpine Overhead Doors, Inc. will not be responsible for any damage caused by materials being fastened, by other trades, to our product. In no way should hung ceiling, metal edge strips, fixtures, etc. be attached to or come in contact with guides, hood, etc.
2. Finish: Exposed ferrous surfaces, other than galvanized surfaces, receive one coat of rust inhibitive metal primer.
3. Operation: Doors are chain operated
4. Alpine Overhead Doors, Inc. meets and exceeds the specifications, section 08360, from Dvirka and Bartilucci - Job# 1851-2.

BUILDERS NOTES:

1. Jambs, lintels, sills or other structural element required to prepare openings are not included by Alpine Overhead Doors, Inc.
2. Openings of sound and suitable construction will be provided by the purchaser for the support of Alpine doors.
3. In the construction of new openings, the purchaser will be responsible for the maintenance of certified dimensions on approved shop drawings, or as guaranteed otherwise.
4. Set guides to the "ow" dimension

REV. #	REVISION	DATE

MATERIAL

CURTAIN: 22 / 24 gauge galvanized roll formed 7/8" thick IMB slat sections
FINISH: Standard

HOOD: 24 gauge galvanized sheet formed to fit hexagon brackets equipped with vinyl weatherstripping
FINISH: Standard

GUIDES: Designed using angles consisting of min. 3/16" structural steel equipped with vinyl weatherstripping
FINISH: Cold Galvanized

BOTTOM BAR: Two galvanized steel angles which extends into guides. equipped with vinyl weatherstripping
FINISH: Standard

IMB-V7™

SALES REP: Bill Putnam

CUSTOMER: URS Corporation

DRAWN BY: Tarek Jaroudi

DATE: Mar. 3, 2003

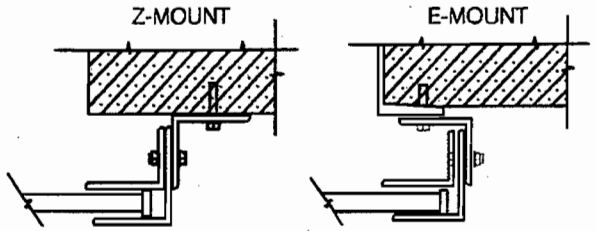
CHECK:

ALPINE® OVERHEAD DOORS, INC.
8 HULSE ROAD - EAST SETAUKET, N.Y. 11733
TEL: (631)473-9300 FAX: (631)642-0800

Alpine®
OVERHEAD DOORS, INC.

GENERAL
INSTALLATION
INSTRUCTIONS

INSIDE & OUTSIDE MOUNT; TYPE 2 & 3A

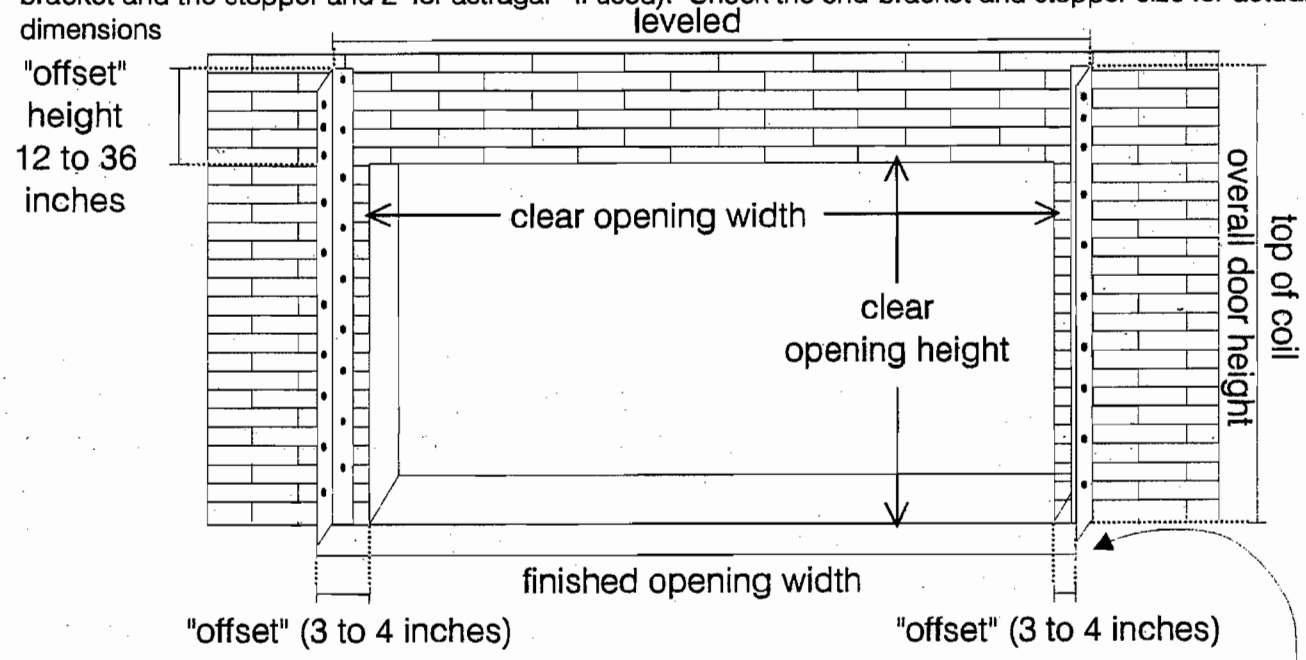


TYPE 2
MOUNTING
TO MANSORY
JAMBS

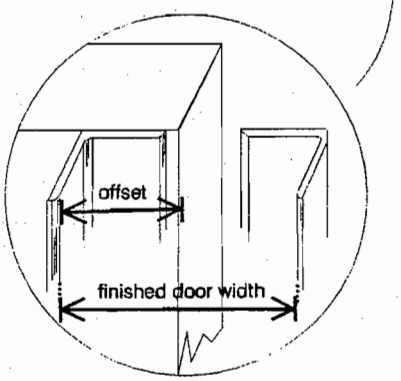
TYPE 3A
MOUNTING
TO STEEL JAMBS

Verify the clear opening dimensions. Generally the clear opening width is offset 3" to 4" on each side, which will be the overall door width. Verify packing list for overall door width and check the markings on the pipe. They should match.

Take Overall Door Width and adjust the center accordingly to the clear open width. Note that guide mounting angles will be offset 3" to 4" on each side of the clear opening width to allow for the guide rails. (ONLY FOR INSIDE & OUTSIDE MOUNTING). Level the mounting guide angles (using a water level) to insure that left and right mounting angles are plumb. Note that in the INSIDE and OUTSIDE MOUNTING condition, the mounting angles will be 1' to 3' higher than the clear opening height (to allow for the end bracket and the stopper and 2" for astragal - if used). Check the end-bracket and stopper size for actual dimensions



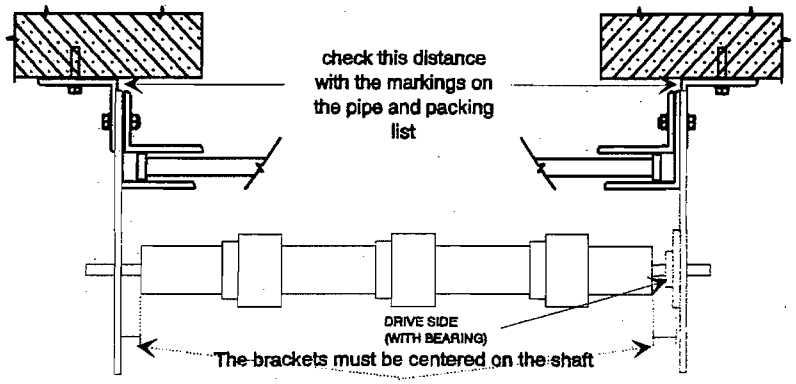
To measure the height offset, measure the height of the end-bracket and add 3" for the height of the stopper.



Alpine®
OVERHEAD DOORS, INC.

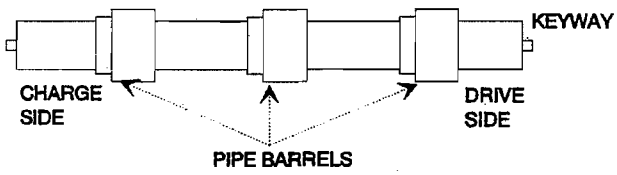
GENERAL
INSTALLATION
INSTRUCTIONS

Mark mounting holes on wall, then use drill and set shields, or drill and tap into steel, or drill holes for the thru wall bolts. Note: It is recommended that you drill a hole at the top and bottom of the mounting angle first. Then set the angle on the wall. Repeat the same for the second mounting angle. Then proceed with the marking and drilling of the remaining holes.

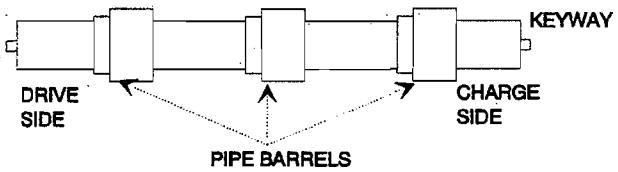


Remove pipe shaft and curtain from the packing case or crate; lay on the floor, as to "hand drive side" (left or right) . Place the brackets on shaft and drive bracket on proper side. If motor operation - mount the drive sprocket to prevent the end bracket from coming off. Set screws. On the charge side mount the charging wheel. Note: on the drive side of the end bracket is a bearing. Set locking screws to prevent the end bracket from sliding. On the tension side DO NOT put a stop bar on the end bracket connecting to the charge wheel at this time. Leave it free to turn. It is important that the end brackets are centered on the pipe shaft.

RIGHT HAND DRIVE

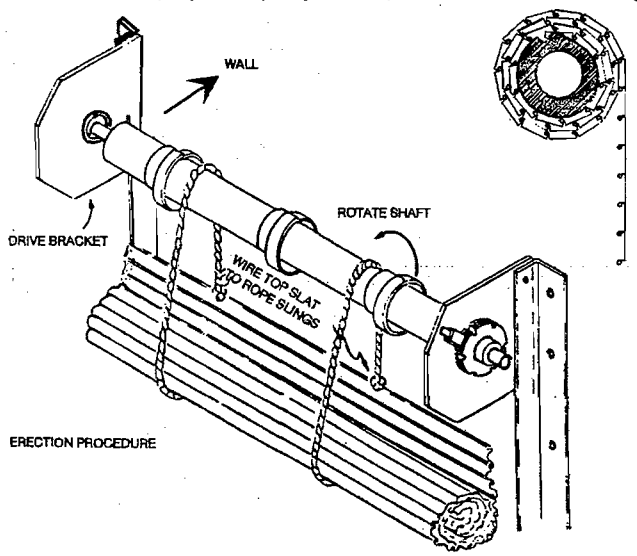


LEFT HAND DRIVE



NOTE: PIPE BARRELS ARE ALWAYS PLACED ON SHAFT WITH WELDED FLANGE FACING LEFT REGARDLESS OF WHETHER THE DOOR IS RIGHT OR LEFT HAND OPERATED (AS OF 1993)

Lift pipe shaft with attached end brackets to the top of the mounting angle and bolt end brackets to mounting angles. Set pipe shaft perfectly leveled. This will insure proper roll-up of the curtain. Once completed and dimensions are verified, and all bolts are secured with proper torque, you can proceed with the mounting of the curtain.



Note: This is the proper way to install the curtain on the shaft.

Lift the rolled up curtain up to 1 foot below the mounted shaft, attach rope slings of adequate size around the curtain (on units 16 ft. or more use 3 or more rope slings), as shown on the left. Once the slings are in place drop the lift slightly putting minimum weight on the rope slings and pull the top slat up between the slings and the spring assembly matching the top slat holes with the holes in the pipe shaft or barrel rings. Fasten with bolts, nuts and washers provided but do not tighten. Adjust the top slat so that there is an equal distance between the edge of the endlock and the inside face of the bracket plates. Now permanently fasten the top slat to the pipe shaft or barrel rings. Remove lift so that all the curtain weight rests on the slings.

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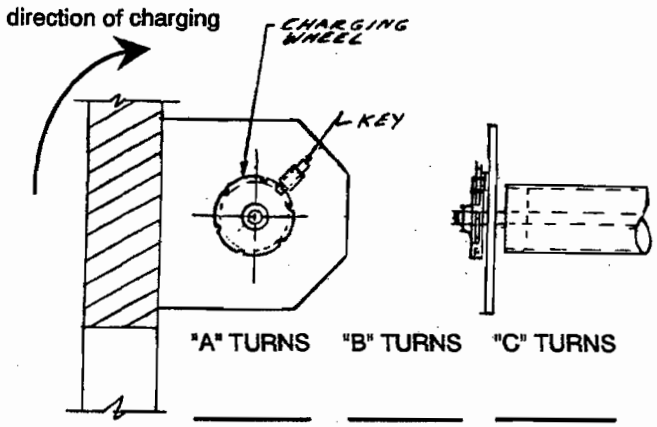
Alpine®
OVERHEAD DOORS, INC.

GENERAL
INSTALLATION
INSTRUCTIONS

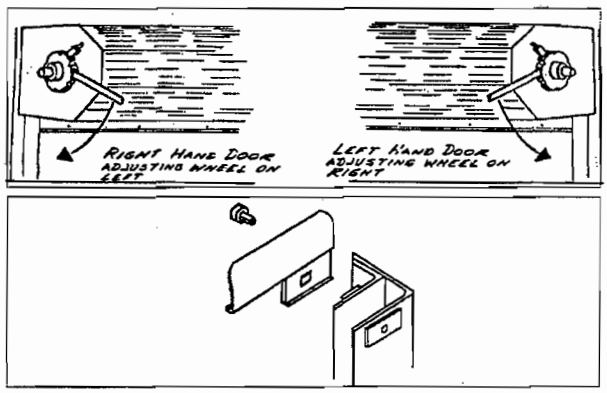


WARNING! Applying spring tension is dangerous. It requires two workers for safety. You will need two 1 1/2" x 1/4" flat bars, 18" long (not provided) to apply tension to the springs. Slide one of the bars into any of the six slots on the adjusting wheel. Wind in the direction the pipe would rotate when the door is going up (i.e. adjuster on the left - clockwise, adjuster on the right - counterclockwise.) Slide the second bar in the slot above, hold and remove the lower bar. Repeat the procedure until the curtain starts to coil around the spring assembly and stop when the bottom bar becomes visible. Line up the adjusting wheel slots with the channel stop and slide the stop bar (1" x 1/4" x 4" flat bar) provided through the channel and into the slot on the adjusting wheel. Remove the adjusting bar. After the pipe assembly is fully charged, place the bottom bar of the curtain into the guides and place bell mounts onto the guide tab with bolts provided. Final adjustments will be completed in a later step.

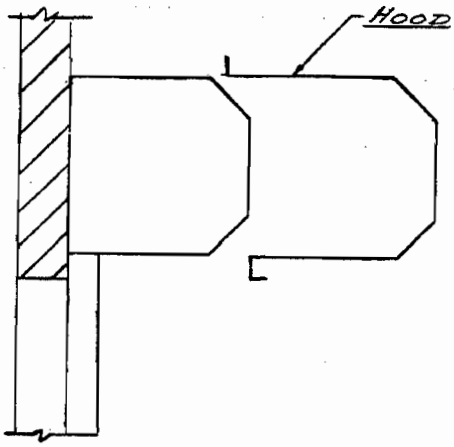
With the slings still in place for safety, fasten both guides with the bolt and nuts provided to the inside face of the wall angles. In all cases the flange faces to the wall and butts up against the bottom edge of the bracket plate.

Apply "A" turns for the initial charge while door is fully raised. The total charge when the door is closed is "B" turns, and the springs are designed to be elastic for "C" turns. Refer to the factory for values of A, B and C for your door.

The door should not drop when half open, nor should it pick up at the top and bottom. If it drops, the charge should be increased. If it picks up, the charge should be decreased.



Attach the chain set or motor operator to the end bracket of the drive side. Be sure that everything is secured properly.



Install sheet metal hood by bolting it to the end brackets. Install additional sheet metal fascias and covers, if provided.

After a few months or a year, the adjustments of the springs at their anchorage to the door load may require a notch or two increase in the charge. A very slight pick up at the top and bottom may be permitted originally to avoid this adjustment.

The guides should be treated with a graphite greased.

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Alpine®
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GENERAL
INSTALLATION
INSTRUCTIONS

MAINTENANCE INSTRUCTIONS

LUBRICATION

The most important single maintenance item on doors of this type is lubrication. This is required only at certain points because all rotating members are equipped with high quality sealed bearings that are lubricated for life.

The curtain guides and the teeth of the gears contained in chain hoist or hand crank mechanism (if supplied) should be lubricated at least twice a year (more often if door works very frequently) with one of the following greases:
- Dixon's #2 Graphite Cup Grease (#1 for summer weather)
- Alemite MP Lithium Grease (#1 for winter weather, #2 for normal)
- Texaco #904 Graphite Grease, or other equivalents

If door is electrically operated, check the oil level in the worm gear speed reducer every six months and replenish if necessary with S.A.E. 140 gear oil for normally heated buildings or thinner grades for outside installations exposed to low temperatures.

PAINT:

All non-lubricated steel surfaces should be painted annualy (more often if required in corrosive atmospheres) with a good grade of rust inhibiting metallic base paint.

SPRING ADJUSTMENT:

In time, the counter balancing springs may lose some of their initial tension; this condition imposes an extra load on the operator and should be corrected as follows.
a) manually operated doors should be opened fully by hand and held open by "C" clamps or vise grip pliers on each guide.
b) Mechanically operated doors should be opened fully and the crank or hand chain should be locked to hold the door open.
c) electrically operated doors should be open fully by pushing the UP or OPEN button; motor brake will hold the door open. Shut off power supply to the motor during adjustment.
d) with a suitable tool (18" or 24" pipe wrench or larger spanner) turn the spring adjusting wheel (1/8 turn at a time) until the door is balanced properly. Make sure locking pawl is properly engaged in spring adjusting wheel.

NOTE: For door with adjusting wheel on left hand side, wind spring clockwise (downward), for door with adjusting wheel on right hand side, wind spring counterclockwise (downward).

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Troubleshooting Manual for Rolling Steel Doors

The following troubleshooting guidelines have been specifically written to provide a reliable source of information to all customers and users of Alpine Overhead Doors, Inc. This information will provide solutions to the most common problems and establishes a systematic sequence required in repairing a rolling steel door.

If a problem is encountered and it is not covered in this manual, kindly call an Alpine sales representative for they are ready to assist you if you require further technical assistance.

	Problem	Causes	Corrections
P1	As the door is in the downward travel, it binds.	a. Curtain binds in guides.	Increase the guide opening. Curtain must be free in guides.
		b. Bolts used to connect the curtain to the barrel are too long.	Replace the bolts with shorter bolts.
		c. Insufficient initial stretch of the torsion spring.	Consult the factory. 1-800-Alpine-4
		d. Incorrect hand of the spring.	Consult the factory. 1-800-Alpine-4
		e. Incorrect spring assembly for the opening.	Check the door mark on the barrel. Locate the correct barrel.
P2	Tension wheel turns freely.	a. Spring broken.	Consult the Factory. 1-800-Alpine-4
		b. Broken shaft pin.	
		c. Broken barrel pin.	
P3	Difficulty applying tension while adjusting the charge wheel.	a. Incorrect spring connection to the spring holders.	Consult the Factory. 1-800-Alpine-4
		b. Incorrect distance between the spring castings.	
		c. Screws connecting the curtain or collar are too long.	
P4	Drive shaft crooked.	a. Broken weld.	Consult the Factory. 1-800-Alpine-4 Possible end plug replacement.
		b. Shipping damage.	

	Problem	Causes	Corrections
C1	Curtain rolls up unevenly.	a. Top slat not in line.	Loosen top screws and straighten the curtain.
		b. Tapped holes in barrel are not on centerline.	Drill and tap the barrel with holes on centerline.
		c. Barrel not level.	Use hydro-level to level the pipe.
		d. Collar assembly improperly aligned.	Consult the factory. 1-800-Alpine-4
		c. Damaged slats in curtain.	Replace damaged slats.
C2	Curtain slats separate.	a. Freight damage.	Replace the curtain.
C3	Curtain separates from the barrel.	a. Curtain does not have ½ wrap on the barrel, when in the closed position.	Insert additional slats in the curtain of the door.
		b. Bolts pulled through the top slat.	Install washers under the head of the bolts.
		c. Interlocks not installed on the motor operated door.	Install interlocks to prevent motor operation, when the door is locked.
C4	Curtain appears to sag at the center.	a. Center of the curtain is against the barrel and the edge of the curtain is pulled toward the lintel, as it enters the guides.	Curvature of the curtain makes it appear to be sagging, when it is actually level.
		b. Barrel deflection on wide doors.	Consult the factory. 1-800-Alpine-4
		c. Starter slats improperly aligned to the barrel.	Remove the starter slat and allow for camber, then tighten.
B1	Bottom Bar Interferes with the vinyl weather-stripping.	a. Incorrect guide opening.	Increase guide openings.
		b. Incorrect cope on bottom bar angle.	Increase cope to clear the weather-stripping.

	Problem	Causes	Corrections
B2	Sensing edge doesn't work.	a. Open circuit in the bottom bar. Confirm this by disconnection the wiring at the bottom bar and insert a continuity tester.	Replace the sensing edge
		b. Open circuit in the coil cord or cord reel. Confirm this by inserting a voltmeter into the plug. Reading should be 24 VAC	Replace the coil cord or coil reel.
		c. Door located in extremely wet or flooded environment.	Eliminate the water and replace the sensing edge.
B3	Locks are inoperable.	a. Key slot of cylinder must be in the horizontal position	Reposition the cylinder and firmly secure with small screws into the bottom bar.
		b. Damaged internal components.	Remove the bottom bar from the guide. Replace the locking mechanism
B4	Electrical interlocks are inoperable	a. Magnet on lock bolt does not line up with the proximity switch on the guide.	Adjust the proximity switch location where it is mounted to the guides.
H1	Hood bends do not align with the end bracket.	a. Incorrect hood size.	Accurately check all dimensions of material supplied and consult factory. 1-800-Alpine-4
K1	Brackets are not perpendicular to the barrel	a. Wall angle flange is not square.	Brace the bracket into position and square.

APPENDIX H

SITE ACTIVITIES LOG AND FIRE CODE INSPECTION FORMS

FRANKLIN CLEANERS SITE, NYSDEC SITE NO. 1-30-050
SITE ACTIVITIES LOG

PERSONNEL ON-SITE	DATE/TIME ON-SITE	TIME OFFSITE	REASON FOR SITE VISIT (CHECK BOX BELOW)			
			☐	Monitoring	☐	Maintenance
			☐	Sampling	☐	Other (Provide Description)
			☐	Alarm Response		
Description:						
			☐	Monitoring	☐	Maintenance
			☐	Sampling	☐	Other (Provide Description)
			☐	Alarm Response		
Description:						
			☐	Monitoring	☐	Maintenance
			☐	Sampling	☐	Other (Provide Description)
			☐	Alarm Response		
Description:						

Franklin Cleaners GWE and TS Site
Site No. 130050
Monthly Inspection of Fire Extinguisher

Date: _____
Serial Number: _____
Initials: _____

	Yes	No	N/A
1. Is the extinguisher located in its designated location?			
2.) Is it clear of obstructions to access or visibility?			
3.) Are operating instructions on the name plate legible and facing outward?			
4.) Is the extinguisher full?			
5.) Pressure gauge (or indicator) in the operable range?			
6.) Are safety seals and/or tamper indicators in place and functional?			
7.) Is the extinguisher in good physical condition?			
8.) Has the extinguisher inspection tag been initialed for the current month?			

Franklin Cleaners GWE and TS Site
Site No. 130050
Emergency Lighting and Exit Sign Test Log

Date: ____________________
Serial Number: ____________________
Initials: ____________________

Test Date	Annual or Monthly (A or M)	Unit Number	Start Time	Stop Time	Pass/Fail	Explanation for failure and planned corrective action

APPENDIX I

SYSTEM SHUTDOWN NOTIFICATION

MEMORANDUM

TO: David Gardner

FROM: Jim Van Horn

DATE: July 07, 2017

SUBJECT: Franklin Cleaners Site
NYSDEC Site No. 130050
Prolonged System Shutdown
D&B Project No. 3150-10

As follow up to your email dated July 5, 2017, the purpose of this memo is to document the NYSDEC's recent decision to shutdown the GWE&TS at the Franklin Cleaners Site and to document the necessary activities to ensure successful startup of the system in the future. In accordance with the recommendations within the recent Site Management Quarterly Reports completed for the Site it was found that:

The operational and performance data set for the GWE&TS indicates that the system, as configured, may be approaching asymptotic conditions. As such it is recommended the continued operation of the GWE&TS be evaluated in accordance with the Site Management Plan. The evaluation should consist of "pulsing" of the system and monitoring of contaminant concentrations within the existing monitoring well network located in the vicinity and downgradient of the GWE&TS. Pulsing would involve the periodic shutdown and startup of the system to allow for the subsurface environment to come to equilibrium prior to resuming groundwater extraction, as necessary.

As such, the NYSDEC has directed that the system be shutdown to perform this evaluation. As the system may be shutdown for a prolonged period, it is recommended that the following items be completed to ensure the successful startup of the system:

1. The current PLC program should be downloaded from the PLC to ensure that a backup is available in the event that it is corrupted or lost during the shutdown period;
2. A full round of maintenance and lubrication should be completed for all major system components in accordance with the 2003 O&M Manual;
3. All major system components should be cleaned, drained and winterized;
4. All free liquids should be removed from the system building and the building should be broom swept;
5. All major system components should be deenergized; however, the heating and ventilation system should remain operational, as well as the building lighting;
6. General facility housekeeping should be completed at a minimum once a quarter;
7. Landscaping activities should continue on a bi-weekly basis during the growing season;
8. Snow removal activities should be completed, as needed, to ensure facility access and access for site monitoring and sampling; and,
9. All other site monitoring and sampling unrelated to the GWE&TS should continue to be performed in accordance with the SMP requirements.

It is recommended that the above items, with the exception of items 6 through 9, be completed by the NYSDEC Remedial Services Contractor under the oversight of D&B. The remaining items shall be completed by the NYSDEC Remedial Services Contractor but do not require oversight by D&B; however, the contractor shall provide notification to the NYSDEC and D&B regarding schedule and completion of these items.