# Former IBM B952/982 Site
## DUTCHESS COUNTY
## POUGHKEEPSIE, NEW YORK

# SITE MANAGEMENT PLAN

## NYSDEC Site Number: 314076

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
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**Revisions to Final Approved Site Management Plan:**

| Revision No. | Date Submitted | Summary of Revisions | NYSDEC Approval Date |
|---|---|---|---|
| 001 | March 2017 | Updates to this SMP include:<br>• Description of the soil removal between former leased Building 952 and 982;<br>• The soil within the former IBM leased Building 952 footprint, as well as soils throughout the Site, were sampled, analyzed and verified to meet restricted residential SCOs.<br>• Restricted requires that the use of the Site has restrictions in the form of an Environmental Easement, which has been prepared for the Site;<br>• Demolition of former IBM Building 952 in accordance with the approved Excavation Work Plan;<br>• Update to the IHWD Site boundary to reflect the demolition of former IBM Building 952;<br>• Update to the groundwater monitoring plan to reflect the decommissioning of nine perimeter monitoring wells;<br>• Installation of the Subslab Depressurization System (SSDS) in Building 982; and<br>• Conversion to the August 2015 SMP template. | |

**MARCH 2017**

## CERTIFICATION STATEMENT

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




Brian Veith P.E.

March 30, 2017 DATE

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

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## DUTCHESS COUNTY
## POUGHKEEPSIE, NEW YORK

## SITE MANAGEMENT PLAN

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## List of Acronyms

| | |
|---|---|
| CAMP | Community Air Monitoring Plan |
| CFR | Code of Federal Regulation |
| COC | Certificate of Completion |
| CP | Commissioner Policy |
| DER | Division of Environmental Remediation |
| EC | Engineering Control |
| ECL | Environmental Conservation Law |
| EWP | Excavation Work Plan |
| HASP | Health and Safety Plan |
| IBM | International Business Machines Corporation |
| IC | Institutional Control |
| IHWD | Inactive Hazardous Waste Disposal |
| NYS | New York State |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| NYCRR | New York Codes, Rules and Regulations |
| O&M | Operation and Maintenance |
| OM&M | Operation, Maintenance and Monitoring |
| PID | Photoionization Detector |
| PRR | Periodic Review Report |
| QA/QC | Quality Assurance/Quality Control |
| QAPP | Quality Assurance Project Plan |
| RAO | Remedial Action Objective |
| RAWP | Remedial Action Work Plan |
| RP | Remedial Party |
| RSO | Remedial System Optimization |
| SCG | Standards, Criteria and Guidelines |
| SCO | Soil Cleanup Objective |
| SMP | Site Management Plan |
| SOP | Standard Operating Procedures |
| SSDS | Subslab Depressurization System |
| SVE | Soil Vapor Extraction |
| SVI | Soil Vapor Intrusion |
| TCL | Target Compound List |
| USEPA | United States Environmental Protection Agency |
| UST | Underground Storage Tank |
| VCA | Voluntary Cleanup Agreement |
| VCP | Voluntary Cleanup Program |



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# SITE MANAGEMENT PLAN
# FOR THE FORMER IBM B952/982 SITE

## EXECUTIVE SUMMARY

# ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification: 314076 Former IBM B952/982 Site; Poughkeepsie, NY

| **Institutional Controls:** | **Responsible Party:** |
|---|---|
| 1. The Site may be used for restricted residential and commercial use. | Site Owner |
| 2. The Site maintains the following IC's:<br>• The Site may only be used for restricted residential and commercial use provided that the long-term Institutional and Engineering Controls included in this SMP are employed;<br>• The Site may not be used for a higher level of use, such as unrestricted use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC;<br>• All future activities on the Site that will disturb remaining contaminated material must be conducted in accordance with this SMP;<br>• The use of the groundwater underlying the Site is prohibited;<br>• Vegetable gardens and farming on the Site are prohibited;<br>• The site owner and remedial party will submit to NYSDEC a written statement that each party, as appropriate to their role at the site, certifies, under penalty of perjury, that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Site at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable. | Site Owner |
| 3. All ECs must be inspected at a frequency and in a manner defined in this SMP. | Site Owner |
| **Engineering Controls:** | **Responsible Party:** |
| 1. Cover System (B982) | Site Owner |
| 2. Groundwater Pump and Treatment System | IBM |
| 3. Subslab Depressurization System | IBM |

Site Identification: 314076 Former IBM B952/982 Site; Poughkeepsie, NY

| | Frequency | Responsible Party |
|---|---|---|
| **Inspections:** | | |
| 1. Cover System (B982) | Annually | Site Owner |
| 2. Groundwater Pump and Treatment System | Monthly | IBM |
| 3. Subslab Depressurization System | Monthly | IBM |
| **Monitoring:** | | |
| 1. Cover System (B982) | Annually | Site Owner |
| 2. Extraction Well | Monthly | IBM |
| 3. Groundwater Monitoring Wells 952-10RA and 952-31R | Annually | IBM |
| 4. Subslab Depressurization System | Monthly | IBM |
| **Maintenance:** | | |
| 1. Cover System (B982) | As needed | Site Owner |
| 2. Groundwater Pump and Treatment System | As needed | IBM |
| 3. Subslab Depressurization System | As needed | IBM |
| **Reporting:** | | |
| 1. Groundwater Pump and Treatment System | Annual | IBM |
| 2. Subslab Depressurization System | Annual | IBM |
| 3. Periodic Review Report | Every 3 years | IBM |

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# SITE MANAGEMENT PLAN
# FOR THE FORMER IBM B952/982 SITE

## SECTION 1.0
## INTRODUCTION

# 1.0 INTRODUCTION

## 1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Former International Business Machines Corporation (IBM) Building 952/982 Site located in Poughkeepsie, New York (hereinafter referred to as the B952/982 "Site"). A site location map is provided as Figure 1-1. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal (IHWD) Site Remedial Program Site No. 314076 which is administered by New York State Department of Environmental Conservation (NYSDEC).

In 1984, upon discovery that a central waste holding tank had leaked, the Site was remediated voluntarily, without a consent order but with the NYSDEC's oversight, by IBM. At that time, IBM occupied the Site as a lessee (the Site was owned by South Road Associates). As such, IBM remains responsible for the current ongoing remedial activities conducted at the site. IBM entered into an Order on Consent, Index #A3-0655-12-10 (Appendix A), issued by the NYSDEC on May 18, 2011, which required the preparation of this SMP as the final phase of the remediation, and for the continued operation and management of Site No. 314076. A Site Plan showing the overall configuration of the exiting Site is provided in Figure 1-2. The remediation boundaries of the Site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix B.

After completion of the 1984 voluntary remedial work, and the subsequent remedial work as part of redevelopment at the Site, which is further described in Section 2.3, some contamination remains in the subsurface at the Site beneath Building 982, which is hereafter referred to as "remaining contamination." Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Dutchess County Clerk, requires compliance with this SMP and all ICs and ECs placed on the site.




**Source: USGS Topo: Poughkeepsie Quadrangle 2016**

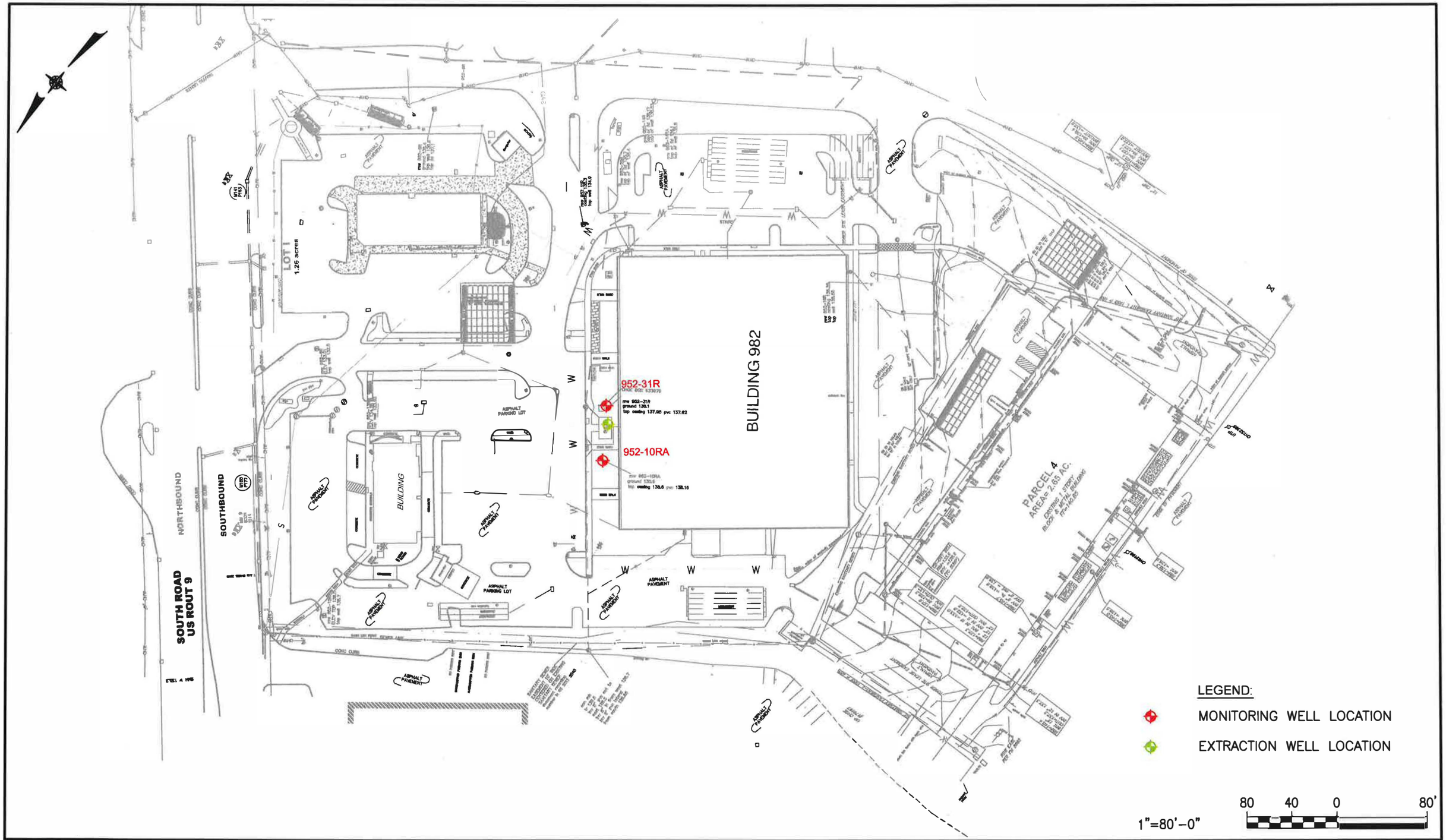
**Approximate Scale: 1" = 2000'**

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

## SITE LOCATION MAP

**FIGURE 1-1**




D&B ENGINEERS AND ARCHITECTS, P.C.

IBM FORMER BUILDING 952 AND 982
NEPTUNE ROAD POUGHKEEPSIE, NEW YORK

## SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 1-2

F:\3866-04\dwg\3866-C-SITEMAP-FIG-1-2.dwg, 3/17/2017 8:44:21 AM, kalesius

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6 NYCRR Part 375 and the Order on Consent (Index #A3-0655-12-10; Site No. 314076) for the site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix C of this SMP.

This SMP was prepared by D&B Engineers and Architects, P.C. (D&B), on behalf of IBM, in accordance with the requirements in NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

## 1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance

with the Environmental Easement for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

## 1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

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

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

Table 1-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix C.

**Table 1-1**
**Notifications***

| Name | Contact Information |
|---|---|
| George Heitzman, NYSDEC Region 3, Remedial Bureau C | (518) 402-9662 |
| NYSDEC Region 3, Hazardous Waste Engineer | (845) 256-3157 |

* Note: Notifications are subject to change and will be updated as necessary.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# SECTION 2.0
# SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

# 2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

## 2.1 Site Location and Description

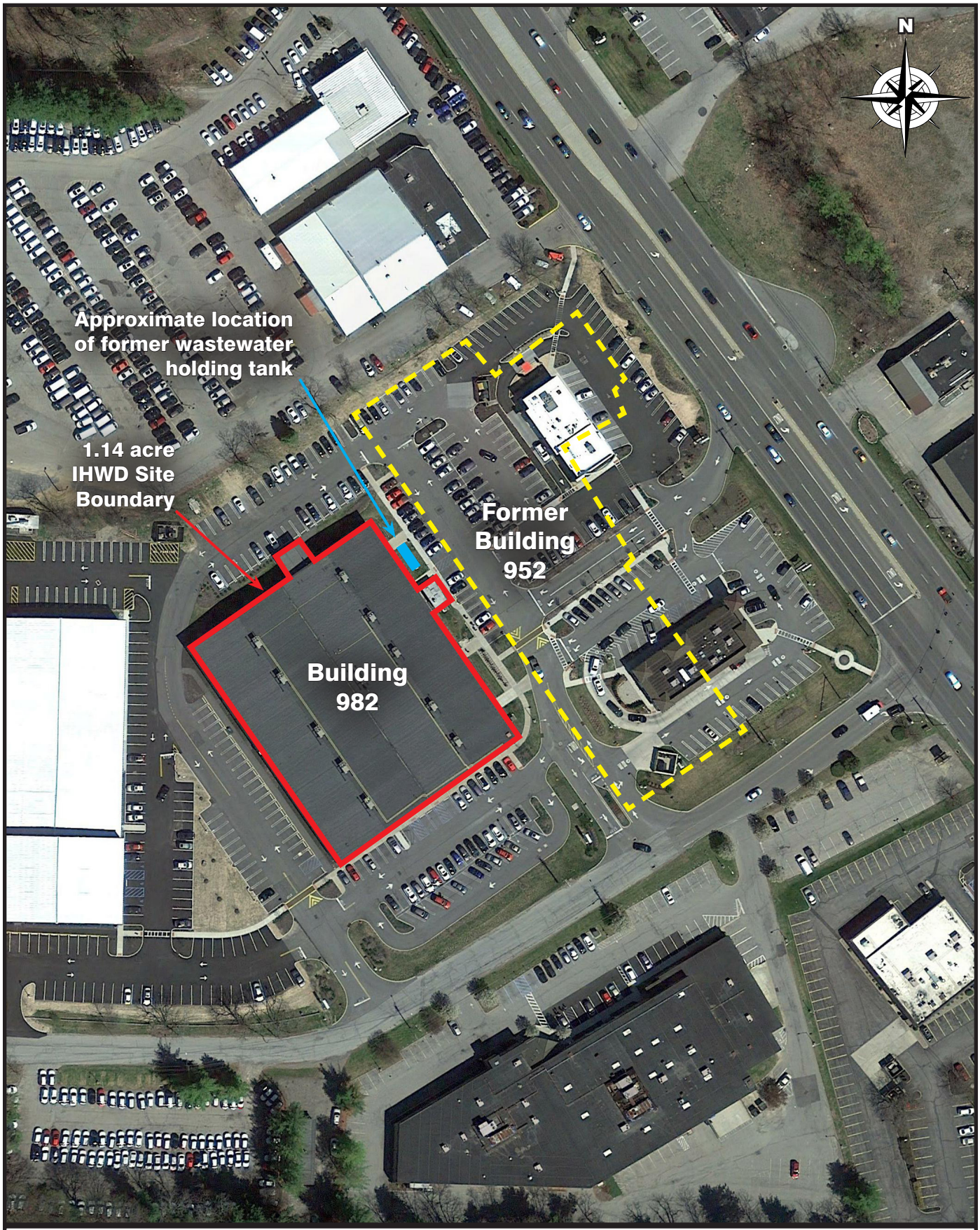
The IBM B952/982 IHWD Site is located in the Town of Poughkeepsie, Dutchess County, New York. The Site, now part of the Neptune Commerce Center, is identified as Lot 3, Tax Map No. 6159, Block 01, Lot 178918 on the Dutchess County Tax Map. The Site is 1.14-acres situated on a 6.17-acres property, bounded by a car dealership to the north, Neptune Road to the south, Route 9 to the east, and other buildings as part Neptune Commerce Center to the west (see Figure 2-1). The boundaries of the Site are more fully described in the metes and bounds description included in the Environmental Easement included as Appendix B – Environmental Easement. The owner of the Site at the time of issuance of this SMP is Neptune Capital Investors, LLC (NCI).

## 2.2 Physical Setting

### 2.2.1 Land Use

The Site consists of one former IBM building (Building 982) that has been fully re-developed for commercial use (Bounce! Trampoline Sports and Crunch Gym), and includes one extraction well, two monitoring wells and associated groundwater treatment shed and a Subslab Depressurization System (SSDS) annex on the north end of the building.

Properties adjoining the Site and in the neighborhood surrounding the Site primarily include both commercial and residential properties. There are two additional commercial properties on the adjoining Neptune Commerce Center parcels.




APPROXIMATE SCALE: 1" = 125'

D&B Engineers and Architects, P.C.

International Business Machines Corporation
Former IBM B952/982 Site, Poughkeepsie, New York
Site Management Plan

## LOCATION OF FORMER IBM LEASED BUILDINGS AND IHWD SITE BOUNDARY

FIGURE 2-1

### 2.2.2 Geology

The Site is underlain with limestone bedrock that ranges from less than 20 feet to over 50 feet below the ground surface. The limestone bedrock is overlain by a variable thickness of unconsolidated sediments, including primarily glacially derived tills, outwash materials consisting of gravels, sands, and silts, lake deposits consisting of alluvial silts and clays, and man-made fill material. The thickness of unconsolidated sediments ranges from more than 55 feet thick, southeast of Building 982, to less than ten feet thick along Route 9.

A detailed description of the site geology is provided in Section 2.3.2 of the Operation and Maintenance (O&M) Plan for the Groundwater Pump and Treatment System, provided in Appendix D. Figures 2-4 and 2-5 of the O&M Plan for the Groundwater Pump and Treatment System show the geologic cross section of the Site.

### 2.2.3 Hydrogeology

The Site lies topographically in a broad upland approximately 135 feet above mean sea level (amsl) between Casper Creek, 2,000 feet to the southeast, and a small unnamed stream, 3,500 feet to the northwest. The site is flanked on the northeast and southwest by two prominent hills with elevations greater than 200 feet amsl. Surface water drainage from the site is primarily to the southeast toward Casper Creek.

Beneath the site, groundwater flow occurs primarily within the dolostone bedrock, with the exception of a few isolated zones of perched water on top of silt and clay lenses within the unconsolidated sediments. In this regard, soils are generally unsaturated, as indicated by a comparison of the bedrock topographic map (Figure 2-6 of the O&M Plan) and the measured groundwater elevations.

Several nested bedrock piezometers have been constructed at this site. Water levels measured in these piezometers indicate a vertical gradient downward in the shallow bedrock and then horizontal flow within the deeper bedrock zone.

Figure 2-7 in the O&M Plan shows groundwater flow directions in the deeper bedrock zones. As shown on this map, the principal directions of groundwater flow are to the east, south and west from a location in front of the former IBM Building 982.

## 2.3 Investigation and Remedial History

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. Full titles for each of the reports referenced below are provided in Section 8.0 – References.

### 2.3.1 Site History

In the mid-1950's, IBM occupied two buildings (former IBM leased Building 952 and former IBM leased Building 982), which were joined by an enclosed walkway. At that time, the Site was owned by South Road Associates. The Site was used primarily for manufacturing and parts cleaning and in later years for computer mainframe and ancillary parts salvage. Various halogenated solvents and Sovasol were used on the Site as part of the manufacturing operations.

In the early 1980's, IBM began to conduct investigations to characterize the hydrogeology and groundwater quality of the Site. As a result of these investigations, IBM discovered that a central waste chemical holding tank had leaked, impacting both groundwater and soils within the vicinity of the tank and under Building 952 and a portion of Building 982. Upon this discovery, IBM prepared a remedial action work plan in 1984 to remove the tank and surrounding impacted soils and that plan was approved by the NYSDEC. Under the supervision of the NYSDEC, IBM removed and disposed of approximately 5,200 cubic yards of material from August 1984 to November 1984. Following completion of the 1984 remedial action, the NYSDEC IHWD Site was approximately 1.66-acres. IBM continued to conduct onsite and offsite groundwater monitoring, in addition to re-sampling impacted soils under Building 952.

The Site was first listed as an Inactive Hazardous Waste Disposal Site in 1984 as a Classification 2 site. Later at some point prior to 1989, the Site was listed as a Classification 2a. On March 8, 1993, IBM submitted a petition to reclassify the Site from a Classification 2a to a Classification 4 on the NYSDEC Part 375 Inactive Hazardous Waste Registry (IHWDS Registry), based on the results of the continued monitoring and investigations completed for the Site. NYSDEC determined that the Site could be reclassified after the design and installation of a groundwater pump and treatment system. Following IBM's installation of a NYSDEC approved groundwater pump and treatment system, the petition was approved on December 13, 1993 (correspondence provided in Appendix F).

IBM ended its lease on February 28, 1994. On April 25, 2005, South Road Associates sold the property to the current owner, NCI. After assuming ownership, NCI redeveloped the Site into a mixed commercial use. Plans were approved to renovate the former IBM leased Building 982 for a mixed commercial use (Bounce! Trampoline Sports and Crunch Gym). In addition, NCI received planning board approval in February 2011 to demolish former IBM Leased Building 952 and construct two new commercial buildings in its place, including use of an adjacent parcel. Work plans for supplemental soil investigations and additional remedial activities were required prior to the site being redeveloped. The following sections will detail the remedial investigations that have taken place at the Site since 1984.

### 2.3.2 Summary of Remedial Investigations

Remedial Investigations (RIs) were performed to characterize the nature and extent of contamination at the Site. The results of the RIs are described in detail in the following reports:

- Lawler, Matusky, and Skelly, Engineers (LMS), August 1982. *Interim Report on Building 952/982.*
- LMS, March 1983. *Final Report: Hydrogeology and Chemistry of Building 952 Area.*
- Conestoga-Rovers & Associates Limited (CRA), April 1984. *Soil Sampling & Analysis Buildings 952 and 982.*
- CRA, May 1985. *Remedial Action Project Soil and Sampling and Analysis Buildings 952 and 982 (Volume 1)*.

- CRA, September 1985. *Remedial Action Plan Construction Implementation Buildings 952 and 982 (Volume 2)*.
- Milton Chazen Associates (MCA), May 1986. *Groundwater Quality Data Report 1984-1985, Building 952 Site.*
- Groundwater Sciences Corporation (GSC), March 1993. *IBM B952/982 Site Reclassification Petition, Volumes 1 & 2.*
- Henningson, Durham & Richardson Architecture & Engineering, P.C. (HDR), December 2011, Revised February 2012. *B952 Excavation Work Plan*.
- Sanborn, Head Engineering, P.C., September 2013. *Subslab Depressurization System (SSDS) Design/Installation Work Plan.*
- Sanborn, Head Engineering, P.C., February 2014. *Subslab Depressurization System Start-Up and Performance Testing Report.*
- HDR, January 2017. *B952 Excavation Work Plan Summary Report*.

Generally, the RIs determined that the onsite groundwater and subsurface soils were contaminated by a former leaking underground waste chemical holding tank located between former Buildings 952 and 982. The onsite soil chemical contamination was generally located in the vicinity of the underground waste chemical holding tank. Additionally, it was determined that soils under Building 952 and a portion of Building 982 were also impacted. According to previous analytical data, compounds with the highest concentrations in the soil include 1,2-dichlorobenzene, methylene chloride, chloroform, bis(2-ethylhexyl)phthalate, and di-n-butyl phthalate.

Below is a summary of site conditions when the RIs were performed from 1981 through the present:

2.3.2.1 – Underground Storage Tanks

There was a central waste chemical holding tank which stored chemicals prior to pickup and transport to a waste handling facility, located in the courtyard between Buildings 952 and 982. Refer to Figure 2-1 for the approximate location of this tank. In October 1981, a single monitoring well, T-71 (later renamed 952-1R) was installed near the abandoned storage tank. The well was screened in the dolostone bedrock since the overlying unconsolidated sediments appeared to be dry. The well was developed and sampled in December 1981 and February 1982.

A summary of the results is provided in Table 2-1.

**Table 2-1**
**Initial Sampling Results for Monitoring Well T-71 (952-1R)**

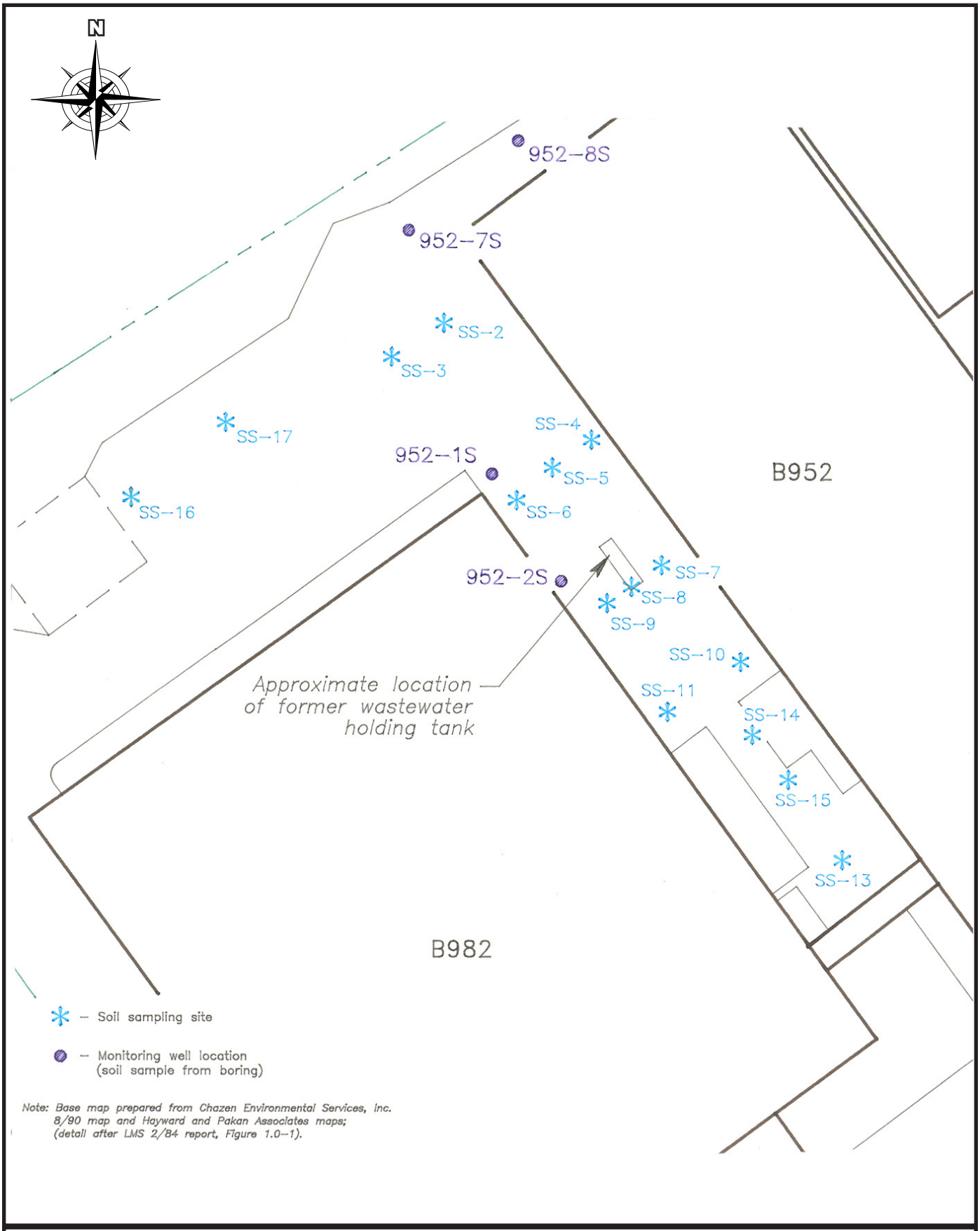
| Parameter | Units | 12/2/81 | 2/17/82 |
|---|---|---|---|
| Acid/phenolics | µg/l | ND | NA |
| Base neutrals | µg/l | ND | NA |
| ***Organic Compounds*** | | | |
| Benzene | µg/l | ≤10 | ND |
| 1,2-Dichloroethane | µg/l | 26 | 10 |
| trans-1,2-Dichloroethylene | µg/l | 36 | 31 |
| 1,1,1-Trichloroethane | µg/l | 77 | 71 |
| Trichloroethylene | µg/l | 54 | 52 |
| ***Pesticides/PCBs*** | | | |
| Aldrin | µg/l | 0.02 | ND |
| ***Metals*** | | | |
| Soluble chromium | mg/l | 0.01 | ND |
| Soluble copper | mg/l | 0.01 | ND |
| Soluble nickel | mg/l | 0.05 | ND |
| Soluble zinc | mg/l | 0.012 | 0.012 |
| ***Petroleum Products*** | | | |
| Oil and grease | mg/l | <5 | <5 |

NA = Not analyzed
ND = None detected

This waste chemical holding tank was removed in 1982. In addition to this tank, there were four tanks which included a fuel oil storage tank, a concrete tank, and two concrete vaults containing water main valves, fittings, and piping, removed as part of the remedial action approved by the NYSDEC and completed by IBM in 1984. Both tanks and piping were removed and properly disposed of.

2.3.2.2 – Soil

From late November to early December 1982, there were 36 soil borings completed both inside and outside the buildings to collect soil samples. These soil sample locations are shown on Figures 2-2 and 2-3. Table 2-2 lists the maximum concentrations of chemicals detected in these soil samples.




**Source: Groundwater Sciences Corporation 1993**

**Not to Scale**

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

## SOIL SAMPLING LOCATION MAP

**FIGURE 2-2**




**Source: Groundwater Sciences Corporation 1993**

**Not to Scale**

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

# SOIL SAMPLING LOCATION MAP BENEATH BUILDINGS

**FIGURE 2-3**

**Table 2-2**
**Summary of Maximum Detected Concentrations**
**for 1982 Soil Sampling Activities**

| Parameter | Sampling Location | 1982 Maximum Detected Concentration |
|---|---|---|
| ***Organic Compounds*** | | |
| 1,2-Dichlorobenzene | 952-SS-08B | 3,200 ug/kg |
| Methylene chloride | 952-SS-09B | 3,110 ug/kg |
| bis(2-Ethylhexyl) phthalate | 952-SS-13 | 1,230 ug/kg |
| di-n-Butyl phthalate | 952-SS-13 | 1,000 ug/kg |
| Pyrene | 952-SS-04A | 997 ug/kg |
| Fluoranthene | 952-SS-04A | 973 ug/kg |
| Butyl benzyl phthalate | 952-L | 833 ug/kg |
| 1,4-Dichlorobenzene | 952-SS-08B | 798 ug/kg |
| Acrylonitrile | 952-E | 765 ug/kg |
| Phenanthrene | 952-GA | 600 ug/kg |
| Toluene | 952-GA | 428 ug/kg |
| 1,3-Dichlorobenzene | 952-SS-08B | 420 ug/kg |
| Benzo(A)anthracene | 952-SS-04A | 363 ug/kg |
| 1,1-Dichloroethane | 952-C | 355 ug/kg |
| Trichloroethylene | 982-ED | 237 ug/kg |
| 1,1,1-Trichloroethane | 952-SS-04B | 184 ug/kg |
| Trichlorofluoromethane | 952-GA | 179 ug/kg |
| 1-1-Dichloroethylene | 952-C | 167 ug/kg |
| 1,1,2,2-Tetrachloroethane | 952-E | 103 ug/kg |
| 1,1,2-Trichloro- 1,2,2-trifluoroethane | 952-SS-04B | 85 ug/kg |
| 1,2-Xylene | 982-ED | 64 ug/kg |
| Bromoform | 952-E | 64 ug/kg |
| ***Petroleum Products*** | | |
| Oil and grease | 952-GA | 5,618 mg/kg |

In March 1992, seven soil samples were collected from five historical sampling locations (Figure 2-3) beneath the concrete slab floor of Building 952. These samples were collected at locations and depths previously sampled in 1982 to determine what changes had occurred over the intervening ten-year period. Table 2-3 compares the analytical results of the samples collected in 1982 with the results of the samples collected in 1992. This comparison indicated that volatile organic compounds (VOCs) in the soil had dissipated and that semivolatile organic

compounds (SVOCs) and oil and grease concentrations in the soil were essentially unchanged after ten years.

**Table 2-3**
**Comparison of 1982 and 1992 Soil Sampling Results**

| Parameter | 1982 Sampling Range of Detects | 1992 Sampling Range of Detects |
|---|---|---|
| ***Organic Compounds (ug/kg)*** | | |
| Trichloroethene | ND – 99 | ND – 6.2 |
| 1,2-Dichlorobenzene | NA | ND – 6.7 |
| Methylene chloride | ND – 332 | ND |
| 1,1-Dichloroethene | ND – 367 | ND |
| 1,1-Dichloroethane | ND – 355 | ND |
| 1,1,1-Trichloroethane | ND – 54 | ND |
| Bromoform | ND – 64 | ND |
| 1,1,2,2-Tetrachloroethane | ND – 103 | ND |
| 1,1,2-Trichloro(1,2,2)trifluoroethane | ND – 79 | NA |
| Ethylbenzene | NA | ND – 38 |
| Toluene | ND – 428 | ND |
| Naphthalene | ND | ND – 280 |
| Acrylonitrile | ND – 79 | ND |
| Phenanthrene | ND – 600 | ND |
| di-n-Butyl phthalate | ND – 726 | ND – 3300 |
| bis(2-Ethylhexyl) phthalate | ND – 335 | ND – 360 |
| Butyl benzyl phthalate | ND – 586 | ND – 1200 |
| ***Petroleum Products (mg/kg)*** | | |
| Oil and grease | ND – 5618 | 29 – 1800 |

NA = Not analyzed
ND = None detected

From 2005 – 2010, the former IBM leased Building 952 and former IBM leased Building 982 remained vacant and the site undeveloped. In June 2011, NCI received Site Plan and Subdivision approvals from the Town of Poughkeepsie. NCI redevelopment activities included the demolition of former IBM leased Building 952 and the construction of two new commercial buildings in its place. Former IBM leased Building 982 would remain intact and be renovated. Former IBM leased Building 982 is considered an engineering control (i.e. cover system) since the building provides a physical barrier which restricts the movement of and eliminates direct human exposure to the potential remaining contamination beneath the buildings which was inaccessible at the time of IBM's 1984 remedial activity. Since NCI's site plan included

demolition of the former IBM leased Building 952 and slab, IBM prepared an Excavation Work Plan (EWP) as required by its approved SMP. The EWP was initiated in September 2012 and IBM completed field activities in June 2013.

The demolition of the former IBM leased Building 952 concrete slab began on October 17, 2012. As the demolition and the removal of the slab/footings progressed two (2) isolated areas under and within the footprint of the former IBM leased Building 952 required further investigation based on PID readings and odor.

Soils that exhibited detections on the PID and/or an odor were excavated, stockpiled on and covered with 30-millimeter (mm) poly sheeting and sampled for laboratory analyses of VOCs and BN-SVOCS via EPA Methods 8260B and 8270D, respectively, as required by the EWP. VOC analytical results, as summarized in Table 2-4, and BN-VOCs, as summarized in Table 2-5, indicated that there were no detections of VOCs or BN-SVOCs, respectively, above NYSDEC required site soil cleanup objectives (SCOs) of restricted residential use.

Post-excavation samples were also collected from each of the excavation areas in accordance with the May 2010 NYSDEC DER-10 *Technical Guidance for Site Investigation and Remediation* and samples analyzed for VOCs and BN-SVOCs by EPA Methods 8260B and 8270D, respectively. Analytical results of the post excavation samples, as summarized in Tables 2-6 and 2-7 for VOCs and BN-SVOCs, respectively, indicate that there were no detections of VOCs or BN-SVOCs above NYSDEC required site SCOs of restricted residential use. The post-excavation sample locations are provided in Figure 2-4.

# Table 2-4
# VOC - Soil Analytical Results – Contaminated Soil
# (Footprint of Demolished Former IBM Leased Building 952)

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | SS001-0-102312 Excavation Area 01 | WC001-103112 (Stockpile Sample from SS001/ Excavation Area 01) | WC001-103112DL (Stockpile Sample from SS001/ Excavation Area 01) (50:1 Dilution) | WW001-110212 Excavation Area 02 | WW001-103112DL Excavation Area 02 (1000:1 Dilution) |
|---|---|---|---|---|---|---|---|
| | **Sampling Date** | | **10/23/12** | **10/31/12** | **10/31/12** | **11/02/12** | **11/02/12** |
| **VOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | Benzene | 4800 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Chlorobenzene | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,2-Dichlorobenzene | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,3-Dichlorobenzene | 49000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,4-Dichlorobenzene | 13000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Ethylbenzene | 41000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Toluene | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | o-Xylene | - | 1.6 J | 210 E | 50 J | 2800 E | 9400 |
| | m-Xylene & p-Xylene | - | 1.9 U | 15 | 180 U | 140 | 3600 U |
| | Xylenes, Total | 100000 | 1.6 J | 230 E | 50 J | 3000 E | 9400 |
| | Styrene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Bromoform | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Bromodichloromethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Carbon tetrachloride | 2400 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Chloroethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 2-Chloroethyl vinyl ether | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Chloroform | 49000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| (1) | trans-1,3-Dichloropropene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Dibromochloromethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1-Dichloroethane | 26000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,2-Dichloroethane | 3100 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1-Dichloroethene | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | trans-1,2-Dichloroethene | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,2-Dichloropropane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Methylene Chloride | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1,1,2-Tetrachloroethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1,2,2-Tetrachloroethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Tetrachloroethene | 19000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1,1-Trichloroethane | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1,2-Trichloroethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Trichloroethene | 21000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Vinyl chloride | 900 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,1-Dichloropropene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,2,3-Trichloropropane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 2,2-Dichloropropane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 2-Chlorotoluene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 4-Chlorotoluene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Bromobenzene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Isopropylbenzene | - | 0.38 J | 15 | 88 U | 45 | 1800 U |

# Table 2-4, continued
# VOC - Soil Analytical Results – Contaminated Soil
# (Footprint of Demolished Former IBM Leased Building 952)

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | SS001-0-102312 Excavation Area 01 | WC001-103112 (Stockpile Sample from SS001/ Excavation Area 01) | WC001-103112DL (Stockpile Sample from SS001/ Excavation Area 01) (50:1 Dilution) | WW001-110212 Excavation Area 02 | WW001-103112DL Excavation Area 02 (1000:1 Dilution) |
|---|---|---|---|---|---|---|---|
| | **Sampling Date** | | **10/23/12** | **10/31/12** | **10/31/12** | **11/02/12** | **11/02/12** |
| **VOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | n-Butylbenzene | 100000 | 0.42 J | 39 | 14 J | 45 | 1800 J |
| | N-Propylbenzene | 100000 | 0.83 J | 55 | 88 U | 67 | 1800 U |
| | 4-Isopropyltoluene | - | 0.34 J | 32 | 88 U | 110 E | 4700 |
| | sec-Butylbenzene | 100000 | 0.49 J | 28 | 88 U | 55 | 1800 U |
| | tert-Butylbenzene | 100000 | 0.93 U | 0.90 U | 88 U | 3.3 | 1800 U |
| | Bromochloromethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Bromomethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Chloromethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | cis-1,2-Dichloroethene | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| (1) | cis-1,3-Dichloropropene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Dibromomethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Dichlorodifluoromethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Trichlorofluoromethane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,4-Dioxane | 13000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 2-Butanone (MEK) | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 2-Hexanone | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 4-Methyl-2-pentanone (MIBK) | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Acetone | 100000 | 4.6 U | 4.5 U | 440 U | 4.4 U | 9000 U |
| | Carbon disulfide | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Vinyl acetate | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Methyl tert-butyl ether | 100000 | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Naphthalene | 100000 | 4.5 | 6.5 | 88 U | 0.89 U | 1800 U |
| | Acrolein | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | Acrylonitrile | - | 4.6 U | 4.5 U | 440 U | 4.4 U | 9000 U |
| | 1,2,4-Trichlorobenzene | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,3,5-Trimethylbenzene | 52000 | 7.3 | 860 E | 230 | 4300 E | 100000 |
| | 1,2,4-Trimethylbenzene | 52000 | 12 | 2000 E | 580 | 4900 E | 130000 |
| | Freon 113 | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |
| | 1,3-Dichloropropane | - | 0.93 U | 0.90 U | 88 U | 0.89 U | 1800 U |

Qualifiers
J – Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U – The analyte was analyzed for but not detected at or above the stated limit.
NR – Not analyzed.
* - LCS exceeded control limits. Data determined to be valid.

(1) Values listed reflect the combined standards for the cis and trans isomers of 1,3-Dichloropropene.
Value is a revision to the Class IIA groundwater quality standard based on the November 18, 1996 Safe Drinking Water Act maximum contaminant level changes and the February 5, 1997 policy memo issued by Assistant Commissioner R. Gimello.

# Table 2-5
# BN-SVOC - Soil Analytical Results – Contaminated Soil
# (Footprint of Demolished Former IBM Leased Building 952)

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | SS001-0-102312 Excavation Area 01 | WC001-103112 (Stockpile Sample from SS001/ Excavation Area 01) | WC001-103112DL (Stockpile Sample from SS001/ Excavation Area 01) (50:1 Dilution) | WW001-110212 Excavation Area 02 | WW001-103112DL Excavation Area 02 (1000:1 Dilution) |
|---|---|---|---|---|---|---|---|
| | **Sampling Date** | | **10/23/12** | **10/31/12** | **10/31/12** | **11/02/12** | **11/02/12** |
| **SEMIVOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | 1,2,4-Trichlorobenzene | - | 370 U | 390 U | NR | 350 U | NR |
| (1) | 2,4-Dinitrotoluene | - | 370 U | 390 U | NR | 350 U | NR |
| (1) | 2,6-Dinitrotoluene | - | 370 U | 390 U | NR | 350 U | NR |
| | 2-Chloronaphthalene | - | 370 U | 390 U | NR | 350 U | NR |
| | 2-Methylnaphthalene | - | 370 U | 390 U | NR | 350 U | NR |
| | 2-Nitroaniline | - | 370 U | 390 U | NR | 350 U | NR |
| | 3,3'-Dichlorobenzidine | - | 370 U | 390 U | NR | 350 U | NR |
| | 3-Nitroaniline | - | 370 U | 390 U | NR | 350 U | NR |
| | 4-Bromophenyl phenyl ether | - | 370 U | 390 U | NR | 350 U | NR |
| | 4-Chloroaniline | - | 370 U | 390 U | NR | 350 U | NR |
| | 4-Chlorophenyl phenyl ether | - | 370 U | 390 U | NR | 350 U | NR |
| | Acenaphthene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| | Acenaphthylene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| | Aniline | - | 370 U | 390 U | NR | 350 U | NR |
| | Anthracene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| | Benzidine | - | 2800 U | 2900 U | NR | 2600 U | NR |
| | Benzo[a]anthracene | 1000 | 370 U | 390 U | NR | 350 U | NR |
| | Benzo[a]pyrene | 1000 | 370 U | 390 U | NR | 350 U | NR |
| | Benzo[b]fluoranthene | 1000 | 370 U | 390 U | NR | 350 U | NR |
| | Benzo[g,h,i]perylene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| | Benzo[k]fluoranthene | 3900 | 370 U | 390 U | NR | 350 U | NR |
| | Benzyl alcohol | - | 69 J | 390 U | NR | 350 U | NR |
| | Bis(2-chloroethoxy)methane | - | 370 U | 390 U | NR | 350 U | NR |
| | Bis(2-chloroethyl)ether | - | 370 U | 390 U | NR | 350 U | NR |
| | Bis(2-ethylhexyl) phthalate | - | 69 J | 390 U | NR | 370 | NR |
| | bis(chloroisopropyl) ether | - | 370 U | 390 U | NR | 350 U | NR |
| | Butyl benzyl phthalate | - | 1500 | 220 J | NR | 250 J | NR |
| | Carbazole | - | 370 U | 390 U | NR | 350 U | NR |
| | Chrysene | 3900 | 370 U | 390 U | NR | 350 U | NR |
| | Dibenz(a,h)anthracene | 330 | 370 U | 390 U | NR | 350 U | NR |
| | Dibenzofuran | - | 370 U | 390 U | NR | 350 U | NR |
| | Diethyl phthalate | - | 370 U | 390 U | NR | 350 U | NR |
| | Dimethyl phthalate | - | 370 U | 390 U | NR | 350 U | NR |
| | Di-n-butyl phthalate | - | 190 J | 390 U | NR | 350 U | NR |
| | Di-n-octyl phthalate | - | 370 U | 390 U | NR | 350 U | NR |
| | Fluoranthene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| | Fluorene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| | Hexachlorobenzene | 1200 | 370 U | 390 U | NR | 350 U | NR |
| | Hexachlorobutadiene | - | 370 U | 390 U | NR | 350 U | NR |
| | Hexachlorocyclopentadiene | - | 370 U | 390 U | NR | 350 U | NR |

## Table 2-5, continued
## BN-SVOC - Soil Analytical Results – Contaminated Soil
## (Footprint of Demolished Former IBM Leased Building 952)

| Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | SS001-0-102312 Excavation Area 01 | WC001-103112 (Stockpile Sample from SS001/ Excavation Area 01) | WC001-103112DL (Stockpile Sample from SS001/ Excavation Area 01) (50:1 Dilution) | WW001-110212 Excavation Area 02 | WW001-103112DL Excavation Area 02 (1000:1 Dilution) |
|---|---|---|---|---|---|---|
| **Sampling Date** | | **10/23/12** | **10/31/12** | **10/31/12** | **11/02/12** | **11/02/12** |
| **SEMIVOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | |
| Hexachloroethane | - | 370 U | 390 U | NR | 350 U | NR |
| Indeno[1,2,3-cd]pyrene | 500 | 370 U | 390 U | NR | 350 U | NR |
| Isophorone | - | 370 U | 390 U | NR | 350 U | NR |
| Naphthalene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| N-Nitrosodi-n-propylamine | - | 370 U | 390 U | NR | 350 U | NR |
| Nitrobenzene | - | 370 U | 390 U | NR | 350 U | NR |
| N-Nitrosodimethylamine | - | 370 U | 390 U | NR | 350 U | NR |
| N-Nitrosodiphenylamine | - | 370 U | 390 U | NR | 350 U | NR |
| Phenanthrene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| Pyrene | 100000 | 370 U | 390 U | NR | 350 U | NR |
| Pyridine | - | 1100 U | 1200 U | NR | 1100 U | NR |

Qualifiers
J – Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U – The analyte was analyzed for but not detected at or above the stated limit.
NR – Not analyzed.
* - LCS exceeded control limits. Data determined to be valid.

(1) Values listed reflect the combined standards for the cis and trans isomers of 1,3-Dichloropropene.
Value is a revision to the Class IIA groundwater quality standard based on the November 18, 1996 Safe Drinking Water Act maximum contaminant level changes and the February 5, 1997 policy memo issued by Assistant Commissioner R. Gimello.

# Table 2-6
# VOC - Soil Analytical Results – Post Excavation Samples

| Sample ID | | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA01-N-110912 | EA01-S-110912 | EA01-E-110912 | EA01-W-110912 | EA01-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **VOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | 1,1,1,2-Tetrachloroethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,1,1-Trichloroethane | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,1,2,2-Tetrachloroethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,1,2-Trichloroethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,1-Dichloroethane | 26000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,1-Dichloroethene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,1-Dichloropropene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,2,3-Trichloropropane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,2,4-Trichlorobenzene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,2,4-Trimethylbenzene | 52000 | 0.98 U | 0.96 U | 1.5 | 0.90 U | 0.93 U |
| | 1,2-Dichlorobenzene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,2-Dichloroethane | 3100 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,2-Dichloropropane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,3,5-Trimethylbenzene | 52000 | 0.98 U | 0.96 U | 4.1 | 0.90 U | 0.93 U |
| | 1,3-Dichlorobenzene | 49000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,3-Dichloropropane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,4-Dichlorobenzene | 13000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 1,4-Dioxane | 13000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 2,2-Dichloropropane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 2-Butanone (MEK) | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 2-Chloroethyl vinyl ether | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 2-Chlorotoluene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 2-Hexanone | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 4-Chlorotoluene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | 4-Isopropyltoluene | | 0.98 U | 0.96 U | 0.23 J | 0.90 U | 0.93 U |
| | 4-Methyl-2-pentanone (MIBK) | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Acetone | 100000 | 74 | 4.8 U | 9.2 | 4.5 U | 4.7 U |
| | Acrolein | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Acrylonitrile | | 4.9 U | 4.8 U | 4.7 U | 4.5 U | 4.7 U |
| | Benzene | 4800 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Bromobenzene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Bromochloromethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Bromodichloromethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Bromoform | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Bromomethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Carbon disulfide | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Carbon tetrachloride | 2400 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Chlorobenzene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Chloroethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Chloroform | 49000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |

## Table 2-6, continued
## VOC - Soil Analytical Results – Post Excavation Samples

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA01-N-110912 | EA01-S-110912 | EA01-E-110912 | EA01-W-110912 | EA01-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **VOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | Chloromethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | cis-1,2-Dichloroethene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| (1) | cis-1,3-Dichloropropene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Dibromochloromethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Dibromomethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Dichlorodifluoromethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Ethylbenzene | 41000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Freon 113 | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Isopropylbenzene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Methyl tert-butyl ether | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Methylene Chloride | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | m-Xylene & p-Xylene | | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U |
| | Naphthalene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | n-Butylbenzene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | N-Propylbenzene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | o-Xylene | | 2 U | 1.9 U | 0.28 J | 1.8 U | 1.9 U |
| | sec-Butylbenzene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Styrene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | tert-Butylbenzene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Tetrachloroethene | 19000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Toluene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | trans-1,2-Dichloroethene | 100000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| (1) | trans-1,3-Dichloropropene | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Trichloroethene | 21000 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Trichlorofluoromethane | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Vinyl acetate | | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Vinyl chloride | 900 | 0.98 U | 0.96 U | 0.95 U | 0.90 U | 0.93 U |
| | Xylenes, Total | 100000 | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U |

## Table 2-6, continued
## VOC - Soil Analytical Results – Post Excavation Samples

| Sample ID | | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA02-N-110912 | EA02-S-110912 | EA02-E-110912 | EA02-W-110912 | EA02-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **VOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | 1,1,1,2-Tetrachloroethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,1,1-Trichloroethane | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,1,2,2-Tetrachloroethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,1,2-Trichloroethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,1-Dichloroethane | 26000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,1-Dichloroethene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,1-Dichloropropene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,2,3-Trichloropropane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,2,4-Trichlorobenzene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,2,4-Trimethylbenzene | 52000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,2-Dichlorobenzene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,2-Dichloroethane | 3100 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,2-Dichloropropane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,3,5-Trimethylbenzene | 52000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,3-Dichlorobenzene | 49000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,3-Dichloropropane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,4-Dichlorobenzene | 13000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 1,4-Dioxane | 13000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 2,2-Dichloropropane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 2-Butanone (MEK) | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 2-Chloroethyl vinyl ether | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 2-Chlorotoluene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 2-Hexanone | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 4-Chlorotoluene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 4-Isopropyltoluene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | 4-Methyl-2-pentanone (MIBK) | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Acetone | 100000 | 4.5 U | 5.0 U | 5.2 U | 5.1 U | 4.7 U |
| | Acrolein | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Acrylonitrile | | 4.5 U | 5.0 U | 5.2 U | 5.1 U | 4.7 U |
| | Benzene | 4800 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Bromobenzene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Bromochloromethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Bromodichloromethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Bromoform | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Bromomethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Carbon disulfide | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Carbon tetrachloride | 2400 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Chlorobenzene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Chloroethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Chloroform | 49000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |

## Table 2-6, continued
## VOC - Soil Analytical Results – Post Excavation Samples

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA02-N-110912 | EA02-S-110912 | EA02-E-110912 | EA02-W-110912 | EA02-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **VOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | Chloromethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | cis-1,2-Dichloroethene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| (1) | cis-1,3-Dichloropropene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Dibromochloromethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Dibromomethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Dichlorodifluoromethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Ethylbenzene | 41000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Freon 113 | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Isopropylbenzene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Methyl tert-butyl ether | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Methylene Chloride | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | m-Xylene & p-Xylene | | 1.8 U | 2.0 U | 2.1 U | 2.1 U | 1.9 U |
| | Naphthalene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | n-Butylbenzene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | N-Propylbenzene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | o-Xylene | | 1.8 U | 2.0 U | 2.1 U | 2.1 U | 1.9 U |
| | sec-Butylbenzene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Styrene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | tert-Butylbenzene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Tetrachloroethene | 19000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Toluene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | trans-1,2-Dichloroethene | 100000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| (1) | trans-1,3-Dichloropropene | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Trichloroethene | 21000 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Trichlorofluoromethane | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Vinyl acetate | | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Vinyl chloride | 900 | 0.90 U | 0.99 U | 1.0 U | 1.0 U | 0.94 U |
| | Xylenes, Total | 100000 | 1.8 U | 2.0 U | 2.1 U | 2.1 U | 1.9 U |

Qualifiers
J – Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U – The analyte was analyzed for but not detected at or above the stated limit.

(1) Values listed reflect the combined standards for the cis and trans isomers of 1,3-Dichloropropene or for the 2,4/2,6-Dinitrotoluene mixture.

Value is a revision to the Class IIA groundwater quality standard based on the November 18, 1996 Safe Drinking Water Act maximum contaminant level changes and the February 5, 1997 policy memo issued by Assistant Commissioner R. Gimello.

# Table 2-7
# BN-SVOC - Soil Analytical Results – Post Excavation Samples

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA01-N-110912 | EA01-S-110912 | EA01-E-110912 | EA01-W-110912 | EA01-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **SEMIVOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | 1,2,4-Trichlorobenzene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| (1) | 2,4-Dinitrotoluene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| (1) | 2,6-Dinitrotoluene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 2-Chloronaphthalene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 2-Methylnaphthalene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 2-Nitroaniline | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 3,3'-Dichlorobenzidine | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 3-Nitroaniline | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 4-Bromophenyl phenyl ether | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 4-Chloroaniline | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | 4-Chlorophenyl phenyl ether | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Acenaphthene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Acenaphthylene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Aniline | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Anthracene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Benzidine | | 2600 U | 2800 U | 2700 U | 2600 U | 2800 U |
| | Benzo[a]anthracene | 1000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Benzo[a]pyrene | 1000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Benzo[b]fluoranthene | 1000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Benzo[g,h,i]perylene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Benzo[k]fluoranthene | 3900 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Benzyl alcohol | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Bis(2-chloroethoxy)methane | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Bis(2-chloroethyl)ether | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Bis(2-ethylhexyl) phthalate | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | bis(chloroisopropyl) ether | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Butyl benzyl phthalate | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Carbazole | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Chrysene | 3900 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Dibenz(a,h)anthracene | 330 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Dibenzofuran | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Diethyl phthalate | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Dimethyl phthalate | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Di-n-butyl phthalate | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Di-n-octyl phthalate | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Fluoranthene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Fluorene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Hexachlorobenzene | 1200 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Hexachlorobutadiene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Hexachlorocyclopentadiene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Hexachloroethane | | 350 U | 370 U | 350 U | 340 U | 380 U |

## Table 2-7, continued
## BN-SVOC - Soil Analytical Results – Post Excavation Samples

| Sample ID | | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA01-N-110912 | EA01-S-110912 | EA01-E-110912 | EA01-W-110912 | EA01-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **SEMIVOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | Indeno[1,2,3-cd]pyrene | 500 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Isophorone | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Naphthalene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Nitrobenzene | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | N-Nitrosodimethylamine | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | N-Nitrosodi-n-propylamine | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | N-Nitrosodiphenylamine | | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Phenanthrene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Pyrene | 100000 | 350 U | 370 U | 350 U | 340 U | 380 U |
| | Pyridine | | 1100 U | 1100 U | 1100 U | 1000 U | 1100 U |

## Table 2-7, continued
## BN-SVOC - Soil Analytical Results – Post Excavation Samples

| | Sample ID | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA02-N-110912 | EA02-S-110912 | EA02-E-110912 | EA02-W-110912 | EA02-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **SEMIVOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | 1,2,4-Trichlorobenzene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| (1) | 2,4-Dinitrotoluene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| (1) | 2,6-Dinitrotoluene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 2-Chloronaphthalene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 2-Methylnaphthalene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 2-Nitroaniline | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 3,3'-Dichlorobenzidine | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 3-Nitroaniline | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 4-Bromophenyl phenyl ether | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 4-Chloroaniline | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | 4-Chlorophenyl phenyl ether | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Acenaphthene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Acenaphthylene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Aniline | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Anthracene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Benzidine | | 2700 U | 2900 U | 2700 U | 2600 U | 2500 U |
| | Benzo[a]anthracene | 1000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Benzo[a]pyrene | 1000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Benzo[b]fluoranthene | 1000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Benzo[g,h,i]perylene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Benzo[k]fluoranthene | 3900 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Benzyl alcohol | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Bis(2-chloroethoxy)methane | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Bis(2-chloroethyl)ether | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Bis(2-ethylhexyl) phthalate | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | bis(chloroisopropyl) ether | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Butyl benzyl phthalate | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Carbazole | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Chrysene | 3900 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Dibenz(a,h)anthracene | 330 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Dibenzofuran | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Diethyl phthalate | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Dimethyl phthalate | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Di-n-butyl phthalate | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Di-n-octyl phthalate | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Fluoranthene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Fluorene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Hexachlorobenzene | 1200 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Hexachlorobutadiene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Hexachlorocyclopentadiene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Hexachloroethane | | 350 U | 380 U | 350 U | 350 U | 330 U |

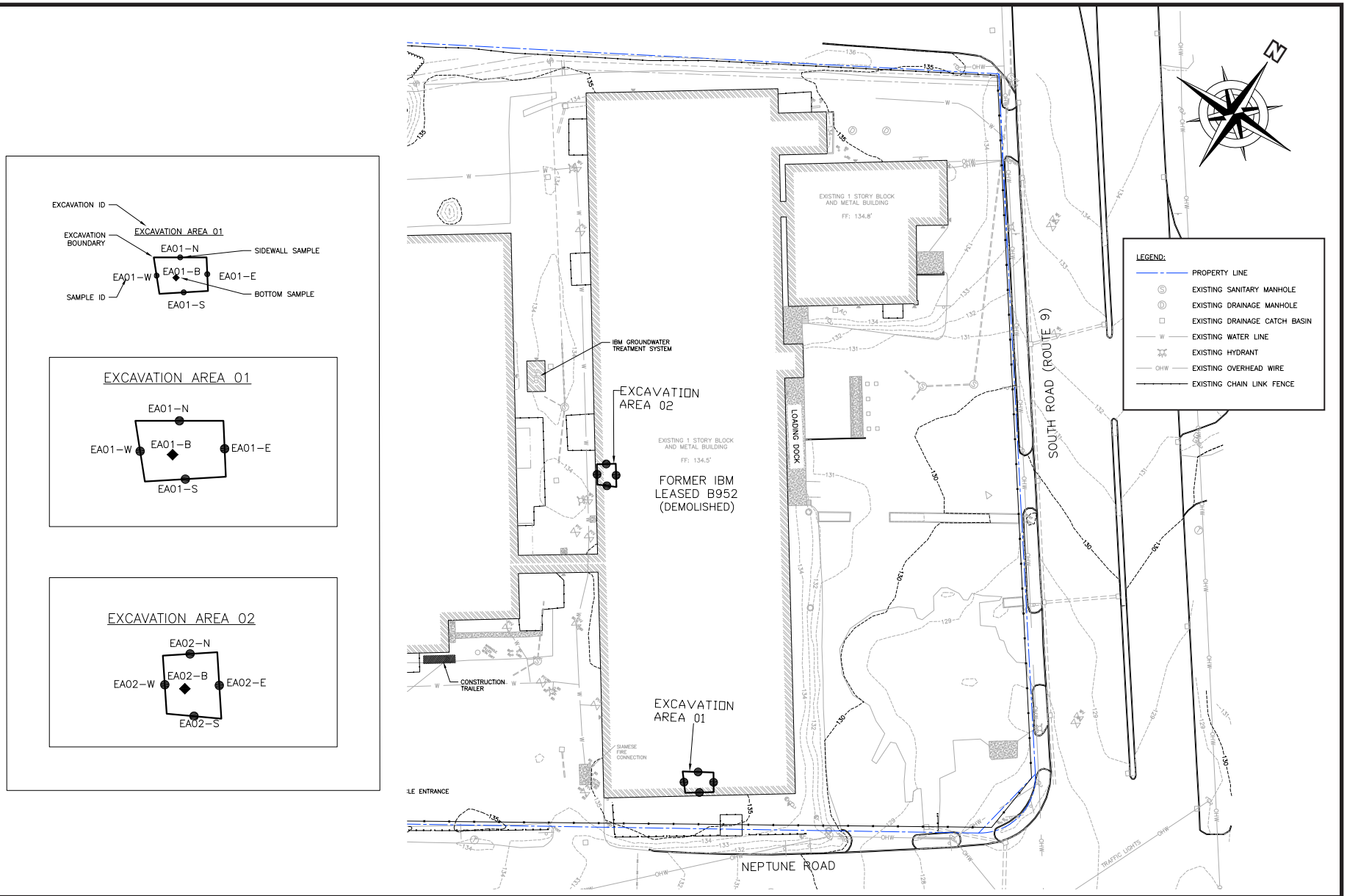
## Table 2-7, continued
## BN-SVOC - Soil Analytical Results – Post Excavation Samples

| Sample ID | | NYS Restricted Residential Soil Cleanup Levels ug/kg | EA02-N-110912 | EA02-S-110912 | EA02-E-110912 | EA02-W-110912 | EA02-B-110912 |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** | **11/09/12** |
| **SEMIVOLATILE COMPOUNDS (GC/MS) (Results in ug/kg)** | | | | | | | |
| | Indeno[1,2,3-cd]pyrene | 500 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Isophorone | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Naphthalene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Nitrobenzene | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | N-Nitrosodimethylamine | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | N-Nitrosodi-n-propylamine | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | N-Nitrosodiphenylamine | | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Phenanthrene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Pyrene | 100000 | 350 U | 380 U | 350 U | 350 U | 330 U |
| | Pyridine | | 1100 U | 1200 U | 1100 U | 1000 U | 1000 U |

Qualifiers
J – Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U – The analyte was analyzed for but not detected at or above the stated limit.

(1) Values listed reflect the combined standards for the cis and trans isomers of 1,3-Dichloropropene or for the 2,4/2,6-Dinitrotoluene mixture.

Value is a revision to the Class IIA groundwater quality standard based on the November 18, 1996 Safe Drinking Water Act maximum contaminant level changes and the February 5, 1997 policy memo issued by Assistant Commissioner R. Gimello.




**Source: HDR - 2017**

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

**Not to Scale**

# POST EXCAVATION SAMPLE LOCATIONS

**FIGURE 2-4**

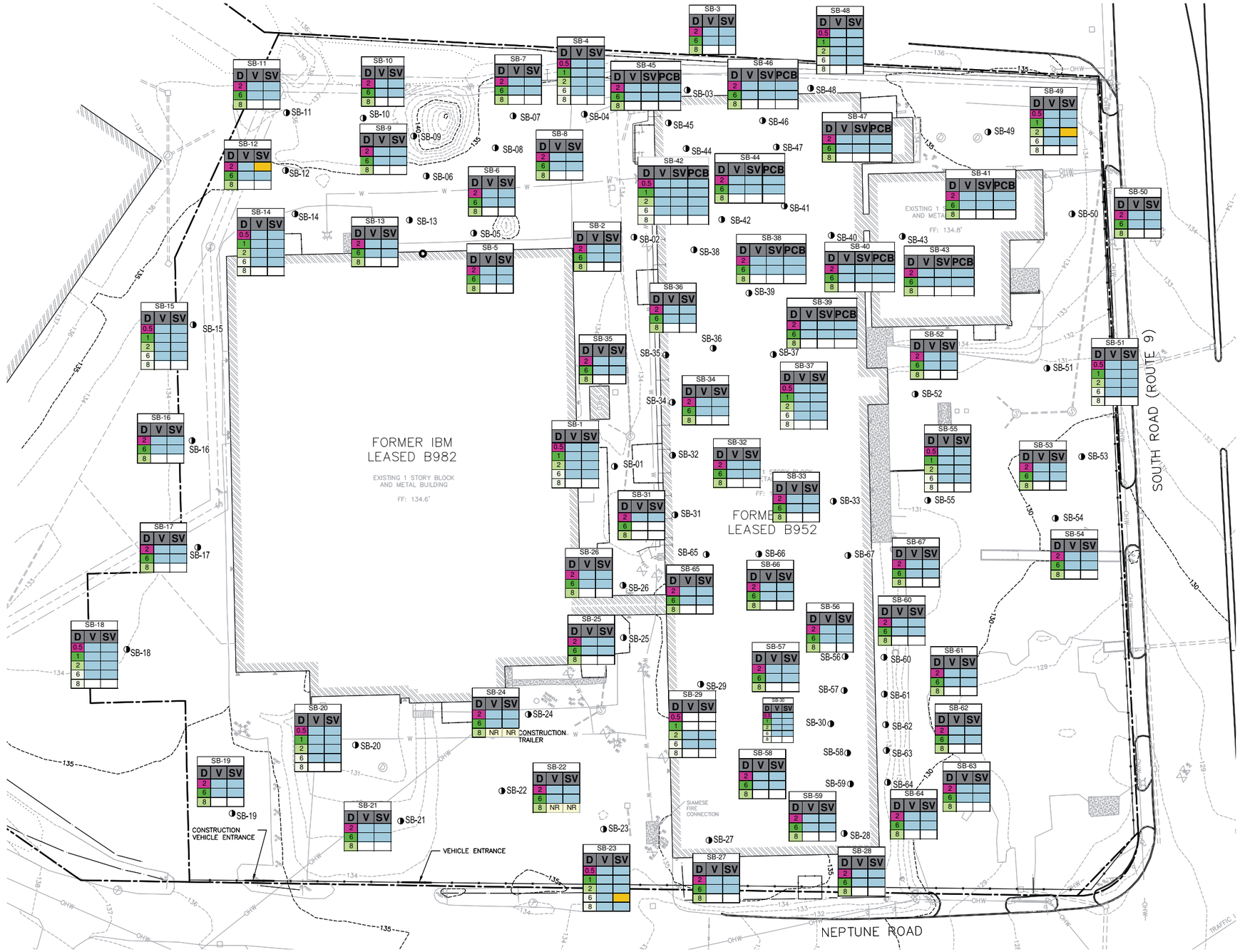
A series of surface and subsurface soil sampling was conducted to (1) verify the effectiveness of the 1984 remedial action to the EWP SCOs; (2) investigate the extent of contamination under the former IBM leased Building 952 once the concrete slab was demolished; and (3) evaluate the soils surrounding the IHWD site within the three new NCI lots for compliance with 6 NYCRR Subpart 375-6 SCOs. A figure summarizing all end-point surface and subsurface soil sampling is shown on Figure 2-5.

Of the 67 borings installed and sampled, 64 boring were all less than restricted residential use SCOs and/or protective of groundwater. Only three (3) borings showed detection of one or more analytes above the NYSDEC SCOs for restricted residential use. These borings are highlighted on Figure 2-5 and include:

- SB-12 (2 ft sample)
- SB-23 (6 ft sample)
- SB-49 (2 ft sample)

As shown on Figure 2-5, laboratory analytical data indicates detections of polycyclic aromatic hydrocarbons (PAHs) above the required site SCOs of restricted residential use for samples collected at SB-12 (2 ft) and SB-49 (2 ft). Samples collected at the 6 ft sample depth in these borings as well as samples collected from adjacent borings at 2 ft and 6 ft sample intervals all met SCOs. Concentrations of a number of PAHs in sample SB-23 (6 ft) exceeded SCOs. Samples collected from the 0.5 ft, 1 ft, 2 ft, and 8 ft intervals in SB-23 met SCOs. A review of the boring logs indicates that there was no observation of staining, odor, or detection utilizing a PID.

On December 10, 2012, IBM submitted a report addressing the results from these three borings to NYSDEC for review and to determine whether NYSDEC would require additional investigation and/or remediation of these three areas. On January 7, 2013, NYSDEC in consultation with NYSDOH determined that based on IBM's report and that these locations fall under the purview of the current IBM SMP, no further investigation and/or remediation of these areas was required at this time.




LEGEND:

- PROPERTY LINE
- LIMIT OF 1984 EXCAVATION
- (S) EXISTING SANITARY MANHOLE
- (D) EXISTING DRAINAGE MANHOLE
- □ EXISTING DRAINAGE CATCH BASIN
- W EXISTING WATER LINE
- EXISTING HYDRANT
- OHW EXISTING OVERHEAD WIRE
- EXISTING CHAIN LINK FENCE

| Legends | |
|---|---|
| 2 | Primary Sample Depth |
| 6 | Contingency Sample Depth |
| V | Volatile Organic Compounds |
| SV | Semi-Volatile Organic Compounds |
| PCB | Polychlorinated biphenyl |
| | Sample results greater than NY State Restricted Residential SCOs |
| | Sample results less than NY State Restricted Residential SCOs |
| NR | Sample results not reported |

| Sample ID | NYS Restricted Use Residential Soil Cleanup Objectives (ppb) | NYS Unrestricted Use Soil Cleanup Objectives (ppb) | SB49-2-092712 | | SB23-6-100312 | | SB12-2-100112 | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | | 09/27/12 | | 10/03/12 | | 10/01/12 | |
| SEMIVOLATILE COMPOUNDS (GC/MS) | | | | | | | | |
| Acenaphthene | 100,000 | **20,000** | 2,900 | U | 18,000 | U | 400 | J |
| Acenaphthylene | 100,000 | **100,000** | 2,900 | U | 18,000 | U | 400 | U |
| Anthracene | 100,000 | **100,000** | 2,900 | U | 12,000 | J | 720 | |
| Benzo[a]anthracene | 1,000 | **1,000** | **1,100** | **J** | **35,000** | **J** | **1,400** | **J** |
| Benzo[a]pyrene | 1,000 | **1,000** | 2,900 | U | **17,000** | **J** | **1,100** | **J** |
| Benzo[b]fluoranthene | 1,000 | **1,000** | 2,900 | U | **34,000** | | **1,700** | **J** |
| Benzo[g,h,i]perylene | 100,000 | **100,000** | 2,900 | U | 18,000 | | 210 | J |
| Benzo[k]fluoranthene | 3,900 | **800** | 2,900 | U | **15,000** | **J** | 660 | |
| Chrysene | 3,900 | **1,000** | 2,900 | U | **33,000** | **J** | **1,300** | |
| Dibenz(a,h)anthracene | 330 | **330** | 2,900 | U | **5,400** | **J** | 88 | J |
| Fluoranthene | 100,000 | **100,000** | 2,900 | U | 65,000 | | 2,700 | |
| Fluorene | 100,000 | **30,000** | 2,900 | U | 18,000 | U | 320 | J |
| Hexachlorobenzene | 1,200 | **330** | 2,900 | U | 18,000 | U | 400 | U |
| Indeno[1,2,3-cd]pyrene | 500 | **500** | 2,900 | U | **17,000** | **J** | 270 | J |
| Naphthalene | 100,000 | **12,000** | **30,000** | | 18,000 | U | 400 | U |
| Phenanthrene | 100,000 | **100,000** | 2,900 | U | 42,000 | | 2,500 | |
| Pyrene | 100,000 | **100,000** | 2,900 | U | 56,000 | | 2,400 | |

**Notes:**

J - Analytical Non-Detect Value
– Analyte detected below quantitation limits
ppb - parts per billion (ug/kg)
* Values that are **bold** exceed the Unrestricted Use Soil Cleanup Objectives
* Values that are **bold and highlighted** exceed both the Restricted Use Residential and Unrestricted Use Soil Cleanup Objectives

**Source: HDR - 2017**

**Not to Scale**

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

D&B Engineers and Architects, P.C.

## SOIL BORING WITH DATA AND EXCEEDANCES

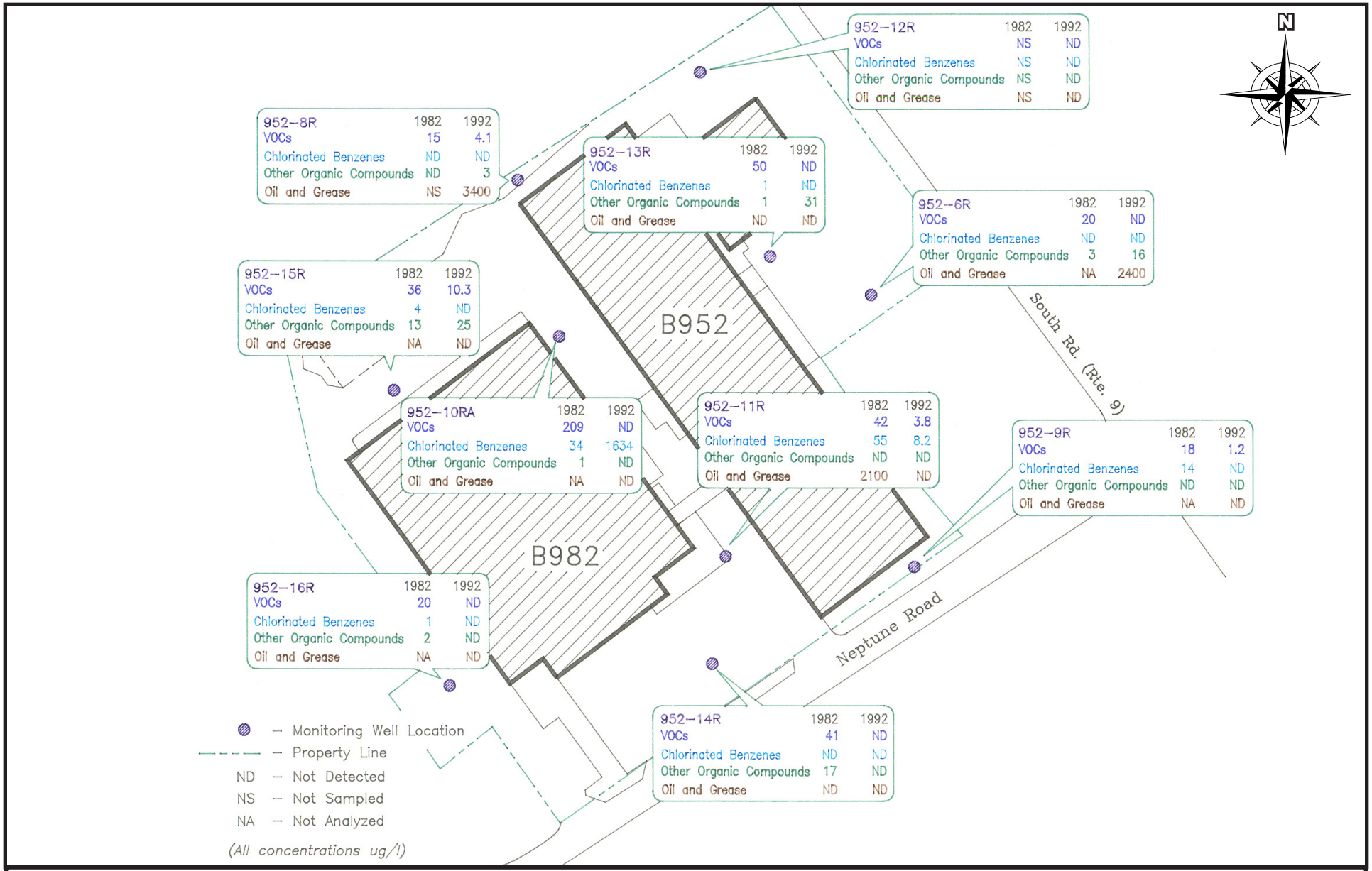
**FIGURE 2-5**

2.3.2.3 – Site-Related Groundwater

IBM installed the groundwater pump and treatment system at the Site for the purpose of collecting groundwater and preventing the onsite groundwater contamination from migrating off-site. Since the startup of the groundwater pump and treatment system began on December 1, 1993, IBM has operated this system solely for the purpose of remediating and containing groundwater contamination on the Site. The groundwater pump and treatment system pumps water from an extraction well, through a treatment system consisting of bag filters and two granular activated carbon units. Treated groundwater is then discharged to a sanitary sewer manhole owned by the Town of Poughkeepsie Arlington Sewer District (ASD). A detailed discussion of the groundwater pump and treatment system can be found in Section 3.0 of the O&M Plan for the Groundwater Pump and Treatment System, included in Appendix D of this SMP.

Groundwater sampling results from 23 monitoring wells installed in 1982 indicated low concentrations of dichlorobenzenes (DCBs), 1,1,1-trichloroethane (TCA), and trichloroethylene (TCE) in or adjacent to the former alcove between Buildings 952 and 982. These contaminants were not detected in down-gradient wells, with the exception of TCA which was detected in former well 952-14R, located near the southern site boundary, at a level below the New York State Groundwater Quality Standard (NYSGWS). Table 2-8 summarizes the VOCs and base neutrals detected in the groundwater at the Site at that time.

After completion of the Remedial Action, IBM continued to conduct groundwater monitoring both on-site and off-site. In all, 143 groundwater samples were collected and analyzed for various parameters from 1985 to 1992. Sampling results completed during November and December 1992 showed no concentrations exceeding the NYSGWS in any of the 13 off-site monitoring wells. For the ten on-site monitoring wells, the NYSGWS was exceeded for one or more constituents in the two wells immediately within or adjacent to the 1984 soil excavation area. Figure 2-6 presents the comparison of the initial characterization sampling completed in 1982 with the sampling results completed in 1992 for the ten on-site wells.




**Source: Groundwater Sciences Corporation 1993**

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

**Not to Scale**

# COMPARISON OF INITIAL CHARACTERIZATION SAMPLING IN 1982 AND FINAL SAMPLING IN 1992

**FIGURE 2-6**

**Table 2-8**
**Summary of Compounds Detected in Groundwater (1982)**

| Volatile Organic Compounds | | Base Neutral Compounds |
|---|---|---|
| 1,1-Dichloroethane | Benzene | |
| 1,1-Dichloroethene | Chlorobenzene | Bis(2-Ethylhexyl) phthalate |
| 1,1,1-Trichloroethane | Chlorodibromomethane | di-(n)Butyl phthalate |
| 1,1,2-Trichloro(1,2,2)trifluoroethane | Dichlorodifluoromethane | di-(n) Octyl phthalate |
| 1,1,2,2-Tetrachloroethane | Methylene Chloride | Fluoranthene |
| 1,2-Dichloroethane | Ethylbenzene | Napthalene |
| 1,2-Dichlorobenzene | Tetrachloroethylene | Phenanthrene |
| 1,2-Dichloroethylene (total) | Bromoform | Pyrene |
| 1,2-Xylene | Trichloroethylene | |
| 1,2,4-Trichlorobenzene | Trichlorofluoromethane | |
| 1,3-Dichlorobenzene | Chloroform | |
| 1,3-Xylene | Toluene | |
| 1,4-Dichlorobenzene | Xylenes(total) | |
| Bromodichloromethane | | |

Other than the NYSDEC-approved suspension of sampling and gauging of all peripheral wells at the site during site development activities (correspondence provided in Appendix F), IBM continues to collect groundwater monitoring samples as specified in Section 4.0 of this SMP. The groundwater pump and treatment system pumps water from a single extraction well (952-30R), through a treatment system consisting of bag filters and two granular activated carbon units to remove volatile and semivolatile organic compounds. The treated groundwater is then discharged to a sanitary sewer system associated with a publicly owned treatment works (POTW), the Arlington Sewage District Treatment Plant. A monitoring well location map is provided on Figure 1-2.

The concentrations of chemicals observed in the untreated groundwater from the monitoring wells have gradually decreased since the groundwater pump and treatment system was installed. More recently, results from samples taken from the extraction well over the past eight years indicate levels have stabilized to where average concentrations for reporting compounds are below the New York State groundwater quality standards. Historical sampling

data results, from 2008 through 2016 for VOCs, SVOCs and Oil and Grease are presented, by monitoring well, in Tables 1 through 24 and can be found in Appendix G.

2.3.2.4 – Site-Related Soil Vapor Intrusion

In 2008, the Site was identified as a legacy vapor intrusion site by the New York State Department of Health (NYSDOH). The current owner of the Site conducted an investigation of this media in 2007 and 2008 without a NYSDEC or NYSDOH approved Work Plan. Although the investigation was completed without an approved Work Plan, the NYSDEC reviewed the findings of the investigation prepared by the owner's consultant, and accepted the consultant's conclusion that exposure by the vapor intrusion pathway is likely.

As a result, IBM undertook the design and installation of a subslab depressurization system (SSDS) that was installed as part of the redevelopment of the former IBM Building 982. IBM elected to install the SSDS system as a pro-active, pre-emptive measure to mitigate the potential for VOCs to enter the indoor air from the subsurface of the building. The design and construction of the SSDS was performed in accordance with the Order on Consent, Index #A3-0655-12-10, issued by the NYSDEC on May 19, 2011. The SSDS installation and start-up was completed in accordance with IBM's SSDS Work Plan and SSDS Design Report for these activities. The SSDS Work Plan was approved by the NYSDEC and the New York State Department of Health (NYSDOH) (the Agencies) in a letter to IBM dated September 18, 2013. The final SSDS Work Plan dated September 26, 2013 incorporated the Agencies comments and approval letter. A copy of the April 25, 2014 approval letter from NYSDEC is included in Appendix F.

## 2.4 Remedial Action Objectives (RAOs)

The following Remedial Action Objectives (RAOs) for the Site were agreed to by IBM and NYSDEC to facilitate redevelopment of the Site.

### 2.4.1 Groundwater RAOs

IBM currently operates and maintains an onsite groundwater pump and treat system as addressed in the site O&M Plan. Long term operation of the system, which began in 1993, and subsequent groundwater monitoring data has shown groundwater quality results combined with observed hydraulic control by the system in the vicinity of the source area indicate the remedy implemented at the site is successful.

### 2.4.2 Soil RAOs

The objective of IBM's remediation work was to verify that the soils within the footprint of the former IBM leased Building 952 (once the building and slab were demolished) were in compliance with the soil cleanup objectives (SCOs) of 6 NYCRR Subpart 375-6 for restricted residential. In addition, at the request of NYSDEC, IBM would also verify that the soils within the footprint of the original 1984 excavation were in compliance with the SCOs of 6 NYCRR Subpart 375-6 for restricted residential.

NYSDEC also requested that IBM evaluate the soils surrounding the IHWD site within the property boundaries of the three NCI parcels proposed for redevelopment for compliance with the SCOs of 6 NYCRR Subpart 375-6 for restricted residential to a depth of 8-ft. If any soils shallower than 8-feet did not meet the SCOs, then IBM would prepare a separate remedial action plan for NYSDEC review and approval.

### 2.4.3 Soil Vapor Intrusion RAOs

In addition to the demolition of former IBM leased Building 952, redevelopment activities also included the renovation of the former IBM leased Building 982. Renovations on former leased Building 982 began in August 2013. The soil vapor intrusion (SVI) investigation by IBM was conducted under a separate remedial action/remedial design work plan and contract. The results of the SVI investigation are detailed in a separate report submitted to and approved

by NYSDEC and NYSDOH. Copies of these reports are maintained by IBM and are available upon request.

## 2.5 Remaining Contamination

### 2.5.1 Soil

As described in the previous sections, the contaminated soil between the buildings was excavated and removed by IBM prior to promulgation of 6 NYCRR Part 375-6: Remedial Program Soil Cleanup Objectives. The soil was excavated and removed based on criteria provided by the NYSDEC to IBM that limited total concentrations of groups of compounds present on the Site instead of individual compounds as provided in Part 375-6. Based on a comparison of the limits provided and cleanup objectives represented in Part 375-6, the area appears to be have been remediated to meet a cleanup level for a restricted residential use. Restricted requires that the use of the site has restrictions in the form of an environmental easement, or other land use control and requires a site management plan to manage the exposure to remaining contamination at the site. The Site currently has an engineering control (NYSDEC approved groundwater pump and treatment system) and therefore falls into the restricted use category.

In addition to the soil removal between former leased Building 952 and 982, the soil within the former IBM leased Building 952 footprint, as well as soils throughout the Site were sampled, analyzed and verified to meet restricted residential SCOs with few exceptions as discussed above. These exceptions have been approved by NYSDEC in a letter dated January 7, 2013 which is included in Appendix F. Contamination associated with former IBM leased Building 982 (i.e. underneath the building footprint) remains at the Site.

### 2.5.2 Groundwater

The onsite groundwater pump and treatment system remains active and continues to provide treatment and hydraulic control of the contamination plume.

### 2.5.3 Soil Vapor

Since potentially contaminated soil and soil vapors remains beneath the former IBM leased Building 982 after completion of the EWP, Institutional and Engineering Controls are required to protect human health and the environment at this building.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# SITE MANAGEMENT PLAN
# FOR THE FORMER IBM B952/982 SITE

## SECTION 3.0
## INSTITUTIONAL AND ENGINEERING CONTROL PLAN

# 3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

## 3.1 General

Since there is the possibility that contaminated soil and groundwater/soil vapor exists beneath the former Building 982, Institutional and Engineering Controls (IC/ECs) are required to protect human health and the environment. This Institutional and Engineering Control Plan describes the procedures for the implementation and management of all IC/ECs at the Site. The IC/EC Control Plan is one component of the SMP and is subject to revision by NYSDEC.

This plan provides:

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

## 3.2 Institutional Controls

A series of ICs are required to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the Site to uses consistent with the Restricted Residential use defined in 6NYCRR Part 375-1(g)(2)(ii), unless otherwise determined based on soil sampling results to meet a more restrictive level. Adherence

to these ICs on the Site are required by the Environmental Easement and will be implemented under this Site Management Plan. These ICs are:

- The Site may be used for restricted residential and commercial use;
- Compliance with the Environmental Easement and this SMP by the Grantor and the Grantor's successors and assigns;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs on the Site must be inspected at a frequency and in a manner defined in the SMP;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to Site Management of the Site must be reported at the frequency and in a manner defined in this SMP.

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

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

- The Site may only be used for restricted residential and commercial use provided that the long-term Institutional and Engineering Controls included in this SMP are employed;
- The Site may not be used for a higher level of use, such as unrestricted use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC;
- All future activities on the Site that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- The use of the groundwater underlying the Site is prohibited;
- Vegetable gardens and farming on the Site are prohibited;
- The Site owner and remedial party will submit to NYSDEC a written statement that each party, as appropriate to their role at the site, certifies, under penalty of perjury, that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing

has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Site at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

## 3.3 Engineering Controls

### 3.3.1 Cover System

Former Building 982 provides a physical barrier which restricts the movement of and eliminates direct human exposure to the possible remaining contamination beneath the building, and as such can be considered a cover system. This cover system is comprised of the concrete building slabs and the actual building structures. Currently the outside structure provides the physical barrier to direct human exposure and the elements. In the event the building structure is removed/demolished and the concrete slabs are exposed, the concrete slabs shall be repaired to provide a surface free of cracks and holes, and the slab will be properly sealed, to continue to provide an effective physical barrier which will restrict the movement of and eliminate direct human exposure to any possible underlying remaining contamination. The Excavation Work Plan (EWP) that appears in Appendix H outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any possible underlying remaining contamination is disturbed. Procedures for the inspection and maintenance of this cover system are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the Site. A generic CAMP is attached as Appendix I and a sample HASP is attached as Appendix J to this SMP that is in current compliance with DER-10, and 29 CFR 1910, 29 CFR 1926, and all other applicable Federal, State and local regulations. Based on future changes to State and Federal health and safety requirements, and specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted with the notification provided in Section H-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the

periodic inspection and certification reports submitted under the Site Management Reporting Plan (See Section 7.1).

### 3.3.2 Groundwater Pump and Treatment System

The ongoing remedial action being performed by IBM at this Site involves the extraction of groundwater from a single extraction well (952-30R), on-site treatment by activated carbon to remove volatile and semivolatile organic compounds and discharge to a sanitary sewer system owned by the Town of Poughkeepsie Arlington Sewage District (ASD). In addition to the extraction well, two groundwater monitoring wells (952-10RA and 952-31R) are present on-site to monitor the horizontal and vertical variation in groundwater elevation and chemistry. The location of the on-site treatment building, extraction well, and groundwater monitoring wells are shown on Figures 2-1 and 2-2 of the O&M Plan for the Groundwater Pump and Treatment System included as Appendix D.

The groundwater pump and treatment system includes two stages. The first is filtration of suspended solids and the second is removal of volatile and semivolatile organics by activated carbon. A process schematic of the groundwater pump and treatment system has been provided as Figure 3-1 in the O&M Plan for the Groundwater Pump and Treatment System, included as Appendix D.

Since the startup of the groundwater pump and treatment system the concentrations of chemicals observed in the untreated groundwater from the extraction well have gradually decreased.

Procedures for operating and maintaining the groundwater pump and treatment system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP) and Appendix D. Procedures for monitoring the system are included in the Monitoring and Sampling Plan (Section 4.0 of this SMP). The Monitoring and Sampling Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the Site, occurs.

### 3.3.3 Subslab Depressurization System

As part of the redevelopment of the Site, IBM also undertook the design and installation of a subslab depressurization system (SSDS) that was installed as part of the redevelopment of the former IBM Building 982. IBM elected to install the SSDS system as a pro-active, pre-emptive measure to mitigate the potential for volatile organic compounds (VOCs) to enter the indoor air from the subsurface of the building. The design and construction of the SSDS was performed in accordance with the Order on Consent, Index #A3-0655-12-10, issued by the NYSDEC on May 19, 2011. The SSDS installation and start-up was completed in accordance with IBM's SSDS Work Plan and SSDS Design Report for these activities. The SSDS Work Plan was approved by the NYSDEC and the New York State Department of Health (NYSDOH) (the Agencies) in a letter to IBM dated September 18, 2013. The final SSDS Work Plan dated September 26, 2013 incorporated the Agencies comments and approval letter. A copy of the April 25, 2014 approval letter from NYSDEC is included in Appendix F.

Procedures for operating and maintaining the Subslab Depressurization System are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP) and in the Operation and Maintenance Manual for the Subslab Depressurization System, provided in Appendix E. Procedures for monitoring the system are included in the Monitoring and Sampling Plan (Section 4.0 of this SMP).

## 3.4 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

### 3.4.1 Cover System

The cover system, comprised of the existing Building 982 on the Site, is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity. The inspection requirements for the cover system are provided in Section 4.3.1.1 of this SMP.

### 3.4.2 Groundwater Pump and Treatment System

The Groundwater Pump and Treatment System will not be discontinued unless prior written approval is granted by the NYSDEC. In the event that monitoring data indicates that the groundwater pump and treatment system may no longer be required, a proposal to discontinue the system, including the results of an impact study, will be submitted by the remedial party. Conditions that may warrant discontinuing the groundwater pump and treatment system include contaminant concentrations in groundwater that: (1) reach levels that are consistently below ambient water quality standards or the site SCOs as appropriate, (2) have become asymptotic to a low level over an extended period of time as accepted by the NYSDEC; or (3) the NYSDEC has determined that the groundwater pump and treatment system has reached the limit of its effectiveness. This assessment will be based in part on post-remediation contaminant levels in groundwater collected from monitoring wells located throughout the site. Systems will remain in place and operational until permission to discontinue their use is granted in writing by the NYSDEC.

### 3.4.3 Subslab Depressurization System

The active SSDS will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH. In the event that monitoring data indicates that the SSDS may no longer be required, a proposal to discontinue the SSDS will be submitted by the remedial party to the NYSDEC and NYSDOH.

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**SITE MANAGEMENT PLAN**
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# SECTION 4.0
# MONITORING AND SAMPLING PLAN

# 4.0 MONITORING AND SAMPLING PLAN

## 4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in Attachment 4 of the Operation and Maintenance Plan for the Groundwater Pump and Treatment System and in the Quality Assurance Project Plan (QAPP), provided in Appendix K.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

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

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

Reporting Requirements are provided in Section 7.0 of this SMP.

## 4.2 Site Wide Inspections

Site-wide inspections are performed, at a minimum, of once a year by both the property owner and IBM. Site-wide inspections are also performed after all severe weather conditions that may affect Engineering Controls or monitoring devices. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. During these inspections, an inspection form will be completed as provided in Appendix L – Site Management Forms.

Annual inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

Reporting requirements are outlined in Section 7.0 of this plan.

### 4.2.1 Property Owner Site Wide Inspection

The annual site-wide inspection completed by the property owner will verify the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of the cover system; and

- General site conditions at the time of the inspection.

During these inspections, an inspection form will be completed (Appendix L) which will compile sufficient information to assess the above is in compliance with the SMP. These inspection forms shall be submitted to IBM annually for inclusion into the Periodic Review Reports.

#### 4.2.2 IBM Site Wide Inspection

The site-wide inspection completed by IBM will be conducted on an annual basis as part of the O&M for the groundwater pump and treatment system discussed in Section 5.2 and the subslab depressurization system as discussed in section 5.3 of this SMP. The visual inspection will verify the following:

- An evaluation of the condition and continued operation of the groundwater pump and treatment system and the subslab depressurization system;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection;
- Compliance with the O&M Plan for the Groundwater Pump and Treatment System and the O&M Manual for the Subslab Depressurization System; and
- Confirm that site records are up to date.

If during an inspection one of the following items above is not in compliance with the SMP, the IBM Program Manager shall be immediately notified. The results of these inspections will be summarized in the Periodic Review Report as discussed in Section 7.2 of this SMP.

## 4.3 Treatment System Monitoring and Sampling

#### 4.3.1 Remedial System Monitoring

Monitoring of the performance of the remedy and overall reduction in contamination on-site will be conducted in accordance with this Site Monitoring Plan. Trends in contaminant

levels in air, soil, and/or groundwater in the affected areas will be evaluated to determine if the remedy continues to be effective in achieving remedial goals. Monitoring programs are summarized in Table 4-1 and outlined in detail in the following sections.

**Table 4-1**
**Remedial System Monitoring Requirements and Schedule**

| Remedial System Component | Monitoring Schedule* | Monitoring Parameter | Operating Range |
|---|---|---|---|
| B982 Cover System | Annually | B982 Cover System | -- |
| **Groundwater Pump and Treatment System** | | | |
| Extraction Well | Monthly | VOCs | EPA Method 8021 |
| Monitoring Wells | Annually | VOCs | EPA Method 8021 |
| Bag Filters | Monthly | -- | -- |
| Activated Carbon | Every 18-24 months | Lead effluent sample | < 1 *u*g/l TCE |
| Transfer Pumps | Annually | -- | -- |
| Pressure Blowers | Annually | -- | -- |
| System Piping | Annually | -- | -- |
| **Subslab Depressurization System** | | | |
| Subslab pressure response | 2x/year | in. w.c. | -0.004 in w.c. or less (greater vacuum) |
| Extraction port vacuums | 2x/year | in. w.c. | As shown on the Performance Monitoring Logsheet |
| Vacuum Blowers | Quarterly | -- | 45 Hz |
| Inline Particulate Filters | Monthly | differential pressure across the filter | 5 in. w.c. |
| System Piping | Monthly | ** | -- |
| Transfer Pump | Quarterly | ** | -- |
| Extraction Ports | Semiannual | ** | -- |
| Equipment Room | Quarterly, or as needed | -- | -- |

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

** The Automation Direct Programmable Logic Controller (PLC) Model P3-550 unit is a microprocessor-based system which continuously monitors and controls the operation of the SSDS. The PLC monitors system operations via input signals from field instrumentation (e.g., float switches, or vacuum and temperature transmitters) and controls the system by issuing commands, or output signals, to equipment (e.g., VFD).

4.3.1.1 – Cover System Monitoring

Monitoring of the cover system will be performed on a routine basis, as identified in Table 4-1. Modification to the frequency will require approval from the NYSDEC. The cover system shall be visually monitored to verify that the building structure is intact and the building is secure. If the structure is removed, exposing the concrete slab, the inspection shall also include a visual inspection of the concrete slab to verify the integrity of the slab. Any cracks or other blemishes observed during the annual inspection shall be immediately repaired upon discovery. The property owner is responsible for monitoring the B982 cover system.

Unscheduled inspections may take place when a suspected failure of the cover system has been reported or an emergency occurs that is deemed likely to affect the cover system.

4.3.1.2 – Groundwater Monitoring

Monitoring of the groundwater pump and treatment system will be performed on a routine basis, as identified in Table 4-1. Modification to the frequency will require approval from the NYSDEC. A visual inspection of the complete system will be conducted during each monitored event. Unscheduled inspections and/or sampling may take place when a suspected failure of the groundwater pump and treatment system has been reported or an emergency occurs that is deemed likely to affect the groundwater pump and treatment system. Groundwater pump and treatment system components to be monitored include, but are not limited to, the components included in Table 4-1.

Groundwater monitoring is performed by IBM. Since the initial NYSDEC approval of the IBM O&M Plan in 1994, there have been several modifications to the groundwater monitoring program that have been approved by the NYSDEC. They are as follows:

- On November 17, 1999, the NYSDEC approved a decrease in monitoring frequency for all monitored wells from quarterly to twice annually.

- On April 23, 2004, the NYSDEC approved the decommission of monitoring wells 952-8R, 952-14S, and 952-15RA. In addition, the monitoring frequency of wells 952-10RA, 952-11R, 952-29R, and 952-31R was reduced to once per year.
- Monitoring well 952-15RB was decommissioned on December 13-14, 2012 as part of site redevelopment activities.
- The decommissioning of perimeter monitoring wells 952-6R, 952-9R, 952-11R, 952-12R, 952-13R, 952-14R, 952-14RA, 952-16R, and 952-29R. In addition, the analytical parameters that the remaining two monitoring wells (952-10RA and 952-31R) are tested for has been reduced to just VOC sampling once per year.

Table 4-2 summarizes the current approved groundwater monitoring plan (GMP).

**Table 4-2**
**Groundwater Monitoring Plan (GMP)**

| Monitoring Well ID | VOCs | Sampling Frequency (per annum) |
|---|---|---|
| 952-10RA | X | 1 |
| 952-30R | X | 12 |
| 952-31R | X | 1 |

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix L – Site Management Forms. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning or the system is not performing within specifications, maintenance and repair, as per the Operation and Maintenance Plan, is required immediately.

4.3.1.3 – Subslab Depressurization System Monitoring

Monitoring of the subslab depressurization system will be performed on a routine basis, as identified in Table 4-1 and in Section 5.0 of the O&M Manual for the Subslab Depressurization System, provided in Appendix E. Modification to the frequency will require approval from the NYSDEC. A visual inspection of the complete system will be conducted during each monitored event. Unscheduled inspections and/or sampling may take place when a suspected failure of the SSDS has been reported or an emergency occurs that is deemed likely to

affect the SSDS. The subslab depressurization system components to be monitored include, but are not limited to, the components included in Table 4-1.

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix L – Site Management Forms. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning or the system is not performing within specifications, maintenance and repair, as per the Operation and Maintenance Plan, is required immediately.

It should be noted that while system operations are monitored, vapor concentrations in the building will not be sampled.

### 4.3.2 Remedial System Sampling

Samples are collected from the two monitoring wells on a routine basis. Sampling locations, required analytical parameters and schedule are provided in Table 4-2. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Detailed sampling and analysis protocols for groundwater are presented in Attachment 4 of the O&M Plan for the Groundwater Pump and Treatment System, included as Appendix D to this SMP, as well as the Quality Assurance Project Plan (QAPP) provided in Appendix K.

### 4.3.3 Monitoring Quality Assurance / Quality Control

All sampling and analyses will be performed in accordance with the requirements of the Quality Assurance Project Plan (QAPP) prepared for the Site,. At this time, groundwater and subslab vapor intrusion are the only media routinely monitored. If, in the future, other media are recommended for routine monitoring, this section of the SMP will be updated. Main Components of the QAPP include:

- QA/QC Objectives for Data Measurement;

- Sampling Program:
  - Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.
  - Sample holding times will be in accordance with USEPA SW846 method requirements.
  - Field QC samples (e.g., trip blanks, coded field duplicates, and matrix spike/matrix spike duplicates) will be collected as necessary.
- Sample Tracking and Custody;
- Calibration Procedures:
  - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
  - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.
- Analytical Procedures

### 4.3.4 Monitoring Reporting Requirements

Forms and any other information generated during regular monitoring events and inspections completed by IBM will be kept on file at an approved location under control of the IBM Program Manager. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be maintained by IBM and submitted to the NYSDEC upon request. Summaries of all inspections, maintenance, and monitoring will be provided in the Periodic Review Report, as specified in the Reporting Plan of this SMP.

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

- Date of event;
- Personnel conducting sampling;
- Description of the activities performed;
- Type of samples collected (e.g., subslab vapor, indoor air, outdoor air, etc);
- Sampling results in comparison to appropriate standards/criteria;

- A figure illustrating sample type and sampling locations;
- Any observations, conclusions, or recommendations; and
- A determination as to whether groundwater conditions have changed since the last reporting event.

Data will be reported in hard copy or digital format as determined by NYSDEC.

### 4.3.5 Monitoring Well Repairs, Replacement and Decommissioning

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

Repairs and/or replacement of the wells will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent periodic report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. Well abandonment will be performed in accordance with NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures" or an alternative decommissioning procedure approved by the NYSDEC. Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.



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# SECTION 5.0
# OPERATION AND MAINTENANCE PLAN

# 5.0 OPERATION AND MAINTENANCE PLAN

## 5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components for both the groundwater pump and treatment system and the subslab depressurization system selected for the Site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the Site to operate and maintain the groundwater pump and treatment system and the subslab depressurization system;
- Includes an operation and maintenance contingency plan; and,
- Will be updated periodically to reflect changes in site conditions or the manner in which the groundwater pump and treatment system and/or subslab depressurization system are operated and maintained.

Further details regarding the Operation and Maintenance of the groundwater pump and treatment system is provided in Appendix D - Operation and Maintenance Plan for the Groundwater Pump and Treatment System and Appendix E – Operation and Maintenance Manual for the Subslab Depressurization System. A copy of these O&M Plans/Manuals, along with the complete SMP, is maintained at the site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of this SMP.

Information on non-mechanical Engineering Controls (i.e. soil cover system) is provided in Section 3.0 - Institutional and Engineering Control Plan.

## 5.2 Operation and Maintenance of the Groundwater Pump and Treatment System

An O&M Manual for the operation and maintenance of the groundwater pump and treatment system has been prepared and is kept at the Site within the groundwater pump and treatment building. This manual is included in Attachment 2 of the O&M Plan for the

Groundwater Pump and Treatment System prepared for the Site which is included as Appendix D to this SMP. The O&M Manual for the groundwater pump and treatment system includes:

- General introduction to the system
- System design information
- As-built drawings for the system
- Manufacturer's recommendations and cut sheets
- Inspection requirements
- Baseline measurements
- Troubleshooting Guide
- Operation Schedule
- Routine maintenance activities and minimum schedules
- Warning devices initiated
- System or component replacement

*General Equipment Monitoring*

A visual inspection of the complete system is conducted by IBM on an annual basis. The groundwater pump and treatment system components monitored include, but are not limited to, the following:

- Extraction Well
- Monitoring Wells
- Bag Filters
- Activated Carbon
- Transfer Pumps
- Pressure Gauges
- Flow meters

The inspection form is presented in Appendix L. If any equipment readings are not within their typical range, any equipment is observed to be malfunctioning, or the system is not

performing within specifications, maintenance and repair as per the O&M manual are required immediately, and the groundwater pump and treatment system restarted.

*Monitoring Schedule*

Samples are collected from the extraction well on a monthly basis and are analyzed for VOCs by USEPA Method 8021. Samples are collected from the two monitoring wells on an annual basis and are analyzed for VOCs by USEPA Method 8021.

Inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or sampling may take place when a suspected failure of the groundwater pump and treatment system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. Monitoring deliverables for the groundwater pump and treatment system are specified later in this Plan.

*Sampling Event Protocol*

Sampling protocols for the extraction well have been provided in Attachment 4 of the O&M Plan for the Groundwater Pump and Treatment System, included in Appendix D, and the monitoring well sampling protocol is provided in the Quality Assurance Project Plan (QAPP), provided in Appendix K.

### 5.2.1 System Start-Up and Testing

System startup is discussed in Chapter 2.0 of the O&M Manual included in Attachment 2 of the O&M Plan for the Groundwater Pump and Treatment System (Appendix D).

### 5.2.2 Routine System Operation and Maintenance

Routine operation procedures are provided in Chapter 2.0 of the O&M Manual included in Attachment 2 of the O&M Plan for the Groundwater Pump and Treatment System

(Appendix D). Maintenance requirements for the system are discussed in Chapter 5.0 of the O&M Manual included in Attachment 2 of the O&M Plan for the Groundwater Pump and Treatment System (Appendix D).

Routine maintenance activities are recorded in a log book that is maintained in the treatment building on Site. The log book provides:

- Date
- Maintenance activities conducted
- Any modifications to the system

Maintenance reports and any other information generated during regular operations at the Site will be kept on-file on-site. All reports, forms, and other relevant information generated by IBM will be available upon request to the NYSDEC. A summary of all maintenance and routine operations at the Site will be included as part of the Periodic Review Report, as specified in the Section 7.2 of this SMP.

### 5.2.3 Non-Routine System Operation and Maintenance

A discussion of the control and alarms systems associated with the overall groundwater pump and treatment system and a troubleshooting guide is provided in Chapter 4.0 of the O&M Manual included as Attachment 2 of the O&M Plan for the Groundwater Pump and Treatment System (Appendix D).

Non-routine maintenance activities are recorded in a log book that is maintained in the treatment building on Site. The log book provides:

- Date
- Maintenance activities conducted
- Any modifications to the system

### 5.2.4 System Monitoring Devices and Alarms

The groundwater pump and treatment system has a warning device to indicate that the system is not operating properly. In addition to having a local alarm, the warning alarms for leaks, flow, and power outages are connected to IBM's SCADA system, which provides notifications of these types of alarms to the IBM operators via a pager. In the event that the warning device is activated, applicable maintenance and repairs will be conducted, as specified in the O&M Manual in Attachment 2 of the O&M Plan for the Groundwater Pump and Treatment System (Appendix D), and the groundwater pump and treatment system restarted. Operational problems will be noted in the subsequent Periodic Review Report.

## 5.3 Operation and Maintenance of the Subslab Depressurization System

The SSDS was designed to extract vapor from beneath approximately 49,000 square feet of floor slab and decrease the potential for VOC-containing vapor migration into the building.

Vapor is capable of being withdrawn from beneath the slab using up to six suction pits and five extraction ports connected to two vacuum blowers installed in a dedicated equipment room at the north end of the building. The SSDS is also equipped with a granular activated carbon (GAC) vapor treatment system consisting of two 700-lb vessels. The GAC vessels are operated in series and under vacuum. The blowers discharge treated vapor to the atmosphere through a discharge stack that extends through the roof of the equipment room and above the main structure roofline.

Operation of the SSDS is controlled and monitored by a programmable logic controller (PLC) installed in the Control Panel which is mounted on the blower skid. The PLC is programmed to send a general alarm via radio signal to the main IBM Poughkeepsie facility in the event of an unscheduled shut down or emergency. The blowers are powered by variable frequency drives (VFDs) that can be adjusted to increase or decrease the blower speed, and hence the vacuum and flow, as appropriate.

### 5.3.1 System Start-Up and Testing

System startup is discussed in Chapter 3.2.1 of the O&M Manual included in Appendix E of this SMP.

### 5.3.2 Routine System Operation and Maintenance

Routine operation procedures are provided in Chapter 3.2 of the O&M Manual included in Appendix E of this SMP. Maintenance requirements for the system are discussed in Chapter 5.0 of the O&M Manual included in Appendix E of this SMP.

### 5.3.3 Non-Routine Operation and Maintenance

A discussion of the control and alarms systems associated with the subslab depressurization system and a troubleshooting guide is provided in Chapter 2.12 of the O&M Manual included as Appendix E of this SMP.

### 5.3.4 System Monitoring Devices and Alarms

Operation of the SSDS is controlled and monitored by a programmable logic controller (PLC) installed in the Control Panel which is mounted on the blower skid. During normal operation, all switches and transmitters are continuously monitored by the PLC for alarm conditions. Transmitters (temperature and vacuum) provide continuous analog signals that are logged by the PLC and available for review via the HMI or download through direct connection to the PLC with a laptop. The PLC is programmed to send a general alarm via radio signal to the main IBM Poughkeepsie facility in the event of an unscheduled shut down or emergency.

In the event that the warning device is activated, applicable maintenance and repairs will be conducted, as specified in the O&M Manual for the Subslab Depressurization System, provided in Appendix E. Operational problems will be noted in the subsequent Periodic Review Report.

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# SECTION 6.0
# PERIODIC ASSESSMENTS/EVALUATIONS

# 6.0 PERIODIC ASSESSMENTS / EVALUATIONS

## 6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

Given the urban nature of the Site and surrounding area, the distance from and elevation above nearby water bodies, and the presence of sufficient municipal storm water collection infrastructure, vulnerability assessments are not warranted.

## 6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the Periodic Review Report (PRR).

The Green Remediation Evaluation will include the following items:

- Energy usage by the Groundwater Pump and Treatment System and the SSDS.
- Fossil fuel usage associated with travel to and from the Site for sampling and monitoring activities;
- Waste generation from groundwater sampling events (i.e., purge and decontamination water); and

- Water usage for decontamination of sampling equipment.

### 6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities. Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

### 6.2.2 Remedial Systems

Remedial systems will be operated properly considering the current site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to operating rates and use of reagents and consumables. Spent materials will be sent for recycling, as appropriate. The SSDS operation will be evaluated as part of the Green Remediation Evaluation.

### 6.2.3 Building Operations

Structures including buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation and water consumption.

### 6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and use of consumables in relation to visiting the Site in order to conduct system checks and or collect samples and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these

periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

Consideration shall be given to:

- Reduced sampling frequencies;
- Reduced site visits and system checks;
- Coordination/consolidation of activities to maximize foreman/labor time; and
- Use of mass transit for site visits, where available.

#### 6.2.5 Metrics and Reporting

As discussed in Section 7.0 information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits; a set of metrics has been developed.

### 6.3 Remedial System Optimization

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;

- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

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# SITE MANAGEMENT PLAN
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## SECTION 7.0
## REPORTING REQUIREMENTS

# 7.0 REPORTING REQUIRMENTS

## 7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix L. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 4-1 and summarized in the Periodic Review Report.

## 7.2 Periodic Review Report

A Periodic Review Report will be submitted to the Department by IBM every third year, as approved in a letter dated April 14, 2011 from the NYSDEC (Appendix F). In order for IBM to comply with the Periodic Review Reporting requirement, the Owner must provide IBM with all documentation related to his activities at the Site, required for inclusion into the report. In the event that the Site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the Site described in the metes and bounds included in the Environmental Easement (Appendix B). The report will be prepared in accordance with NYSDEC DER-10 and submitted within 90 days of the end of each certification period. Summaries of media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site;
- Results of the required annual site inspections and severe condition inspections, if applicable;
- A summary of any discharge monitoring data and/or information generated during the reporting period with comments and conclusions;

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends;
- Results of all analyses and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format, if required;
- A site evaluation, which includes the following:
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; and
  - The overall performance and effectiveness of the remedy.
- A performance summary for all treatment systems at the Site during the calendar year, including information such as:
    - The number of days the system was run for the reporting period;
    - The average, high, and low flows per day;
    - The contaminant mass removed;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;
  - A description of the resolution of performance problems;
  - A summary of the performance, effluent and/or effectiveness monitoring; and
  - Comments, conclusions, and recommendations based on data evaluation.

The Periodic Review Report will be submitted by IBM, in hard-copy format, to the NYSDEC Central Office and in electronic format (CD) to NYSDEC Central Office and the NYSDOH Bureau of Environmental Exposure Investigation.

### 7.2.1 Certification of Institutional and Engineering Controls

#### 7.2.1.1 – IBM Certification

After the last inspection of the reporting period, IBM shall have a Professional Engineer licensed to practice in New York State prepare the following certification:

For each engineering control identified for the Site, I certify that all of the following statements are true:

- The inspection of the Site to confirm the effectiveness of the engineering controls required by the remedial program was performed under my direction;
- The engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;
- If a financial assurance mechanism is required under the oversight document for the Site, the mechanism remains valid and sufficient for the intended purpose under the document;
- The engineering control systems, relevant to the groundwater pump and treatment system, are performing as designed and are effective;
- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program and generally accepted engineering practices; and
- The information presented in this report is accurate and complete.
- That all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, or my delegated successor, am certifying as Remedial Party for the Site.

The signed certification will be included in the Periodic Review Report described above.

7.2.1.2 – Owner's Certification

After the last inspection of the reporting period, the Owner shall have a qualified environmental professional or a Professional Engineer licensed to practice in New York State, prepare the following certification:

For each institutional or engineering control identified for the Site, I certify that all of the following statements are true:

- The inspection of the Site to confirm the effectiveness of the institutional and engineering controls, relevant to the cover system, required by the remedial program was performed under my direction;
- The institutional control and/or engineering control, relevant to the cover system, employed at this site is unchanged from the date the control was put in place, or last approved by the Department;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;
- Access to the Site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;
- Use of the site is compliant with the environmental easement;
- The engineering control, relevant to the cover system, is performing as anticipated and is effective;
- The information presented in this report is accurate and complete.
- I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Representative] for the Site.

The signed certification shall be submitted by the property owner to IBM for inclusion into the Periodic Review Report.

## 7.3 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 institutional or engineering control, a corrective measures plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the corrective measures plan until it is approved by the NYSDEC.

## 7.4 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the Department for approval. The RSO report will document the research/investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# SITE MANAGEMENT PLAN
# FOR THE FORMER IBM B952/982 SITE

## SECTION 8.0
## REFERENCES

## 8.0 REFERENCES

6 NYCRR Part 375, *Environmental Remediation Programs.* December 14, 2006.

Contestoga-Rovers & Associates Limited, May 1985. *Remedial Action Project Soil and Sampling and Analysis Buildings 952 and 982 (Volume 1)*.

Contestoga-Rovers & Associates Limited, September 1985. *Remedial Action Plan Construction Implementation Buildings 952 and 982 (Volume 2)*.

Lawler, Matusky, and Skelly, Engineers, August 1982. *Interim Report on Building 952/982.*

Lawler, Matusky, and Skelly, Engineers, March 1983. *Final Report: Hydrogeology and Chemistry of Building 952 Area.*

Conestoga-Rovers & Associates Limited, April 1984. *Soil Sampling & Analysis Buildings 952 and 982.*

Groundwater Sciences Corporation, March 1993. *IBM B952/982 Site Reclassification Petition, Volumes 1 & 2.*

Groundwater Sciences Corporation, February 1994. *Operation and Maintenance Manual: Groundwater Remediation System, Building 952/982*.

Groundwater Sciences Corporation, March 2014. *2012-2013 Groundwater Monitoring Report Neptune Commerce Center*.

Henningson, Durham & Richardson Architecture & Engineering, P.C., December 2011, Revised February 2012. *B952 Excavation Work Plan*.

Henningson, Durham & Richardson Architecture & Engineering, P.C., January 2017. *B952 Excavation Work Plan Summary Report*.

Milton Chazen Associates, May 1986. *Groundwater Quality Data Report 1984-1985, Building 952 Site.*

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

NYSDEC, November 1992. *Technical Administrative Guidance Memorandum 3028, Contained-In Criteria*.

NYSDEC, November 2009. CP-43: *Groundwater Monitoring Well Decommissioning Policy*.

NYSDEC, May 2010. *DER-10 – Technical Guidance for Site Investigation and Remediation*.

NYSDEC, October 2010. CP-51: *Soil Cleanup Guidance*.

Sanborn, Head Engineering, P.C., September 2013. *Subslab Depressurization System (SSDS) Design/Installation Work Plan.*

Sanborn, Head Engineering, P.C., February 2014. *Subslab Depressurization System Start-Up and Performance Testing Report.*

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX A
# ORDER ON CONSENT INDEX #A3-0655-12-10

**New York State Department of Environmental Conservation**
**Office of General Counsel, 14th Floor**
625 Broadway, Albany, New York 12233-1500
**Fax:** (518) 402-9018 or (518) 402-9019
**Website:** www.dec.ny.gov

Joe Martens
Commissioner

May 19, 2011

Michael Domitrovits,
International Business Machines Corp.
2455 South Road - P536
Poughkeepsie, NY 12601

Re: IBM – Neptune Road Site
Site #314076 Order on Consent

Dear Mr. Domitrovits:

Enclosed please find a fully executed version of the above-referenced Order on Consent bearing Dale Desnoyers' original signature.

If you have any questions in this matter, please contact Dena Putnick at (518) 402-9512.

Thank you.

Sincerely yours,

Elissa Armater

Elissa Armater
Legal Assistant

Enclosure

Cc: Steve Brannen (w/enclosure)
International Business Machines Corp.
2455 South Road, Mail drop P536
Poughkeepsie, NY 12601-5400

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

In the Matter of the
Development and Implementation
of a Remedial Program for an
Inactive Hazardous Waste Disposal
Site under Article 27, Title 13
of the Environmental Conservation Law
by

International Business Machines, Corporation,

Respondent.

**ORDER ON CONSENT**
**and**
**ADMINISTRATIVE**
**SETTLEMENT**

Index # A3-0655-12-10

Site # 314076

**WHEREAS,**

1. A. The New York State Department of Environmental Conservation ("Department") is responsible for inactive hazardous waste disposal site remedial programs pursuant to Article 27, Title 13 of the Environmental Conservation Law ("ECL") and Part 375 of Title 6 of the Official Compilation of Codes, Rules and Regulations ("6 NYCRR") and may issue orders consistent with the authority granted to the Commissioner by such statute.

B. The Department is responsible for carrying out the policy of the State of New York to conserve, improve and protect its natural resources and environment and control water, land, and air pollution consistent with the authority granted to the Department and the Commissioner by Article 1, Title 3 of the ECL.

C. This Order is issued pursuant to the Department's authority under, inter alia, ECL Article 27, Title 13 and ECL 3-0301, and resolves Respondent's liability to the State as provided at 6 NYCRR 375-1.5(b)(5).

2. International Business Machines, Corporation ("IBM" or "Respondent") is a company existing under the laws of the State of New York. IBM leased the Site is located at Neptune Road, Poughkeepsie, Dutchess County, State of New York (hereinafter the "Site") from the 1950's until 1993 and IBM manufactured printed circuits and stored halogenated solvents on the Site. Exhibit "A" is a map of the Site showing its general location.

3. The Site is currently listed in the *Registry of Inactive Hazardous Waste Disposal Sites in New York State* as Site Number 314076 with a Classification of 04 pursuant to ECL 27-1305.

4. Neptune Capital Investors, LLC acquired the Site from South Road Associates in 2005. Currently, the Site is owned by Neptune Capital Investors, LLC (hereinafter the "Owner").

5. Prior to 1981 IBM disposed of certain hazardous and industrial wastes at the Site. IBM primarily used the Site for manufacturing, parts cleaning and for mainframe computer and ancillary equipment parts salvage. The hazardous and industrial wastes that were disposed included, but were not necessarily limited to, tetrachloroethylene, trichloroethene, methylene chloride, trichloroethylene, dichlorobenzes and other organic chemicals and solvents.

6. From approximately 1981 through 1993 IBM undertook remedial investigations and remedial actions on their own accord, without a consent order, but with the Department's oversight. Based on IBM's remedial actions the Department reclassified the Site from a class 2a site to a class 4 site in 1993. Continuous management and operation and maintenance plans (O&M plan) have continued at the Site since 1993.

7. A remedial investigation and remedial design was implemented and completed in 1984 under the supervision of a NYSDEC on-site monitor. In 1995 the United States Environmental Protection Agency issued a Final Screening Site Inspection and determined that no further remedial action was required.

8. An O& M Plan, dated February 24, 1994, outlines the groundwater collection and treatment system that was installed in 1993 at the Site. That O&M Plan has been updated and approved several times since its implementation, including the most recent updated approved by NYSDEC on Arpil 24, 2004.

9. In 2008 the Site was identified as a soil vapor legacy site by the New York State Department of Health. The Owner of the Site conducted an investigation, to which it was determined that mitigation of the Site is necessary when the Site is redeveloped.

10. The Department and the Respondent acknowledge that the goal of this Order shall be to develop, update and implement a Site Management Plan (SMP) for the Site as the final stage of the remedial program. This will entail implementing the legacy review, updating the SMP to today's standards, implementing an institutional control, implementing site management and any other actions that are necessary to protect public health and the environment.

11. The current Department approved SMP is hereby superseded by this Order. Activities taken by Respondents at the Site will be subject to the terms and provisions of this Order and will be taken pursuant to an updated Department approved SMP to be developed under and in accordance with the terms of this Order.

12. The Department, by executing this Order, in no way waives its rights, authority or obligations to require the Respondent, or any other responsible party, to perform additional investigations and remediation.

13. The Respondent, by executing this Order, in no way waives its right to contest matters not specifically conceded in this Order, or with respect to any subsequent Order or Orders regarding the Site.

14. Respondent consents to the issuance of this Order without (i) an admission or finding of liability, fault, wrongdoing, or violation of any law, regulation, permit, order, requirement, or standard of care of any kind whatsoever; (ii) an acknowledgment that there has been a release or threatened release of hazardous waste at or from the Site; and/or (iii) an acknowledgment that a release or threatened release of hazardous waste at or from the Site constitutes a significant threat to the public health or environment.

15. Solely with regard to the matters set forth below, Respondent hereby waives any right to a hearing as may be provided by law, consents to the issuance and entry of this Order, and agrees to be bound by its terms. Respondent consents to and agrees not to contest the authority or jurisdiction of the Department to issue or enforce this Order, and agrees not to contest the validity of this Order or its terms or the validity of data submitted to the Department by Respondent pursuant to this Order.

**NOW,** having considered this matter and being duly advised, **IT IS ORDERED THAT:**

I. Initial Submittals

A. Not Applicable. As discussed above, Respondent has previously undertaken substantial work at and in the vicinity of the Site. Respondent's initial submittals are summarized in Exhibit "B".

II. Development, Performance, and Reporting of Work Plans

A. Work Plans

All activities at the Site that comprise any element of an Inactive Hazardous Waste Disposal Site Remedial Program shall be conducted pursuant to one or more Department-approved work plans ("Work Plan" or "Work Plans") and this Order and all activities shall be consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, as required under CERCLA, 42 U.S.C. § 9600 et seq. The Work Plan(s) under this Order shall address both on-Site and off-Site conditions and shall be developed and implemented in accordance with 6 NYCRR § 375-1.6(a). All Department-approved Work Plans shall be incorporated into and become enforceable parts of this Order. Upon approval of a Work Plan by the Department, Respondent shall implement such Work Plan in accordance with the schedule contained therein. Nothing in this Subparagraph shall mandate that any particular Work Plan be submitted.

Each Work Plan submitted shall use one of the following captions on the cover page:

1. Site Characterization ("SC") Work Plan: a Work Plan whose objective is to identify the presence of any hazardous waste disposal at the Site;

2. Remedial Investigation/Feasibility Study ("RI/FS") Work Plan: a Work Plan whose objective is to perform a Remedial Investigation and a Feasibility Study;

3. Interim Remedial Measure ("IRM") Work Plan: a Work Plan whose objective is to provide for an Interim Remedial Measure;

4. Remedial Design/Remedial Action ("RD/RA") Work Plan: a Work Plan whose objective is to provide for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in the ROD; or

5. Site Management Plan: a Work Plan whose objective is to identify and implement the institutional and engineering controls required for the Site, as well as any necessary monitoring and/or operation and maintenance of the remedy.

B. Submission/Implementation of Work Plans

1. (a) An updated Site Management Plan ("SMP") shall be submitted to the Department within sixty (60) Days after the effective date of this Order.

(b) The Department may request that Respondent submit additional or supplemental Work Plans for the Site. Within thirty (30) Days after the Department's written request, Respondent shall advise the Department in writing whether it will submit and implement the requested additional or supplemental Work Plan or whether it elects to terminate this Order pursuant to Paragraph XIII. If Respondent elects to submit and implement such Work Plan, Respondent shall submit the requested Work Plan within sixty (60) Days after such election. If Respondent elects to terminate this Order or fails to make a timely election, this Order shall terminate pursuant to Paragraph XIII.

(c) Respondent may opt to propose one or more additional or supplemental Work Plans (including one or more IRM Work Plans) at any time, which the Department shall review for appropriateness and technical sufficiency.

(d) Any request made by the Department under Subparagraph II.B.1.(b) shall be subject to dispute resolution pursuant to Paragraph XII.

2. A Professional Engineer must stamp and sign all Work Plans other than SC or RI/FS Work Plans.

3. During all field activities conducted under this Order, Respondent shall have on-Site a representative who is qualified to supervise the activities undertaken. Such representative may be an employee or a consultant retained by Respondent to perform such supervision as set forth in 6 NYCRR Part 375-1.6(a)(3).

C. Modifications to Work Plans

The Department shall notify Respondent in writing if the Department determines that any element of a Department-approved Work Plan needs to be modified in order to achieve the objectives of the Work Plan as set forth in Subparagraph II.A or to ensure that the Remedial Program otherwise protects human health and the environment. Upon receipt of such notification, Respondent shall, subject to Respondent's right to terminate pursuant to Paragraph XIII, provide written notification as provided at 6 NYCRR 375-1.6(d)(3) as to whether it will modify the Work Plan, or invoke dispute resolution

D. Submission of Final Reports and Annual Reports

This Site requires site management; therefore the Respondent shall submit an annual report by the March 31 for the previous calendar year. Such annual report shall be signed by a Professional Engineer or by such other qualified environmental professional as the Department may find acceptable and shall contain a certification as provided at 6 NYCRR 375-1.8(h)(3). Respondent may petition the Department for a determination that the institutional and/or engineering controls may be terminated. Such petition must be supported by a statement by a Professional Engineer that such controls are no longer necessary for the protection of public health and the environment. The Department shall not unreasonably withhold its approval of such petition.

E. Review of Submittals other than Progress Reports and Health and Safety Plans

1. The Department shall make a good faith effort to review and respond in writing to each submittal Respondent makes pursuant to this Order within sixty (60) Days. The Department's response shall include an approval or disapproval of the submittal, in whole or in part. All Department-approved submittals shall be incorporated into and become an enforceable part of this Order.

2. If the Department disapproves a submittal, it shall specify the reasons for its disapproval. Within fifteen (15) Days after the date of the Department's written notice that Respondent's submittal has been disapproved, Respondent shall notify the Department of its election as provided at 6 NYCRR 375-1.6(d)(4). If Respondent elects to modify the submittal, Respondent shall, within thirty (30) Days after such election, make a revised submittal that addresses all of the Department's stated reasons for disapproving the first submittal. In the event that Respondent's revised submittal is disapproved, the Department shall set forth its reasons for such disapproval in writing and Respondent shall be in violation of this Order unless it invokes dispute resolution pursuant to Paragraph XII and its position prevails. Failure to make an election or failure to comply with the election is a violation of this Order.

G. Release and Covenant Not to Sue

Upon the Department's issuance of a Certificate of Completion as provided at 6 NYCRR 375-1.9 and 375-2.9, Respondent shall obtain the benefits conferred by such provisions, subject to the terms and conditions described therein.

III. Progress Reports

Not applicable

IV. Penalties

A. 1. Respondent's failure to comply with any term of this Order constitutes a violation of this Order, the ECL, and 6 NYCRR 375-2.11(a)(4). Nothing herein abridges Respondent's right to contest any allegation that it has failed to comply with this Order.

2. Payment of any penalties shall not in any way alter Respondent's obligations under this Order.

B. 1. Respondent shall not suffer any penalty or be subject to any proceeding or action in the event it cannot comply with any requirement of this Order as a result of any Force Majeure Event as provided at 6 NYCRR 375-1.5(b)(4). Respondent must use best efforts to anticipate the potential Force Majeure Event, best efforts to address any such event as it is occurring, and best efforts following the Force Majeure Event to minimize delay to the greatest extent possible. "Force Majeure" does not include Respondent's economic inability to comply with any obligation, the failure of Respondent to make complete and timely application for any required approval or permit, and non-attainment of the goals, standards, and requirements of this Order.

2. Respondent shall notify the Department in writing within five (5) Days of the onset of any Force Majeure Event. Failure to give such notice within such five (5) Day period constitutes a waiver of any claim that a delay is not subject to penalties. Respondent shall be deemed to know of any circumstance which it, any entity controlled by it, or its contractors knew or should have known.

3. Respondent shall have the burden of proving by a preponderance of the evidence that (i) the delay or anticipated delay has been or will be caused by a Force Majeure Event; (ii) the duration of the delay or the extension sought is warranted under the circumstances; (iii) best efforts were exercised to avoid and mitigate the effects of the delay; and (iv) Respondent complied with the requirements of Subparagraph IV.B.2 regarding timely notification.

4. If the Department agrees that the delay or anticipated delay is attributable to a Force Majeure Event, the time for performance of the obligations that are affected by the Force

Majeure Event shall be extended for a period of time equivalent to the time lost because of the Force Majeure event, in accordance with 375-1.5(4).

5. If the Department rejects Respondent's assertion that an event provides a defense to non-compliance with this Order pursuant to Subparagraph IV.B, Respondent shall be in violation of this Order unless it invokes dispute resolution pursuant to Paragraph XII and Respondent's position prevails.

V. Entry upon Site

A. Respondent hereby consents, upon reasonable notice under the circumstances presented, to entry upon the Site (or areas in the vicinity of the Site which may be under the control of Respondent) by any duly designated officer or employee of the Department or any State agency having jurisdiction with respect to matters addressed pursuant to this Order, and by any agent, consultant, contractor, or other person so authorized by the Commissioner, all of whom shall abide by the health and safety rules in effect for the Site, for inspecting, sampling, copying records related to the contamination at the Site, testing, and any other activities necessary to ensure Respondent's compliance with this Order. Upon request, Respondent shall (i) provide the Department with suitable work space at the Site, including access to a telephone, to the extent available, and (ii) permit the Department full access to all non-privileged records relating to matters addressed by this Order. Raw data is not considered privileged and that portion of any privileged document containing raw data must be provided to the Department. In the event Respondent is unable to obtain any authorization from third-party property owners necessary to perform its obligations under this Order, the Department may, consistent with its legal authority, assist in obtaining such authorizations.

B. The Department shall have the right to take its own samples and scientific measurements and the Department and Respondent shall each have the right to obtain split samples, duplicate samples, or both, of all substances and materials sampled. The Department shall make the results of any such sampling and scientific measurements available to Respondent.

VI. Payment of State Costs

A. Within forty-five (45) days of the effective date of this Order, Respondent shall pay to the Department $10,000. This sum of money shall represent reimbursement for past State Costs as provided at 6 NYCRR 375-1.5(b)(3) and shall be accepted as settlement to all previous past costs associated with this Site.

B. Within forty-five (45) Days after receipt of an itemized invoice from the Department, Respondent shall pay to the Department a sum of money which shall represent reimbursement for State Costs, other than those identified in Subparagraph VI.A, for work performed at or in connection with the Site through and including the Termination Date, as provided at 6 NYCRR 375-1.5(b)(3).

C. Costs shall be documented as provided by 6 NYCRR 375-1.5(b)(3)(ii). The Department shall not be required to provide any other documentation of costs, provided however, that the Department's records shall be available consistent with, and in accordance with, Article 6 of the Public Officers Law.

D. Such invoice shall be sent to Respondent at the following address:

Michael Domitrovits
International Business Machines Corp.
2455 South Road- P536
Poughkeepsie, New York 12601
domitrov@us.ibm.com

E. Each such payment shall be made payable to the New York State Department of Environmental Conservation and shall be sent to:

**Bureau of Program Management**
**Division of Environmental Remediation**
**New York State Department of Environmental Conservation**
**625 Broadway**
**Albany, New York 12233-7012**
**Attn: Bureau Director**

F. Each party shall provide written notification to the other within ninety (90) Days of any change in the foregoing addresses.

G. Respondent may contest invoiced costs as provided at 6 NYCRR 375-1.5(b)(3)(v) and (vi).

VII. Reservation of Rights

A. Except as provided at 6 NYCRR 375-1.9 and 375-2.9, nothing contained in this Order shall be construed as barring, diminishing, adjudicating, or in any way affecting any of the Department's rights or authorities, including, but not limited to, the right to require performance of further investigations and/or response action(s), to recover natural resource damages, and/or to exercise any summary abatement powers with respect to any person, including Respondent.

B. Except as otherwise provided in this Order, Respondent specifically reserves all rights and defenses under applicable law respecting any Departmental assertion of remedial liability and/or natural resource damages against Respondent, and further reserves all rights respecting the enforcement of this Order, including the rights to notice, to be heard, to appeal, and to any other due

process. The existence of this Order or Respondent's compliance with it shall not be construed as an admission of liability, fault, wrongdoing, or breach of standard of care by Respondent, and shall not give rise to any presumption of law or finding of fact, or create any rights, or grant any cause of action, which shall inure to the benefit of any third party. Further, Respondent reserves such rights as it may have to seek and obtain contribution, indemnification, and/or any other form of recovery from its insurers and from other potentially responsible parties or their insurers for past or future response and/or cleanup costs or such other costs or damages arising from the contamination at the Site as may be provided by law, including but not limited to rights of contribution under section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B).

VIII. Indemnification

Respondent shall indemnify and hold the Department, the State of New York, the Trustee of the State's natural resources, and their representatives and employees harmless as provided by 6 NYCRR 375-2.5(a)(3)(i).

IX. Public Notice

A. Within thirty (30) Days after the effective date of this Order, Respondent shall provide notice as required by 6 NYCRR 375-1.5(a). Within sixty (60) Days of such filing, Respondent shall provide the Department with a copy of such instrument certified by the recording officer to be a true and faithful copy.

B. If Respondent proposes to transfer by sale or lease the whole or any part of Respondent's interest in the Site, or becomes aware of such transfer, Respondent shall, not fewer than forty-five (45) Days before the date of transfer, or within forty-five (45) Days after becoming aware of such conveyance, notify the Department in writing of the identity of the transferee and of the nature and proposed or actual date of the conveyance, and shall notify the transferee in writing, with a copy to the Department, of the applicability of this Order. However, such obligation shall not extend to a conveyance by means of a corporate reorganization or merger or the granting of any rights under any mortgage, deed, trust, assignment, judgment, lien, pledge, security agreement, lease, or any other right accruing to a person not affiliated with Respondent to secure the repayment of money or the performance of a duty or obligation.

X. Environmental Easement

A. If a Department-approved final engineering report of Site Management Work Plan for the Site relies upon one or more institutional and/or engineering controls, Respondent (or the Owner of the Site) shall submit to the Department for approval an Environmental Easement to run with the land in favor of the State which complies with the requirements of ECL Article 71, Title 36, and 6 NYCRR 375-1.8(h)(2). Upon acceptance of Environmental Easement by the State, Respondent shall comply with the requirements of 6 NYCRR 375-1.8(h)(2).

B. If the ROD or Site Management Work Plan provide for no action other than implementation of one or more institutional controls, Respondent shall cause an environmental easement to be recorded under the provisions of Subparagraph X.A. If Respondent does not cause such environmental easement to be recorded in accordance with 6 NYCRR 375-1.8(h)(2), Respondent will not be entitled to the benefits conferred by 6 NYCRR 375-1.9 and 375-2.9.

XI. Communications

A. All written communications required by this Order shall be transmitted by United States Postal Service, by private courier service, or hand delivered as follows:

1. Communication from Respondent shall be sent to:

**Michael J. Ryan, P.E.**
**Director, Remedial Bureau C**
**NYS Department of Environmental Conservation**
**Division of Environmental Remediation**
**625 Broadway**
**Albany, NY 12233**

With copies to:

**Department of Environmental Conservation**
**Region 3**
**21 South Putt Corners Road**
**New Paltz, NY 12561-1696**
**Attn: Division of Environmental Remediation**
**Regional Hazardous Waste Engineer**

Note: two hard copies (one unbound) of work plans are required, as well as one electronic copy.

**Michael J. Ryan, P.E.**
**Director, Remedial Bureau C**
**NYS Department of Environmental Conservation**
**Division of Environmental Remediation**
**625 Broadway**
**Albany, NY 12233**

with copies to:

**Steven Bates**
**Bureau of Environmental Exposure Investigation**
**New York State Department of Health**
**Flanigan Square**
**547 River Street**
**Troy, New York 12180-2216**
**smb02@health.state.ny.us**

**Dena Putnick, Esq. (correspondence only)**
**New York State Department of Environmental Conservation**
**Office of General Counsel**
**625 Broadway, 14th Floor**
**Albany, New York 12233-1500**
**dnputnic@gw.dec.state.ny.us**

2. Communication to be made from the Department shall be sent to:

Michael Domitrovits
International Business Machines Corp.
2455 South Road- P536
Poughkeepsie, New York 12601
domitrov@us.ibm.com

B. The Department and Respondent reserve the right to designate additional or different addressees for communication upon written notice to the other.

C. Each party shall notify the other within ninety (90) Days after any change in the addresses in this Paragraph XI or in Paragraph VI.

XII. Dispute Resolution

In the event disputes arise under this Order, Respondent may, within fifteen (15) Days after Respondent knew or should have known of the facts which are the basis of the dispute, initiate dispute resolution in accordance with the provisions of 6 NYCRR 375-1.5(b)(2). Nothing contained in this Order shall be construed to authorize Respondent to invoke dispute resolution with respect to the remedy selected by the Department in the ROD or any element of such remedy, nor to impair any right of Respondent to seek judicial review of the Department's selection of any remedy.

XIII. Termination of Order

A. This Order will terminate upon the earlier of the following events:

1. Not applicable to this Order requiring Site management of the Site; or

2. The Department's written determination that Respondent has completed all phases of the Remedial Program (including Site Management), in which event the termination shall be effective on the 5th Day after the date of the Department's approval of the final report relating to the final phase of the Remedial Program.

B. Notwithstanding the foregoing, the provisions contained in Paragraphs VI and VIII shall survive the termination of this Order and any violation of such surviving Paragraphs shall be a violation of this Order, the ECL, and 6 NYCRR 375-2.11(a)(4), subjecting Respondent to penalties as provided under Paragraph IV so long as such obligations accrued on or prior to the Termination Date.

C. If the Order is terminated pursuant to Subparagraph XIII.A.1, neither this Order nor its termination shall affect any liability of Respondent for remediation of the Site and/or for payment of State Costs, including implementation of removal and remedial actions, interest, enforcement, and any and all other response costs as defined under CERCLA, nor shall it affect any defenses to such liability that may be asserted by Respondent. Respondent shall also ensure that it does not leave the Site in a condition, from the perspective of human health and environmental protection, worse than that which existed before any activities under this Order were commenced. Further, the Department's efforts in obtaining and overseeing compliance with this Order shall constitute reasonable efforts under law to obtain a voluntary commitment from Respondent for any further activities to be undertaken as part of a Remedial Program for the Site.

XIV. Miscellaneous

A. Respondent agrees to comply with and be bound by the provisions of 6 NYCRR Subparts 375-1 and 375-2; the provisions of such Subparts that are referenced herein are referenced for clarity and convenience only and the failure of this Order to specifically reference any particular regulatory provision is not intended to imply that such provision is not applicable to activities performed under this Order.

B. The Department may exempt Respondent from the requirement to obtain any state or local permit or other authorization for any activity conducted pursuant to this Order in accordance with 6 NYCRR 375-1.12(b), (c), and (d).

C. 1. Respondent shall use best efforts to obtain all Site access, permits, easements, approvals, institutional controls, and/or authorizations necessary to perform Respondent's obligations under this Order, including all Department-approved Work Plans and the schedules contained therein. If, despite Respondent's best efforts, any access, permits, easements, approvals, institutional controls, or authorizations cannot be obtained, Respondent shall promptly notify the Department and include a summary of the steps taken. The Department may, as it deems appropriate and within its authority, assist Respondent in obtaining same.

2. If an interest in property is needed to implement an institutional control required by a Work Plan and such interest cannot be obtained, the Department may require Respondent to modify the Work Plan pursuant to 6 NYCRR 375-1.6(d)(3) to reflect changes necessitated by Respondent's inability to obtain such interest.

D. The paragraph headings set forth in this Order are included for convenience of reference only and shall be disregarded in the construction and interpretation of any provisions of this Order.

E. 1. The terms of this Order shall constitute the complete and entire agreement between the Department and Respondent concerning the implementation of the activities required by this Order. No term, condition, understanding, or agreement purporting to modify or vary any term of this Order shall be binding unless made in writing and subscribed by the party to be bound. No informal advice, guidance, suggestion, or comment by the Department shall be construed as relieving Respondent of Respondent's obligation to obtain such formal approvals as may be required by this Order. In the event of a conflict between the terms of this Order and any Work Plan submitted pursuant to this Order, the terms of this Order shall control over the terms of the Work Plan(s). Respondent consents to and agrees not to contest the authority and jurisdiction of the Department to enter into or enforce this Order.

2. i. Except as set forth herein, if Respondent desires that any provision of this Order be changed, Respondent shall make timely written application to the Commissioner with copies to the parties listed in Subparagraph XI.A.1.

ii. If Respondent seeks to modify an approved Work Plan, a written request shall be made to the Department's project manager, with copies to the parties listed in Subparagraph XI.A.1.

iii. Requests for a change to a time frame set forth in this Order shall be made in writing to the Department's project attorney and project manager; such requests shall not be unreasonably denied and a written response to such requests shall be sent to Respondent promptly.

F. 1. If there are multiple parties signing this Order, the term "Respondent" shall be read in the plural, the obligations of each such party under this Order are joint and several, and the insolvency of or failure by any Respondent to implement any obligations under this Order shall not affect the obligations of the remaining Respondent(s) under this Order.

2. If Respondent is a partnership, the obligations of all general partners (including limited partners who act as general partners) under this Order are joint and several and the insolvency or failure of any general partner to implement any obligations under this Order shall not affect the obligations of the remaining partner(s) under this Order.

3. Notwithstanding the foregoing Subparagraphs XIV.F.1 and 2, if multiple parties sign this Order as Respondents but not all of the signing parties elect to implement a Work Plan, all Respondents are jointly and severally liable for each and every obligation under this Order through the completion of activities in such Work Plan that all such parties consented to; thereafter, only those Respondents electing to perform additional work shall be jointly and severally liable under this Order for the obligations and activities under such additional Work Plan(s). The parties

electing not to implement the additional Work Plan(s) shall have no obligations under this Order relative to the activities set forth in such Work Plan(s). Further, only those Respondents electing to implement such additional Work Plan(s) shall be eligible to receive the Liability Limitation referenced in Paragraph II.G..

G. Respondent shall be entitled to receive contribution protection and/or to seek contribution to the extent authorized by ECL 27-1421(6) and 6 NYCRR 375-1.5(b)(5).

H. Unless otherwise expressly provided herein, terms used in this Order which are defined in ECL Article 27 or in regulations promulgated thereunder shall have the meaning assigned to them under said statute or regulations.

I. Respondent's obligations under this Order represent payment for or reimbursement of response costs, and shall not be deemed to constitute any type of fine or penalty.

J. Respondent and Respondent's successors and assigns shall be bound by this Order. Any change in ownership or corporate status of Respondent shall in no way alter Respondent's responsibilities under this Order.

K. This Order may be executed for the convenience of the parties hereto, individually or in combination, in one or more counterparts, each of which shall be deemed to have the status of an executed original and all of which shall together constitute one and the same.

L. The effective date of this Order is the 10th Day after it is signed by the Commissioner or the Commissioner's designee.

DATED:

MAY 18 2011

JOE MARTENS
COMMISSIONER
NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

By: _____

Dale A. Desnoyers, Director
Division of Environmental Remediation

CONSENT BY RESPONDENT

Respondent hereby consents to the issuing and entering of this Order, waives Respondent's right to a hearing herein as provided by law, and agrees to be bound by this Order.

**International Business Machines, Corporation**

By: Michael A. Desens

Title: Senior Location Executive

Date: 5/10/2011

STATE OF NEW YORK )
) ss:
COUNTY OF Dutchess )

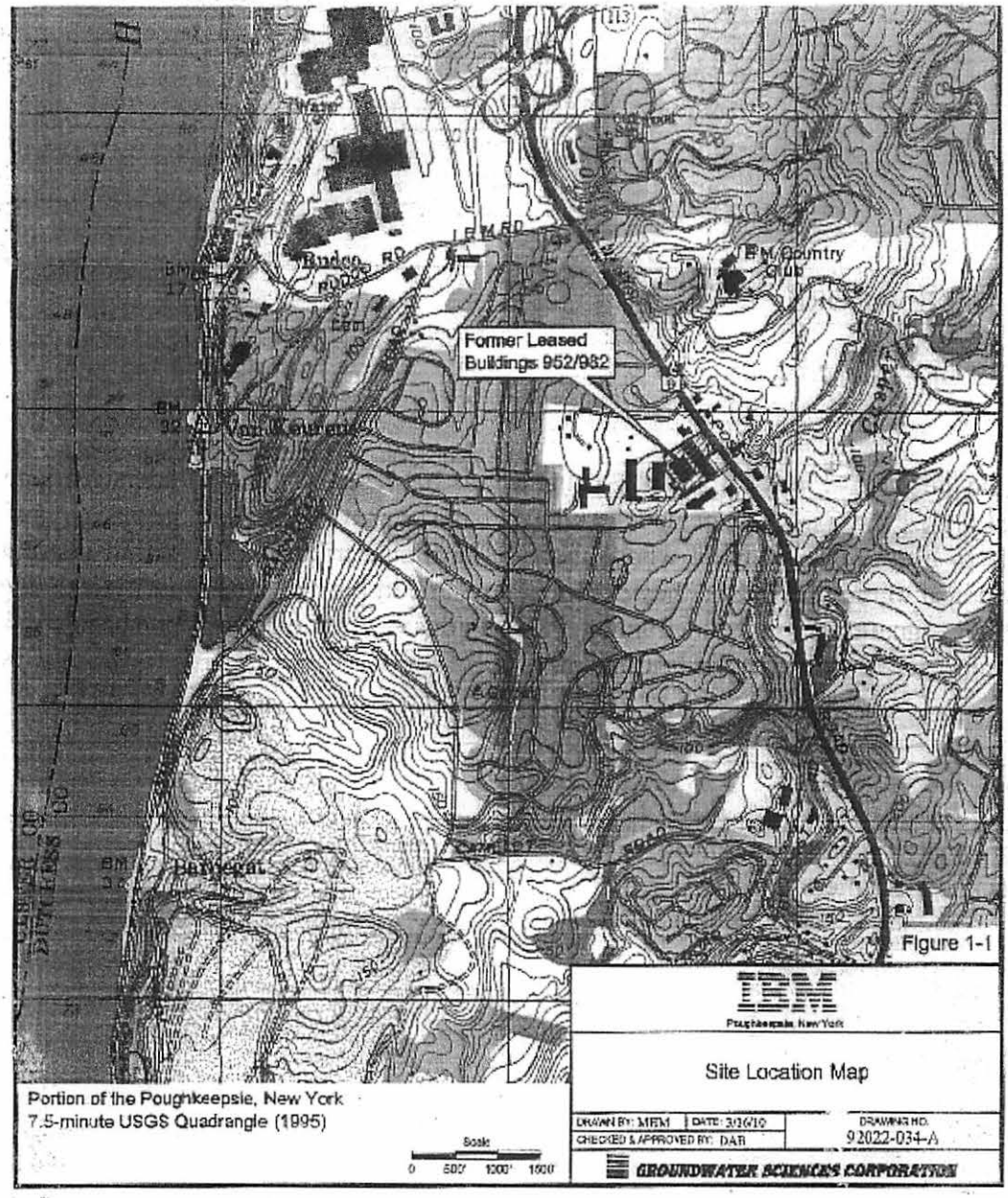
On the 10th day of May, in the year ~~2010~~ 2011, before me, the undersigned, personally appeared Michael A. Desens, personally known to me or proved to me on the basis of satisfactory evidence to be the individual~~(s)~~ whose name is ~~(are)~~ subscribed to the within instrument and acknowledged to me that he~~/she/they~~ executed the same in his~~/her/their~~ capacity~~(ies)~~, and that by his~~/her/their~~ signature~~(s)~~ on the instrument, the individual~~(s)~~, or the person upon behalf of which the individual~~(s)~~ acted, executed the instrument.

Joanne L. Richardson
Signature and Office of individual
taking acknowledgment

JOANNE L. RICHARDSON
Notary Public, State of New York
Qualified in Dutchess County
Commission Expires 4/13/2015

EXHIBIT "A"

Map of Site



# EXHIBIT "B"

| IBM Poughkeepsie Correspondences/Reports Provided to NYSDEC Regarding Former Building 952/982 | | |
|---|---|---|
| REPORT CATALOG | REPORT DATE | Document Type |
| Hydrogeology and Chemistry of the Building 952 Area (Final Report) | 3/17/1983 | Report |
| Data Report for the 1982 Environmental Assessment Program | 5/1/1983 | Report |
| Data Report : Hydrogeology and Chemistry of the Building 952 Area | 2/20/1984 | Report |
| List of NYSDEC-submitted Reports for purpose of reclassification | 1/31/1991 | Correspondence |
| B952/982 Site Reclassification Petition, Vol. 1 | 3/8/1993 | Report |
| B952/982 Site Reclassification Petition, Vol. 2 | 3/8/1993 | Report |
| Petition to Reclassify the IBM B952/982 Site from a Class 2a to a Class 4 (Site Code: 314076) | 3/8/1993 | Correspondence |
| Supporting Certification Document for the B952/982 Site Reclassification Petition | 5/20/1993 | Correspondence |
| Excavation of Soils at IBM B952/982 Site | 7/30/1993 | Correspondence |
| Transmittal of Operations and Maintenance Plan and Groundwater Monitoring Data, First and Second Quarters 1993, IBM B952/982 Site, New York State Registry No. 314076 | 8/23/1993 | Correspondence |
| B952/982 Leased Property Reclassification | 10/1/1993 | Correspondence |
| Transmittal of Groundwater Data, IBM B952/982 | 10/22/1993 | Correspondence |
| Transmittal of Groundwater Data, IBM B952/982 | 10/25/1993 | Correspondence |
| Transmittal of Groundwater Data, IBM B952/982 | 10/27/1993 | Correspondence |
| Operation and Maintenance Manual, Groundwater Remediation System, Building 952/982 | 2/1/1994 | Report |
| Operation and Maintenance Plan for the Groundwater Collection and Treatment System, IBM Building 952 and Building 982 Leased Property | 2/24/1994 | Report |
| 1994 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/31/1995 | Report |
| 1995 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/22/1996 | Report |
| 1996 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/26/1997 | Report |
| 1997 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/30/1998 | Report |
| 1998 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/31/1999 | Report |
| Transmittal of Historical Groundwater Monitoring Data, Former Building 952/982 Site, Inactive Hazardous Waste Disposal Site 314076, | 2/1/2000 | Correspondence |
| 1999 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/31/2000 | Report |
| 2000 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/30/2001 | Report |
| Response to NYSDEC's Request to Consider Measures to Increase Rate of Mass Removal | 5/4/2001 | Correspondence |

| IBM Poughkeepsie Correspondences/Reports Provided to NYSDEC Regarding Former Building 952/982 | | |
|---|---|---|
| REPORT CATALOG | REPORT DATE | Document Type |
| 2001 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/29/2002 | Report |
| 2002 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/31/2003 | Report |
| 2003 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/31/2004 | Report |
| 2004 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/31/2005 | Report |
| 2005 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/30/2006 | Report |
| 2006 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/29/2007 | Report |
| 2007 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/28/2008 | Report |
| 2008 Annual Groundwater Monitoring Report for the Groundwater Collection and Treatment System, Former Building 952 and Building 982 Leased Property | 3/30/2009 | Report |
| Response to NYSDEC Correspondence dated September 17, 2009 – Site Management Periodic Review – Neptune Road, Site No. 314076 | 10/13/2009 | Correspondence |
| 2009 Periodic Review Report for the Former Building 952 and Building 982 Leased Property (Site ID: 314076) | 3/30/2010 | Report |

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX B
# ENVIRONMENTAL EASEMENT / METES AND BOUNDS SITE DESCRIPTION


SOUTH ROAD
US ROUTE 9
NORTHBOUND
SOUTHBOUND
NEPTUNE ROAD
LOT 1
1.96 acres
FILED MAP 5692A
Tax No.
6159-01-206622
L 22316 P 2295
LOT 2
FILED MAP 5692A
Tax No. 6159-01-184942
L 22005 P 3483
BUILDING
ff elev 153.85
BUILDING 982
LOT 3
FILED MAP 5692A
Tax No.
6159-01-176918
L 22005 P 3468
PARCEL 4
AREA= 2.65 AC.
EXISTING 1 STORY
BLOCK & METAL BUILDING
FF=140.85
ENVIRONMENTAL EASEMENT
POINT OF BEGINNING
ENVIRONMENTAL EASEMENT
POINT OF COMMENCEMENT
TOWER
SITE
LEASE
EASEMENT
PER FM 5892
Lands N/F Mulcahy
L 19959 P 988
filed map 10071
Lands Now or Formerly of
HARRIET KIRSCHENBAUM
DOC. #02-2007-4432
14-6159-01-123903
tie course
S25°18'58"E
131.77
S36°17'35"E
19.16'
S36°16'49"E
142.17'
S53°50'24"W
201.05'
S53°45'14"W
19.18'
S53°35'05"W
19.18'
S36°03'56"E
80.17'
N54°01'17"E
61.80'
S36°19'49"E
22.67'
N36°11'45"W
22.72'
N53°42'03"E
235.49'
N53°34'30"E
133.86'
N36°12'37"W
241.46'
N16°32'30"W
252.78'
S89°03'57"E
280.35'
S89°56'10"E
687.25'
N00°03'57"W
467.95'
S00°03'57"E
387.50'
S89°44'27"E
719.17'
N89°04'30"E
275.00'
S89°44'10"E
224.68'
N00°04'30"E
455.67'
S89°56'10"E
687.25'
Bldg 4
Bldg 5
Bldg 6
Bldg 7
Bldg 8
Bldg 9
Bldg 10
Bldg 11
Bldg 12
Bldg 13
Bldg 14
Bldg 15
Bldg 16
Bldg 17
Bldg 18
Bldg 19
Bldg 20
Bldg 21
Bldg 22
Bldg 23
Bldg

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX C
# LIST OF SITE CONTACTS

# APPENDIX C
# LIST OF SITE CONTACTS

Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions that apply to or impact the ongoing remedial action at the Site. A Health and Safety Plan, provided in Appendix J of this SMP, as well as in Attachment 5 of the O&M Plan for the Groundwater Pump and Treatment System, provides a discussion of the emergency procedures that should be followed for the incidents mentioned above.

**Emergency Telephone Numbers**

In the event of any environmentally related situation or unplanned occurrence associated with the ongoing remedial action requiring assistance, the Owner or Owner's representative(s) shall contact the appropriate party from the contact list in Table C-1 below. For emergencies associated with the ongoing remedial action, appropriate emergency response personnel should be contacted. Prompt contact should also be made to the IBM Program Manager if the emergency is directly related to the groundwater pump and treatment system or the subslab depressurization system in operation at the Site. These emergency contact lists must be maintained in an easily accessible location at the Site.

**Table C-1: Emergency Contact Numbers**

| | |
|---|---|
| Medical, Fire, and Police | 911 |
| One Call Center | (800) 272-4480<br>(3 day notice required for utility markout) |
| Poison Control Center | (800) 222-1222 |
| Pollution Toxic Chemical Oil Spills | (800) 424-8802 |
| NYSDEC Spills Hotline | (800) 457-7362 |

IBM shall be immediately notified of any on-site emergency, including all accidents and injuries to personnel, and incidents involving damage to the groundwater pump and treatment system or the subslab depressurization system, regardless of whether or not medical attention is required. Notifications of emergencies associated with the ongoing remedial action shall be made to IBM Emergency Control and the IBM Program Manager at the numbers listed in Table C-2.

**Table C-2: Contact Numbers**

| | |
|---|---|
| Steve Brannen, IBM Program Manager | (845) 433-1509 |
| IBM Emergency Control | (845) 433-3333 |

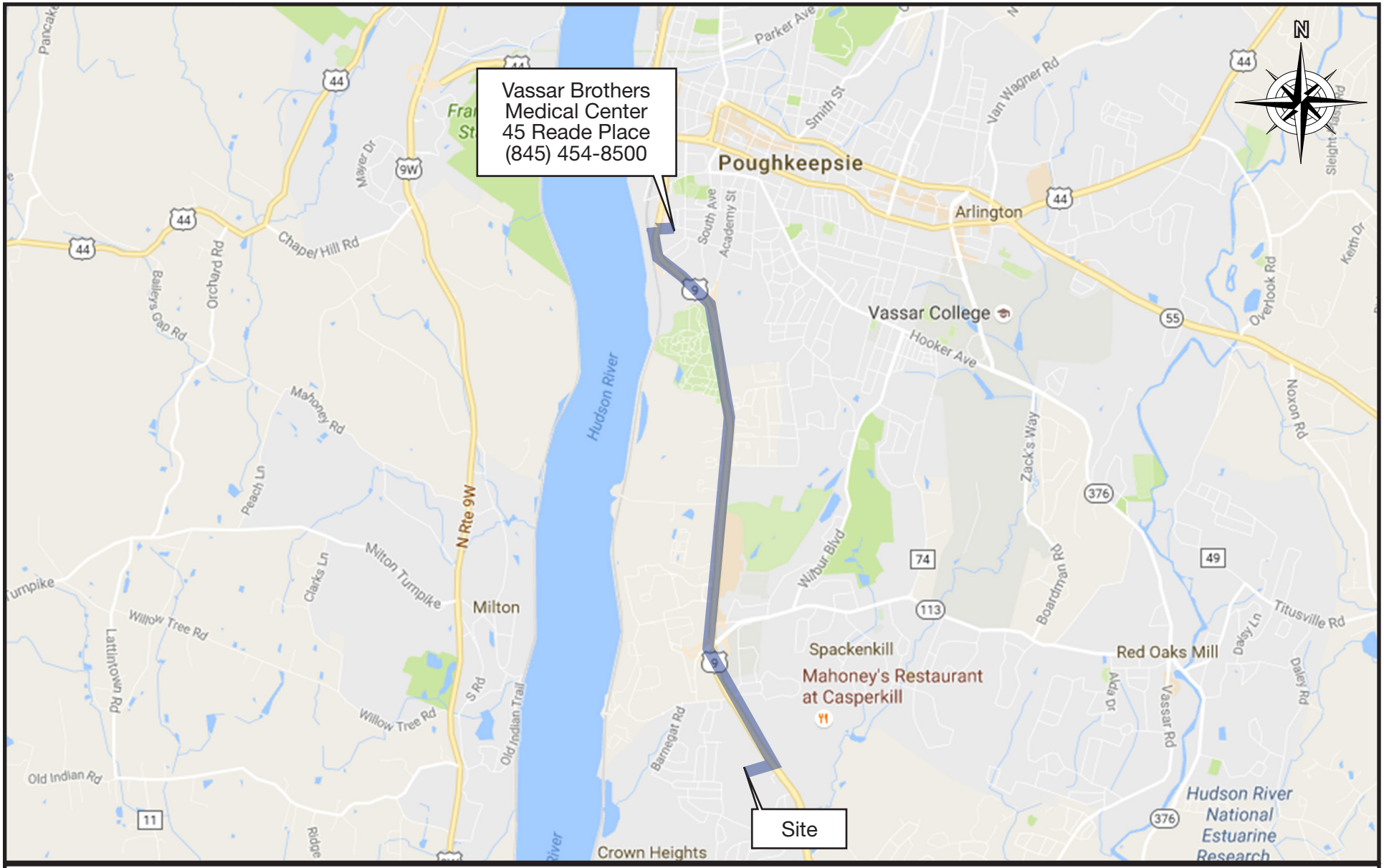
* Note: Contact numbers subject to change and should be updated as necessary

**Map and Directions to Nearest Health Facility**

| | |
|---|---|
| Site Location: | Neptune Road, Poughkeepsie, NY |
| Nearest Hospital Name: | Vassar Brothers Medical Center |
| Hospital Location: | Reade Place, Poughkeepsie, NY |
| Hospital Telephone: | 845-454-8500 |
| Total Distance: | 5.0 miles |
| Total Estimated Time: | 10 minutes |

Directions to the Hospital:

1. Route 9 North to Columbia Street Exit.
2. At end of exit ramp turn right.
3. At first stop sign turn right.
4. Proceed approximately 1 block (follow signs for Hospital), Emergency Room entrance sign will be on the right and general parking will be on the left.




D&B Engineers and Architects, P.C.

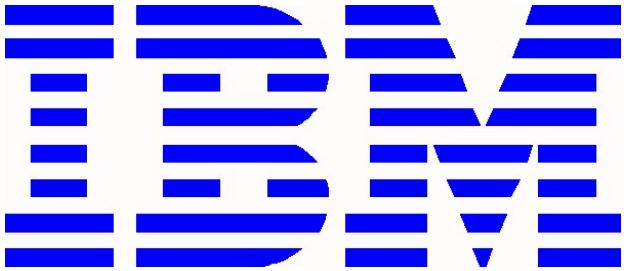
**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Site Management Plan**

## HOSPITAL ROUTE MAP

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX D
# OPERATION AND MAINTENANCE (O&M) PLAN FOR THE GROUNDWATER PUMP AND TREATMENT SYSTEM



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# OPERATION AND MAINTENANCE PLAN

for the

GROUNDWATER PUMP AND TREATMENT SYSTEM
at the
FORMER IBM B952/982 SITE

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
Groundwater Sciences Corporation
2601 Market Place Street, Suite 310
Harrisburg, Pennsylvania 17110

**Revised and Updated By:**
D&B Engineers and Architects, P.C.
330 Crossways Park Drive
Woodbury, New York 11797

MARCH 2017

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### List of Attachments


Attachment 1 Monitoring Well Logs
Attachment 2 Operation and Maintenance Manual
Attachment 3 952-30R Step Drawdown Test, Long-Term Pumping Test Data
Attachment 4 Groundwater Sampling/Analytical Protocols
Attachment 5 Health and Safety Plan/Emergency Contingency Plan
Attachment 6 Groundwater Treatment System Inspection Forms

# 1.0 INTRODUCTION

This plan has been prepared by D&B Engineers and Architects, P.C. (D&B) for the International Business Machines Corporation (IBM) Building 952/982 Site located in Poughkeepsie, New York (hereinafter referred to as the "Site"). As such, it is intended to satisfy the requirement for an Operation and Maintenance Plan (O&M Plan) for the groundwater pump and treatment system, installed by IBM at the Site in the fall of 1993.

The requirement for this O&M Plan was stated by the New York State Department of Environmental Conservation (NYSDEC) in a letter to Robert Newhard of IBM from Michael J. O'Toole of NYSDEC, dated November 4, 1993. This Plan has been prepared in accordance with the requirements of the DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010) and as set forth in the Order on Consent (Index #A3-0655-12-10, dated May 18, 2011) between IBM and NYSDEC. It has been prepared by D&B Engineers and Architects, P.C. on behalf of IBM.

## 1.1 Intended Use of Plan

This plan is intended to be used by persons involved in the operation, maintenance, monitoring and inspection of the groundwater pump and treatment system at the Site. This includes employees of IBM, its contractors and subcontractors and NYSDEC personnel involved in overseeing and reviewing the results of this remediation effort. For this reason, copies of this plan are being provided to all individuals involved in any one of these capacities and a full copy is also stored in the building housing the extraction well and the treatment system.

## 1.2 Scope and Content

The contents of this plan focus on two principal areas:

- the operation and maintenance of the groundwater pump and treatment system; and
- the monitoring of the system's effectiveness.

However, to first familiarize the user with the Site, Section 2.0 presents background information, including the site location and description, the site history and the site hydrogeology. Section 3.0 then presents a description of the site remedial action associated with the groundwater pump and treatment system, an operation plan for the groundwater extraction activity and monitoring and reporting plans for the extraction and treatment system and the groundwater monitoring network.

Appendices to this plan contain well logs, a full copy of the Operation and Maintenance Manual to be used by operators of the groundwater pump and treatment system, pumping test data, a sampling and analysis protocol and a Health and Safety Plan.

## 2.0 BACKGROUND INFORMATION

This section of the O&M Plan presents background information for the Site. The following three subsections discuss the Site's description, remedial history and hydrogeology, respectively.

### 2.1 Site Description

The IBM B952/982 Inactive Hazardous Waste Disposal (IHWD) Site is located in the Town of Poughkeepsie, Dutchess County, New York. The property, now part of the Neptune Commerce Center, is identified as Lot 3, Tax Map No. 6159, Block 01, Lot 178918 on the Dutchess County Tax Map (see Figure 2-1). The Site is 1.14-acres situated on a 6.17-acres property, bounded by a car dealership to the north, Neptune Road to the south, Route 9 to the east, and other buildings as part Neptune Commerce Center to the west. The boundaries of the Site are more fully described in the metes and bounds description, which can be found in the Environmental Easement, included as Appendix B of the Site Management Plan.

As shown on Figure 2-1, the Site consists of one former IBM building (Building 982) that has been fully re-developed for commercial use, and includes an extraction well, two monitoring wells and associated groundwater treatment shed and the SSDS annex on the north end of the building.

Properties adjoining the Site and in the neighborhood surrounding the Site primarily include both commercial and residential properties. There are two additional commercial properties on the adjoining Neptune Commerce Center parcels.

### 2.2 Site History

In the mid-1950's, IBM occupied two buildings (former IBM leased Building 952 and former IBM leased Building 982), which were joined by an enclosed walkway. At that time, the Site was owned by South Road Associates. The Site was used primarily for manufacturing and

parts cleaning and in later years for computer mainframe and ancillary parts salvage. Various halogenated solvents and Sovasol were used on the Site as part of the manufacturing operations.

In the early 1980's, IBM began to conduct investigations to characterize the hydrogeology and groundwater quality of the Site. As a result of these investigations, IBM discovered that a central waste chemical holding tank had leaked, impacting both groundwater and soils within the vicinity of the tank and under Building 952 and a portion of Building 982. Upon this discovery, IBM prepared a remedial action work plan in 1984 to remove the tank and surrounding impacted soils and that plan was approved by the NYSDEC. Under the supervision of the NYSDEC, IBM removed and disposed of approximately 5,274 cubic yards of material from August 1984 to November 1984. Following completion of the 1984 remedial action, the NYSDEC IHWD Site was approximately 1.66-acres. IBM continued to conduct onsite and offsite groundwater monitoring, in addition to re-sampling impacted soils under Building 952.

The Site was first listed as an Inactive Hazardous Waste Disposal Site in 1984 as a Classification 2 site. Later at some point prior to 1989, the Site was listed as a Classification 2a. On March 8, 1993, IBM submitted a petition to reclassify the Site from a Classification 2a to a Classification 4 on the NYSDEC Part 375 IHWD Site Registry, based on the results of the continued monitoring and investigations completed for the Site. NYSDEC determined that the Site could be reclassified after the design and installation of a groundwater pump and treatment system. Following IBM's installation of a NYSDEC approved groundwater pump and treatment system, the petition was approved on December 13, 1993.

IBM ended its lease on February 28, 1994. On April 25, 2005, South Road Associates sold the property to the current owner, Neptune Capital Investors, LLC (NCI). After assuming ownership, NCI redeveloped the Site into a mixed commercial use. Plans were approved to renovate the former IBM Building 982 for a mixed commercial use (Bounce! Trampoline Sports and Crunch Gym). In addition, NCI received planning board approval in February 2011 to demolish former IBM Building 952 and construct two new commercial buildings in its place, including use of an adjacent parcel. Work plans for supplemental soil investigations and additional

remedial activities were required prior to the site being redeveloped. The following sections will summarize the remedial investigations that have taken place at the Site.

### 2.2.1 Previous Remediation Activities

In the early 1980s, IBM began to investigate possible releases to the subsurface at the Site. This eventually lead to the installation and sampling of soil borings and groundwater monitoring wells. The Remedial Investigations (RIs) performed are described in detail in Section 2.3.2 of the Site's Site Management Plan (SMP) and are summarized below.

#### 2.2.1.1 – Soil Investigations

The following summarizes the soil investigations and remedial activities:

- There was a central waste chemical holding tank which stored chemicals prior to pick up and transport to a waste handling facility, located in the courtyard between Buildings 952 and 982. In October 1981, a single monitoring well, T-71 (later renamed 952-1R) was installed near the abandoned storage tank. The well was developed and sampled in December 1981 and February 1982.
  - Based on the results of these soil and groundwater investigations, remedial design and implementation was undertaken to remove soil from the area between B952 and B982 following soil cleanup criteria specified by NYSDEC. This activity included extensive soil sampling to determine soil that would be removed and soil that would be left in place or used as backfill, and a subsequent program of soil excavation and disposal.
  - Excavation began in August 1984 and continued through November 1984. Soil was segregated during excavation according to the NYSDEC criteria such that 5,274 cubic yards of soil were disposed of by secure landfilling and 5,297 cubic yards were stockpiled and reused as backfill material by mixing with 4,999 cubic yards of imported clean soil.
- From late November to early December 1982, there were 36 soil borings completed both inside and outside Buildings 952 and 982 to collect soil samples.
- In March 1992, seven soil samples were collected from five historical sampling locations beneath the concrete slab floor of B952. These samples were collected at locations and depths that had previously been sampled in 1982 to determine what changes had occurred over the intervening ten-year period. A comparison of the analytical results of the samples collected in 1982 with the results of the samples

collected in 1992 shows that volatile organic compounds (VOCs) in the soil had dissipated and that semi-volatile organic compounds (SVOCs) and oil and grease concentrations in the soil were essentially unchanged after ten years. These results also show that no proposed state or federal action levels are exceeded.

- From 2005 to 2010, the former IBM Building 952 and former IBM Building 982 remained vacant and the property undeveloped.
- In June 2011, NCI received Site Plan and Subdivision approvals from the Town of Poughkeepsie. NCI redevelopment activities included the demolition of former IBM Building 952 and the construction of two new commercial buildings in its place. Former IBM Building 982 would remain intact and be renovated. IBM prepared an Excavation Work Plan (EWP) as required by its approved SMP. The EWP was initiated in September 2012 and IBM completed field activities in June 2013.
- As the demolition and the removal of the slab/footings of Building 952 progressed, two isolated areas under and within the footprint of the building required further investigation based on PID readings and odor. Soils that exhibited detections on the PID and/or an odor were excavated, stockpiled on and covered with 30-millimeter (mm) poly sheeting and sampled for laboratory analyses of VOCs and base neutral (BN)-SVOCS via EPA Methods 8260B and 8270D, respectively. Analytical results indicated that there were no detections of VOCs and BN-SVOCs above NYSDEC required site soil cleanup objectives (SCOs) of restricted residential use.
- Post-excavation samples were also collected from each of the excavation areas and the samples were analyzed for VOCs and BN-SVOCs by EPA Methods 8260B and 8270D, respectively. Analytical results of the post excavation samples indicated that there were no detections of VOCs or BN-SVOCs above NYSDEC required site SCOs of restricted residential use.
- A series of surface and subsurface soil sampling was conducted to (1) verify the effectiveness of the 1984 remedial action to the EWP SCOs; (2) investigate the extent of contamination under the former IBM leased Building 952 once the concrete slab was demolished; and (3) evaluate the soils surrounding the IHWD site within the three new NCI lots for compliance with 6 NYCRR Subpart 375-6 SCOs.
  - Of the 67 borings installed and sampled, 64 boring were all less than restricted residential use SCOs and/or protective of groundwater. Only three (3) borings showed detection of one or more analytes above the NYSDEC SCOs for restricted residential use.
  - On December 10, 2012, IBM submitted a report addressing the results from these three borings to NYSDEC for review and to determine whether NYSDEC would require additional investigation and/or remediation of these three areas. On January 7, 2013, NYSDEC in consultation with NYSDOH determined that based on IBM's report and that these locations fall under the purview of the current IBM SMP, no further investigation and/or remediation of these areas was required at this time.

2.2.1.2 – Groundwater Investigations

The following summarizes the groundwater investigations and remedial activities:

- 143 groundwater samples were collected and analyzed for various parameters during the eight-year period from 1985 to 1992. Analytical results for the ten on-site monitoring wells existing at that time showed that the New York State Groundwater Quality Standards (NYSGQS) were exceeded for one or more constituents only in two wells immediately within or adjacent to the 1984 soil excavation area.
- In the fall of 1993, five additional monitoring wells were installed at the site. Sampling results from these monitoring wells were consistent with the conclusions of the post-remedial monitoring program discussed above; they confirm that groundwater concentrations exceeding the NYSGQS occur only in the immediate vicinity of the 1984 soil excavation (extraction well 952-30R and monitoring wells 952-10RA and 952-31R). The location of the extraction well and groundwater monitoring wells are shown in Figure 2-2.
- Since the startup of the groundwater pump and treatment system began on December 1, 1993, the concentrations of chemicals observed in the untreated groundwater from the monitoring wells have gradually decreased. More recently, results from samples taken from the extraction well over the past several years indicate levels have stabilized to where average concentrations for reporting compounds are below the New York State groundwater quality standards.

## 2.3 Hydrogeology

The Site, as shown on Figure 2-3, lies topographically in a broad upland approximately 135 feet above mean sea level (amsl) between Casper Creek, 2,000 feet to the southeast, and a small unnamed stream, 3,500 feet to the northwest. The site is flanked on the northeast and southwest by two prominent hills with elevations greater than 200 feet amsl. Surface water drainage from the site is primarily to the southeast toward Casper Creek.

### 2.3.1 Geologic Setting

Also, illustrated on Figure 2-3 is the location of the site in a one-mile-wide strip of land oriented northeast-southwest and underlain by dolostone of the Wappinger Formation ($OC_w$). The formation boundary on the northwest side of this band is a thrust fault contact with the shaley

Normanskill Formation ($O_n$). The formation boundary on the southeast side of this band is a normal stratigraphic contact with the Normanskill Formation.

The dolostone bedrock of the Wappinger Formation is overlain by a variable thickness of unconsolidated sediments, including till, outwash, and lacustrine deposits. These unconsolidated sediments are of glacial origin and are the result of erosion and sedimentation by continental glaciers which smoothed bedrock topography, rounded-off hilltops, and filled valleys with sediments over a period of several hundred thousand years. These sediments have since been reworked by recent streams and now almost completely blanket the bedrock in the area of the site.

### 2.3.2 Site Geology

As described in the previous section, 31 borings were drilled to characterize the geology of the Site and adjacent properties also formerly leased by IBM. The following sections describe the unconsolidated sediments and bedrock encountered in these borings.

#### 2.3.2.1 – Unconsolidated Sediments

Two cross sections of the Site have been drawn to describe the subsurface geology. As shown on these cross sections (Figures 2-4 and 2-5), the primary unconsolidated sediments found under the Site are, from oldest to youngest:

1. Glacial till, a poorly sorted mixture of boulders, gravel, sand, silt, and clay deposited directly by contact with ice;
2. Generally, poorly sorted outwash material consisting of gravels, sands, and silts which is the result of re-working of till and other materials by glacial meltwater;
3. Alluvial silts and clays which are the results of deposition in a low-energy environment such as a glacial lake;
4. Man-made fill materials which lack bedding or structure.

The unconsolidated sediments are approximately 45 feet thick at borings 952-11R and 952-29R southeast of B982 and at boring 952-15R on the northwest side of B982, but are less than ten feet thick along South Road on the northeast side of B952.

2.3.2.2 – Bedrock

As previously noted, the bedrock underlying the site is dolostone, a calcium magnesium carbonate rock prone to solution weathering by groundwater, particularly in zones where the rock is highly fractured. Solution features were apparent in some of the borings, particularly 952-11R which contained an open void from 79 to 105 feet below ground surface. The bedrock in the area of the site generally strikes N 25-35° E and dips to the southeast at varying angles greater than 45°. The overlying contact with the unconsolidated sediments is an erosional surface.

Figure 2-6 is a top of bedrock topographic contour map. Total relief of the bedrock surface beneath the site property is approximately 30 feet, ranging from a low of 90 ft amsl at boring 952-29R to a high of 119 ft amsl at boring 952-12R. The bedrock contour map generally reveals a depression centered on Building 982 and open to the east beneath the southern half of where Building 952 once stood; the bedrock surface surrounding this depression generally rises to the north and west.

2.3.3 Groundwater Flow

Beneath the site, groundwater flow occurs primarily within the dolostone bedrock. In this regard, apart from isolated zones of perched water on top of silt and clay lenses within the unconsolidated sediments, soils are generally unsaturated, as indicated by a comparison of the bedrock topographic map (Figure 2-6) and the measured groundwater elevations.

Several nested bedrock piezometers have been constructed at this site. Water levels measured in these piezometers indicate a vertical gradient downward in the shallow bedrock and then horizontal flow within the deeper bedrock zone.

Figure 2-7 shows groundwater flow directions in the deeper bedrock zones. As shown on this map, the principal directions of groundwater flow are to the east, south and west from a mound centered nearest the groundwater pump and treatment shed. As indicated by the contours, groundwater capture at the site is established by extraction well 952-30R.

# 3.0 GROUNDWATER PUMP AND TREATMENT SYSTEM REMEDIAL ACTION

This section of the report presents a description of the groundwater pump and treatment system remedial action being performed at the Site, as well as operating, monitoring and reporting plans for this system. The final subsection of this section also discusses action levels and associated contingency plans for this remedial action.

## 3.1 System Description

This remedial action involves the extraction of groundwater from a single extraction well (952-30R), on-site treatment by activated carbon to remove volatile and semi-volatile organic compounds, and discharge to a sanitary sewer system associated with a publicly owned treatment works (the Arlington Sewage District Treatment Plant). Additionally, two monitoring wells are present on the site to monitor the horizontal and vertical variation in groundwater elevation and chemistry (952-10RA and 952-31R). These components of the remedial action system are described in the following three subsections, and their locations are shown on Figures 2-1 and 2-2.

### 3.1.1 Extraction Well and Monitoring Wells

The locations of the extraction well and the 2 monitoring wells are shown on Figure 2-2. The logs for these wells are reproduced in Attachment 1. As shown on these well logs, the monitoring wells are small-diameter PVC screen and pipe completions.

The extraction well (952-30R) is a 6-inch diameter open hole completion, which is necessary for the installation of a groundwater extraction pump. The pump in this well is a Grundfos Model SP 5S-9/5SO5-9, stainless steel submersible pump with a 2 wire, Franklin 0.5=HP, 230-Volt motor with a rated flow of 5 gallons per minute (gpm). The total depth of the extraction well is 66 feet and the pump intake is set at a depth of 63.5 feet. The discharge from

the well is controlled by an automatic pump controller and motorized valve, which is designed to maintain the pumping water level within the 1-foot depth interval from 58.9 to 59.9 feet, thus maximizing the continuous long-term yield of the well. This depth interval also maintains the pumping water level above the principal water-bearing zone in the extraction well, which, as noted on the well log in Attachment 1, is at the depth of 65 to 66 feet. Additional information on the well pump controls and motorized valve are included in the Operation and Maintenance Manual, a complete copy of which is reproduced in Attachment 2.

#### 3.1.2 Treatment System

The treatment system for this groundwater extraction effort includes essentially two stages. The first is filtration of suspended solids and the second is removal of volatile and semi-volatile organics by activated carbon. Figure 1-3 is a groundwater treatment system process schematic, which can be found in Exhibit 2 of the O&M Manual. As shown on this schematic, the groundwater flow first passes through two bag filters, the first a coarse filter (50 micron) and the second, a fine filter (5 micron). From there, the flow passes through two granular activated carbon filters, including a primary and secondary unit operating in series. This figure also shows the location of the many sampling ports, pressure gauges, and ball valves used in the monitoring and flow control associated with this treatment process.

#### 3.1.3 POTW Discharge

The discharge from this treatment system is to a sanitary sewer manhole. This manhole is located east of the building housing the treatment plant as shown on Figure 3-1. Connection to the manhole is below grade.

### 3.2 Operating Plan

The operating plan for this groundwater extraction and treatment system was developed on the basis of pumping tests performed on well 952-30R and data collected during the initial start-

up in December 1993 and over the first two months of operation in December 1993 and January 1994.

### 3.2.1 Well 952-30R Pumping Tests

On October 23, 1993, a step drawdown test was performed on well 952-30R. In performing this test, steps of 5, 10 and 15 gpm were attempted. However, it was only possible to achieve the 5 and 10 gpm pumping rates. Based on the results of this test, a long-term pumping test was begun on October 25, 1993, with a desired long-term pumping rate of 9 gpm. The data for this long-term pumping test are reproduced in Attachment 3 of this report.

As shown in Attachment 3, it was not possible to sustain a continuous 9 gpm pumping rate at this well. In fact, during most of the 72-hour long-term test, the pumping rate was at or below 5 gpm and appeared to stabilize near the end of the test at a rate of approximately 4 gpm.

On the basis of this long-term test, it was anticipated that the average yield of this well would be on the order of 4-5 gpm. However, due to seasonal and storm related variations in recharge that could be expected in this area, it is anticipated that the peak yield from this well might be as high as 10 gpm.

### 3.2.2 Initial Start-Up and Operation

Start-up of the groundwater extraction and treatment system was initiated on December 1, 1993 at 10:00 a.m. During the first six days of operation, the system was operated manually, with close observations being made of the pumping rate, pressure readings, and performance of the automatic control valve. After this initial period of operation, the system was essentially monitored daily beginning December 10, 1993 for totalizer reading, pressure readings and observations regarding the position of the motorized control valve.

The initial rate at start-up was generally in the range of 6-8 gpm, which declined during the month of December to a rate between 3 and 4 gpm where it stabilized during January and early

February 1994. This is consistent with the observations made during the long-term pumping test in October 1993.

Based on initial operating data, it is necessary to change the suspended solids filters, roughly every two to three three weeks, due to a buildup of pressure upstream from these filters, which would otherwise result in a reduction in the pumping rate from the extraction well. The operating information also shows that during this initial two-month operating period, the only occasion on which the motorized valve was fully open and the pumping water level was above the normal range was when the pressure upstream from these filters was apparently restricting the instantaneous pumping rate. Therefore, it is important that the observation of these pressure readings be performed at a minimum every month and that the filters are changed at appropriate intervals.

### 3.2.3 Anticipated Effectiveness

The effectiveness of this groundwater extraction and treatment system can be measured in three ways: (1) the hydraulic effectiveness of groundwater extraction in containing the area of elevated chemical concentrations in groundwater, (2) the effectiveness of this groundwater extraction system in eventually reducing the measured groundwater concentrations in this area of elevated levels, and (3) the effectiveness of the treatment system in removing organic compounds from the extracted groundwater prior to discharge to the POTW. The following three subsections address each of these measures of effectiveness.

#### 3.2.3.1 – Hydraulic Effectiveness

The hydraulic effectiveness of this groundwater extraction system has been demonstrated by the results of the long-term pumping test performed in October 1993. Very high drawdown affects were observed in the adjacent monitoring wells 952-10RA and 952-31R, which are also the wells in which the elevated organic chemical concentrations have been observed. In this regard, Table 3-1 is a listing of the concentrations of the three principal organic compounds detected in each of

these two monitoring wells and the pumping well, which correspond to the three isomers of dichlorobenzene (DCB).

**Table 3-1**
**Principal Organic Compounds Detected, 952-10RA and 952-31R**

| Well Number/Date | 1,2-Dichloro-benzene | 1,3-Dichloro-benzene | 1,4-Dichloro-benzene |
|---|---|---|---|
| **952-30R (Pumping Well)** | | | |
| *Prepumping* | | | |
| 10/13/93 | 22,150** | 2,550** | 4,500** |
| 10/20/93 | 8,400** | 1,080** | 1,750** |
| *After Step Test* | | | |
| 10/23/93 | 840 | 130 | 200 |
| *During Long-Term Test* | | | |
| 10/26/93 - 14 hours | 2,000 | 310 | 460 |
| 10/27/93 - 36 hours | 1,050** | 160** | 220** |
| 10/28/93 - 60 hours | 1,100 | 180 | 240 |
| 10/28/93 - End of Test | 580** | 115** | 145** |
| **952-10RA (Monitoring Well)** | | | |
| *Prepumping* | | | |
| 10/13/93 | 15,100** | 2,100** | 3,350** |
| 10/20/93 | 16,800** | 2,250** | 3,580** |
| *During Long-Term Test* | | | |
| 10/26/93 | 11,000 | 2,000 | 3,000 |
| 10/27/93 | 9,500 | 1,900 | 2,800 |
| 10/28/1993 | 10,000 | 1,700 | 2,700 |
| 10/28/93 - End of Test | 8,500** | 1,450** | 2,250** |
| **952-31R (Monitoring Well)** | | | |
| *Prepumping* | | | |
| 10/13/1993 | 1,700** | 140** | 300** |
| 10/20/1993 | 8,100** | 880** | 1,550** |
| *During Long-Term Test* | | | |
| 10/26/1993 | 3,800 | 550 | 880 |
| 10/27/1993 | 1,700 | 300 | 440 |
| 10/28/1993 | 1,000 | 160 | 250 |
| 10/28/93 End of Test | 705** | 140** | 210** |

Notes:
* All results in (µg/l)
** Average of multiple runs

These chemical results not only show relatively high initial concentrations of these three isomers of DCB, but also consistently declining numerical concentrations of these constituents in each of the two monitoring wells and the pumping well during the pumping test. Taken together with the drawdown data, these organic chemical concentration data show that the pumping well exerts strong hydraulic control on the area within which elevated concentrations occur.

3.2.3.2 – Long-Term Reduction of Concentrations

Groundwater monitoring is performed by IBM on a periodic basis to assess the performance of the remedy. As the result of declining groundwater quality results, there have been several modifications to the groundwater monitoring program that have been approved by the NYSDEC. They are as follows:

- On November 17, 1999, the NYSDEC approved a decrease in monitoring frequency for all monitored wells from quarterly to twice annually.
- On April 23, 2004, the NYSDEC approved the decommission of monitoring wells 952-8R, 952-14S, and 952-15RA. In addition, the monitoring frequency of wells 952-10RA, 952-11R, 952-29R, and 952-31R was reduced to once per year.
- Monitoring well 952-15RB was decommissioned on December 13-14, 2012 as part of site redevelopment activities.
- The decommissioning of monitoring wells 952-6R, 952-9R, 952-11R, 952-12R, 952-13R, 952-14R, 952-14RA, 952-16R, and 952-29R. In addition, the analytical parameters that the remaining two monitoring wells (952-10RA and 952-31R) are tested for has been reduced to just VOC sampling once per year.

Subsequent groundwater monitoring data has shown groundwater quality results, combined with observed hydraulic control by the system in the vicinity of the source area, indicate the remedy implemented at the site is successful.

With regard to the monitoring well chemistry, monitoring wells 952-10RA and 952-31R are the two wells at which the concentrations have been the highest and most persistent. The concentrations of SVOCs in these wells have consistently been below the NYSDEC Class GA

Standards or Guidance Values, with the exception of 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenze and 1,2,4-Trichlorobenzene. However, these four constituents have, and will continue to be, analyzed for as part of the VOC analyses.

3.2.3.3 – Treatment System Effectiveness

As noted above, the treatment system has been designed to accomplish two treatment steps. The first is the removal of suspended solids and the second is the removal of organic compounds. Data collected from the system includes the results of total suspended solids analyses of water passing through this treatment system, including sampling locations before the bag filters, between the bag filters, after the bag filters, after carbon unit number 1, and after carbon unit number 2. Data shows that most of the solids removal that occurs is associated with the initial bag filter, which removes solids greater than 50 microns. Beyond that, some additional removal occurs in the 5-micron filter, but it is obvious that suspended solids associated with colloidal-size particles less than 5 microns pass through even this final bag filter and, in fact, appear to pass through both of the carbon units as well. The effluent concentrations for these total suspended solids do not exceed the appropriate discharge limits for the POTW and, therefore, are not a matter of concern. They are also not a matter of concern with respect to clogging of the carbon units since the carbon units do not appear to be removing much, if any, of this material. The most important conclusion to be drawn from this data is that the fraction of the suspended solids that could be retained within the carbon units, and therefore clog them, is being effectively removed by the bag filters, including primarily the coarse filter at 50 microns. There is, therefore, no need to adjust the filtering system associated with the removal of the total suspended solids.

Data has also been collected on the influent and effluent concentrations for all of the organic constituents detected in the influent water chemistry. On the basis of these results for SW846 Methods 8010, 8020 and 8270 analyses of influent and effluent chemistry, it is apparent that the carbon filters are very effective in removing the organic constituents to levels that are not detectable at 1 ug/l. This is well within the discharge limitations for the POTW and, therefore, no adjustment or improvement in the organic removal treatment units is required.

## 3.3 Monitoring Plan

The monitoring plan for the groundwater pump and treatment system includes three elements: the extraction well, the treatment system, and the groundwater monitoring wells. The following three subsections describe the sampling and analysis plan for each of these components of this remedial activity.

### 3.3.1 Extraction Well

In order to calculate the mass of chemicals removed by the groundwater extraction system, totalizer readings from the meter for this extraction well will be recorded at a minimum of once per month. The data record for each of these entries will include the date and time at which the reading was taken, the totalizer reading itself, and any comments regarding the position of the motorized control valve.

A sample will be collected from the wellhead sampling port prior to any treatment at a minimum of monthly, to be analyzed for volatile organic compounds by Method 8021. The analysis, reporting and associated QA/QC for these extraction well samples will be performed as described in Attachment 4 and in accordance with the modified NYSDEC program for QA/QC requirements to be performed as part of long-term monitoring activities.

### 3.3.2 Treatment System

Monitoring requirements for the treatment system are specified in the Operation & Maintenance Manual (Attachment 2). As described in that manual, they include monthly sampling of groundwater influent, the effluent from carbon unit number 1, and the final effluent from carbon unit number 2. Analyses will be performed for those analytes required by the POTW by appropriate methods and subject to the QA/QC requirements of the POTW discharge program. To the extent possible, this treatment system monitoring will be performed concurrent with the monitoring of the extraction well described above, which would represent the influent groundwater chemistry sample.

### 3.3.3 Groundwater Monitoring Wells

In addition to sampling the extraction well monthly, groundwater samples will be collected from each of two monitoring wells, shown on Figure 2-2, on an annual basis. The analyses to be performed on samples from each of these monitoring wells and associated frequencies are presented in Table 3-2. Essentially, this monitoring plan calls for the analysis of all groundwater samples for VOCs by Method 8021. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan (QAPP) provided in Appendix K of the Site Management Plan. All sampling activities for these monitoring wells and the extraction well will be performed in accordance with the Health and Safety Plan presented in Attachment 5.

**Table 3-2**
**Groundwater Monitoring Plan**

| Well No. | VOCs 8021 | Frequency |
|---|---|---|
| 952-10RA | X | Annually |
| 952-31R | X | Annually |

## 3.4 Reporting

All data collected as a part of the operating and monitoring plans described above will be reported to NYSDEC in an annual interpretive reported to be submitted on or before March 31 of each year for the preceding calendar year. This report will include databases, spreadsheets, tables, figures and graphs necessary to describe the progress of the remedial activity during the preceding year, including the effectiveness of the groundwater extraction system and the groundwater treatment system. Any operating problems encountered during the preceding year will be described, together with the solutions implemented to mitigate these problems. Also, any proposed

revisions to the operating or monitoring plans for the system will be provided in this annual report, along with justification for such modifications.

### 3.5 Action Levels and Contingency Plan

The action levels for this site shall correspond to the New York State Groundwater Quality Standards (NYSGQS). If the concentration of one of these constituents observed in either of the two monitoring wells (952-10RA and 952-31R) exceeds the NYSGQS, then appropriate actions will be taken following consultation with NYSDEC. Comparison of the analytical results for each constituent at each downgradient perimeter well to the NYSGQS will be performed as follows:

1. If the concentration of a given constituent at a given monitoring well numerically exceeds the NYSGQS during any routine annual sampling event, then confirmation sampling will be performed immediately within the same year. If the confirmation sampling does not indicate a concentration which numerically exceeds the NYSGQS, then routine annual monitoring will continue.
2. If the confirmation sample also numerically exceeds the NYSGQS, then the sampling at the related well or wells will be increased in frequency to twice per year for a period of one year. At the end of that yearly sampling program, the concentration of each constituent at each well will be compared to the NYSGQS by a measure of central tendency corresponding to the clipped mean (omitting the highest and lowest values). If this mean value exceeds the NYSGQS, then the concentration for that constituent will be considered to exceed the NYSGQS for that well for that year.

# FIGURES



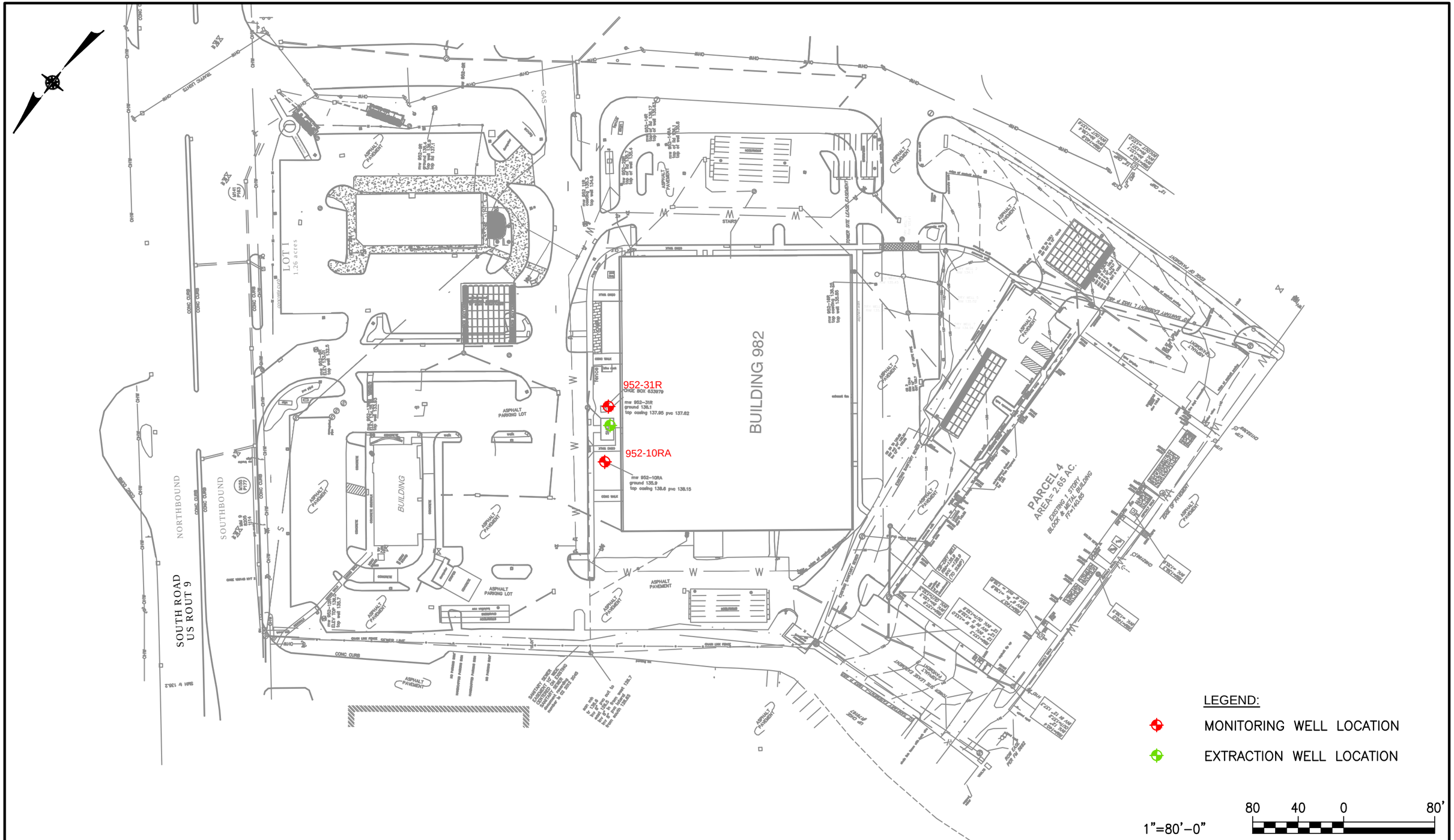

APPROXIMATE SCALE: 1" = 125'

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Operations and Maintenance Plan**

## LOCATION OF IHWD SITE BOUNDARY AND ASSOCIATED REMEDIAL ACTIVITIES

**FIGURE 2-1**



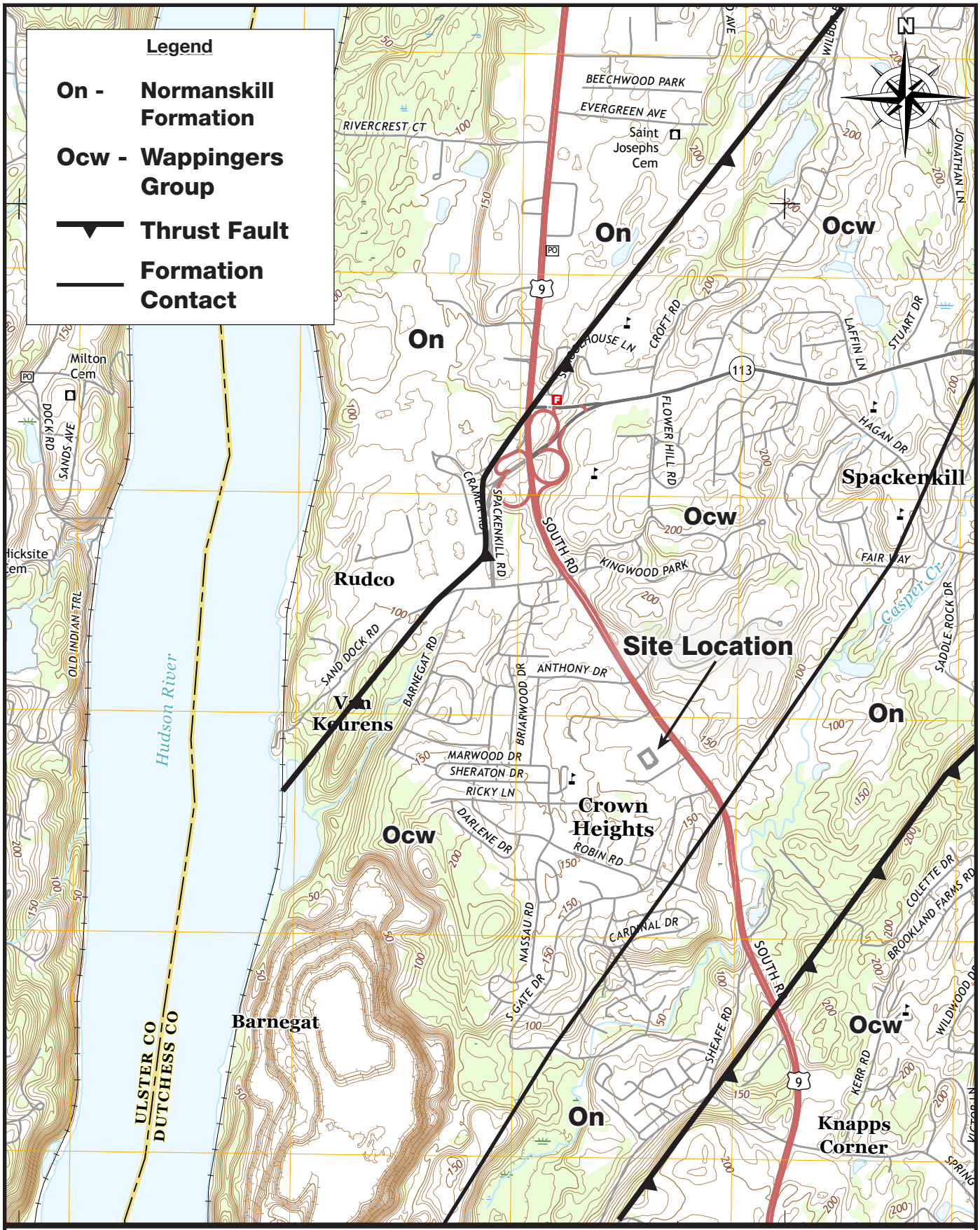

D&B ENGINEERS AND ARCHITECTS, P.C.

OPERATION AND MAINTENANCE PLAN
FORMER IBM B952/982 SITE, POUGHKEEPSIE, NEW YORK

**EXTRACTION AND MONITORING WELL LOCATION MAP**

**FIGURE 2-2**

F:\3866-04\dwg\3866-04-3-C-SITEMAP-FIG-2-2.dwg, 1/30/2017 2:54:41 PM, kalesius




Source: USGS Topo: Poughkeepsie Quadrangle 2016

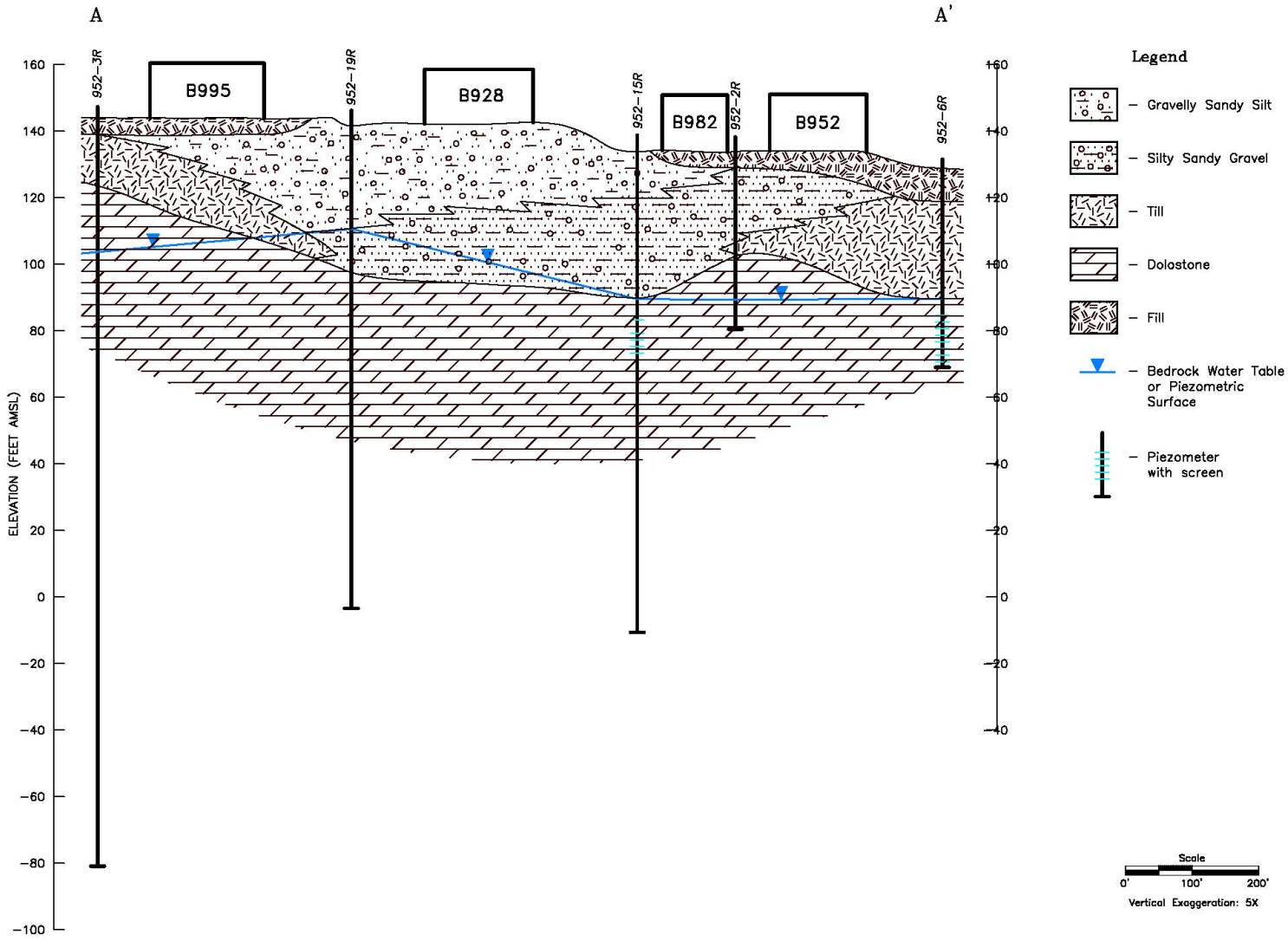
Approximate Scale: 1" = 2000'

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Operation and Maintenance Plan**

## GEOLOGIC SETTING/SITE LOCATION MAP

**FIGURE 2-3**



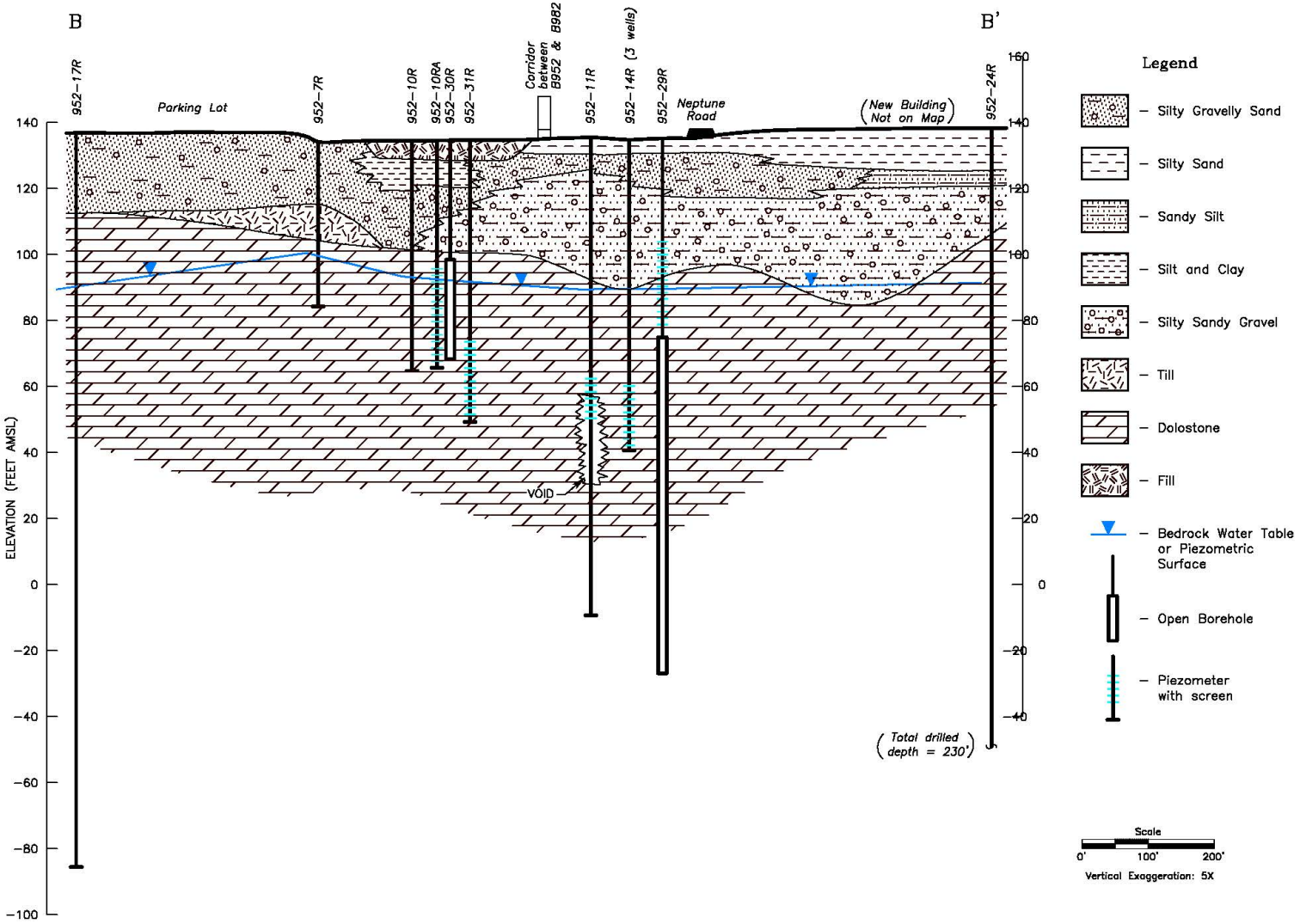

**Source: Groundwater Sciences Corporation 1993**

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**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Operations and Maintenance Plan**

## CROSS SECTION A - A'

**FIGURE 2-4**



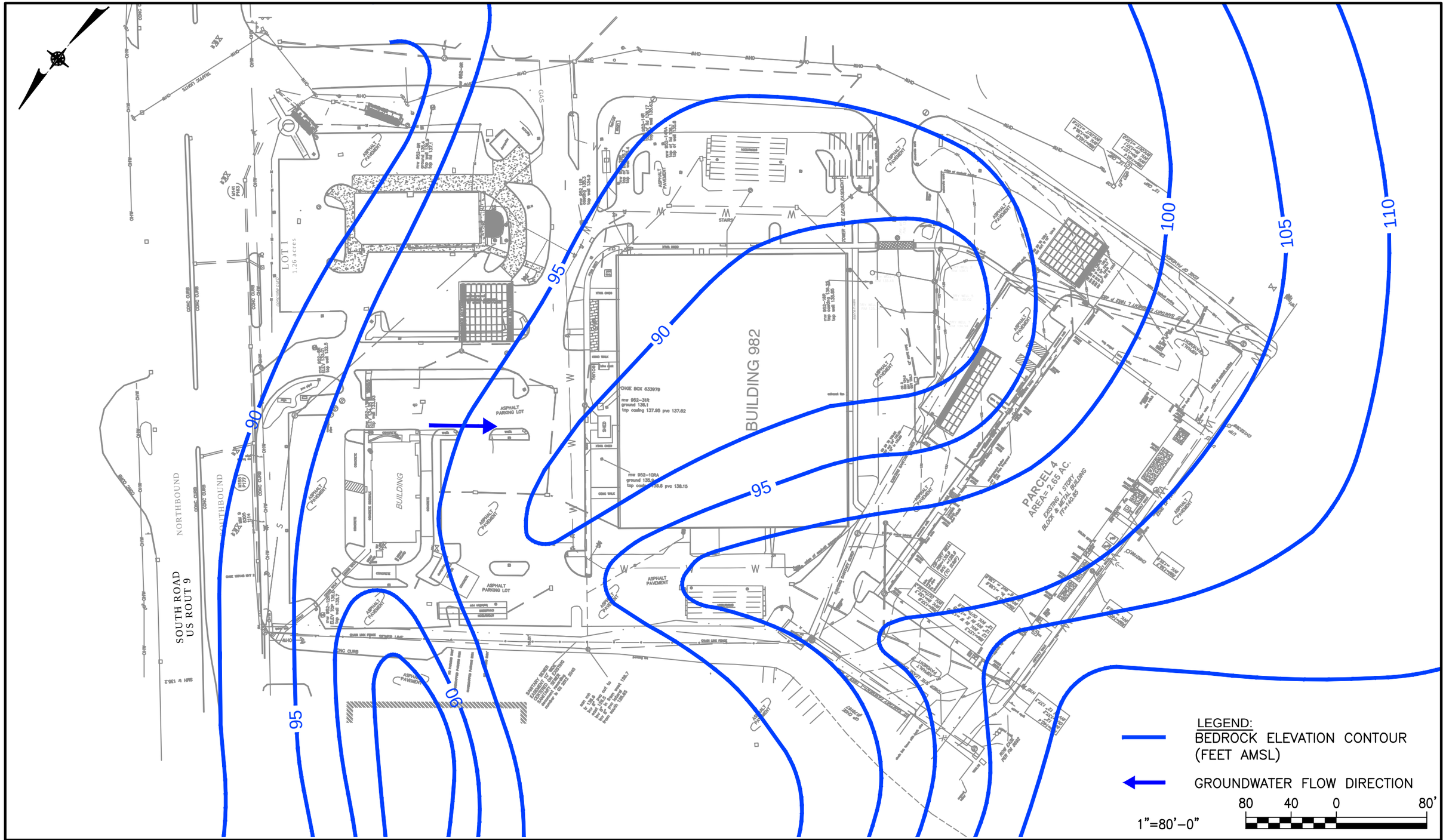

**Source: Groundwater Sciences Corporation 1993**

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**Operations and Maintenance Plan**

## CROSS SECTION B - B'

**FIGURE 2-5**



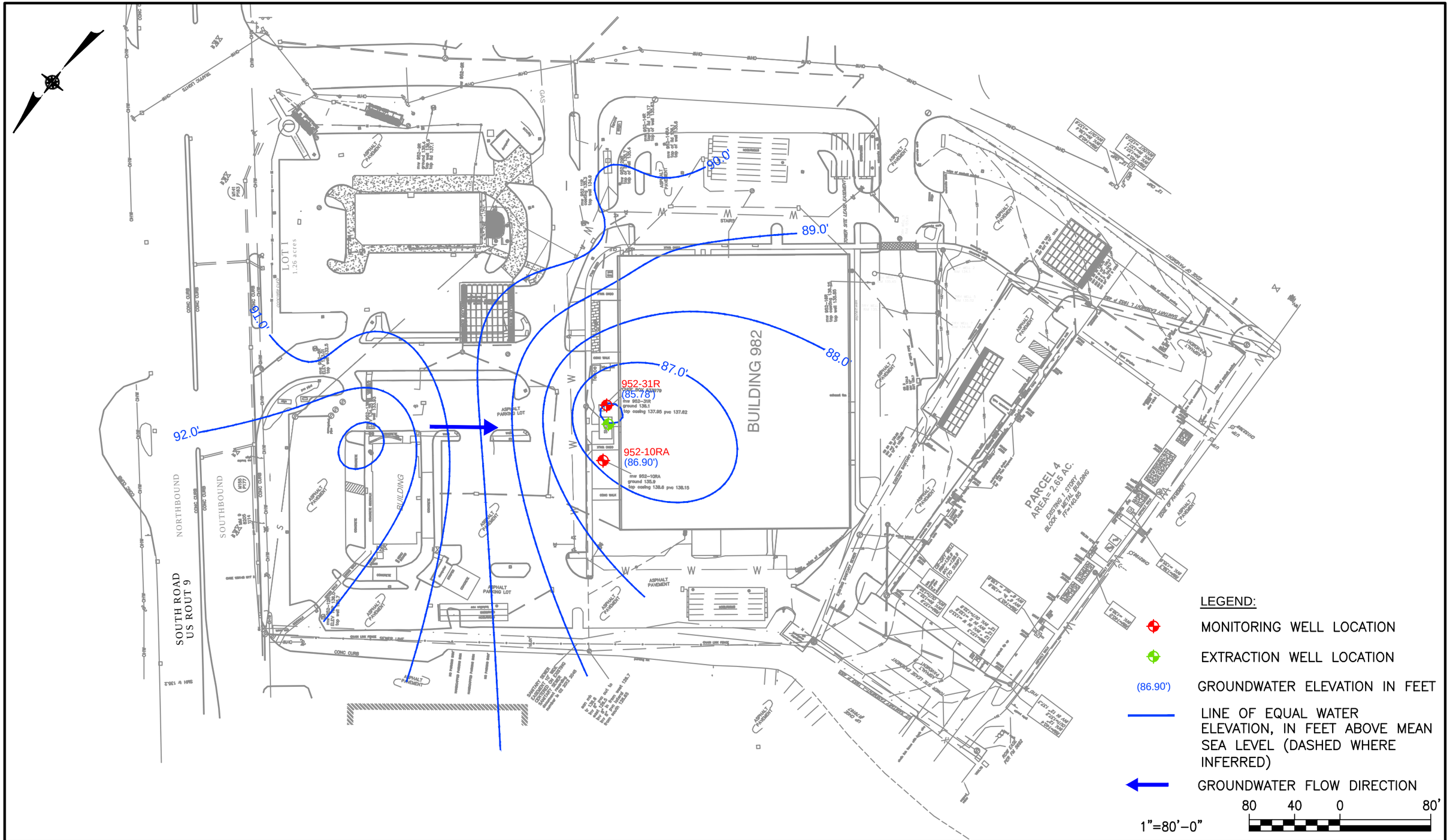

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**TOP OF BEDROCK TOPOGRAPHIC CONTOUR MAP**

**FIGURE 2-6**

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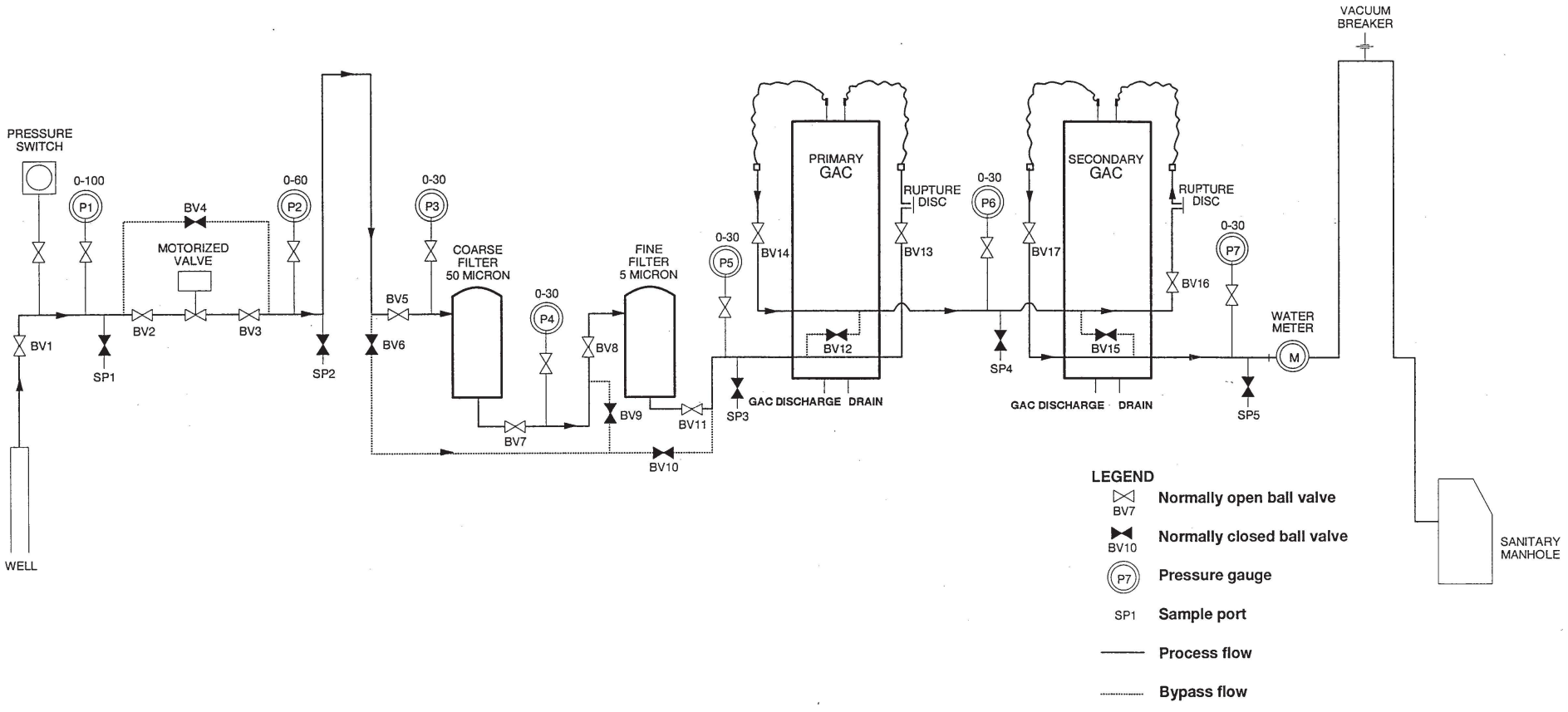

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**GROUNDWATER FLOW DIRECTION AND CONTOUR MAP**

**FIGURE 2-7**

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**Operations and Maintenance Plan**

# GROUNDWATER TREATMENT SYSTEM PROCESS SCHEMATIC

**FIGURE 3-1**

# Attachment 1

# Monitoring Well Logs

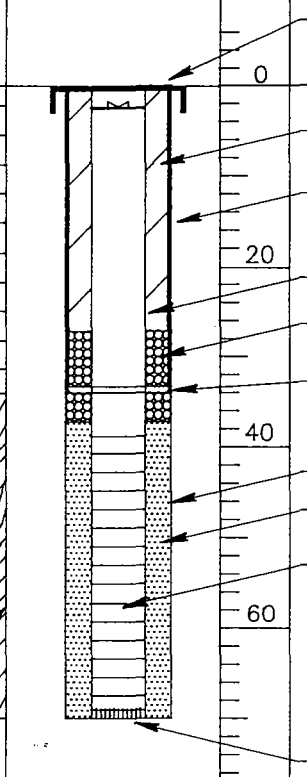
# Air Rotary Drilling Log

Client: IBM – Poughkeepsie
Project No. 90012

Boring No. 952–10RA
Location IBM Poughkeepsie
B952/982 alcove



| Depth Feet | Sample Number | Overburden/Lithologic Description | Graphic Log |
|---|---|---|---|
| 0 | | Ground Surface | |
| | | Brown shale fill; dry. | |
| 20 | | | |
| | | Dark gray weathered dolostone at 34'.<br>Solvent odor detected at 36'. | |
| 40 | | Competent bedrock at 39'; dark gray dolostone.<br>1–5 HNu units detected throughout interval in exhaust from tank.<br>weathered zone at 50' | |
| 60 | | Dark orange cuttings, weathered zone; increase in water 55'–58'.<br>Dark gray dolostone. | |
| | | Total Depth: 70.0'. | |
| 80 | | | |
| 100 | | | |
| 120 | | | |




Well Construction Details

Driller: T.J. Andrews Well Drilling
Logged by: G. Spiciarich, GSC
Drilling Started: 4–10–91
Drilling Completed: 4–12–91
Well Construction: 4–12–91
Well Developed: 4–16–91

Notes:
6" Odex system used.

Est. Yield Open Hole: >1 gpm.

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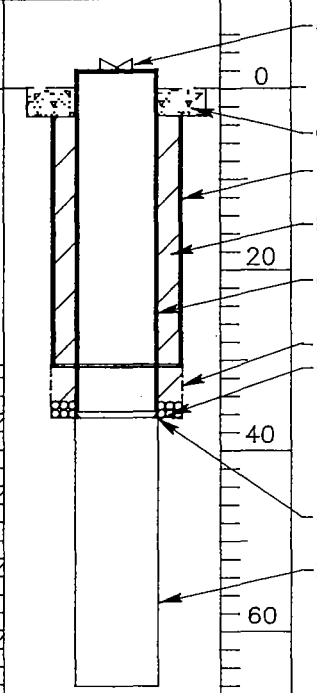
Geologic Log: 952–10RA

Air Rotary Drilling Log

Client: IBM MHV, Poughkeepsie, B952/982 Site
Project No. 92022.04

Boring No. 952–30R TOC Elev. 136.69'
Location B952/982 alcove, southeast of 952–10RA Page 1 of 1

| Depth Feet | Overburden/Lithologic Description | Graphic Log |
|---|---|---|
| 0 | Ground Surface | |
| | FILL. | |
| 20 | | |
| | DOLOSTONE: med. gray (Wappinger Formation). | |
| | : soft at 37'; no water. | |
| 40 | : soft at 38.5'; no water. | |
| | | |
| 60 | : weathered zone at 60', 1/2 gpm. | |
| | : weathered zone at 65'–66', 3 gpm. | |
| | Total Depth: 66.0'. | |
| 80 | | |
| 100 | | |
| 120 | | |




Driller: Boyd Artesian, Inc.
Logged by: C. Rine/L. Roach, GSC
Drilling Started: 10–7–93
Drilling Completed: 10–7–93
Well Construction: NA
Well Developed: 10–7–93
Well Coords: N9271.9819
E3824.6171

Notes:

Strong odor of mothballs noted at:
38.5' HNu = 10 ppm
51.0'
60.0' HNu = 30 ppm

No odor at 42'–51'.
Slight odor at 43', 52–59'; 61–65'.

Est. Yield Open Hole: 4–8 gpm

*GROUNDWATER SCIENCES CORPORATION*

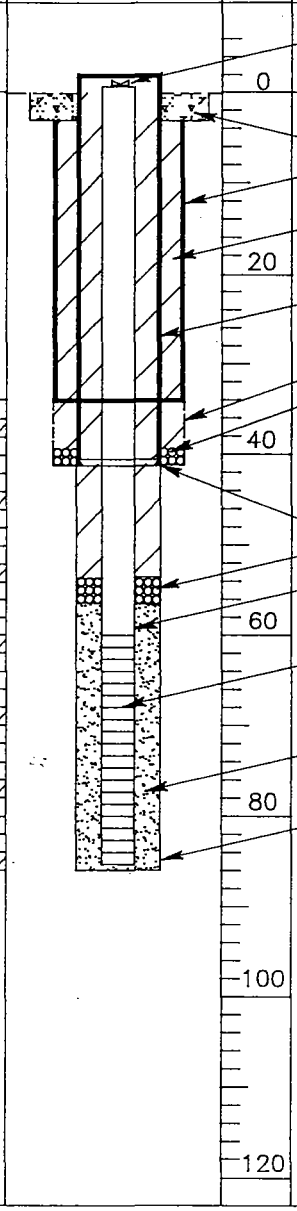
Geologic Log: 952–30R

Air Rotary Drilling Log

Client: IBM MHV, Poughkeepsie, B952/982 Site
Project No. 92022.04

Boring No. 952–31R TOC Elev. 137.07'
Location B952/982 alcove, southeast of 952–30R Page 1 of 1

| Depth Feet | Overburden/Lithologic Description | Graphic Log |
|---|---|---|
| 0 | Ground Surface | |
| | FILL. | |
| 40 | DOLOSTONE: med. gray (Wappinger Formation). | |
| | : weathered zone at 46'–47.5'; no water. | |
| 60 | | |
| | : weathered zone at 76'–77'; no water. | |
| 80 | : weathered zone at 82.5'–84'; no water. | |
| | Total Depth: 86.0'. | |
| 100 | | |
| 120 | | |



Well Construction Graphic

Depth Feet: 0, 20, 40, 60, 80, 100, 120

Well Construction Details:
- 2" locking/sealing cap
- Concrete
- 10" steel casing, welded
- Bentonite slurry
- 6" steel casing, threaded/coupled
- 10" rollerbit hole
- Bentonite pellets
- 6" steel drive shoe
- Bentonite pellets
- 2" Sch 40 FJ PVC riser
- 2" Sch 40 FJ 10–slot PVC screen (85.0'–60.0')
- 00 Morie sand
- Nominal 6" open hole

Driller: Boyd Artesian, Inc.
Logged by: C. Rine, GSC
Drilling Started: 10–8–93
Drilling Completed: 10–9–93
Well Construction: 10–9–93
Well Developed: 10–12–93
Well Coords: N9251.7733
E3839.2222

Notes:
No odors detected.
HNu = 0 throughout.

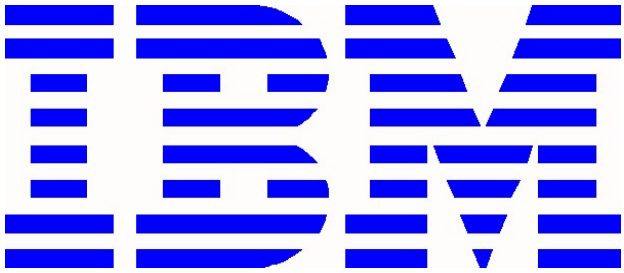
Est. Yield Open Hole: <1/4 gpm

*GROUNDWATER SCIENCES CORPORATION*

Geologic Log: 952–31R

# Attachment 2

# Operation and Maintenance Manual



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# OPERATION AND MAINTENANCE MANUAL

for the

GROUNDWATER PUMP AND TREATMENT SYSTEM

at the

FORMER IBM B952/982 SITE

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
Lawler, Matusky & Skelly Engineers
Environmental Science & Engineering Consultants
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**Revised and Updated By:**
D&B Engineers and Architects, P.C.
330 Crossways Park Drive
Woodbury, New York 11797

MARCH 2017

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Appendix A Groundwater Pump, Pump Controller and Motorized Valve
Appendix B Filter Units
Appendix C Granular Activated Carbon (GAC) Units
Appendix D Other Equipment

- Water Meter
- Pressure Gauges
- Diaphragm Seals


### List of Exhibits


1. Site Location / Site Plan (Figures 1-1 and 1-2)
2. Treatment System Schematic Diagram (Figure 1-3)
3. Electrical Work
4. Depression Pump Control Layout
5. Depression Pump Electrical Schematic

# 1.0 INTRODUCTION

## 1.1 Scope

Electrical, mechanical, and structural information is provided in this manual for the operation of the "Groundwater Pump and Treatment System at the Former B952/982 Site".

- Chapter 1.0 presents a general description of the system.
- Chapter 2.0 covers the equipment and operation of that equipment in pumping, filtering and remediating the groundwater. It does not include the electrical equipment in the system.
- Chapter 3.0 provides a description of the electrical power distribution as well as the electrical equipment needed for the system.
- Chapter 4.0 discusses the controls and alarms associated with the system so that it may operate properly and safely. An outline of system troubleshooting procedures is also included in Chapter 4.
- Chapter 5.0 gives a brief description of the maintenance requirements of the Remediation System.

## 1.2 General Description

The Groundwater Pump and Treatment System at the Former IBM B952/982 Site is designed to pump and treat groundwater. The system is designed to treat an average flow of 5 gpm and a maximum flow of 10 gpm. The hydraulic capacity of the system is approximately 15 gpm.

The main components of the system are a recovery well (No. 952-30R) located inside a small treatment building in the area adjacent to Building 982 (see Exhibit 1 for the Site Location Map and the Site Plan on Figures 1-1 and 1-2, respectively). A ½-HP submersible pump is installed in the well along with four conductivity (level) probes for pump control. Contaminated groundwater discharged from the pump passes through a motorized

flow control valve into two bag filter units installed in series. The first filter contains a coarse filter media (50 micron) and the second filter a fine media (5 micron). The purpose of these filters is to remove sediment or particulate matter that may clog the two downstream granular activated carbon (GAC) units. The GAC units consist of a primary and secondary unit in series. The activated carbon in each of these units adsorbs the contaminants and discharges essentially clean water to a sanitary manhole of the Arlington Sewer District. A schematic of the treatment system is shown on Figure 1-3 and can be found in Exhibit 1.

## 1.3 Notes on Exhibits and Appendices

Exhibits Nos. 1, 2, and 3 are design drawings while Appendices A, B and C provide installation and operation data on the pumping equipment, filters and GAC units. A ppendix D contains Operation and Maintenance information on other equipment. Exhibits Nos. 4 and 5 show the groundwater depression pump control layout and electrical schematic. The Exhibits and Appendices are attached to the back of this manual.

**Exhibit 1** contains a Site Plan and a Location Plan.

**Exhibit 2** contains a treatment system schematic, in addition to a list of influent contaminants and the required system performance. General notes on the installation and operation of the system equipment is also contained on this exhibit. (Note: The schematic shown on this Exhibit is general and does not show all piping, fittings valves, etc. For a more complete schematic see Figure 1-3.

**Exhibit 3** indicates the electrical work including a treatment building electrical plan, single line diagram and electrical notes.

**Exhibit 4** shows the depression pump control layout.

**Exhibit 5** shows the depression pump electrical schematic.

**Appendix A** contains a pump control schematic, electrical diagrams of the pump control panel, cycle timer data, pump controller operation data and pump performance curves and data.

**Appendix B** contains operation and maintenance data for the two bag filter units including shutdown and cover removal procedures, media replacement, cover replacement and startup procedures.

**Appendix C** contains a general description of the GAC units in addition to the specifications for the units, installation and operation instructions, a granular activated carbon information and specification Bulletin, material safety data sheets, Principles of Activated Carbon, a Glossary of terms commonly used in adsorption, an Operating Manual, spent carbon acceptance procedure and instructions for carbon acceptance canisters.

**Appendix D** contains Installation, Operation and Maintenance data for other equipment (water meter, valves, gauges, unit heater, etc.). Additional data and information obtained by operators of this facility should also be attached to this manual.

## 2.0 SYSTEM EQUIPMENT AND OPERATION

### 2.1 Scope

The equipment used in pumping and remediating groundwater is described in this Chapter. This chapter does not describe equipment used in the distribution of electrical power or equipment that is primarily electrical in nature. Such equipment will be described in Chapter 3, "Electrical System".

### 2.2 Groundwater Pump and Treatment System Components

#### 2.2.1 Groundwater Pump

The groundwater pump is used to pump contaminated groundwater from below ground, through the treatment system, to final discharge and treatment at the Arlington Sewer District Treatment Plant. The pump is located in the recovery well located inside the treatment building.

The pump is of the submersible type and includes a 0.5-HP, 230 volt, 1 phase 60 hertz motor. The pump is a Grundfos Model SP 5S-9/5SO5-9, with a rated flow of 5 GPM (see Appendix A). The pump/motor is approximately 3.96" diameter and 24.57" long. It weighs about 21.6 lbs. and has a 1" discharge.

#### 2.2.2 Pump Controller and Motorized Valve

Pump on/off operation is controlled by pump controller and a series of 4 level (conductivity) probes also located in the recovery well. The Controller utilizes the level probes and a repeat cycle timer for automatic adjustment of a motorized flow control valve. In general, the objective of the controller and motorized valve is to maintain the water level in the well within a 12" range determined by the valve open and valve close probe settings. Thus, with the pump running continuously, its discharge can be throttled by modulating the

motorized valve, thus producing a variable discharge rate that will match the well yield at the predetermined drawdown elevation. The pump controller is Model No. 5115-NP1-2-1B-AV, manufactured by Environmental Restoration Systems, Inc. A detailed description of the operation of the controller and motorized valve can be found in Appendix A.

### 2.2.3 Filter Units

The purpose of the two filter units is to filter out sediment and particulate matter that would clog the GAC units. The two filter units are operated in series with the coarse filter containing a 50 micron media and the fine filter containing a 5 micron media.

Three 0-30 psi diaphragm type pressure gauges are provided on the inlet and discharge lines to the filters. Pressure readings should be made and recorded each time a clean filter bag is installed in a filter. When the pressure drop across either filter (i.e., the difference between the gauges before and after the filter) reaches 15 psi, or the pressure on any gauge reaches 40 psi, both filter bags should be replaced.

The filter units are rated at 100 gpm at 1 psi of clean water and have a structural capacity of 30 psi differential pressure. Filters are Parker Model 4, FCB-12. Filter bags are 7" diameter and 30 1/2" long polypropylene bags.

### 2.2.4 GAC Units

Two GAC units are provided to treat filtered groundwater from the two bag filters. The two GAC units are connected in series with the first unit known as the primary unit and the other unit called the secondary unit. Each unit contains 1,000 lbs. of granular activated carbon and has a maximum operating pressure of 75 psi.

When the concentration of the lead effluent sample exceeds the detection limit for Trichloroethylene (TCE) (1 *u*g/l), (i.e., breakthrough), the carbon in both units are replaced. This complete changeout of the GAC units occurs approximately every 18-24 months. Recent sampling

events have indicated that the analytical result of the lead effluent sample is trending toward lower numbers, which may extend the life the carbon in the units to every 24 months before changeout is necessary.

When breakthrough is achieved, the pumps to the system are turned off, the liquid is blown out of the vessels and the carbon change out procedures occurs, as follows:

- The hatches at the top of the building are unlocked and removed;
- The inlet flanges on top of each GAC vessel are removed;
- The spent carbon is vacuumed out into drums;
- A funnel is placed on the roof and positioned over the GAC unit;
- The carbon is filled into the vessels through the funnel;
- The inlet flanges on the vessels are re-secured;
- The hatches on the roof are replaced and locked;
- The vessels are bled out and returned to service; and
- The pumps are turned back on.

The carbon change out procedure takes approximately 4-6 hours. When completed, the drums of spent carbon are transported to Building O28, the permitted hazardous waste storage building to await proper transportation and disposal. The acceptance facility is Calgon.

There is a stock of carbon located in Building O28. When the change out occurs and the carbon bags are utilized, a new shipment of carbon is ordered so that a supply is always readily available.

GAC units are Calgon Cyclesorb FPl. Appendix C contains a detailed description of the GAC units including installation and operation instructions. Filter Operation and Maintenance instructions are included in Appendix B.

## 2.3 Pumping Well Valve Configuration and Valve Operation Procedures

### 2.3.1 Description

The discharge control valves that regulate flow and pressure are mounted on the north wall of the 952-30R pump building. There are two valves: a bypass-valve; and an electrically controlled valve. The bypass valve is located directly above the control valve. The control valve is an electro mechanical Worcester Control Series 75 valve located directly below the bypass-valve. The control valve has standard PVC ball valves on the inlet and outlet to allow isolation of the Worcester control valve for maintenance and to limit maximum flow.

### 2.3.2 Starting Procedures

In starting the pumping system, it is essential that the rate of discharge be increased gradually such that the resulting turbidity in the well is minimized. Typically, the bypass-valve should always be open to at least one gpm, such that in the event the control valve fails in the closed position, the pump will not burn out or be damaged. The standard PVC ball valve located on the inlet side of the control valve should at all times be kept in the open position. Note that the combined flow of the bypass valve and the control valve should not exceed 8 gpm.

When starting the pump, first adjust the bypass ball valve to one gpm with the control discharge ball valve closed. After verifying a flow of one gpm on the flow meter, adjust the control discharge PVC ball valve in increments of one gpm for each thirty seconds until a total flow of eight gpm is indicated by the flow meter.

### 2.3.3 Daily Operation, Abnormal Weather Conditions and Auto Cycle

After starting the pump, the pump run (green) light and the high-water level (red) light will remain on for approximately 24 to 36 hrs. The discharge flow rate should be measured and recorded in the 952-30R pump station field note book. If the high-water level light remains on for more than 72 hrs., observe the high-water level (red) light for thirty minutes to ensure

that it is not part of the normal operation cycle. If the high-water level (red) light remains on, and the flow is eight gpm as indicated by the flow meter, and the pressure at pressure gauge #2 or #3 (the gauges located after the control and bypass valves, but before the bag filters) is indicating less than 25 psi, adjust the standard ball valve on the discharge side of the Worcester control valve in increments of one half gpm per day until the control panel displays only a pump run (green) light.

During normal operation, the Worcester control valve may cycle open indicating high level (red) or may cycle closed (amber) indicating low level. These oscillations will occur less frequently as the Worcester control valve micro-adjusts the flow of the pump to match the yield of the well.

Under normal conditions, after the control valve has stabilized, a pump run (green) light will be the only light observed. Note that during periods of heavy precipitation or conditions of snow melt, with increased recharge to the aquifer, the pumping rate may need to be increased above eight gpm as described previously.

## 3.0 ELECTRICAL SYSTEM

### 3.1 Scope

This chapter deals with the electrical supply and distribution associated with the Groundwater Remediation system. A description is also provided of the electrical equipment.

### 3.2 Description

System is 3 phase, 4W, 120/208V supplied from an existing panel board in Building 982. Supply enters the Treatment Building via an underground feeder in conduit, 4# 8 + 1# 8 GRD- 2"C. Supply is fed through a disconnect load center. The Load Center feeds lighting, receptacle and unit heater circuits directly. The load Center also feeds 1/2 HP, 240 V, 1 phase pump motor via a 3KVA, 208V - 120/240V step-up transformer. All distribution feeders are #12 conductor in 3/4" conduit except for the unit heater, which is #10 conductor.

### 3.3 Equipment

1. Load Center: 120/208 VAC, 3 phase, 4W, 125A MLO, 12 circuit w/circuit breakers by Square D.
2. Disconnect Switch: 3D, 240 VAC, 60A, in NEMA 1 enclosure, non-fused by Square D.
3. Unit Heater: 7.5 KW, 3-phase, 240 VAC, Type LUH by Chromalox PN. LUH-07-23, ceiling mounted, thermostatically controlled.
4. Lighting Fixtures: 1 lamp, 40 W, 4' industrial watertight fluorescent by Day-Brite P.N. R41141, manually operated.
5. Step-up Transformer: 3 KVA, 1 phase, 208V - 120/240V by Westinghouse PN. 529N11S03N.
6. Receptacles, Duplex, GFC1, 15A, 125V, straight blade.

## 4.0 CONTROL AND ALARM SYSTEMS

## 4.1 Scope

This chapter discusses the control and alarms systems associated with the overall groundwater pump and treatment system. The liquid level control switches installed in the well control the operation of the groundwater pump and motorized valve. The filters and GAC units do not have separate controls.

## 4.2 Controls

### 4.2.1 Pump Controls

The submersible groundwater pump pumps water through the entire treatment system including its eventual discharge to the sanitary sewer. Hence, the pump controls are the only ones for the treatment process.

The pump control panel has 4 indicating lights to inform the operator of the pumping status. These lights include the following:

- **Pump Running** - When lit this light indicates that the pump is running.
- **Valve Open** - When lit this light indicates that the water level in the well is above the desired range and that the motorized valve is fully open.
- **Valve Close** - When lit, this light indicates that the water level in the well is below the desired range and that the motorized valve is fully closed.

  Note: When the Pump Running light is on and when both Valve Open and Valve Close lights are off, the water level in the well is within the desired range and the motorized valve is partially open.
- **High Level** - When lit, this light indicates that there is water in the sump pit and that the groundwater pump has therefore been shut down.

The pump and the entire treatment process will shut down automatically under the following conditions:

1. High level in the sump pit as sensed by the high level float switch.
2. Low temperature in the building as sensed by the room thermostat.
3. High pressure in the pump discharge line immediately upstream from the motorized valve as sensed by the pressure switch.
4. Low water level in the well as sensed by the pump off level probe in the well.

## 4.3 System Troubleshooting Procedures

| Possible Problem | Probable Cause | Corrective Action/Remarks |
|---|---|---|
| 1. Pump not running | a. Pump shutdown due to high level in sump pit caused by leakage from process piping or equipment. | a. Repair leak, empty sump pit and restart pump. |
| | b. Pump shutdown due to low temperature in building. | b. Check temperature in building, raise temperature setting on thermostat or check/repair unit heater and restart |
| | c. Pump shut down due to high pressure in pump discharge line caused by closed ball valve, closed motorized valve, plugged filter or plugged GAC unit. | c. Check that all valves are in proper position, check position and operation of motorized valve, check filters and GAC units for possible clogging. Correct accordingly and restart |
| | d. Pump shut down due to low water level in the well. | d. Check water level in well. This may be normal rather than problem. |
| 2. High Pressure Drop across Filter Unit | a. Plugged Filter Unit | a. Replace filter media |
| 3. High Pressure Drop across GAC Unit | a. Plugged GAC Unit | a. Backwash GAC Unit |

## 5.0 MAINTENANCE

### 5.1 General

Maintenance requirements for the treatment process is minimal since there are few moving parts. (i.e., Pump and motorized valve). The remaining parts are passive (i.e., piping, valves, filters and GAC units) and do not require extensive maintenance.

The operator should become familiar with the detailed Installation, Operation and Maintenance information contained in the Appendices for each piece of equipment. Safety warnings associated with each piece of equipment should also be strictly adhered to.

### 5.2 Groundwater Pump

Maintenance requirements are minimal. The groundwater pump is capable of continuous operation.

### 5.3 Pump Controller and Motorized Valve

Maintenance requirements are minimal. The pump controller and motorized valves are capable of continuous operation.

### 5.4 Filter Units

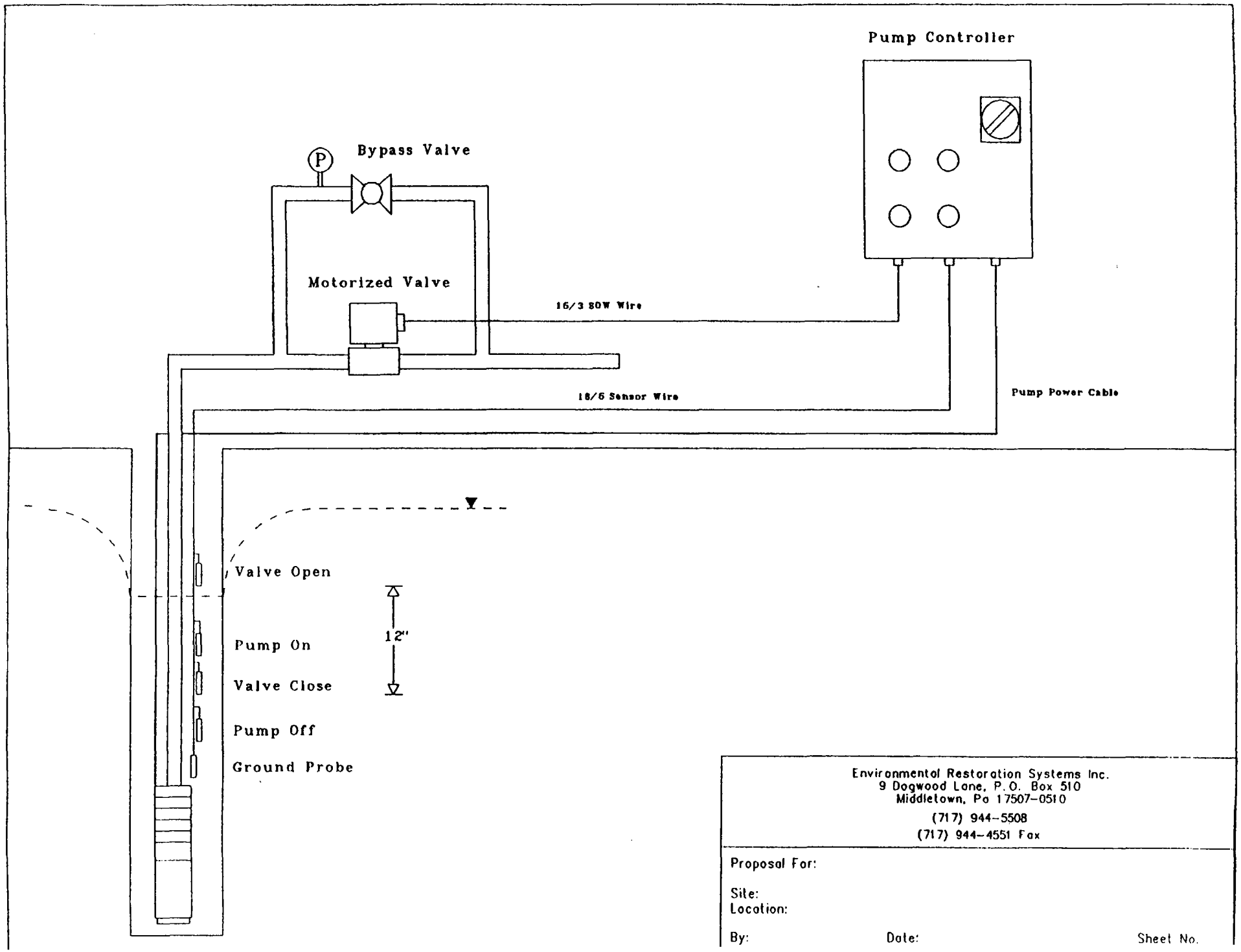
- Periodically check the pressure drop across each filter unit. An increase in pressure differential may indicate a clogged or plugged media (filter bag).
- Replace the filter bags in both filters whenever the pressure drop across either filter exceeds 15 psi, or the incoming pressure to a filter reaches 40 psi.
- Clean and inspect the shell O-ring and seating surfaces each time the filter cover is removed. Replace worn or damaged parts when needed before reassembling cover.

## 5.5 GAC Units

- Periodically check pressure drop across each GAC unit. An increase in pressure differential may indicate a build-up of solids on the top of the GAC bed.
- Backflush the GAC unit whenever the pressure drop across the unit is excessive.
- Periodically check for trapped air in the GAC Units by isolating the individual unit and opening the vent.
- Replace the carbon in both units when priority organic concentrations exceed limits.
- If extended shut-down of a GAC unit is planned, the unit should be drained.

# APPENDIX A

## GROUNDWATER PUMP, PUMP CONTROLLER AND MOTORIZED VALVE




Environmental Restoration Systems Inc.
9 Dogwood Lane, P.O. Box 510
Middletown, Pa 17507-0510
(717) 944-5508
(717) 944-4551 Fax

Proposal For:

Site:
Location:

By: Date: Sheet No.

# Environmental Restoration Systems Inc.

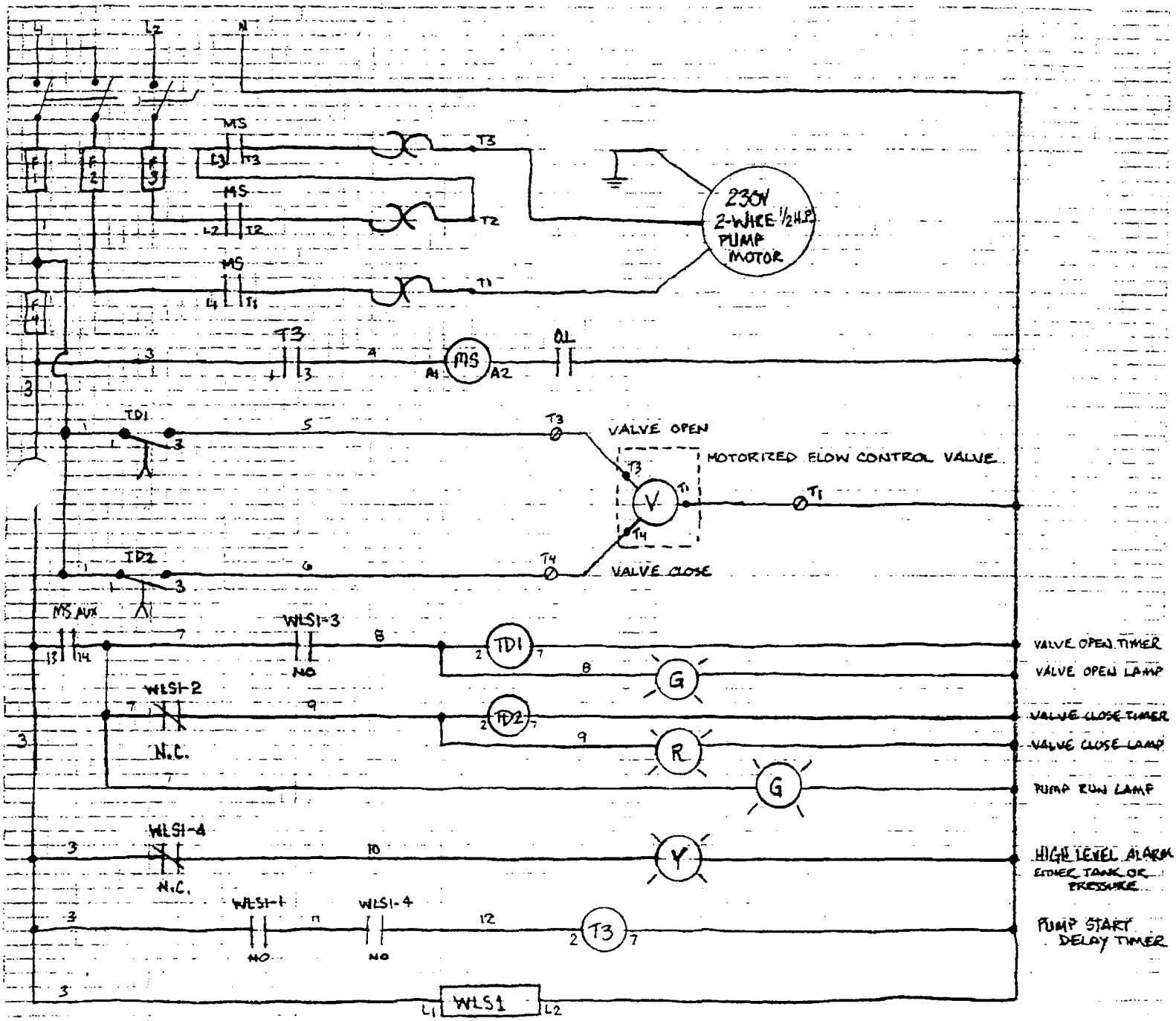
SUBJECT ELECTRIC PUMP CONTROL - WITH AUTOMATED FLOW CONTROL UTILIZING A MOTORIZED VALVE

PROJECT NUMBER

PHASE TASK

BY JPM DATE 11/3/93 CHECKED BY DATE

SHEET NUMBER 1 OF 2




F1 = LPJ-5SP

F2 = LPJ-8SP

F3 = LPJ-8SP

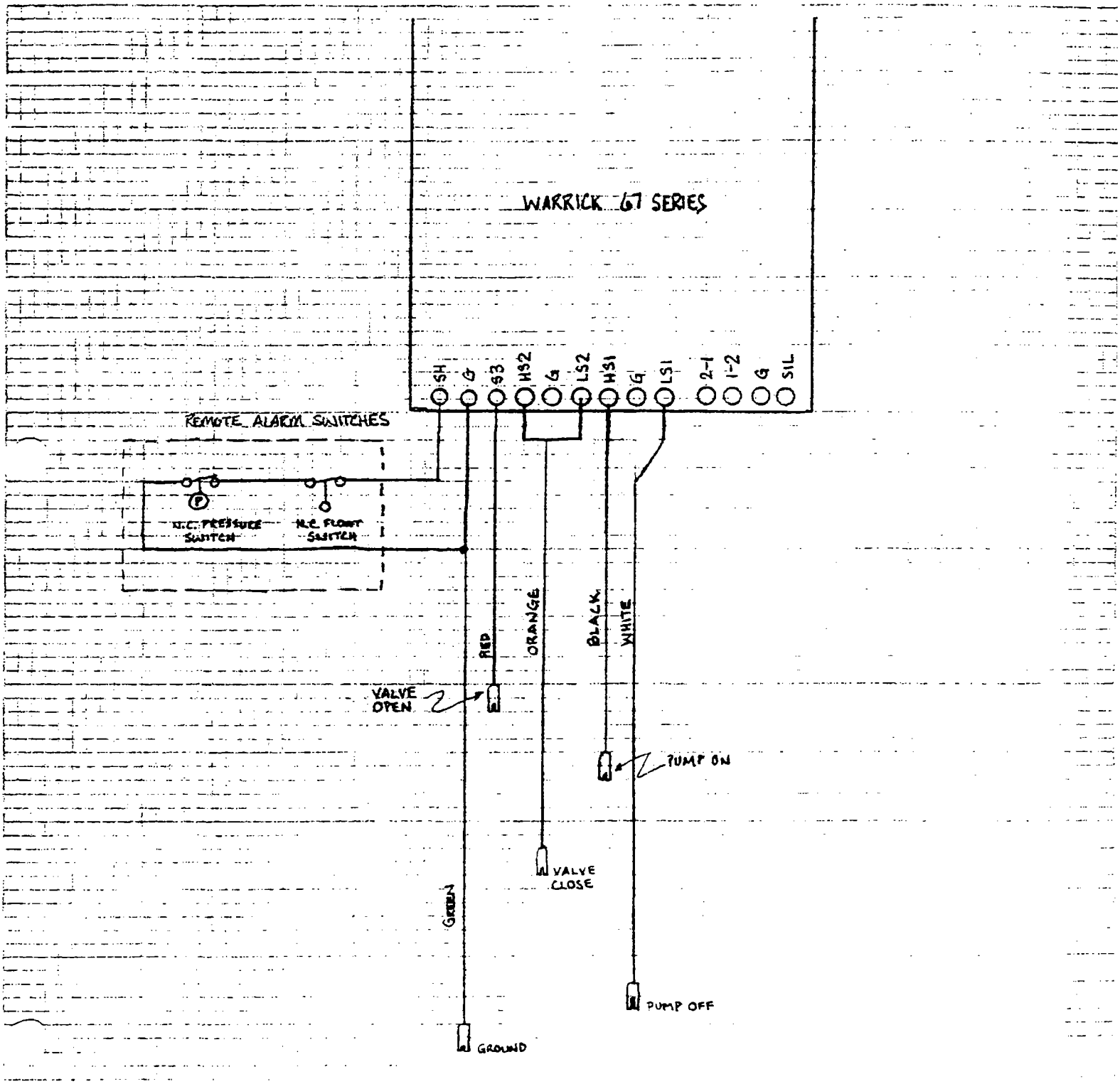
F4 = MDL-1

# Environmental Restoration Systems Inc.

SUBJECT Probe Hook-up PROJECT NUMBER

PHASE TASK

BY JPM DATE 11/3/93 CHECKED BY DATE SHEET NUMBER 2 OF 2



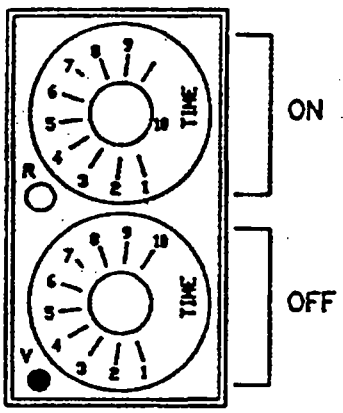

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# WRIGHT MODULAR RECOVERY SYSTEM

## NOTE 1A

CYCLE TIMER NOTE FOR ALL
W.M.R.S. ELECTRIC/PNEUMATIC CONTROLLERS

## PUMP STROKE TIMER ADJUSTMENTS

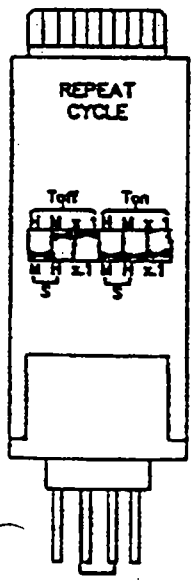


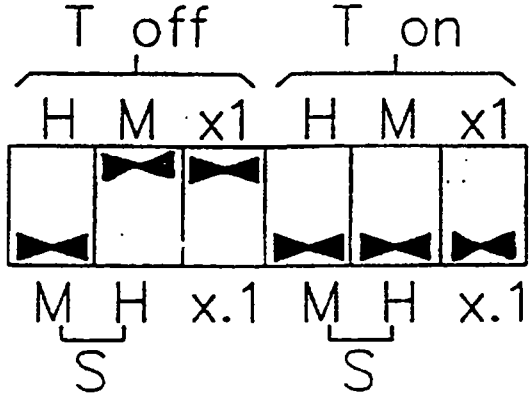

TOP KNOB ADJUSTS DURATION OF ELECTRICAL PULSE THAT CAUSES VALVE MOVEMENT. SMALLER PULSES WILL KEEP THE VALVE FROM OVER SHOOTING THE OPTIMAL FLOW RATE.

BOTTOM KNOB ADJUSTS DURATION OF PAUSE BETWEEN ELECTRICAL PULSES. ALLOW ENOUGH TIME FOR THE WELL LEVEL TO REACT TO THE NEW FLOW RATE CAUSED BY THE PULSE.

## TIMER SIDE VIEW & AVAILABLE TIME RANGES

FACTORY SETTINGS AS SHOWN




ADJUSTMENT KEY

| | | | |
|---|---|---|---|
| H=HOURS | x | 1 | (EXAMPLE: M X 1 X DIAL NUMBER) |
| M=MINUTES | x | .1 | (EXAMPLE: M X .1 X DIAL NUMBER) |
| H/M ] S=SECONDS | | | |

MULTIPLIERS

## Single Electric Pump Controller #5115-NP1-2-1B-AV

Custom Electric Pump Controller to operate one 230/1/60 ½ HP electric submersible pump. Controller will utilize level probes in the well for automatic adjustment of a motorized flow control valve. An intrinsically safe high level shut-off circuit is provided in the controller for hook-up to the existing pressure switch and the high level float switch. Also included: Nema 4 enclosure; indicator lamps for "pump run", "high level or high pressure alarm", "valve open" and "valve close"; cover mounted disconnect switch; pump start delay timer; individual valve open and close "bump" timers; IEC motor starter with overload; primary fuse protection; 1½" PVC ball valve with 115 vac motorized actuator; five point conductivity probe.

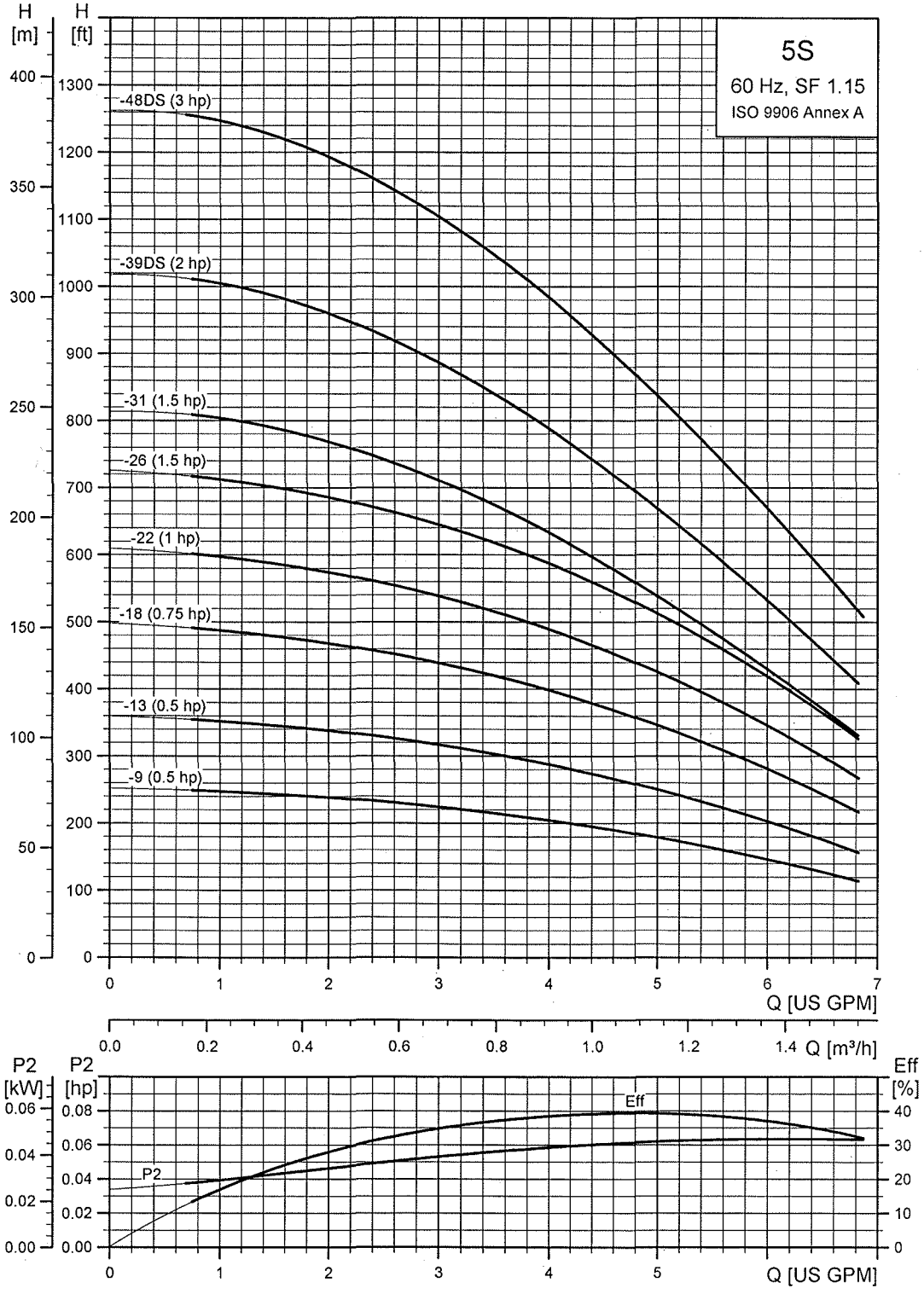
### Controller Operation

The operation of the electric submersible pump is controlled by four conductivity probes in the well, a motorized valve and a pump control panel. The signals from the probes will bump the motorized valve open or closed (depending on the current water level in the well) to attempt to maintain a fluid level between the valve open and valve close probes. If water is over the valve open probe we know that the flow must be increased in order to bring the level down. At this point a signal is sent to the valve open timer to begin its operation, a short (.5 second) adjustable pulse is sent to the motorized valve open terminal causing the valve to deflect in a small increment thus allowing the pumping rate to be increased. The valve open timer then will wait for an predetermined time (adjustable 0 to 10hrs) for the well to react to the flow change. If the well level is still above the valve open probe at the end of wait time the timer will send another bump open signal to the valve and continue this cycle of bumping and waiting until the water level falls below the valve open probe. Once this occurs there is no output to the valve so that it will hold its current position. If the water level falls below the valve close probe we know the flow rate needs to be restricted in order to bring the water level back to our desired depth, at this point the valve close timer follows the same sequence as above to close the valve. If at any point the well flow rate falls below the minimum flow set point of the bypass valve (this is set to a point that will keep the pump from running below its minimum rated flow to protect the motor from over heating), the eventual outcome will see the water level falling below the pump off probe and shutting down the pump. The pump will be restarted after the well recovers over the on probe and the adjustable pump start delay timer times out. The time on this timer should be set to a point not to allow the pump to be restarted beyond the rated number of starts per hour. If this timer is set too low and the well recharges to the on probe quickly, damage could occur to the pump motor from starting the motor too frequently. The system is capable of continuous operation on the on and off probes but may be an indication that the submersibe well pump is oversized for the minimum flow rate of the well and the minimum flow required for cooling of the submersible motor. Motor cooling shrouds are recommended in applications that will permit it use.

# 6. Curve charts and technical data

## 4" and larger wells

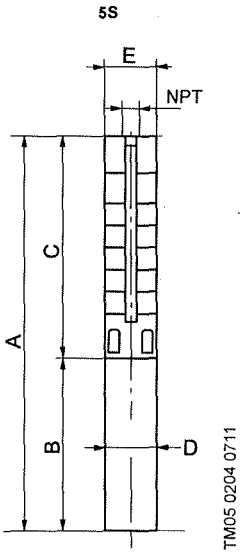
## SP 5S (5 gpm)




TM05 0229 2112

# 4" and larger wells - continued
# SP 5S (5 gpm) / 4 inch motor

| Pump model | Nom. head [ft] | Ph | Volts [V] | Motor [Hp] | | Dimensions A [in. (mm)] | B [in. (mm)] | C [in. (mm)] | D [in. (mm)] | E [in. (mm)] | Net weight (complete) [lb] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **5S, motor dia. 4 inch, 2 wire motor, 60 Hz - rated flow 5 gpm (1" NPT)** | | | | | | | | | | | |
| 5S05-9 | 171 | 1 | 230 | 0.5 | ■ | 24.57 (624) | 11.03 (280) | 13.55 (344) | 3.74 (95) | 3.98 (101) | 21.6 |
| 5S05-13 | 247 | 1 | 115 | 0.5 | ■ | 27.88 (708) | 11.03 (280) | 16.86 (428) | 3.74 (95) | 3.98 (101) | 26.9 |
| | | | 230 | 0.5 | ■ | 27.88 (708) | 11.03 (280) | 16.86 (428) | 3.74 (95) | 3.98 (101) | 26.1 |
| 5S07-18 | 343 | 1 | 230 | 0.75 | ■ | 32.60 (828) | 11.62 (295) | 20.99 (533) | 3.74 (95) | 3.98 (101) | 29.7 |
| 5S10-22 | 419 | 1 | 230 | 1 | ■ | 36.50 (927) | 12.21 (310) | 24.30 (617) | 3.74 (95) | 3.98 (101) | 32.4 |
| 5S15-26 | 495 | 1 | 230 | 1.5 | ■ | 41.30 (1049) | 13.71 (348) | 27.60 (701) | 3.74 (95) | 3.98 (101) | 41.4 |
| 5S15-31 | 527 | 1 | 230 | 1.5 | ■ | 47.21 (1199) | 13.71 (348) | 33.51 (851) | 3.74 (95) | 3.98 (101) | 47.7 |
| **5S, motor dia. 4 inch, 3 wire motor, 60 Hz - rated flow 5 gpm (1" NPT)** | | | | | | | | | | | |
| 5S05-9 | 171 | 1 | 230 | 0.5 | ■ | 24.57 (624) | 11.03 (280) | 13.55 (344) | 3.74 (95) | 3.98 (101) | 22.5 |
| 5S05-13 | 247 | 1 | 115 | 0.5 | ■ | 27.88 (708) | 11.03 (280) | 16.86 (428) | 3.74 (95) | 3.98 (101) | 26.9 |
| | | | 230 | 0.5 | ■ | 27.88 (708) | 11.03 (280) | 16.86 (428) | 3.74 (95) | 3.98 (101) | 25.2 |
| 5S07-18 | 343 | 1 | 230 | 0.75 | ■ | 32.60 (828) | 11.62 (295) | 20.99 (533) | 3.74 (95) | 3.98 (101) | 28.8 |
| 5S10-22 | 419 | 1 | 230 | 1 | ■ | 36.50 (927) | 12.21 (310) | 24.30 (617) | 3.74 (95) | 3.98 (101) | 32.4 |
| 5S15-26 | 495 | 1 | 230 | 1.5 | ■ | 41.30 (1049) | 13.71 (348) | 27.60 (701) | 3.74 (95) | 3.98 (101) | 37.8 |
| | | 3 | 230 | 1.5 | ■ | 39.81 (1011) | 12.21 (310) | 27.60 (701) | 3.74 (95) | 3.98 (101) | 38.7 |
| | | | 460 | 1.5 | ■ | 39.81 (1011) | 12.21 (310) | 27.60 (701) | 3.74 (95) | 3.98 (101) | 38.7 |
| 5S15-31 | 527 | 1 | 230 | 1.5 | ■ | 47.21 (1199) | 13.71 (348) | 33.51 (851) | 3.74 (95) | 3.98 (101) | 47.7 |
| | | 3 | 230 | 1.5 | ■ | 45.71 (1161) | 12.21 (310) | 33.51 (851) | 3.74 (95) | 3.98 (101) | 45.0 |
| | | | 460 | 1.5 | ■ | 45.71 (1161) | 12.21 (310) | 33.51 (851) | 3.74 (95) | 3.98 (101) | 45.0 |
| 5S20-39DS | 663 | 1 | 230 | 2 | • | 59.61 (1514) | 19.49 (495) | 40.12 (1019) | 3.74 (95) | 4.25 (108) | 57.6 |
| | | 3 | 230 | 2 | ■ | 53.82 (1367) | 13.71 (348) | 40.12 (1019) | 3.74 (95) | 4.25 (108) | 54.0 |
| | | | 460 | 2 | ■ | 53.82 (1367) | 13.71 (348) | 40.12 (1019) | 3.74 (95) | 4.25 (108) | 54.0 |
| 5S30-48DS | 816 | 1 | 230 | 3 | • | 70.16 (1782) | 22.60 (574) | 47.56 (1208) | 3.74 (95) | 4.25 (108) | 77.4 |
| | | 3 | 230 | 3 | • | 65.56 (1665) | 18.00 (457) | 47.56 (1208) | 3.74 (95) | 4.25 (108) | 77.4 |
| | | | 460 | 3 | • | 65.56 (1665) | 18.00 (457) | 47.56 (1208) | 3.74 (95) | 4.25 (108) | 77.4 |




**E = Maximum diameter of pump including cable guard and motor.**

Notes:
Control box is required for 3-wire, single-phase applications. Data does not include control box.
DS designation = Built into sleeve, 1 - 1/2" NPT, 6" minimum well diameter.
Performance conforms to ISO 9906. 1999 (E) Annex A. Minimum submergence is 2 feet.

- ■ MS 402 motor.
- • MS 4000 motor.

# Installation Operation & Maintenance Instructions

**SERIES 75 ELECTRIC VALVE ACTUATORS**

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## ILLUSTRATIONS


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**Worcester Controls**
P.O. BOX 538, 33 LOCKE DRIVE
MARLBOROUGH, MA 01752-0005
(508) 481-4800 TELEX 6817563
A BTR Company

Description:

Worcester Controls Series 75 actuators are reversible electric quarter-turn valve actuators. Standard units can provide up to 3000 in-lbs of torque and have capacitor-start, capacitor-run 25% duty cycle motors and permanently lubricated gear trains. These actuators are equipped with integral thermal overload protection [AC motors only] with automatic reset and internal adjustable limit switches. In the event of electrical power failure, W and X models feature manual override capabilities.

WARNING: SERIES 75 ACTUATORS ARE ELECTRO MECHANICAL DEVICES SUBJECT TO NORMAL WEAR AND TEAR. ACTUATOR LIFE IS DEPENDENT UPON APPLICATION AND ENVIRONMENTAL CONDITIONS. IF APPLIED IN HAZARDOUS SERVICES, SUCH AS BUT NOT LIMITED TO, MEDIA TEMPERATURE EXTREMES, TOXINS, FLAMMABLES, OR OTHER SERVICES WHERE IMPROPER OR INCOMPLETE OPERATION COULD PRODUCE A SAFETY HAZARD, IT IS INCUMBENT UPON THE SYSTEM DESIGNER AND THE USER TO PROVIDE PROPER WARNING DEVICES SUCH AS TEMPERATURE SENSORS, OXYGEN SENSORS AND FLOW SENSORS. WORCESTER ALSO RECOMMENDS THAT THE OPTIONAL AUXILIARY LIMIT SWITCHES BE USED FOR MONITORING AND/OR ELECTRICAL INTERLOCK.

CAUTION: Worcester recommends that all product which must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to: relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40°F may occur.

Installation:

A. Attach mounting bracket to actuator using four [4] socket head cap screws and lock-washers. Tighten securely with proper Allen wrench.

B. Attach bracket/actuator assembly to valve as follows:

1. Valve Models 44 [1/4"-2"], 59 [1/4"-1 1/2"]:

CAUTION: Ball valves can trap pressurized media in the cavity. If valve is installed in line and is or has been in operation, make sure there is NO pressure to or in the valve before removing any valve body bolts.

a. Close valve [valve is closed when flats on stem are perpendicular to the line of flow].

b. Remove handle nut, handle, lockwasher and stop. Replace lockwasher and handle nut while holding retaining nut securely with wrench.

c. Transfer all valve information from stop plate to the bracket nameplate.

d. C4 (extended Cryo) valves require no further disassembly. For all other valves, remove upper two valve body bolts and nuts from valve.

e. Center coupling on valve stem.

f. Lower mounting bracket/actuator assembly over coupling and onto valve, making sure that male actuator shaft engages slot in coupling.

g. Secure bracket to valve using new longer valve body bolts and nuts provided in mounting kit. Tighten valve body nuts to body bolts to the following torques:

| | Torque | |
|---|---|---|
| Bolt Size | Carbon Steel Bolts | Stainless Steel Bolts |
| 1/4" | 8-10 ft.-lbs. | 6- 8 ft.-lbs. |
| 5/16" | 13-17 ft.-lbs. | 10-12 ft.-lbs. |
| 3/8" | 18-22 ft.-lbs. | 16-18 ft.-lbs. |
| 7/16" | 40-45 ft.-lbs. | 28-32 ft.-lbs. |

2. Valve Models 45 [2 1/2"-6"], 59 [2"-4"], 51/52 [1/2"-10"], 151/301 [3"-6"], 82/83 [1/2"-10"], 94 [1/2"-6"]:

CAUTION: Ball valves can trap pressurized media in the cavity. If valve is installed in line and is or has been in operation, make sure there is NO pressure to or in the valve before removing any valve body bolts.

a. Close valve [for valves 1/2"-2", the valve is closed when flats on valve stem are perpendicular to the line of flow; for valves 3" and larger, where the valve stem is square, check ball position for closure].

b. For 1/2"-2" 51/52 and 1/2"-1 1/2" 82/83, remove handle nut, lockwasher, handle, stop and stop screw. Replace lockwasher and handle nut while holding retaining nut securely with wrench.

For 2" 59 R2 and 2 1/2" 45 R2, 2" and 2 1/2" 82/83 valves and valves 3" and larger, remove handle [if necessary], retaining nut, stop and stop screws. Replace with valve stem spacer [except 8", 10" 82/83 & 10" 51/52] and retaining nut. Tighten retaining nut securely with wrench.

For 1/2"-2" 94 valves, remove handle (if any).

For 3"-6" 94 valves, remove handle assembly, stop, and spacer (if any).

c. Center coupling on valve stem.

d. Lower mounting bracket/actuator assembly over coupling and onto valve, making sure that male actuator shaft engages slot in coupling.

e. Secure bracket to valve using cap screws and lockwashers provided in mounting kit. Tighten securely.

3. Valve Models WS, WC, WK [2"-12"]:

a. Close valve [valve is closed when the small diameter cross hole through the top of the shaft is parallel to the axis of the pipe].

b. If valve is installed in the pipe and is operated by means of a lever handle, remove the handle and latch plate from the valve after DEPRESSURIZING THE PIPE in which the valve is installed.

To remove handle, drive the pin which secures the handle to the valve stem through until it clears the stem. Lift handle from valve stem. Remove the two bolts and nuts that hold the latch plate to the mounting pad and remove latch plate.

c. Install coupling on valve stem by aligning the small diameter cross hole in coupling and valve stem. Drive the drive pin through coupling and valve stem until centered.

d. Lower mounting bracket/actuator assembly over coupling and onto valve, making sure that the male actuator shaft engages slot in coupling.

e. Secure bracket to valve by inserting mounting bolts through holes in bracket and valve mounting pad. Place nuts on end of mounting bolts and tighten securely.

f. Connect power source to actuator as described in sections A and B of Electrical Installation & Adjustment instructions.

g. Cycle actuator to "Open" position.

h. Verify proper indexing of "Closed" position limit switch by cycling actuator to "Closed" position. Actuator motion must be stopped by limit switch and cam before motor stalls. Adjust cam if necessary. This procedure is critical to ensure proper operation of the unit.

i. Recheck indexing in both directions. Adjust cams if necessary.

j. Verify operation of mechanical brake [a mechanical brake should always be used when actuating a butterfly valve with an electric actuator].

Note: Sizes 25 and 3075 actuators utilize a self-locking gear train and, therefore, do not require a mechanical brake.

k. Replace actuator cover as described in section D of Electrical Installation & Adjustment instructions.

C. Series 75 actuator in modulating control service and interface with PC and/or computer.

1. Series 75 actuators can be used for modulating control service operated directly by programmable controller or computer under specific conditions as follows:

   a. To achieve stable control, an actuator with a longer cycle time is recommended.

   b. To eliminate overheating from frequent start-ups, 75% or 100% duty cycle actuators are required.

   c. To eliminate problems with interfacing, and to protect the output circuitry of the controller, use Worcester Controls I-75 interface board.

2. Alternately a controller coupled with a Series 75 actuator must have:

   a. Two outputs [one to open, one to close] per actuator being controlled.

   b. 9 amp minimum output rating.

   c. Buffered output - resistor and capacitor wired in series across each triac.

If a controller output does not meet these requirements, two relays [one to open, one to close] may be installed between controller and each actuator. Failure to observe these precautions will result in controller output damage.

Electrical Installation & Adjustment:

CAUTION: It is recommended that the actuator motor not be driven directly from the PLC output. The inrush current/back EMF can destroy the PLC output card triacs if they are not of sufficient rating. As a minimum these should be rated 800 volt, 12 amp triacs. In addition to these ratings, snubber circuits should be utilized to help protect the triacs. This applies to 120 VAC motors only. 240 VAC motors should never be driven directly from a PLC output card.

A. To gain access to terminal strip, it is necessary to remove the actuator cover.

10-2275 [General Purpose] - Loosen cover screws and lift cover from unit.

10-2275 W or X - Remove declutch knob screw and lift knob from shaft. Remove the 2 cover screws from cover (the other 6 screws are in an envelope and inside the cover) and lift cover from unit.

25-3075 W or X - Remove indicator knob capscrew with Allen wrench and lift knob from shaft. Remove the cover screws and lift cover from unit.

B. Make conduit connection to NPT fitting on actuator base [1/2" NPT for 10-3075]. Connect power supply to actuator terminal strip as shown on electrical schematic diagram located inside actuator cover and on page 15 of manual. The actuator should be electrically grounded in accordance with standard procedures. See table below for minimum fuse size when overcurrent protection is used in motor power circuit.

INSTALLATION CAUTION: In cases where the conduit connected to the actuator may be partially or completely run underground, or through which moisture may contact energized live parts, or where the actuator and/or conduit is exposed to temperature differences, the conduit should be sealed within 18" of the actuator in accordance with the National Electrical Code.

Minimum Fuse Size for Overcurrent Protection

| Actuator Size | Voltage | Fuse Rating |
|---|---|---|
| 10-22 | 120 VAC | 5A |
| 25/30 | 120 VAC | 10A |
| 10-22 | 240 VAC | 3A |
| 25/30 | 240 VAC | 5A |
| 10-22 | 12 VDC | 10A |
| 10-22 | 24 VDC | 5A |
| 25/30 | 24 VDC | 20A |

NOTE: The table shows the minimum size to prevent inrush current from blowing the fuse.

C. When electrical installation is complete, it is advisable to check the indexing of the actuator before replacing the cover.

10-3075 [All]: Actuate valve to "Open" position. If valve does not fully open, or turns past open position, unfasten cam by loosening set screw. Actuate valve to correct position. Adjust cam so that it just throws micro switch in this position. Tighten set screw and re-check indexing. Repeat this procedure for "Closed" position. WARNING: Do not bend switch arms when adjusting cams for actuator travel limits. Doing so will damage the cams.

NOTE: If one or more of the options listed in Options & Adjustments Section have been installed, follow specific instructions for those options as necessary before replacing cover.

D. Replace actuator cover. Tighten all cap screws securely.

For X Models Only:

After placing the cover on the actuator, tighten the cover bolts in a criss-cross fashion to a torque of 70-80 in.-lbs.

A feeler gage, being 1/8" to 1/2" wide and .0015 thousandths thick, shall be used to check the clearance between the base and cover flange.

This feeler gage shall not penetrate the base/cover flange gap any more than 1/8".

10-2275 W or X: Replace declutching knob, taking care that knob set screw engages milled flat on clutch shaft and indicates proper position on labeled cover.

25-3075 W or X: Replace indicator knob in its proper position to give correct indication. Tighten indicator's cap screw securely.

Options & Adjustments:

A. Center-Off Kit (180° Rotation)

1. Readjustment of "Center-Off" Cams [if necessary]:

a. With the actuator placed with the cover removed and the terminal strip facing the operator, switches 1 and 3 are to the right and switches 2 and 4 are to the left of the main shaft.

b. Installation for 10-22 75 actuators:

Place the cam spacer, cam #3, cam spacer, and cam #4 over the shaft. [CAUTION: Do not bend the limit switch levers.] Loosen their set screws as necessary to slide the cams into position. There are now four cams on the shaft. Per the drawing, the cams are numbered 1 through 4, from bottom to top. [See proper drawing for the approximate location and correct orientation of the center-off cams.]

c. Installation for 25-30 75 actuators:

Place the two slotted bushings into the two center off cams [#3, #4]. Loosen the cam set screws as necessary. Slide over the actuator's sensing shaft a cam spacer [nylon washer], cam #3, the other cam spacer, and cam #4. There are now four cams and two spacers on the sensing shaft. Per the drawing, these cams are now numbered 1 through 4, from bottom to top. [See proper drawing for approximate location and correct orientation of the center-off cams].

d. Using the manual override (see page 13) as necessary, set the actuator shaft to a "center-off" location whatever required.

Set cam #3 such that hook of switch 3 lever arm has just dropped off the cam. Tighten cam screw without moving cam.

Set cam #4 such that hook of switch 4 lever arm will match the arch of cam #4. Tighten cam screw without moving cam.

Release manual override.

e. Power the actuator to the full clockwise [CW] limit, to the 0° reference position. Check position of ball and valve stem to verify that valve is in the true 0° position, as required by the application.

f. Repeat the above step for the 180° or full CCW position. Verify that the driven device is in the required position.

g. Apply power to terminals 1 and 7 for AC(+ to 7 and - to 8 for DC) to verify proper operation of center-off switches. With the actuator shaft positioned at the 180° position, power applied to terminals 1 and 7 for AC(+ to 7 and - to 8 for DC) moves the actuator shaft clockwise [CW] to the center-off position.

With the actuator shaft at the full clockwise position, 0 degrees, apply power to terminals 1 and 7 for AC(+ to 7 and - to 8 for DC). The actuator shaft should move counter-clockwise CCW to the center-off position.

SPECIAL NOTE: If during any of these checks, the actuator shaft stops other than at the required positions, a readjustment of the center-off cams is needed. At no time shall both center-off switches be activated by their cams at the same time. The N.O. contacts on both center-off switches are typically closed. The center-off switch levers must be tripped by their center-off cams at different times.

Therefore, the center-off cams should be set as close to the 90 degree position as possible, yet the cam/switch actuation for each switch is never at the identical position.

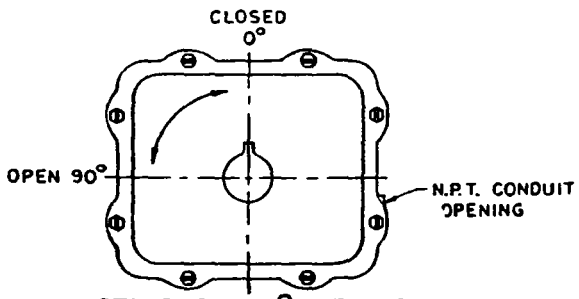
If the center-off switches are set to actuate at a close angular differential, the actuator shaft may oscillate, or not operate. Loosen one cam and move this cam to increase the actuation differential between each of the center-off switches.

If the center-off switches are set to actuate at a wide angular differential, the actuator will not stop at a true center-off position. Adjust one or both cams to decrease the angular differential between each of these switches.

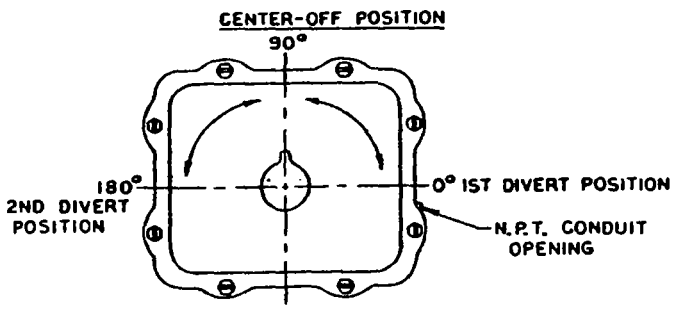
h. As a final check, alternately apply power to terminals 1 and 4, 1 and 3 and 1 and 7 for AC, (+ to the 1 and - to the 4; - to 1 and + to 3; - to 8 and + to 7 for DC).

No oscillation or hunting of the actuator output shaft should occur.

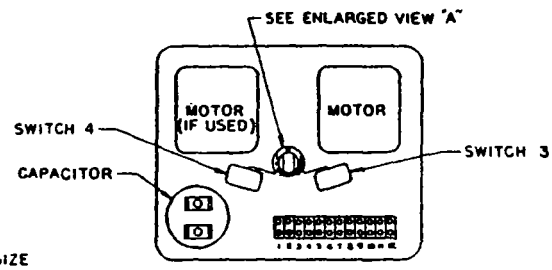
If the above problems are noted, simply readjust the center-off cams as noted in Step g.



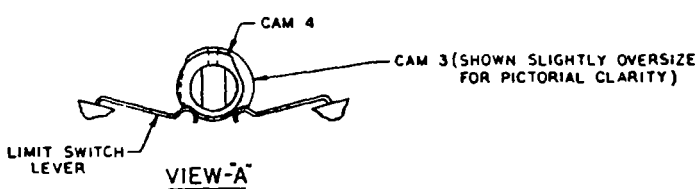

STANDARD 90° ACTUATOR
SERIES 75W & 75X SHOWN




180° CENTER-OFF ACTUATOR
SERIES 75W & 75X SHOWN

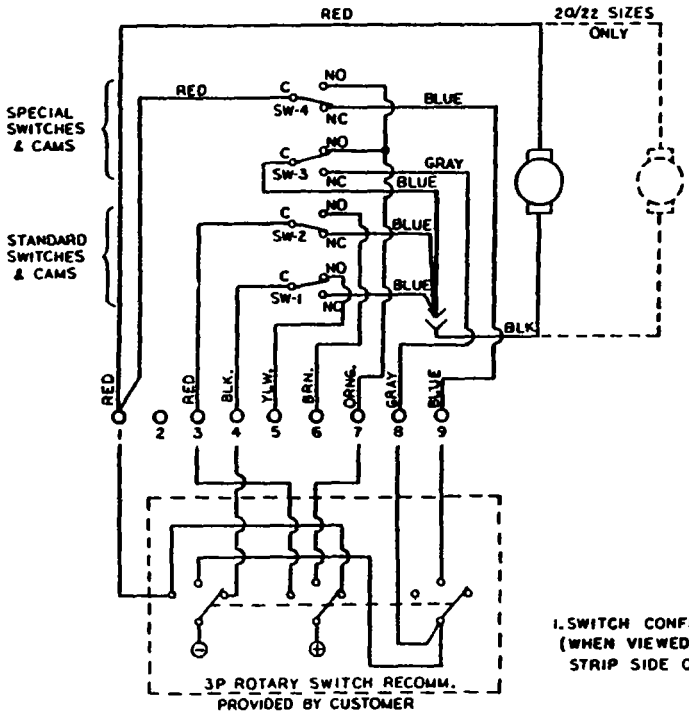



TYP. VIEW SHOWING LOCATION OF CENTER-OFF CAMS & LIMIT SWITCHES SET UP AT THE CENTER-OFF POSITION

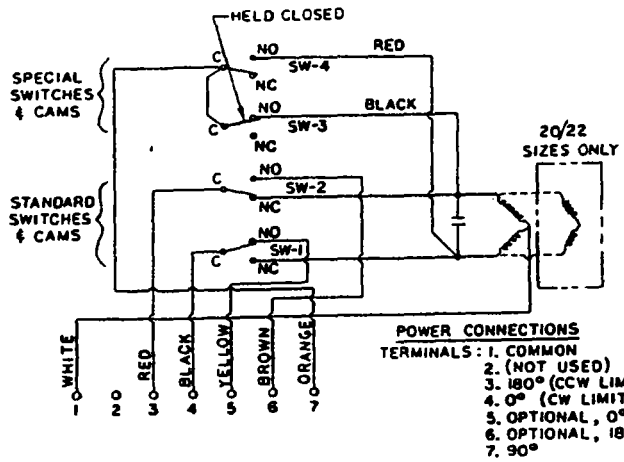



VIEW "A"

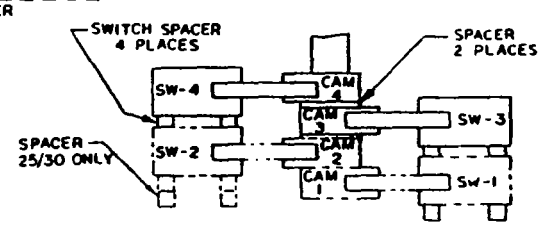
FOR 10-22 75 DC ACTUATOR




FOR 10-22 & 25/30 75 AC ACTUATOR




1. SWITCH CONFIGURATION IS AS FOLLOWS (WHEN VIEWED FROM THE TERMINAL STRIP SIDE OF THE ACTUATOR):




2. ACTUATOR SHOWN AT 0° POSITION (ALL THE WAY CW
3. CAM SETTINGS ARE AS FOLLOWS:
   SWITCH 1. OPENS AT 0°. CONTROLS 1ST DIVERT POSITION.
   SWITCH 2. OPENS AT 180°. CONTROLS 2ND DIVERT POSITION.
   SWITCH 3. OPENS AT 89°. CONTROLS CENTER-OFF POSITION FROM 1ST DIVERT POSITION.
   SWITCH 4. OPENS AT 91°. CONTROLS CENTER-OFF POSITION FROM 2ND DIVERT POSITION.

NOTE: 1. SWITCH 1 & 2 AND CAM 1 & 2 ARE STANDARD. SWITCH 3 & 4 AND CAM 3 & 4 ARE CENTER-OFF TYPE.
2. USE CAM SPACER AS NEEDED TO LINE UP CAM & SWITCH.

B. Feedback Potentiometers (Single, Dual)

The potentiometer, as part of the Series 75 Actuator, is used to obtain feedback representing the actuator's position. It requires a power supply, which may be furnished by the end user and/or by optional devices such as a 4-75 (4-20 mA) Position Indicator or AF17 Positioner.

A Dual Potentiometer is used with the AF17 Positioner or 4-75 Position Indicator when remote resistance indication is required.

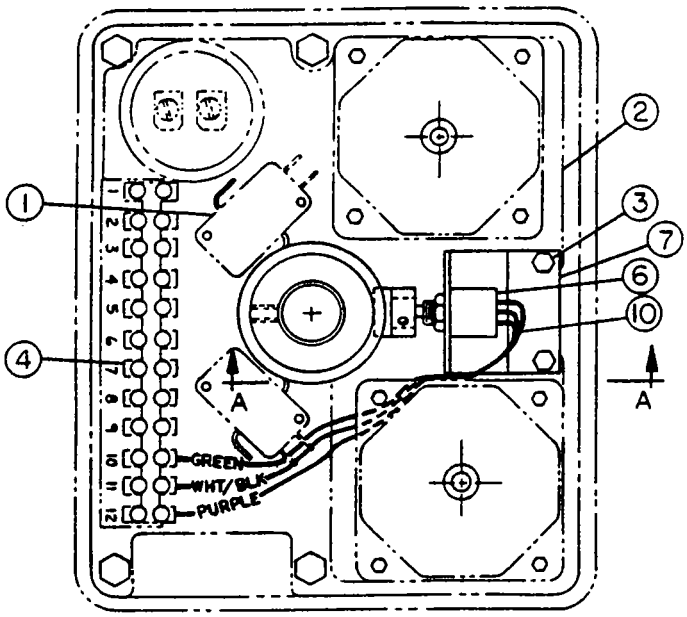
The Dual Potentiometer is required when both AF17 and 4-75 options are to be used together, one pot for each device.

Each pot can serve only one function. Remote resistance monitoring and an AF17, for instance, cannot share a pot.

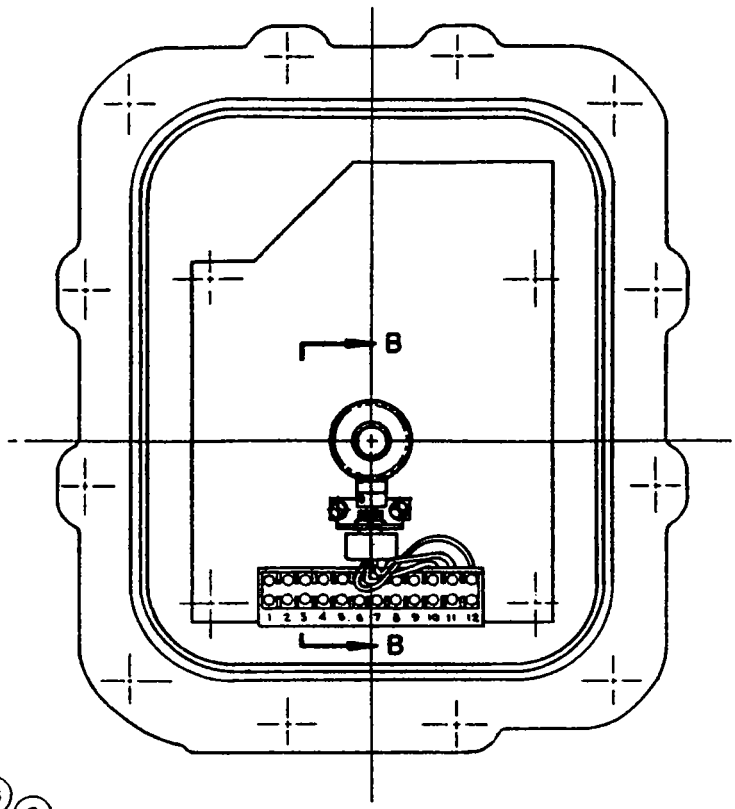
For wiring of a single or dual potentiometer to an AF17 Positioner, see AF17 Installation, Operation & Maintenance manual.

NOTE 1: If M2 option [two extra limit switches] is present, a feedback potentiometer must be directly wired to external indication.

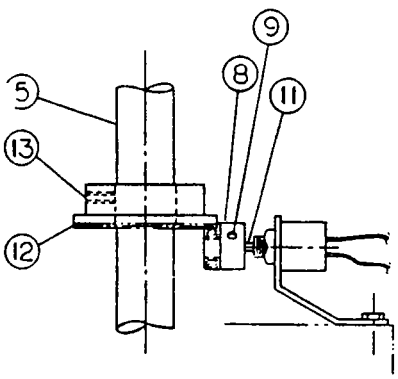
NOTE 2: In the case of a dual potentiometer, D75, "A" [front, close to the bracket] potentiometer wires are wired to the terminal strip, the same as a single potentiometer would be. "B" [rear, far from the bracket] potentiometer wires must be wired directly to external instrumentation. If M2 option is present, both pots must be wired directly to external instrumentation.



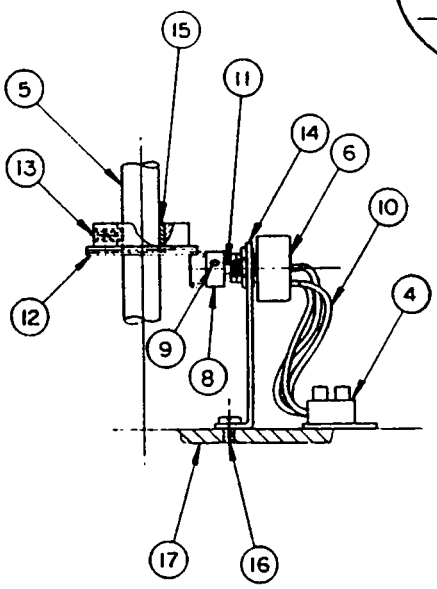

10-2275
PLAN VIEW
SEE NOTES ABOVE




25/3075
PLAN VIEW
SEE NOTES ABOVE




VIEW A-A




VIEW B-B

| ITEM | DESCRIPTION |
|---|---|
| 1 | Limit Switches |
| 2 | Motor Module |
| 3 | Motor Module Mtg. Screws |
| 4 | Terminal Strip |
| 5 | Actuator Shaft |
| 6 | Potentiometer |
| 7 | Potentiometer Bracket |
| 8 | Spur Gear |
| 9 | Spur Gear Set Screw |
| 10 | Potentiometer Leads |
| 11 | Potentiometer Shaft |
| 12 | Bevel Gear |
| 13 | Bevel Gear Set Screw |
| 14 | Potentiometer Bracket |
| 15 | Spacer |
| 16 | Mounting Screw |
| 17 | Motor Support Plate |

ILLUSTRATIONS SHOW SINGLE POTENTIOMETER ONLY

1. Adjusting Potentiometer:

NOTE: Potentiometers are adjusted at factory. If readjusting is necessary, follow instructions below.

a. Important:

The actuator must be in "OPEN" position [maximum counterclockwise rotation to begin the potentiometer alignment sequence.

b. 10-2275 Actuator:

Place the large bevel gear [12] over the actuator shaft with the gear teeth down.

25-3075 Actuator:

Insert spacer [15] into large bevel gear [12] and place gear over the actuator shaft with the teeth down.

c. Adjust the potentiometer spur gear [8] until there is approximately 1/16" engagement with the large bevel gear. Tighten the spur gear set screw [9]. It is allowed to bend potentiometer bracket to get proper engagement.

d. Rotate the bevel gear back and forth to ensure smooth and easy operation of the potentiometer.

e. Important:

FOR 90°VALVES: With the actuator in the OPEN [full CCW] position, rotate the bevel gear, turning the potentiometer until approximately 110 Ohms, but more than 90 Ohms is measured between terminals 10 [green] and 11 [white/black or white] with an Ohm meter.

Electrical Schematic is found on page 15.

f. With the potentiometer reading the value as indicated above, tighten the set screw on the bevel gear to fix the bevel gear to the actuator shaft. Recheck the resistance between terminals 10 [green] and 11 [white/black or white].

g. Power the actuator to the CLOSED [full CW] position. The actuator shaft should move clockwise 90°.

h. At the CLOSED position, measure the resistance at the terminal strip between terminals 11 [white/black or white] and 12 [purple]. Resistance measured with an Ohm meter should be approximately 110 Ohms, but more than 90 Ohms.

The feedback potentiometer is now adjusted for use in the 75 actuator.

i. Dual Potentiometer:

To check for resistance values, turn the potentiometer shaft until the resistance between terminals 1 and 2 of the "A" pot measures approximately 100 Ohms. The resistance between corresponding terminals of the "B" pot should be within ± 10 ohms of the "A" pot reading. If it is not, loosen the ring that retains the assembly, and turn only "B" pot until its resistance measures correctly. The terminals of the"A" and "B" pots should be approximately in line at this point. Tighten the retaining ring, and recheck values.

## C. I-75 Interface

### 1. Description:

The I-75 Interface is designed to be used and mounted on Series 75 Actuator as one of many standard options. Function of I-75 Interface is to allow Series 75 Actuator to be powered by 120 or 240 VAC power supply, operated directly by any programmable controller, microprocessor, and/or computer regardless of output rating of these devices. According to control input there are several options of I-75 Interface:

5V for input to be 5 VDC
XV for input to be 12 VDC
XX for input to be 24 VDC
15 for input to be 120 VAC

These options can be identified by the nameplate on the circuit board.

### 2. Indication and Repair:

L.E.D. Indicators - Light emitting diodes marked LD1, LD2 are in input circuits and indicating what particular input is on. Left, LD2, L.E.D. indicates that CCW, open, signal is on. Right, LD1, L.E.D. indicates that CW, close, signal is on.

If a malfunction occurs, look for the following:

If particular input is energized and corresponding LED light is not on, check for component damage or other continuity disruption in corresponding CCW and/or CW input curcuit. If everything appears to be OK, replace matching opto-couple OC2 or OC1.

Input circuit is OK. LED is lighted and actuator is not running. If components and continuity in corresponding power circuit are alright, then failed component is triac TX2 or TX1 depending which way the actuator doesn't run, CCW or CW.

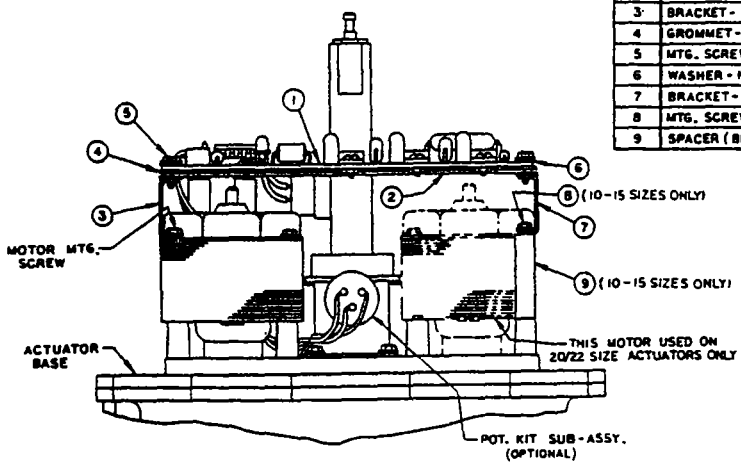
If the actuator doesn't run in either direction, it is likely that the actuator is defective. To check this, remove the red and black leads from terminals 3 and 4 of the actuator (coming from Interface board) and the AC line connections from terminals 1 and 2. Tape these leads. Using a test cable, apply power to actuator terminals 1 and 3. The 120 VAC actuator only (see Note) should rotate CCW until stopped by the CCW limit switch. Then apply power to terminals 1 and 4 to check CW 120 VAC actuator and the CW limit switch. If the actuator does not operate, check 120 VAC associated wiring, terminal strip, the limit switches, motor, and capacitor. Check switch continuity. Check for an open motor winding, and check for a shorted capacitor. If the problem in the actuator still cannot be determined, return the unit for service. If the actuator functions properly, the problem is in interface board.

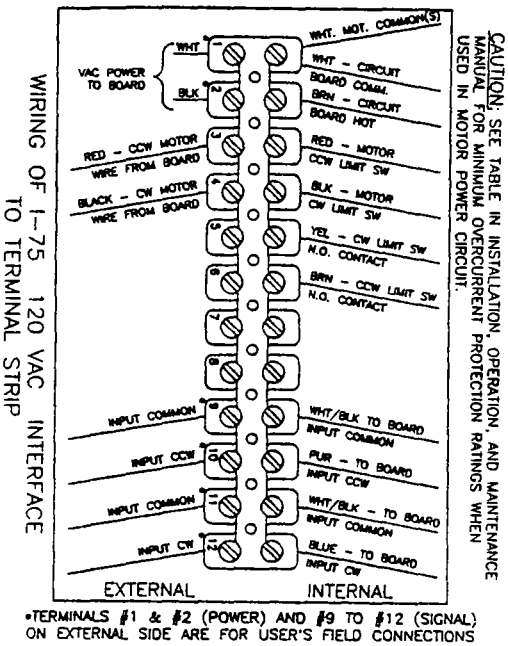
Request RPA (return product authorization) number from the factory, replace defective board, and return it to the factory with proper description of problem and application.

NOTE: The limit switches for the 240 VAC I-75 actuator do not control the motor circuit, they control input circuit only. When applying power to terminals 1 & 3, and 1 & 4 to check CCW, CW rotations, do this momentarily so that you do not override 0-90° quadrant.

10-22 SIZE 75 ACTUATOR

| ITEM | DESCRIPTION |
|---|---|
| 1 | CIRCUIT BOARD SUB-ASSY. |
| 2 | INSULATING BOARD |
| 3 | BRACKET - RIGHT (LONG) |
| 4 | GROMMET - RUBBER |
| 5 | MTG. SCREWS (CIR. BOARD) |
| 6 | WASHER - NYLON |
| 7 | BRACKET - LEFT (SHORT) |
| 8 | MTG. SCREWS (BRACKET) |
| 9 | SPACER (BRACKET) |



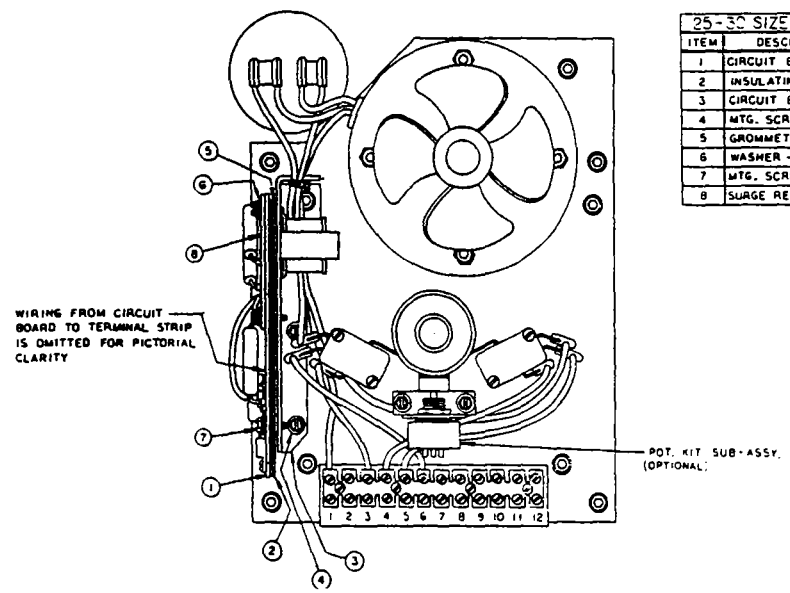



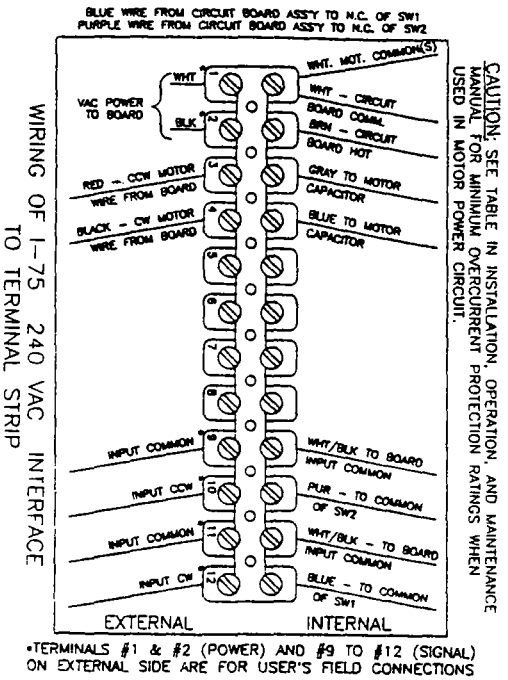

CAUTION: SEE TABLE IN INSTALLATION, OPERATION, AND MAINTENANCE MANUAL FOR MINIMUM OVERCURRENT PROTECTION RATINGS WHEN USED IN MOTOR POWER CIRCUIT.

•TERMINALS #1 & #2 (POWER) AND #9 TO #12 (SIGNAL) ON EXTERNAL SIDE ARE FOR USER'S FIELD CONNECTIONS

25-30 SIZE 75 ACTUATOR

| ITEM | DESCRIPTION |
|---|---|
| 1 | CIRCUIT BOARD SUB-ASSY. |
| 2 | INSULATING BOARD |
| 3 | CIRCUIT BOARD BRACKET |
| 4 | MTG. SCREW (BRACKET) |
| 5 | GROMMET - RUBBER |
| 6 | WASHER - NYLON |
| 7 | MTG. SCREW (CIR. BOARD) |
| 8 | SURGE RES. GRD. SUB-ASSY. |




CAUTION: SEE TABLE IN INSTALLATION, OPERATION, AND MAINTENANCE MANUAL FOR MINIMUM OVERCURRENT PROTECTION RATINGS WHEN USED IN MOTOR POWER CIRCUIT.

•TERMINALS #1 & #2 (POWER) AND #9 TO #12 (SIGNAL) ON EXTERNAL SIDE ARE FOR USER'S FIELD CONNECTIONS

D. M1 or M2 (Extra Limit Switches)

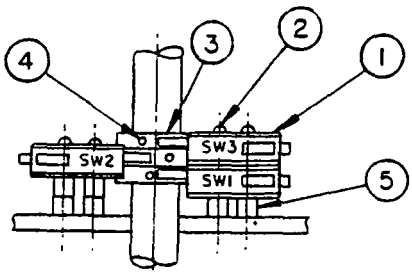
1. Setting:

NOTE: Switches and cams are set at factory. If resetting is necessary, use the following procedure:

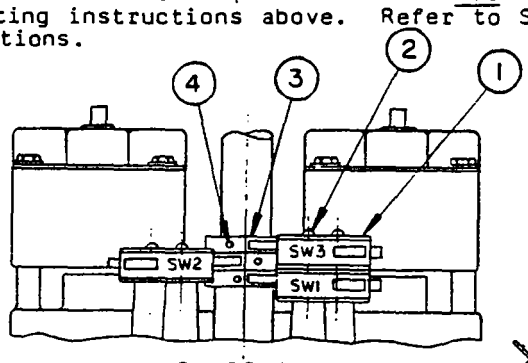
a. Bring actuator into position desired to actuate extra switch. Turn extra cam in direction of normal travel until switch just throws.

b. Advance cam in same direction by 1-3° and secure cam by tightening the set screw (4).

To add a fourth switch (not shown), add the switch to the one remaining position. Add the fourth cam (not shown) and position it so that cam set screw faces terminal strip when cam is in contact with limit switch to give desired function. Cam lobe must approach switch lever from lever pivot end and not from free end - see top view below. Follow setting instructions above. Refer to Schematic on page 15 for making electrical connections.

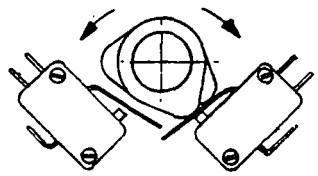



25 & 3075




10 - 2275

| ITEM | DESCRIPTION |
|---|---|
| 1 | Extra Switch |
| 2 | #4-40 Screws (2) |
| 3 | Extra Cam |
| 4 | Set Screw (1) |
| 5 | Spacers |



TYP. TOP VIEW

E. Mechanical Brake (10-2275 Actuators)

NOTE: Mechanical brake should require no adjusting.

1. Testing & Troubleshooting:

a. Energize actuator for rotation in both open and closed directions. At the rated actuator voltage, the brake coil is energized and moves the plunger to release brake arm[s]. A small clearance must exist between the brake arm and the brake disc when power is applied to the actuator.

b. If the brake arm does not clear the brake disc, realign the coil housing so that coil plunger can move further toward the center of the actuator, permitting more movement of the brake arm.

c. Plunger chattering indicates a low actuator voltage or a plunger movement in excess of design conditions. If actuator voltage is at the rated conditions, realign coil housing so that coil moves away from the center of the actuator to reduce plunger movement.

d. All coil movement is done in small increments of .015 inches or less.

e. Once proper operation of the brake is verified, replace actuator cover.

F. CLC Module (Cycle Length Control)

CAUTION: CLC MODULE MUST BE USED WITH PROPER LINE VOLTAGE.

Control of the actuator's cycle time is achieved by breaking up the power applied to the actuator into a series of pulses.

The length of time a power pulse is applied is controlled by the "ON" adjustable control (control at CCW, for max. pulse length).

The interval between pulses is controlled by the "OFF" adjustable control (control at CCW for longest interval between pulses).

To adjust, start with both controls at midpoint. To reduce cycle time, turn "ON" control in CCW direction and "OFF" control in CW direction. To increase cycle time turn "ON" control in CW direction and "OFF" in CCW direction.

IMPORTANT: The minimum "ON" pulse must allow the actuator to move a closed valve out of its seat. Verify proper CLC operation by opening a fully closed valve.

G. Heater & Thermostat

NOTE: Heater & thermostat option requires no adjusting. If defects are found, notify factory.

The thermostat will close its contacts at 80°F [power on] and open its contacts at 95°F [power off].

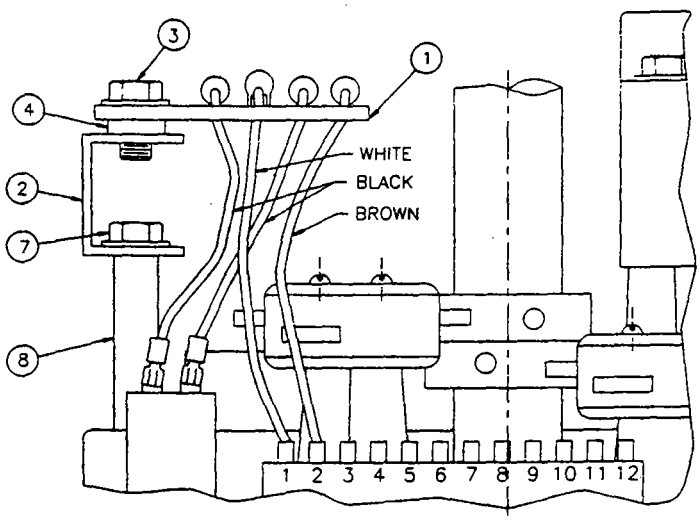
Electrical Schematics for above options found on page 15.

H. Drain/Breather (V53) Option (10-2275 Actuators)

If actuator is equipped with drain/breather at bottom of base, actuator must be operated in an upright position for drain to operate properly.

I. Voltage Transient Suppression Board (120/240 VAC only)

The SP-75 Voltage Transient Suppression Board is used to protect against voltage surges that could damage the actuator. This option is not needed with the AF17, HQ99 positioners, or the I-75 Interface, which have this circuitry incorporated.

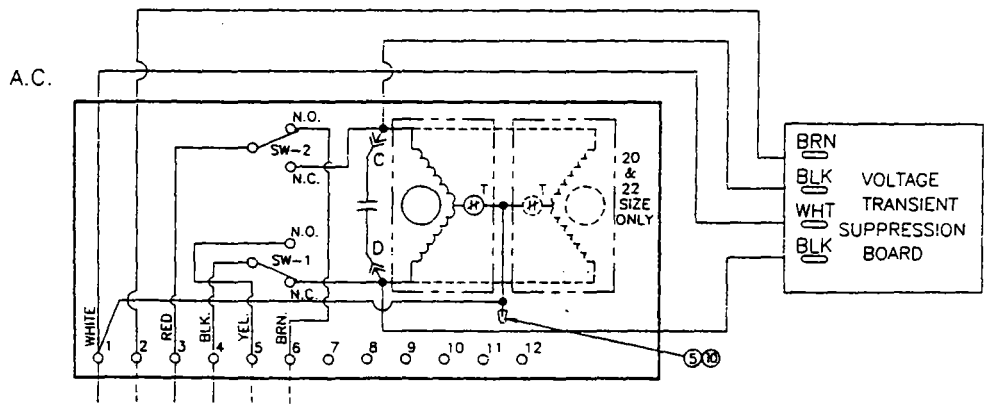



10 & 15 75 ASSEMBLY SHOWN. FOR 12, 20, & 22 SIZES, THE CIRCUIT BOARD BRACKET IS MOUNTED ON THE MOTOR USING EXISTING SCREWS AND ITEMS 7 & 8 ARE NOT USED.

FOR 25 & 30 SIZES THE CIRCUIT BOARD IS MOUNTED VERTICALLY USING AN "L" BRACKET & (2) 8-32x3/8 PAN HEAD MACHINE SCREWS.

For 10 thru 30 Sizes

| ITEM | QTY | DESCRIPTION |
|---|---|---|
| 1 | 1 | Circuit Board |
| 2 | 1 | Bracket (left) |
| 3 | 2 | #6-32 x 1/2 Hex Head Slotted Screws |
| 4 | 2 | Nylon Washer |
| 5 | 1 | Closed End Splice |
| 6 | 1 | Cable tie (not shown) |
| 7 | 2 | #6-32 x 1 3/4 Hex Head Slotted Screws (10 & 15 sizes only) |
| 8 | 2 | Spacers (10 & 15 sizes only) |
| 9 | 2 | #8-32 x 3/8 Screws (25/30 sizes only - not shown) |
| 10 | 1 | 3" Pigtail |




J. Position Indicator

1. Description:

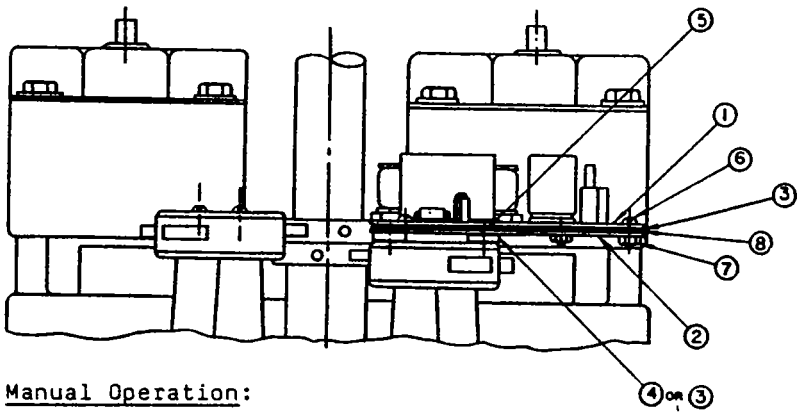
The 4-75 position indicator is designed to be used and mounted with the standard Series 75 (sizes 10-30), 120 VAC actuator, with all its standard options. (For mounting with AF17 or HQ99 positioners, or I75 W/CLC options, see 4-75 instruction sheet). Its output is suited for 4-20 mA DC meter with 0-100% scale (such as General Electric Type GE 185) which is not part of the package. If properly calibrated, it indicates actuator shaft position from close (0°, 0%) to open (90°, 100%).

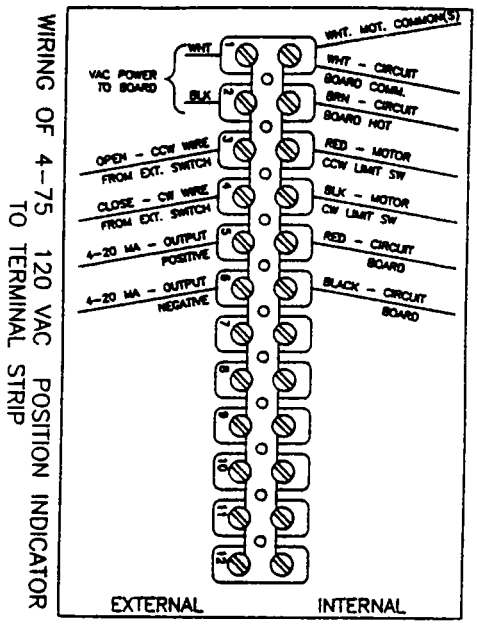
It is combined with standard potentiometer kit - PK75, which supplies information on shaft position. If feedback potentiometer is required for other functions such as remote resistance indication, or with an AF17 positioner, a dual potentiometer kit - DPK75 has to be used. Each potentiometer can serve only one function. A 4-75 Position Indicator and an AF17 Positioner, for instance, cannot share a pot. See potentiometer kit instructions for installation procedures.

2. Adjustment and Calibration: The feedback potentiometer has to be adjusted to obtain proper resistance range. With actuator in closed, extreme CW (clockwise) direction, the resistance between white/black and purple wires to be 100 ± 10 Ohms. The actuator in open, extreme (CCW) counter clockwise) direction, the resistance between white/black and green wires should be a minimum of 50 Ohms. To obtain proper 4-20 mA output, the indicator has to be calibrated. Using ammeter adjust two potentiometers P1, P2 on the board. Locate the actuator in close position (0%) and adjust P1 potentiometer (adjacent to purple wire) to obtain 4 mA on the ammeter. Move the actuator to open position (100%) and adjust P2 potentiometer (adjacent to green wire) to obtain 20 mA. Because adjustment of one potentiometer effects the other, repeat the procedure several times to obtain proper values.

3. Repair: In case of factory repair, contact factory, request RPA (Return Product Authorization) number from the factory. After receiving new circuit board replace defective board and return it back to factory with description of problem and application.

| ITEM | QTY | DESCRIPTION |
|---|---|---|
| 1 | 1 | Circuit Board |
| 2 | 1 | Mounting Plate |
| 3 | 5 | Spacers (.06") |
| 4 | 2 | Spacers (.25") |
| 5 | 2 | Flat Head Screws |
| 6 | 3 | Round Head Screws |
| 7 | 3 | Nuts |
| 8 | 1 | Insulator |
| 9 | 3 | Parallel Connectors (Not Shown) |
| 10 | 3 | Cable Ties (Not Shown) |
| 11 | 1 | Potentiometer Kit (Not Shown) |




Manual Operation:

IMPORTANT: Disconnect actuator from power supply. If power is not off, motor will start when cam moves from limit switch.

A. 10-2275 W or X: Pull the declutching knob all the way up and hold. Apply wrench to exposed flats on actuator shaft and rotate to desired position. To re-engage, return shaft to original position of disengagement and release declutch knob.

B. 25-3075 W or X: Simply turn manual override handwheel in the desired direction [clockwise rotation of handwheel causes actuator drive shaft to rotate clockwise, when viewed from above]. The manual override can be used at any time without damaging the actuator.

NOTE: Actuator should be manually operated only over the range for which it is set up to operate electrically. Operation beyond this range will totally disrupt indexing.

Maintenance & Trouble-Shooting:

The Series 75 electric valve actuator requires no regular maintenance. Should the unit fail to operate, however, the following are hints for trouble-shooting. If the unit still fails to operate, consult the factory.

Electrical Supply: Be sure the Series 75 is supplied with the correct voltage.

Electrical Connections: Does the wiring conform to the wiring diagram?

Limit Switches: If both switches are depressed simultaneously, the unit will not operate. Make sure the switches trip one at a time.

Capacitor: The AC motors are operated with a capacitor. If the capacitor is defective, it will prevent the motor from starting and/or running. Replace if necessary. If capacitor has metal retaining ring, insulating fiber washer must be used.

Motor: If one of the motor windings is open or short-circuited, the unit will not operate. If motor is hot, allow it to cool down so that the stator is at room temperature. Apply voltage to motor. If motor still fails to operate, replace entire motor module.

DC Motors - DC motors use no thermostat and are therefore not protected against high temperatures and currents. Use of these motors above rated torques [loads] and/or duty cycle can cause permanent damage. If a DC motor module fails to operate under minimal torque loading, replace entire motor module.

Gear Train:

10-2275 (A11) - Remove motor module from the actuator. Rotate the motor by hand. Spinning the motor shaft should rotate the module output pinion. If module output pinion fails to rotate, replace entire motor module. Also, check bull gear for missing or broken teeth. Replace if necessary.

25-3075 (A11) - Remove actuator from valve. Rotating the motor shaft manually should cause the actuator output shaft to rotate. If output shaft does not rotate, gearing has been damaged. Return actuator to factory for repair.

Valve: The problem may lie with the valve instead of with the actuator. Check the operation of the valve by removing the actuator and operating the valve by hand.

Options: For troubleshooting or adjustment of options, see Options & Adjustment section for individual options.

Spare Parts:

The following are recommended spare parts which should be kept on hand for Series 75 electric actuators:

1 Limit Switch Kit
1 Capacitor [AC units only]

When ordering spare parts, please specify actuator size, voltage and cycle time.

ELECTRICAL REQUIREMENTS:

The following table represents current draw [locked rotor conditions] in amperes at various voltages for each motor.

| Suffix Code | Duty Cycle | Voltage | Actuator Size 10 | 12 | 15 | 20 | 22 | 25 | 30 |
|---|---|---|---|---|---|---|---|---|---|
| Blank | 20% | 120 AC | -- | -- | .7 | -- | -- | -- | -- |
| Blank | 25% | 120 AC | 0.7 | 0.7 | -- | 1.5 | 1.5 | 3.25 | 3.75 |
| 2 | 10% | 120 AC | 1.5 | 1.5 | -- | 2.75 | 2.75 | -- | -- |
| 4 | 75% | 120 AC | 0.30 | 0.30 | -- | 0.70 | 0.70 | 2.90 | 3.10 |
| 5 | 100% | 120 AC | 0.25 | 0.25 | -- | 0.50 | -- | -- | -- |
| Blank | 25% | 240 AC | 0.4 | 0.4 | -- | 0.9 | 0.9 | 1.6 | 1.75 |
| 2 | 10% | 240 AC | 0.6 | 0.6 | -- | 1.25 | 1.25 | -- | -- |
| 4 | 75% | 240 AC | 0.15 | 0.15 | -- | 0.35 | 0.35 | 1.5 | 1.5 |
| 5 | 100% | 240 AC | -- | -- | -- | -- | -- | -- | -- |
| Blank | 25% | 12 DC | 2.8 | 2.8 | -- | 5.6 | 5.6 | -- | -- |
| Blank | 25% | 24 DC | 1.5 | 1.5 | -- | 3.0 | 3.0 | -- | -- |

If a mechanical brake and/or heater is used on 12 or 24 VDC actuators, increase the locked roto currents shown above by the following values (This applies to DC voltages only):

Mechanical Brake: 12 VDC - 0.8 amp; 24 VDC - 0.4 amp.
Heater: 12 VDC - 1.2 amp; 24 VDC - 0.6 amp.
Mechanical Brake & Heater: 12 VDC - 2.0 amp; 24 VDC - 1.0 amp.

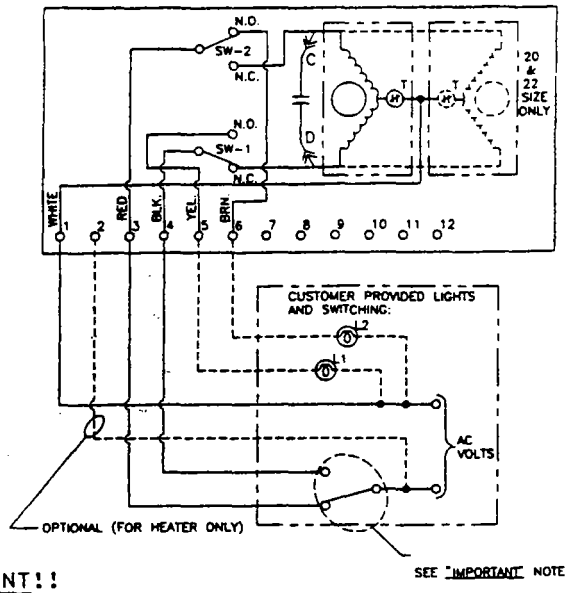
CYCLE TIME [Sec.]:

| Suffix Code | Actuator Size 10 | 12 | 15 | 20 | 22 | 25 | 30 |
|---|---|---|---|---|---|---|---|
| Blank | 5 | 8 | 5 | 5 | 8 | 10 | 15 |
| 2 | 2.5 | 4 | -- | 2.5 | 4 | -- | -- |
| 4 | 17 | 27 | -- | 17 | 27 | 15 | 23 |
| 5 | 17 | 27 | -- | 27 | -- | -- | -- |

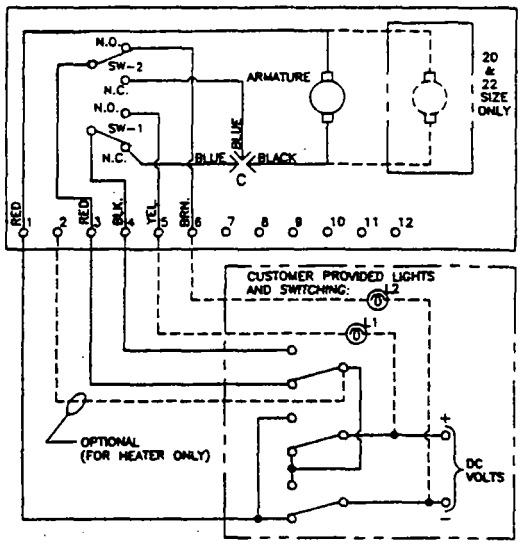
## ELECTRICAL SCHEMATIC [SERIES 75]:

[Actuator shown in counter-clockwise extreme of travel, or "open" position.]

A.C.




D.C.




IMPORTANT!!

EACH ACTUATOR SHOULD BE ELECTRICALLY POWERED THRU ITS OWN INDIVIDUAL SINGLE POLE SWITCH CONTACTS TO ISOLATE THE UNUSED WINDING.

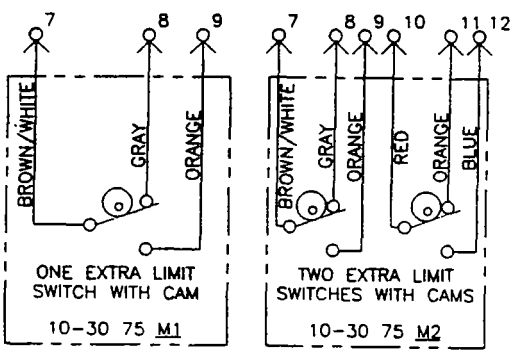
EACH MOTOR HAS A "THERMAL PROTECTOR" AS SHOWN BY  IN DIAGRAM.



SEE TABLE ON PAGE 4 FOR MINIMUM FUSE SIZE WHEN OVERCURRENT PROTECTION IS USED IN MOTOR POWER CIRCUIT.

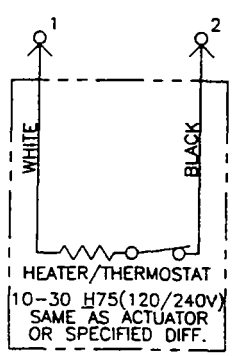
## ELECTRICAL SCHEMATICS FOR OPTIONS (SERIES 75):

[For installation of options, refer to installation instructions contained in respective kit.]

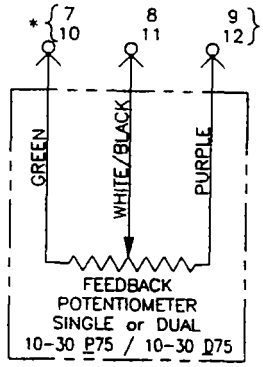




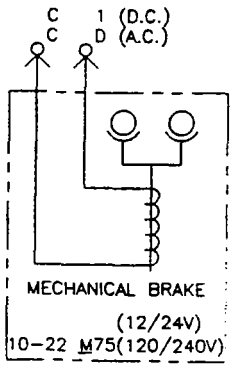





OTHER TERMINALS MAY BE REQUIRED FOR HEATER ISOLATION FROM MOTOR POWER SOURCE.

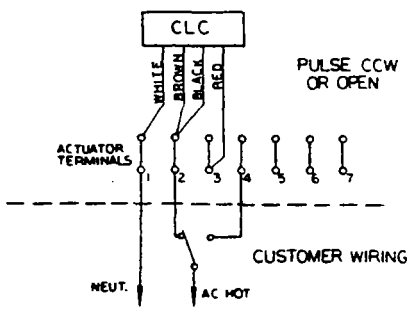



* - TERMINALS 7,8,9 WITH AF-17 POS. WITH DUAL POT. ONLY. TERMINALS 10,11,12 WITH ACTUATOR ONLY.

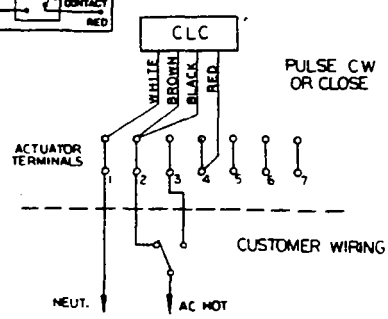



Cycle Length Control

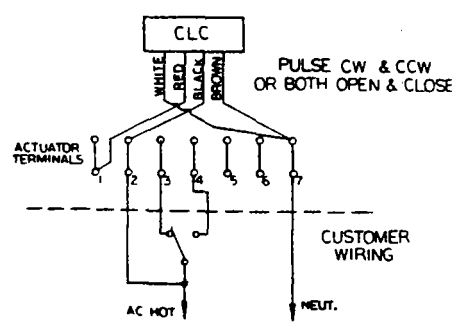



10-30 C 75 120A/240A D



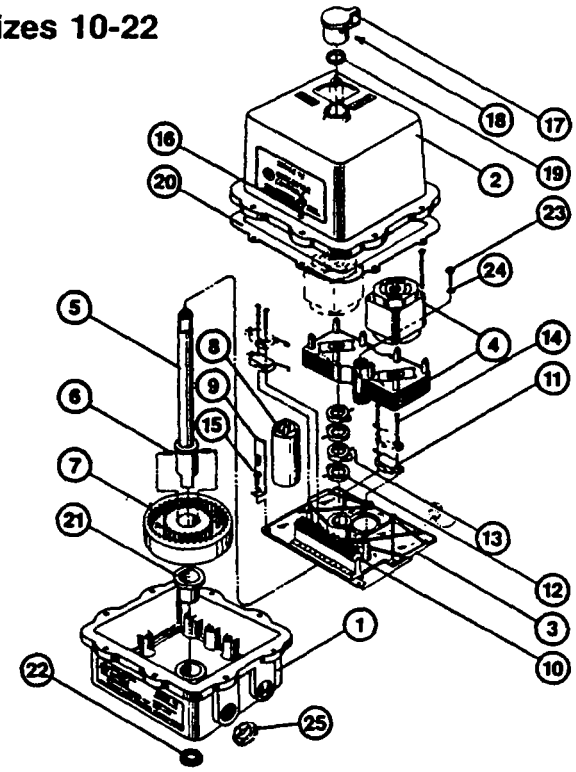

10-30 C 75 120A/240A C




10-30 C 75 120A/240A

# Parts List & Materials of Construction

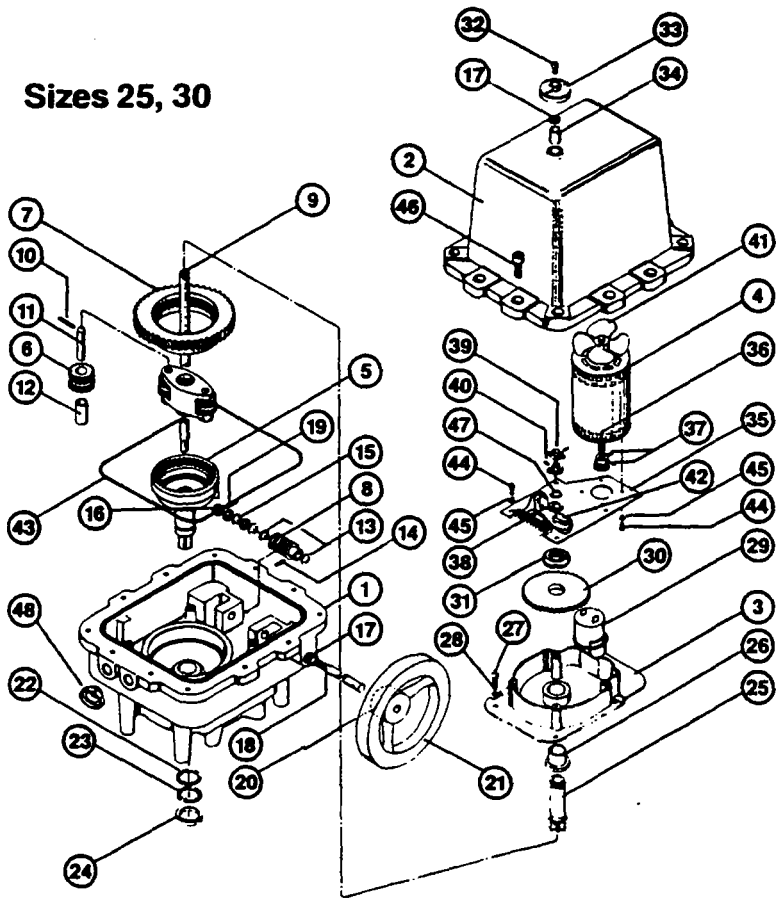
## Sizes 10-22



| Item | Qty. | Description | Material |
|---|---|---|---|
| 1 | 1 | Base | Aluminum Casting |
| 2 | 1 | Cover | Aluminum Casting |
| 3 | 1 | Base Plate | Zinc Casting |
| 4 | 1 | Motor Module | Zinc Casting |
| 5 | 1 | Output Shaft | Steel |
| 6 | 2 | Gear Drive Pin | Steel |
| 7 | 1 | Bull Gear | Steel |
| 8 | 1 | Capacitor (w/Fiber Washer if Required | Phenolic Encapsulated |
| 9 | 1 | Capacitor Bracket | Steel |
| 10 | 1 | Terminal Strip | Polyethylene Based Material |
| 11 | 2 | Limit Switch | Phenolic Encapsulated |
| 12 | 2 | Limit Switch Cam | Zinc Casting |
| 13 | 1/Cam | Cam Set Screw | Steel |
| 14 | 4 | Limit Switch Screw | Steel |
| 15 | 6 | Base Plate Screw | Steel |
| 16 | 8 | Hex Screw (W,X) | Stainless Steel |
| 16 | 4 | Hex Screw (G,P) | Steel |
| 17 | 1 | Position Indicator (W,X) | Molded Phenolic |
| 18 | 1 | Indicator Set Screw (W,X) | Steel |
| 19 | 1 | Seal (W,X) | Reinforced Rubber |
| 20 | 1 | Gasket (W only) | Neoprene |
| 21 | 1 | Bearing | Bronze |
| 22 | 1 | Seal | Reinforced Nitrile |
| 23 | 4 | Screw | Steel |
| 24 | 4 | Lock Washer | Steel |
| 25 | 1 | Conduit Plug | Polyethylene |

NOTE: Series 75 W and X are shown. General purpose units have different bases and covers.

## Sizes 25, 30



| Item | Qty. | Description | Material |
|---|---|---|---|
| 1 | 1 | Base | Aluminum |
| 2 | 1 | Cover | Aluminum |
| 3 | 1 | Gear Train Support | Aluminum |
| 4 | 1 | Motor | |
| 5 | 1 | Output Gear | Steel Casting |
| 6 | 2 | Planet Gear | Hardened Steel |
| 7 | 1 | Planetary Gear | Ductile Iron |
| 8 | 1 | Worm Gear | Steel |
| 9 | 1 | Sensing Shaft | Steel |
| 10 | 2 | Pin, Spring | Steel |
| 11 | 2 | Shaft | Hardened Steel |
| 12 | 2 | Bushing | Bronze |
| 13 | 2 | Thrust Washer | Steel |
| 14 | 1 | Pin, Spring | Steel |
| 15 | 4 | Belleville Washer | Steel |
| 16 | 1 | Nut | Steel |
| 17 | 2 | Seal | Rubber, Steel |
| 18 | 1 | Manual Override Shaft | Steel |
| 19 | 1 | Pin, Cotter | Steel |
| 20 | 1 | Pin, Spring | Steel |
| 21 | 1 | Handwheel, Manual Override | Aluminum |
| 22 | 1 | Thrust Washer | Steel |
| 23 | 1 | Tru-arc Ring | Steel |
| 24 | 1 | Seal | Rubber, Steel |
| 25 | 1 | Sun Gear | Steel |
| 26 | 1 | Bushing | Bronze |
| 27 | 4 | Cap Screw | Steel |
| 28 | 4 | L Washer | Steel |
| 29 | 1 | Capacitor (w/Fiber Washer if Required | Phenolic Encapsulated |
| 30 | 1 | Input Gear | Steel |
| 31 | 1 | Nut | Steel |
| 32 | 1 | Cap Screw | Steel |
| 33 | 1 | Position Indicator | Aluminum |
| 34 | 1 | Bushing | Bronze |
| 35 | 1 | Motor Support Plate | Aluminum |
| 36 | 1 | Gear, Pinion | Steel |
| 37 | 2 | Set Screw | Steel |
| 38 | 1 | Terminal Strip | Polyethylene Based Material |
| 39 | 2 | Limit Switch Cam | Zinc Casting |
| 40 | 1/Cam | Set Screw | Steel |
| 41 | 1 | Fan | Plastic |
| 42 | 2 | Limit Switches | Phenolic Encapsulated |
| 43 | 1 | "O" Ring (W only) | Buna |
| 44 | 9 | Cap Screw | Steel |
| 45 | 9 | Lock Washer | Steel |
| 46 | 12 | Cap Screw | Steel |
| 47 | 1 | Sensing Shaft Ret. Ring | Steel |
| 48 | 1 | Conduit Plug | Polyethylene |

# APPENDIX B

# FILTER UNITS

# Fulflo® Filtration Products and Systems

## Installation and Operating Instructions for Stock No. 2P839 - 2P840 - 2P841 - 2P842

**⚠WARNING**

**To minimize the risk of serious injury and property damage:**

- Do not use with gases—use for liquid filtration only
- Do not use with toxic liquids requiring ASME-approved vessels
- Do not exceed operating pressure of 100 PSIG at 200°F
- Read and follow these instructions and safety information

## Contents


I. Shutdown and Cover Removal Procedure (For initial assembly and start up, refer to Section III)

II. Media Replacement

III. Cover Replacement and Start-Up


*NOTE: **Store this instruction manual in the plastic bag provided and retain permanently on or adjacent to filter vessel.***

**Commercial Filters**

Parker Filtration

# I. Shut Down and Cover Removal Procedure

***Note: Inlet, outlet, vent and drain connections are labeled on this vessel.***

**WARNING: Do not service this vessel while inlet or outlet valves are open or while unit contains pressure. Do not, at any time, remove or loosen clamp before draining. Failure to open drain and vent will result in pressurized liquid being trapped in vessel. Pressurized liquid will spray out when clamp is loosened which could cause serious injury or damage.**

1. Close inlet valve.
2. Close outlet valve.
3. Before opening vessel, vent pressure by opening vent cock.

**WARNING: Protect face and keep hands clear of vent cock while venting pressure.**

4. Open drain.
5. Leave vent cock open to allow vessel to drain properly.
6. Loosen and remove only one of the V-band clamp bolts and then remove the V-clamp.
7. Turn cover counter-clockwise to disengage the internal safety-latch.
8. Remove cover from vessel.

# II. Media Replacement

**WARNING: Use protective eyewear and handwear when changing bag used in filtering chemicals.**

1. Follow shutdown procedure.
2. Remove bag hold down ring by grasping handle and lifting upward.
3. Grasp filter bag at top rim and lift upward to remove. Discard bag.
4. Remove, clean and inspect retainer basket for damage. Replace if necessary.**
5. Inspect the vessel interior. For effective filtration, clean and inspect the basket seating area and bag sealing surface.
6. Insure that retainer basket is firmly seated on the support ring.
7. Install new filter bag by dropping bag in strainer, making sure bag is snug with strainer. There should be no gap between bag retainer ring and strainer basket.
8. Replace bag hold down ring making sure ring is firmly seated against top of bag.
9. Follow start-up procedure.

## PARTS LIST
## 2P839 and 2P840
## 2P841 and 2P842
## BAG AND STRAINER FILTER VESSELS

| ITEM NO. | DESCRIPTION | 2P839 PART NO. | 2P840 PART NO. |
|---|---|---|---|
| 1. | LEG ASSEMBLY | 3420-5027 | |
| 2. | VENT COCK | 1510-1-006 | |
| 3. | HEAD ASSEMBLY | 2901-5161 | |
| 4. | CLAMP | 1390-1-028 | |
| 5. | SHELL O-RING | 4150-5310 | |
| 6. | BAG OR STRAINER | VARIABLE | |
| 7. | RETAINER BASKET | 0370-5069 | 0370-5070 |
| 8. | SHELL ASSEMBLY | 5412-5819 | 5412-5771 |
| 9. | BAG HOLD DOWN RING | 2840-5110 | |

| ITEM NO. | DESCRIPTION | 2P841 PART NO. | 2P842 PART NO. |
|---|---|---|---|
| 1. | LEG ASSEMBLY | 3420-5028 | |
| 2. | VENT PLUG | 4570-154-9500 | |
| 3. | HEAD ASSEMBLY | 7317-0164 | |
| 4. | CLAMP | 1390-1-028 | |
| 5. | SHELL O-RING | 4150-5310 | |
| 6. | BAG OR STRAINER | VARIABLE | |
| 7. | RETAINER BASKET | 0370-5069 | 0370-5070 |
| 8. | SHELL ASSEMBLY | 5413-5364 | 8357-0217 |
| 9. | BAG HOLD DOWN RING | 2840-5110 | |

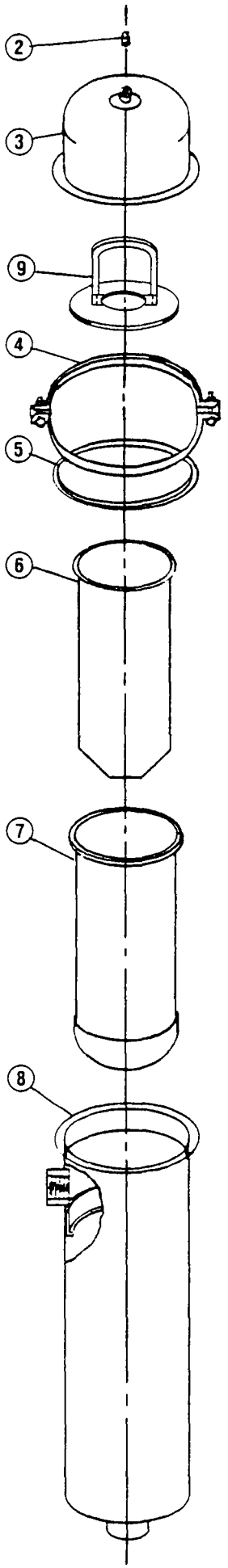
NOTES:
1. SHELL O-RING (ITEM #5) IS BUNA-N. OPTIONAL O-RINGS ARE AS FOLLOWS:
   VITON-A PT.NO. 4150-5285
   BUTYL PT.NO. 4150-5312
2. WHERE ONLY ONE PART NUMBER IS SHOWN, IT IS COMMON TO BOTH MODELS

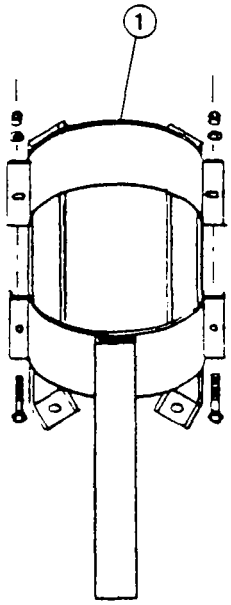
For replacement parts call:
Parts Company of America
1250 Busch Parkway
Buffalo Grove, IL 60089
1-800-323-0620

*Model FCB does not have independent drain. Draining must occur through outlet pipe.

**Use only Commercial Filters approved Fulflo replacement bolt and V-clamp.

***Replace any worn or damaged parts only with Commercial Filters approved Fulflo replacement parts.




OPTIONS:
Wall Mounting Brackets Part No. 0820-5094 (Carbon Steel) and 0820-5095 (Stainless Steel) are available for all size units.

# Bag Vessel and Filter Cross Reference

| GRAINGER MODEL NO. | PARKER FILTER MODEL NO. | POLYPROPYLENE BAGS SIZE 1* | POLYESTER BAGS SIZE 2** |
|---|---|---|---|
| 2P839 | FCB11 | 2P829 - 2P833 | 2P817 - 2P822 |
| 2P840 | FCB12 | 2P834 - 2P838 | 2P823 - 2P828 |
| 2P841 | 4FCB11 | 2P829 - 2P833 | 2P817 - 2P822 |
| 2P842 | 4FCB12 | 2P834 - 2P838 | 2P823 - 2P828 |

SIZE 1 BAGS — 16½" LONG X 7" DIAMETER SIZE 2 BAGS — 30½" LONG X 7" DIAMETER

The lower the Micron rating, the finer filtration is attained. For best results, the highest Micron rated bag should be used to attain desired filtration level.

*Numbers correspond to 5, 10, 25, 50 and 100 Micron ratings consecutively. (Example 2P829 denotes 5 Micron, 2P830 denotes 10 Micron, etc.)

**Numbers correspond to 5, 10, 25, 50, 75 and 100 Micron ratings consecutively.

Additional filter bag materials and Micron sizes can be purchased through Grainger.

# III. Cover Replacement and Start-up Procedures (or Initial Assembly and Start-up)

***Note: Inlet, outlet, vent and drain connections are labeled on the vessel.***

1. Before installing cover, inspect vessel and all components for wear, corrosion or other damages.

**WARNING: Operating vessel with damaged or worn parts could cause serious injury and damage.**

2. Clean and inspect O-ring seating surfaces. Repair if necessary. Re-lubricate O-ring heavily with petroleum jelly.

3. Clean and inspect O-ring for damage. Replace if necessary.**

4. To reposition the cover, first align the outside locating lugs on the cover and body and then turn the cover clockwise engaging the internal safety latch.

5. Re-install V-band clamp on vessel.*

**WARNING: Inspect V-band clamp and bolts for wear or damage. Replace, if necessary. Operating vessel with damaged or worn clamp and bolts could cause serious injury or damage.**

6. Re-install bolt and tighten clamp and bolts with a torque wrench.

**WARNING: Do not exceed 10½ ft. lb. of torque. Over-tightening can damage clamp which could cause serious injury and damage.**

7. Leave vent cock open.

**WARNING: Failure to leave vent cock open when starting fluid flow will allow air to become entrapped and compressed in upper portion of vessel. Compressed air might damage clamp and rupture vessel resulting in serious injury and damage.**

8. Close drain.

9. Open inlet valve and allow vessel to fill slowly.

10. Close the vent cock after air is expelled from the vessel and liquid begins to bleed from vent.

11. Open outlet valve.

**WARNING: If vessel leaks, do not tighten V-band clamp while filter vessel is pressurized. Doing so could damage clamp and rupture vessel resulting in serious injury and damage.**

12. If vessel leaks, repeat shut-down and start-up procedures. Clean O-ring seating surfaces and install a new O-ring.

For Technical Questions contact your local branch or call Grainger Technical Department 1-708-913-7400.

*Use only Commercial Filters approved Fulflo replacement bolt and V-clamp or other parts.

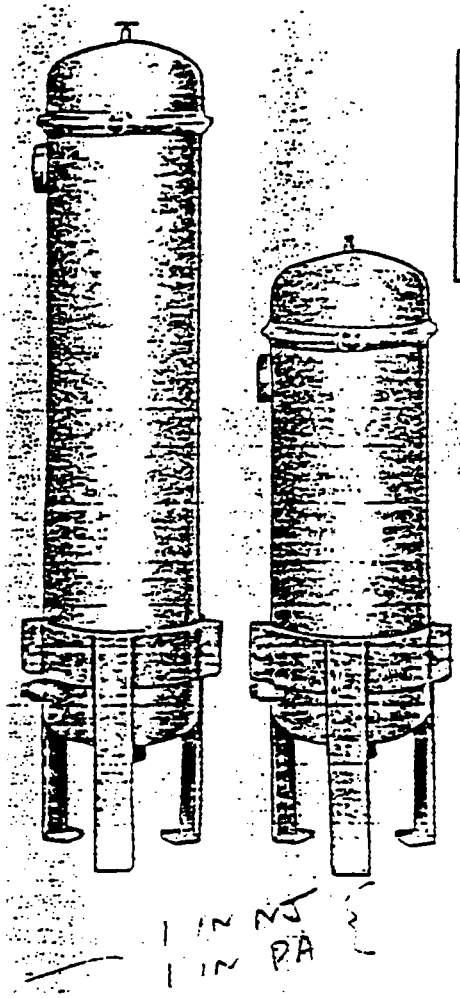
**Replace any worn or damaged parts only with Commercial Filters approved Fulflo replacement parts.

Form D-37
Effective 1/91
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3130-5010

⚠ WARNING! FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.
This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.
The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

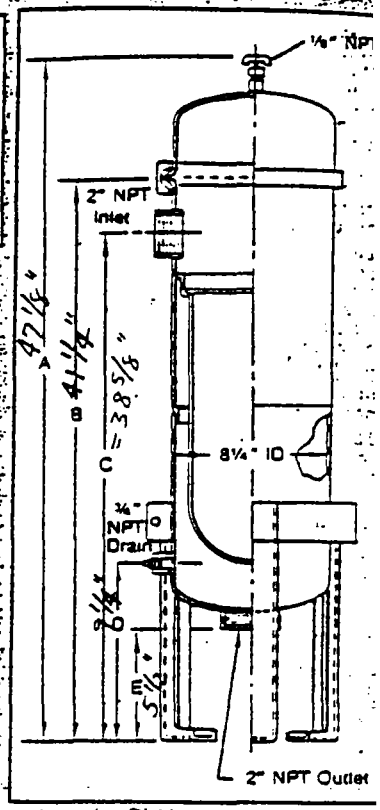
# HIGH FLOW BAG FILTER HOUSINGS



- Carbon or stainless steel housings
- Quick open V band clamp for speedy bag filter removal
- Patented safety latch design cover with standard air vent
- Adjustable legs
- 2" NPT side inlet and bottom outlet
- Includes 20 mesh 316 stainless steel strainer for filtration and bag support

Parker Filtration

NEW LINE




**Economical FCB series housings** are for manufacturing, commercial and industrial applications requiring fluid filtration. Units come complete with strainer; can be used with strainer alone or with strainer and bag (order bags separately on facing page) for attaining varying degrees of filtration. Bag filtration assemblies can be used for filtering water and thick liquids such as coolants, cutting oils, inks, lubricants, paints, resins, solvents, adhesives, and petroleum oils. For use with nonflammable liquids compatible with filter component materials.

**Handle flow rates to 100 GPM** (water), liquid pressures to 100 PSI and liquid temperatures to 200°F.

**Construction:** Carbon or 304 st steel housings depending on Buna-N O-ring cover seal. 316 SS 2 strainer. Check application for ch compatibility.

**Two housing lengths:** Filter housi single or double length bags dep on filtering needs and preference.

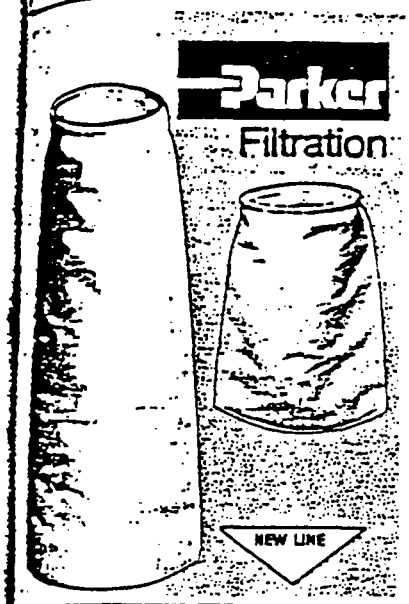
## BAG FILTER HOUSINGS SPECIFICATIONS AND ORDERING DATA

| Material | Maximum Flow (GPM) | Dimensions (inches) A | B | C | D | E | Parker Model | Stock No. | List | Each |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbon steel | 80 | 35 1/2 | 29 1/2 | 28 7/8 | 9 1/4 | 5 1/2 | FCB-11 | 2P839 | $785.00 | $756.94 |
| Carbon steel | 100 | 47 1/8 | 41 1/4 | 38 5/8 | 9 1/4 | 5 1/2 | FCB-12 | 2P840 | 895.00 | 863.00 |
| 304 Stainless Steel | 80 | 35 1/2 | 29 1/2 | 28 7/8 | 9 1/4 | 5 1/2 | 4FCB-11 | 2P841 | 1425.00 | 1374.06 |
| 304 Stainless Steel | 100 | 47 1/8 | 41 1/4 | 38 5/8 | 9 1/4 | 5 1/2 | 4FCB-12 | 2P842 | 1550.00 | 1494.59 |

## FILTER HOUSING CROSS REFERENCE GUIDE

| Stock No. | Parker Model | Stramrite | Filter Specialists Inc. | Reseal |
|---|---|---|---|---|
| 2P839 | FCB-11 | UFI-90 | BFNS11-1-CS-150-2 | 8152P1NC |
| 2P840 | FCB-12 | UFI-180 | BFNS12-1-CS-150-2 | 8302P1NC |
| 2P841 | 4FCB-11 | UFI-90-304 | BFNS11-1-304-150-2 | 8152P1NS |
| 2P842 | 4FCB-12 | UFI-180-304 | BFNS12-1-304-150-2 | 8302P1NS |

# PARKER FULFLO® FILTER BAGS




- Ideal for applications associated with high flow rates and higher viscosities
- Bags are fast and easy to replace
- Ratings from 5 to 100 microns (5 microns equal 2 ten thousandths of an inch)
- Support ring provides a positive seal within vessel

Fulflo filter bags are for fine straining and filtering of fluids. Bags are made to fit Parker filter housings (sold on facing page) and other manufacturers' filter housings. Bags can also replace other manufacturers' bag models. See Cross Reference Chart below. Suitable for high viscosity liquids to 10,000 CPS. Additional outer cover prevents filter fibers from migrating downstream. For use with non-flammable liquids compatible with bag materials.

**Operating temperatures:** Polyester bags have a maximum operating temperature of 275°F; polypropylene bags have a maximum operating temperature of 200°F.

**Applications:** Typical filter bag applications include water, inks, petroleum oils, solvents, adhesives, paints, coolants, and resins.

**FDA:** Polyester bags comply with all FDA regulations governing food grade materials.

**Dimensions:**

**Size 1:** 16¼" Long bag has 7" diameter, 2.0 sq-ft surface area, and 2.1 gallon volume.

**Size 2:** 30½" Long bag has 7" diameter, 4.4 sq-ft surface area, and 4.6 gallon volume.

## FILTER COMPATABILITY*

| Substances | Compatability Polyester | Compatability Polypropylene |
|---|---|---|
| Organic Solvents | Excellent | Excellent |
| Animal, Petroleum, and Vegetable Oils | Excellent | Excellent |
| Micro-organisms | Excellent | Excellent |
| Alkalies | Good | Excellent |
| Organic Acids | Good | Excellent |
| Oxidizing Agents | Good | Good |
| Mineral Acids | Good | Good |

(*) Use chart as a guide only. Chemical compatibility should be checked for specific fluid.

## CROSS REFERENCE AND ORDERING DATA

| Micron Rating | Max Flow Rate* | AFF | Manufacturers' Cross Reference Rosedale | Filter Specialists Inc. | Parker Model | Stock No. | List Pkg.† | Each Pkg.† | Shpg. Wt. |
|---|---|---|---|---|---|---|---|---|---|
| **SIZE 1 POLYESTER BAGS** | | | | | | | | | |
| 5 | 80 GPM | PE5P1S | PE5P1S; PE5G1S | PEIF5P1S; PEIG5P1S | G1PE5 | 2P817 | $25.70 | $24.79 | 5.0 |
| 10 | 80 | PE10P1S | PE10P1S; PE10G1S | PEIF10P1S; PEIG10P1S | G1PE10 | 2P818 | 25.70 | 24.79 | 5.0 |
| 25 | 80 | PE25P1S | PE25P1S; PE25G1S | PEIF25P1S; PEIG25P1S | G1PE25 | 2P819 | 25.70 | 24.79 | 5.0 |
| 50 | 80 | PE50P1S | PE50P1S; PE50G1S | PEIF50P1S; PEIG30P1S | G1PE50 | 2P820 | 25.70 | 24.79 | 5.0 |
| 75 | 80 | PE75P1S | PE75P1S; PE75G1S | PEIF75P1S; PEIG75P1S | G1PE75 | 2P821 | 25.70 | 24.79 | 5.0 |
| 100 | 80 | PE100P1S | PE100P1S; PE100G1S | PEIF100P1S; PEIG100P1S | G1PE100 | 2P822 | 25.70 | 24.79 | 5.0 |
| **SIZE 2 POLYESTER BAGS** | | | | | | | | | |
| 5 | 160 | PE5P2S | PE5P2S; PE5G2S | PEIF5P2S; PEIG5P2S | G2PE5 | 2P823 | 42.10 | 40.59 | 7.0 |
| 10 | 160 | PE10P2S | PE10P2S; PE10G2S | PEIF10P2S; PEIG10P2S | G2PE10 | 2P824 | 42.10 | 40.59 | 7.0 |
| 25 | 160 | PE25P2S | PE25P2S; PE25G2S | PEIF25P2S; PEIG25P2S | G2PE25 | 2P825 | 42.10 | 40.59 | 7.0 |
| 50 | 160 | PE50P2S | PE50P2S; PE50G2S | PEIF50P2S; PEIG30P2S | G2PE50 | 2P826 | 42.10 | 40.59 | 7.0 |
| 75 | 160 | PE75P2S | PE75P2S; PE75G2S | PEIF75P2S; PEIG75P2S | G2PE75 | 2P827 | 42.10 | 40.59 | 7.0 |
| 100 | 160 | PE100P2S | PE100P2S; PE100G2S | PEIF100P2S; PEIG100P2S | G2PE100 | 2P828 | 42.10 | 40.59 | 7.0 |
| **SIZE 1 POLYPROPYLENE BAGS** | | | | | | | | | |
| 5 | 80 | PO5P1S | PO5P1S; PO5G1S | POIF5P1S; POIG3P1S | G1P5 | 2P829 | 27.30 | 26.32 | 5.0 |
| 10 | 80 | PO10P1S | PO10P1S; PO10G1S | POIF10P1S; POIG10P1S | G1P10 | 2P830 | 27.30 | 26.32 | 5.0 |
| 25 | 80 | PO25P1S | PO25P1S; PO25G1S | POIF25P1S; POIG25P1S | G1P25 | 2P831 | 27.30 | 26.32 | 5.0 |
| 50 | 80 | PO50P1S | PO50P1S; PO50G1S | POIF50P1S; POIG50P1S | G1P50 | 2P832 | 27.30 | 26.32 | 5.0 |
| 100 | 80 | PO100P1S | PO100P1S; PO100G1S | POIF100P1S; POIG100P1S | G1P100 | 2P833 | 27.30 | 26.32 | 5.0 |
| **SIZE 2 POLYPROPYLENE BAGS** | | | | | | | | | |
| 5 | 160 | PO5P2S | PO5P2S; PO5G2S | POIF5P2S; POIG5P2S | G2P5 | 2P834 | 43.90 | 42.34 | 7.0 |
| 10 | 160 | PO10P2S | PO10P2S; PO10G2S | POIF10P2S; POIG10P2S | G2P10 | 2P835 | 43.90 | 42.34 | 7.0 |
| 25 | 160 | PO25P2S | PO25P2S; PO25G2S | POIF25P2S; POIG25P2S | G2P25 | 2P836 | 43.90 | 42.34 | 7.0 |
| 50 | 160 | PO50P2S | PO50P2S; PO50G2S | POIF50P2S; POIG30P2S | G2P50 | 2P837 | 43.90 | 42.34 | 7.0 |
| 100 | 160 | PO100P2S | PO100P2S; PO100G2S | POIF100P2S; POIG100P2S | G2P100 | 2P838 | 43.90 | 42.34 | 7.0 |

*Flow rate depends on fluid viscosity (thickness), temperature, and the amount of contamination. Flow rates listed assume clear water at 70°F and 1 PSI drop across bags per package.

10 Bags/Unit - 39.0 ea

CHOOSE FROM MANY BRANDS OF INDUSTRIAL PUMPS

Including Ingersoll-Rand, Mec-O-Matic, Teel, Hale and Little Giant

SEE WARRANTY INFORMATION ON PAGE OPPOSITE INSIDE BACK COVER

# APPENDIX C

## GRANULAR ACTIVATED CARBON (GAC) UNITS

CALGON

CALGON CARBON CORPORATION

EQUIPMENT BULLETIN

# CYCLESORB℠ FP1

## GENERAL DESCRIPTION

Calgon Carbon's Cyclesorb FP1 is a compact, portable liquid treatment unit that contains all the essential elements of a full scale carbon adsorption system. Containing 1000 pounds of granular activated carbon, the Cyclesorb FP1 can treat up to 30 gpm for removal of dissolved organic contaminants. When treatment is complete, the Cyclesorb FP1 becomes a convenient shipping container which can be returned to Calgon Carbon for safe reactivation of the spent carbon.

The Cyclesorb FP1 is ideal for many low flow or short duration treatment projects, including:

- Groundwater contaminated by leaking underground storage tanks
- Wastewater stored in tanks or lagoons
- Chemical spills
- Small wastewater or process streams
- Storage tank or pipeline washing
- Off-spec product batches
- Dechlorination or decolorization
- Pump tests
- Feasibility or pilot plant studies

## FEATURES

**Flexibility** - The Cyclesorb FP1 treats the liquid downflow through a fixed bed of granular activated carbon, and therefore can handle varying flows and on-off operating conditions. The units can be arranged in parallel to treat higher flows, or can be connected in series to optimize carbon usage.

**Recommended Design** - The Cyclesorb FP1 has flexible connections to the FRP vessel to eliminate potential for piping stress on the vessel, and a metal frame to protect the FRP vessel from damage during shipping and handling.

**Corrosion Resistance** - The Cyclesorb FP1 adsorber is made from fiberglass-wrapped polyethylene, and the piping and other accessories are made from industrial plastics to give the system the capability to handle a wide range of corrosive wastewaters or liquids.

**Higher Operating Pressures** - The Cyclesorb FP1 adsorber vessel is rated to 150 psig in accordance with NSF-44 Standards, and the prepiped assembly has a maximum operating pressure of 75 psig at 140°F.

**Granular Activated Carbon** - The Cyclesorb FP1 unit can be provided with any of Calgon Carbon's extensive product line of granular activated carbon. Calgon Carbon's Technical Service Representative can assist in selecting the most cost effective carbon for specific applications.

**Safe Spent Carbon Handling** - When treatment is complete, the Cyclesorb FP1 becomes the shipping container for the return of the spent carbon to a Calgon Carbon reactivation facility. This feature eliminates the need to handle spent carbon at the site. When returned to Calgon Carbon, the spent carbon is safely reactivated, and all the adsorbed contaminants are thermally destroyed.



**Service or Purchase Options** - The Cyclesorb FP1 is available on a service or purchase basis. With the service option, Calgon Carbon retains ownership of the unit, takes responsibility for inventory and maintenance, and provides a new unit when the spent unit is to be removed so continuous treatment is assured. If the Cyclesorb FP1 is purchased, Calgon Carbon can provide refill and maintenance service.

## SPECIFICATIONS

| | |
|---|---|
| Granular activated carbon per unit | 1,000 lb (454kg) |
| Maximum operating pressure | 75 psig (517 kPa) @140° F |
| Pressure relief | Graphite rupture disk @75 psig |
| Vacuum rating | Must be protected against vacuum |
| Temperature rating | 140° F (60°C) |
| Wetted parts materials | High density polyethylene polypropylene, PVC, graphite, viton vinyl ester, ethylene propylene rubber |
| Connections | 1 1/2" Kamlock (inlet / outlet)<br>1/2" FNPT (sample/vent/drain)<br>2" Kamlock (carbon fill)<br>2" FNPT (carbon discharge) |
| Frame | Epoxy Mastic painted metal |
| Frame dimensions | 45" X 45" X 96" height (1145 mm x 1145 mm x 2440 mm height) |
| Lifting | Fork lift truck or web slings around corner posts |
| Weights | Empty: 560 lb. (255 kg)<br>With dry carbon (ship): 1,560 lb. (710 kg)<br>With wet, drained carbon (return): 2,560 lb. (1165 kg)<br>Operating: 4,000 lb. (1820 kg) |

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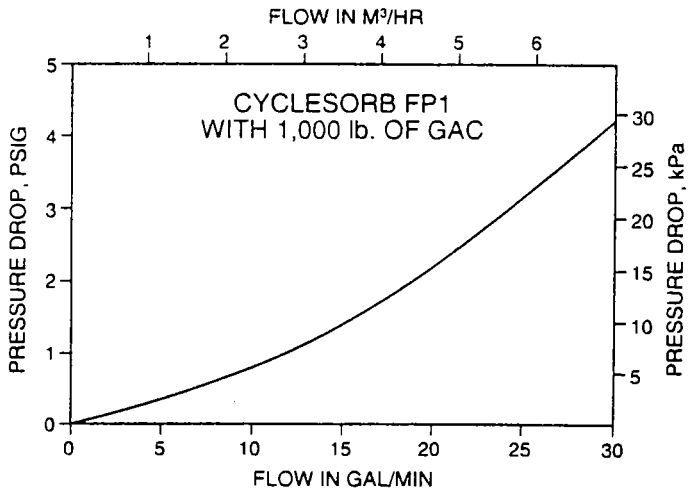
## RETURN FOR REACTIVATION

The Cyclesorb FP1 unit serves as a safe and convenient shipping container to return the spent carbon to Calgon Carbon for reactivation. Spent carbon reactivation is an integral component of the Service Agreement where Calgon Carbon provides a unit with fresh carbon to replace the unit being returned. If the unit is purchased, Calgon Carbon still is able to offer exchange services incorporating most of the return and refill elements of the Cyclesorb Service.

Prior to reactivation, an acceptability test is conducted on a small carbon sample provided with the initial Cyclesorb FP1 adsorber, which is exposed to the water or wastewater to simulate spent carbon characteristics. After this test is complete, carbon acceptance documentation is provided to allow return of the initial and subsequent Cyclesorb FP1 units used in the same service.

When treatment is complete, the Cyclesorb FP1 adsorber is drained of liquid, capped and shipped back to a Calgon Carbon reactivation facility. Calgon Carbon's Flexible Service Plan also offers services such as transportation assistance and on-site exchange services. A Technical Sales Representative will be able to review the many options available for purchase, service, return and carbon exchange.

At the reactivation facility, the spent carbon is thermally reactivated and the adsorbed organic contaminants are destroyed. The Cyclesorb FP1 units are cleaned, inspected, maintained and returned to inventory. Cyclesorb FP1 units are then taken from ready inventory, filled with the specified carbon and provided to the next Service customer for replacement or start of treatment.




## PRECAUTIONARY STATEMENTS

Do not strike vessel or subject it to impact, as such practices will damage the structural integrity of the unit.

The rupture disk must not be plugged or restricted, as the system must be able to relieve overpressurization to prevent component failure or vessel rupture. The installation must include vacuum relief, as vacuum created by a siphon loop or other means will cause collapse of the internal vessel wall.

The system includes flexible connections on the inlet and outlet. These flexible connectors should not be replaced by rigid piping, as expansion of the vessel under pressure could cause damage to the piping or the vessel.

**CAUTION** Wet activated carbon preferentially removes oxygen from the air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures should be followed, including all applicable federal and state requirements. For information regarding human and environmental exposure, call (412) 787-6700 and request to speak to Regulatory and Trade Affairs.

For detailed information on the products described in this bulletin, please contact one of our Regional Sales Offices located nearest to you:


**New Jersey**
Bridgewater, NJ 08807
Tel (908) 526-4646
Fax (908) 526-2467

**Pennsylvania**
Pittsburgh, PA 15230-0717
Tel (412) 787-6700
800/4-CARBON
Fax (412) 787-6676

**Illinois**
Lisle, IL 60532
Tel (708) 505-1919
Fax (708) 505-1936

**California-North**
San Mateo, CA 94404
Tel (415) 572-9111
Fax (415) 574-4466

**Texas**
Houston, TX 77040-6071
Tel (713) 690-2000
Fax (713) 690-7909

**California-South**
Carlsbad, CA 92008
Tel (619) 431-5550
Fax (619) 431-8169

**Latin America/ Asia-Pacific**
Pittsburgh, PA 15230-0717
Tel (412) 787-4519
Fax (412) 787-4523

**Canada**
Calgon Carbon Canada, Inc.
Mississauga, Ontario
Canada L4V 1N3
Tel (905) 673-7137
Fax (905) 673-8883

**Europe**
Chemviron Carbon
Brussels, Belgium
Tel 32 2 773 02 11
Fax 32 2 770 93 94


If at any time our products or services do not meet your requirements or expectations, or if you would like to suggest any ideas for improvement, please call us at 1-800-548-1999. From outside the U.S. please call +1-412-787-6700.

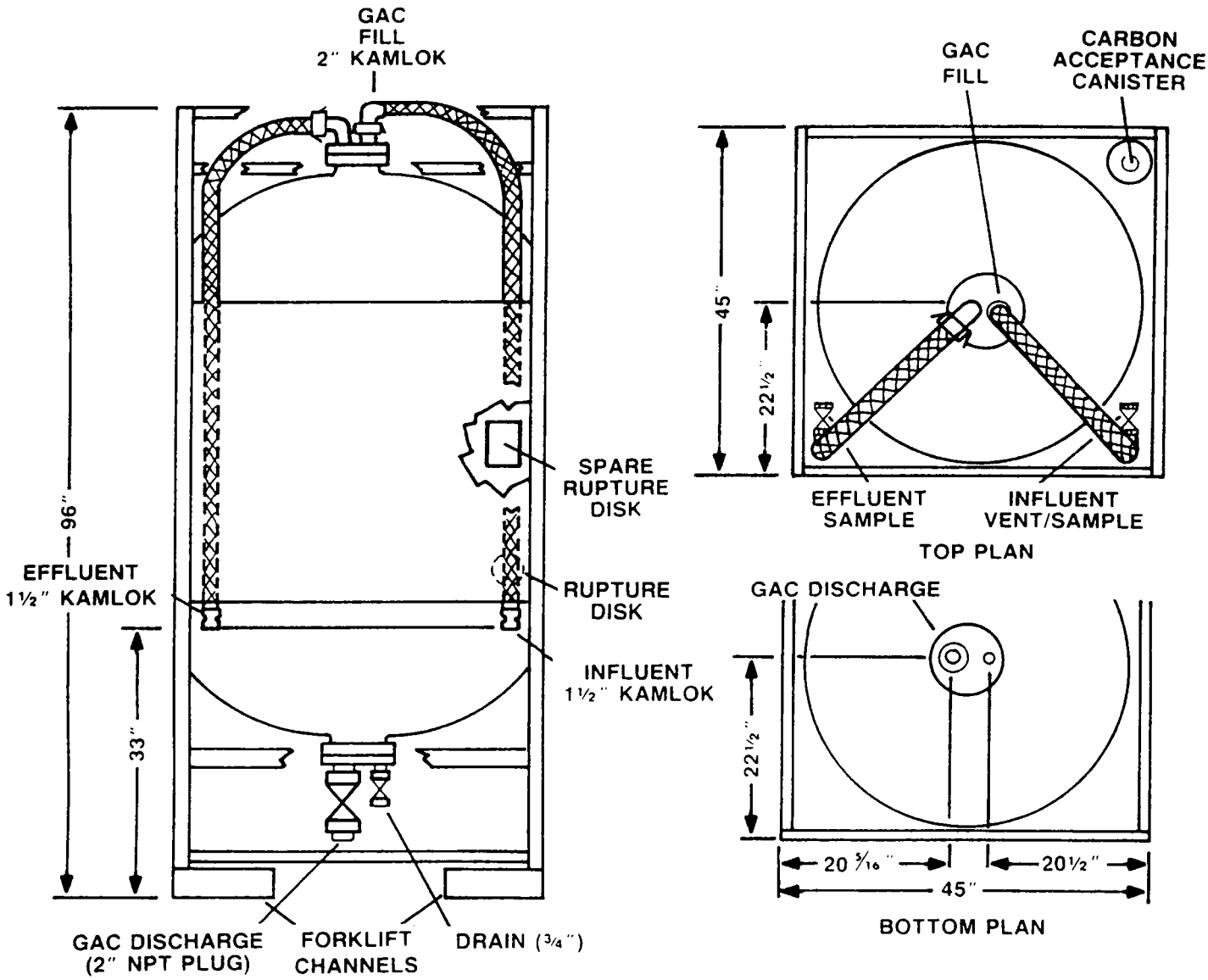
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DATA SHEET

# CYCLESORB FP1




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# DESCRIPTION

The Cyclesorb FP1 is a corrosion resistant, pressure rated transportable adsorber, designed to contain 1000 pounds of granular activated carbon (GAC) and treat flows up to 30 gpm.

# SPECIFICATIONS

**Adsorber Vessel:**

The Cyclesorb FP1 adsorber is constructed of fiberglass reinforced plastic with an internal lining of high density polyethylene (HDPE). The vessel is rated to 150 psig at 150°F in accordance with NSF-44. The maximum allowable working conditions are 75 psig at 140°F and no vacuum. The vessel has a 42 inch nominal OD, and has a 340 gallon capacity. The water is collected by a polypropylene nozzle.

**Piping and Accessories:**

The Cyclesorb FP1 piping consists of Schedule 80 polypropylene piping and polypropylene hose. Piping is threaded, and hoses have polypropylene Kamlok Connections. GAC Discharge is equipped with a polypropylene ball valve, with a threaded union connection and a 2 inch threaded (plugged) outlet. The GAC Fill is accessed by removing the influent hose at the top of the adsorber. Connections at the system are polypropylene connections as follows:

| | |
|---|---|
| Influent | 1½ inch Kamlok |
| Effluent | 1½ inch Kamlok |
| GAC Discharge | 2 inch NPT |
| GAC Fill | 2 inch Kamlok |

The influent and effluent lines are equipped with ½ inch ball valves for sample and/or vent. The adsorber is equipped with a 75 psig graphite rupture disk: on the influent line. Gaskets, as required, are EPR rubber.

**Wetted Parts Summary-Process Flow:**

Wetted parts are polyethylene, polypropylene, EPR rubber (gaskets) PVC (sample valves/drain valve) and graphite (rupture disk).

**Frame:**

The Cyclesorb FP1 frame is designed to contain and protect the adsorber and piping during operation and transport. The frame is constructed of metal and is 45" x 45" x 96" high. The frame is equipped with fork channels, and may be moved via forklift or lifted with 4-point web slings around corner posts.

**Granular Activated Carbon:**

The Cyclesorb FP1 can be provided with 1000 pounds of selected grades of liquid phase granular activated carbons, including both virgin or reactivated grades.

**Weights:**

| | |
|---|---|
| Empty | 560 lb |
| With dry GAC | 1,560 lb |
| With wet, drained GAC | 2,560 lb |
| Operating | 4,000 lb |

**Miscellaneous:**

1. Cyclesorb FP1 is provided with spare rupture disks and container located on frame.

2. Cyclesorb FP1 may be provided with carbon acceptance canister for accelerated collection of spent carbon sample.

# PERFORMANCE

Pressure drop performance is based upon "general" granular activated carbon in mesh size ranges from 8x30 to 12x40.

| APPROX. FLOW (GPM) | APPROX. PRESSURE DROP (psig) |
|---|---|
| 10 | 1.0 |
| 20 | 2.5 |
| 30 | 5.0 |

NOTE: Above performance based upon average GAC packed bed and clean water; actual conditions may vary.

# SERVICES

Cyclesorb FP1 may be provided on a service basis, whereby Calgon Carbon retains ownership of units and is responsible for exchange services. Calgon Carbon also offers carbon exchange services for purchased Cyclesorb FP1 units. Contact a Technical Sales Representative for more information.

*Calgon Carbon Corporation practices a policy of continuous product improvement. It reserves the right to alter designs and specifications without prior notice.*

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# CALGON CARBON CORPORATION
# CYCLESORB ADSORBERS
# INSTALLATION AND OPERATION

Calgon Carbon's Cyclesorb adsorbers are individual, compact, transportable liquid phase adsorbers. Cyclesorbs were developed for convenient installation and operation, with capability for return to Calgon Carbon for reactivation of the spent granular activated carbon ( GAC ) and refill with fresh GAC. Calgon Carbon offers many types of GAC which can be selected for the specific treatment application.

Cyclesorbs are available in the following standard units:
Cyclesorb; 2000 lb. GAC capacity, stainless steel
Cyclesorb FP1; 1000 lb. GAC capacity, FRP/Polyethylene

The specific Cyclesorb Product Bulletin and Drawing / Specification Sheet is considered to be part of these instructions and should be referred to when necessary.

## SHIPMENT

Cyclesorb adsorbers are shipped as a single adsorber, without crating or containers. The Cyclesorb is provided with fork channels for movement with fork trucks, and lifting points if the unit is to be moved with a crane. The Cyclesorbs are shipped filled with the specified amount of dry GAC.

Shipping weights are as follows:
Cyclesorb: 3,035 lb
Cyclesorb FP1: 1,560-2,320 lb (depending on frame type)

## WETTING AND DEAERATION

As the Cyclesorb is shipped with dry GAC, the carbon must be wetted and deaerated prior to use. This procedure displaces air from the internal structure of the carbon granule, thus assuring that the liquid to be treated is in contact with the carbon surface.

Prior to operation, the adsorber must be filled with clean, uncontaminated liquid. With the vent valve open, the liquid is introduced through the effluent line, and the unit is filled until the liquid flows out the vent. The Cyclesorb should be allowed to set for a minimum of 24 hours, but preferably for 72 hours, to allow most of the carbon internal surface to be wetted. The wetting curve provided indicates how much of the internal surface becomes wetted over time.

After wetting, the carbon bed can be deaerated by draining the adsorber, and again filling the adsorber upflow with uncontaminated water. This procedure will eliminate any air pockets which may have formed between the carbon granules.

The cyclesorb is now ready for operation.

INSTALLATION

The Cyclesorbs should be set on a flat surface, capable of supporting the operating weight of the Cyclesorb. Operating weights of the units are as follows:

| | |
|---|---|
| Cyclesorb: | 7,400 lb |
| Cyclesorb FP1: | 4,000-4,760 lb |

The influent and effluent piping should be connected to the unit by flexible hoses and Kamlok type male hose connections. Connection sizes are as follows:

| | |
|---|---|
| Cyclesorb: | 2 inch |
| Cyclesorb FP1: | 1 1/2 inch |

The effluent piping should be designed to allow flooded operation of the Cyclesorb at all times. If the effluent line does not provide for backpressure on the Cyclesorb unit, then the discharge piping should include an elevated piping loop to assure flooded operation. The Cyclesorb must remain full of liquid at all times to assure effective operation.

In addition to the piping loop, a drain connection is recommended on the discharge piping. This drain allows for draining of the unit prior to disconnection or temporary shutdown.

FILTRATION

As granular activated carbon is an effective filter, a filter should be installed prior to the Cyclesorb if the liquid to be treated contains substantial amounts of suspended solids. A simple cartridge or screen filter helps prevent pressure buildup in the GAC bed.

If suspended solids do accumulate on the top of the GAC bed, the Cyclesorb can be backflushed to remove solids and resume operation. Clean, uncontaminated liquid should be introduced to the unit through the effluent connection. This liquid flows upflow through the unit and should exit through the vent line - directed to a backflush water collection point or drain. The flow rate should not be high enough to cause carbon granules to exit. Typical backflush rates are as follows:

| | |
|---|---|
| Cyclesorb: | 100 gpm |
| Cyclesorb FP1: | 75 gpm |

OPERATION

With the Cyclesorb full of liquid, flow can be introduced to the unit; through the influent connection, flows downflow through the carbon bed and exits through the effluent connection.

Flowrates to the Cyclesorb should be determined based upon the required contact time between the liquid and the carbon media. The required contact time normally is determined prior to installation and operation of the Cyclesorb. Calgon Carbon should be consulted for advice about the proper contact time for specific applications.

Cyclesorbs can be manifolded in parallel operation for higher flowrates. For series operation, two Cyclesorbs can be connected sequentially, as normal pressure drop will not exceed the recommended operating pressure.

Cyclesorbs are provided with rupture discs to assure that the design pressure is not exceeded. If the rupture discs burst, do not continue to operate by blinding the rupture disc line. Investigate the cause of the high pressure and remedy. Spare rupture discs are provided in the spare rupture disc holder on the unit. Replace the rupture discs before continuing operation and contact Calgon Carbon for replacement of spare discs.

- MONITORING

Cyclesorb units only require periodic monitoring if properly installed. The following items may be monitored:

1) Pressure: Check influent and effluent pressure. Increase in pressure differential may indicate build-up of filtered solids.
2) Samples: Influent and effluent sample points are provided for liquid analysis to determine system performance.
3) Air: Check system occasionally to assure that the Cyclesorb is full of liquid. Check for trapped air by isolating Cyclesorb ( shut influent and effluent ) and opening influent sample tap or vent.

SHUTDOWNS

For short term shutdowns, simply isolate Cyclesorb unit by shutting influent and effluent lines and open vent line. For extended shutdowns, also drain the Cyclesorb of interstitial liquid.

SPENT CARBON ACCEPTANCE

Prior to return of either Cyclesorb or the spent GAC to Calgon Carbon, the spent GAC must undergo carbon acceptance testing. This carbon acceptance testing procedure should be addressed prior to contracting for the Cyclesorb or Refill Service. The Cyclesorb is provided with a carbon acceptance canister. Influent liquid should be introduced to the acceptance canister, and allowed to flow for enough time to allow the carbon to adsorb sufficient amounts of contaminants

for acceptance testing. The acceptance canister should then be drained, sealed and shipped to Calgon Carbon in accordance with instructions to allow for testing.

CYCLESORB RETURN TO CALGON CARBON

No Cyclesorbs can be returned to Calgon Carbon for Refill Service or spent carbon reactivation unless the carbon acceptance procedure has been completed, and an acceptance number provided.

Prior to return shipment, the Cyclesorb is disconnected from the influent and effluent lines, and all liquid is drained from the adsorber using either the effluent line or the sample connection at the effluent connection point. Do not open the GAC discharge valve to drain liquid from the unit.

After draining, all hose caps should be placed on the hose connectors. The Calgon Carbon Technical Sales Representative should be notified when the Cyclesorb is ready to ship. The Cyclesorb shipment should be accompanied with the site name and the carbon acceptance number provided by Calgon Carbon.

Calgon Carbon retains the right to refuse receipt of shipments that are not properly identified, or that do not include the proper carbon acceptance number.

SPENT CARBON DISCHARGE

The Cyclesorb may have the spent GAC removed at the site rather than returned to Calgon Carbon. For spent carbon discharge, the unit is first disconnected from the influent and effluent, as it would be for shipment. The unit is lifted onto piers or other support to connect the GAC discharge to a receiving container using flexible hose.

The unit is pressurized to 15 psig, by using a water connection to the influent hose connection point. When pressurized, the bottom GAC discharge valve is opened and the carbon-liquid slurry is transferred from the Cyclesorb to the receiving container. When the transfer is complete ( water only in hose ), the Cyclesorb may be partially refilled with liquid and the transfer repeated to assure more complete removal of spent carbon from the Cyclesorb. If all of the spent GAC is not removed from the Cyclesorb, initial effluent from a refilled unit may show contamination. NOTE: The stainless steel Cyclesorb can use compressed air at 15 psig as a pressure source, but use of air pressure on the Cyclesorb FP1 is not recommended due to the ploypropylene piping on the unit.

## FRESH CARBON FILL

Fresh carbon may be filled either as a carbon-liquid slurry or dry. For dry fill either the access hatch on the Cyclesorb or top assembly on the Cyclesorb FP1 can be opened, and the carbon filled directly. For slurry fill, a 2 inch hose can be connected to one of the top connection, and the carbon-liquid slurry transferred into the cyclesorb, using wither pressurized or eductor transfer from the shipping container. Excess water can be drained from the bottom effluent connection, or allowed to overflow from the top connection not used for carbon transfer.

After transfer of spent carbon is complete, it is recommended that the inside of the Cyclesorb be washed to remove all contamination and any trace of spent carbon. After system is washed, the Cyclesorb should also be checked thoroughly and any minor maintenance conducted.

After refill, the same procedure for wetting, deaeration and startup should be followed as described in these instructions.

## SAFETY CONSIDERATIONS

It is unlikely that a worker would be able to physically enter a Cyclesorb adsorber. However, the following information and precautions apply to a partially closed container or situations where carbon is to be removed from the Cyclesorb and stored elsewhere.

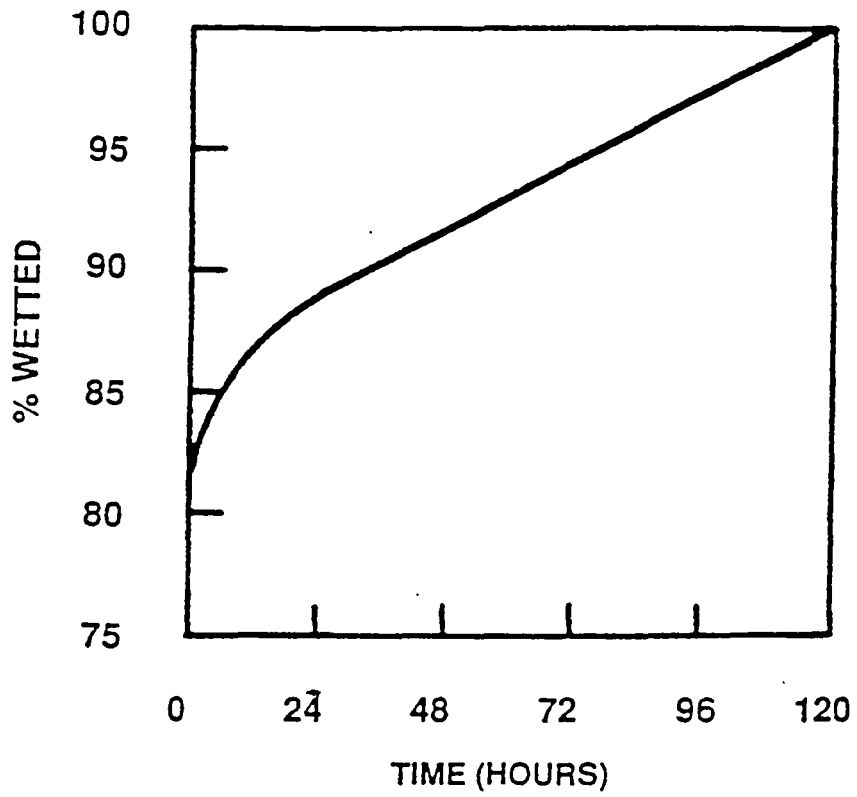
Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.

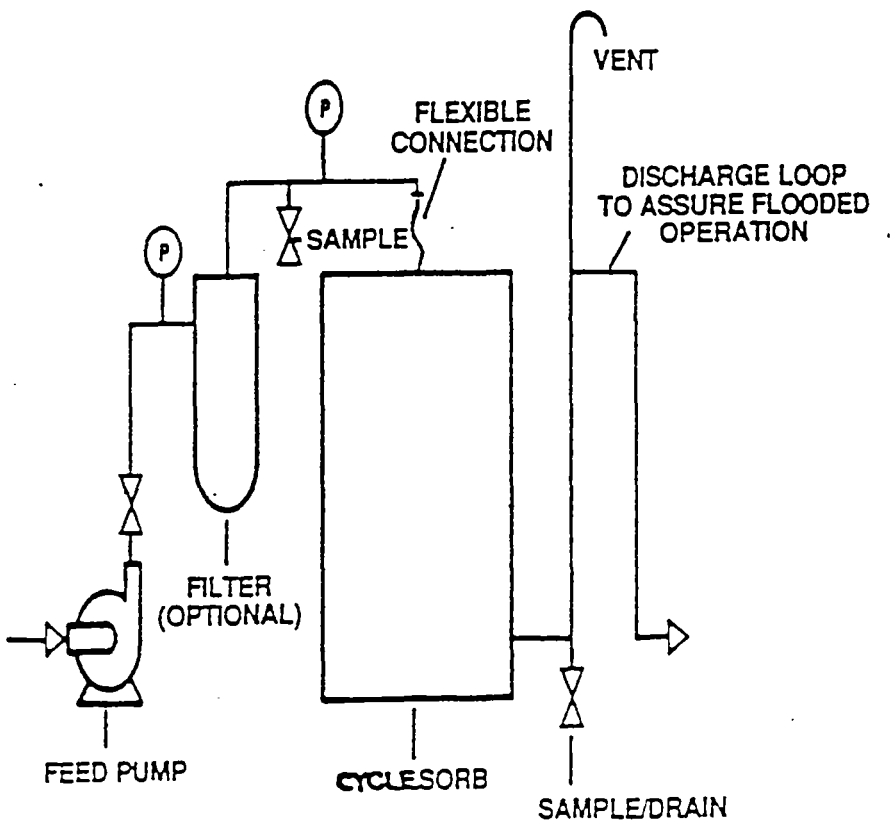
The Cyclesorb adsorbers are also equipped with rupture discs to prevent overpressurization of the vessels. These rupture discs must remain open upstream to the vessel and downstream to an open vent. These rupture discs must not be removed and/or replaced with a blind flange or plug.

## ASSISTANCE

For any technical assistance, contact the Calgon Carbon Technical Sales Representative for your account.

WETTING CURVE FOR GAC
77°F/25°C)




TYPICAL CYCLESORB INSTALLATION

CALGON CARBON CORPORATION

# FILTRASORB® 300 and 400 FOR WASTEWATER TREATMENT

**ACTIVATED CARBON PRODUCT BULLETIN**

## GRANULAR ACTIVATED CARBON PRODUCTS REMOVE DISSOLVED ORGANIC CHEMICALS FROM MUNICIPAL WASTEWATERS ECONOMICALLY AND RELIABLY

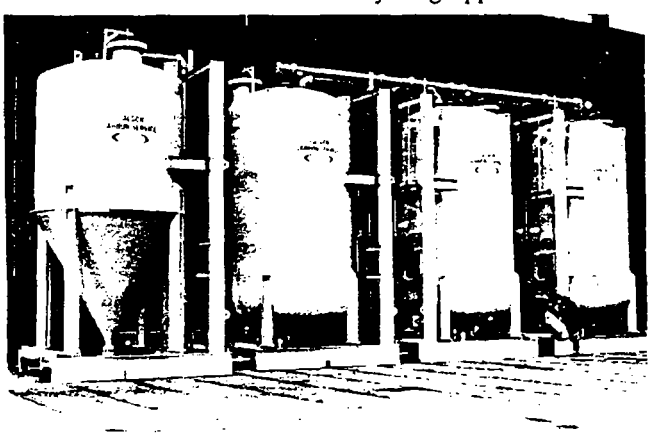
Filtrasorb 300 and 400 are two grades of granular activated carbon manufactured by Calgon Carbon Corporation for removal of organic pollutants from municipal wastewaters. These carbons are manufactured from select grades of bituminous coal to produce a high-density, high surface area, durable granular product capable of withstanding the abrasion and dynamics associated with repeated reactivation, hydraulic transport, backwashing and mechanical handling.

## PURPOSES

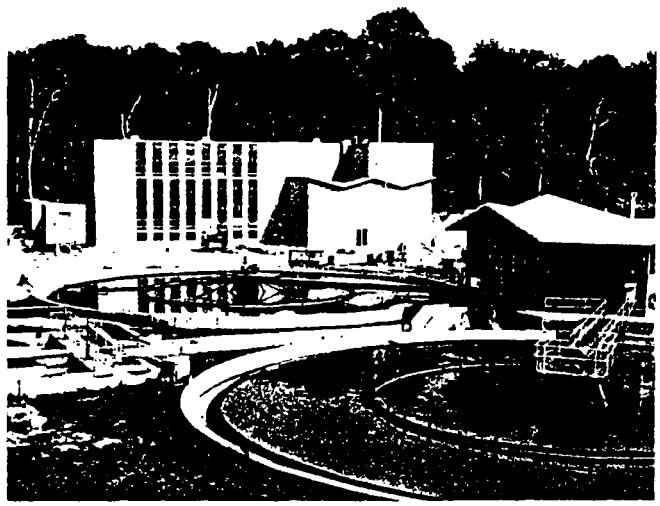
Filtrasorb granular activated carbons can perform the role of adsorbing dissolved organic contaminants from water and wastewater. Filtrasorb is effective in removing from wastewaters many dissolved toxic organic chemicals listed by the EPA as priority pollutants and hazardous substances. These include benzene, phenols, dieldrin, toluene, DDT, polychlorinated biphenyls and many others. It is also effective in removing refractory organic chemicals not responsive to biological treatment.

**Municipal Wastewater Treatment** applications can include the following:

- Applying point source treatment to remove organic chemicals
- Pre-treatment to biological waste treatment systems
- Polishing effluent from biological waste treatment systems
- Providing total wastewater treatment
- Polishing effluent from a biological wastewater treatment system in order to remove dissolved organic chemicals which were refractory to biological treatment.
- Recycling the treated water for replacement of groundwater or for other suitable recycling applications.



A "point source" Filtrasorb adsorption system at a wastewater plant cleans up toxic organic chemicals before discharging effluent. Wastes of this type can upset the effectiveness of biological type treatment operations.



Because of the large volume of industrial wastes treated in this municipal plant, the use of Filtrasorb carbon provides greater reliability than a biological treatment system.

## ADVANTAGES AND BENEFITS

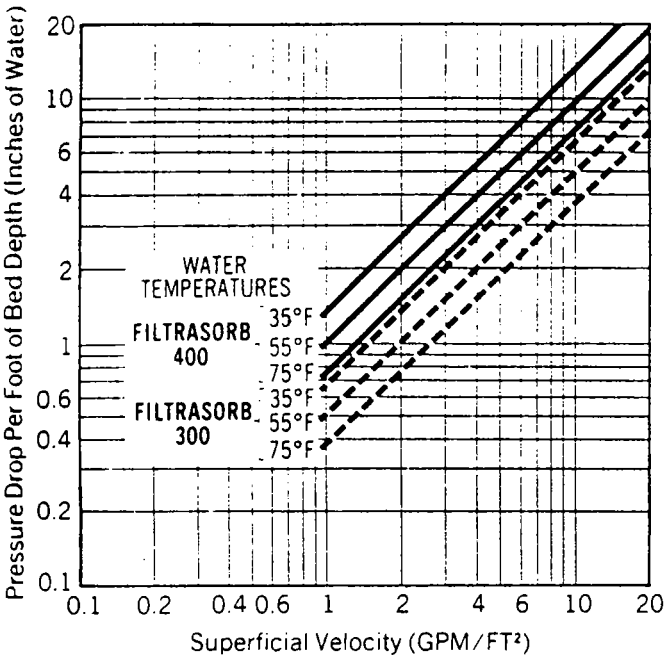
- **Provides ultimate disposal of pollutants** — When Filtrasorb carbon is saturated with organic chemicals, the process of thermal reactivation destroys the organic chemicals at very high temperatures in a reactivation furnace. This includes destruction of refractory and toxic chemicals which would otherwise be hard to destroy.
- **Economical to use** — Because of its *high surface area* and abrasion resistance, Filtrasorb can be reactivated repeatedly and returned to service to provide maximum economy.
- **Effective in treating a wide range of impurities** — Filtrasorb carbon removes hundreds of specific organic compounds from wastewaters, including many on the EPA lists of priority pollutants and hazardous substances.

These carbons are produced with an exceptionally high internal surface area of optimum pore size for adsorption of both high and low molecular weight pollutants.

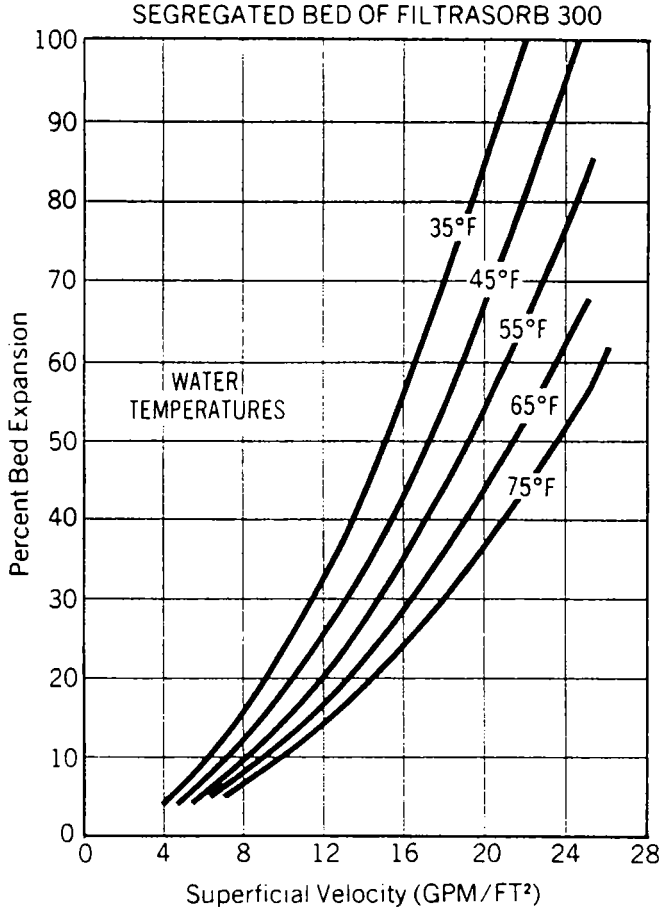
- **High surface area** — Because of its numerous pores in a wide range of sizes, Filtrasorb provides a very high capacity and efficiency for removing dissolved organic chemicals. Total surface area measures approximately 950 to 1050 square meters per gram ($N_2$, BET procedure).
- **Reliability** — Systems using Filtrasorb carbons accommodate changes in flow rates and increases in concentration of pollutants whether caused by spills, peak loads, pretreatment upsets or other variations in the wastewater effluent.
- **Suitable for backwash operations** — Filtrasorb carbons are of high density, wet readily, and do not float, thus minimizing loss during backwash operations.

For the purpose of estimating the volume of Filtrasorb in a system utilizing backwash procedures, Filtrasorb 300 has a backwashed and settled bulk density of 27-28 lbs. per cubic foot, and Filtrasorb 400 has a backwashed and settled bulk density of 26-27 lbs. per cubic foot.

DOWNFLOW PRESSURE DROP
THROUGH A BACKWASHED SEGREGATED
BED OF FILTRASORB 300 AND FILTRASORB 400




PERCENT BED EXPANSION OF A BACKWASHED-
SEGREGATED BED OF FILTRASORB 300




## REACTIVATION

Numerous installations have demonstrated the feasibility and economy of thermal reactivation.

Exhausted granular carbon can be reactivated on your plant site in a high-temperature furnace, or it can be done by Calgon Carbon Corporation under a service agreement.

## SPECIFICATIONS

| | Filtrasorb 300 | Filtrasorb 400 |
|---|---|---|
| Iodine Number (min.) | 900 | 1000 |
| Abrasion Number (min.) | 75 | 75 |
| Moisture (max.) | 2.0% | 2.0% |
| Effective Size (mm) | 0.8-1.0 | 0.55-0.75 |
| Water Soluble Ash (max.) | 0.5% | 0.5% |
| U.S. Standard Series Sieve Size: | | |
| Larger than No. 8 (max.) | 15% | — |
| Smaller than No. 30 (max.) | 4% | — |
| Larger than No. 12 (max.) | — | 5% |
| Smaller than No. 40 (max.) | — | 4% |

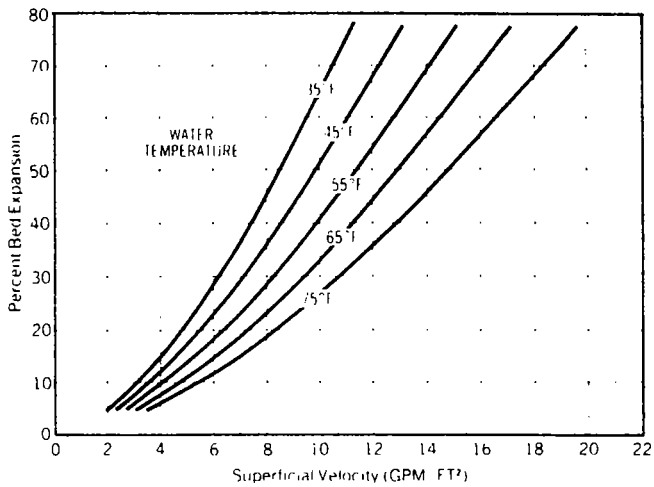
## PACKAGING

Filtrasorb can be supplied in four-ply polyethylene reinforced kraft bags 25 kg. (55.1 lbs.) net, bulk packs, 1000 lb. Super Sacs, or bulk shipped by truck. Shipping point: Catlettsburg, Kentucky.

## CAUTION

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low-oxygen spaces should be followed, including all applicable Federal and State requirements.

PERCENT BED EXPANSION OF A BACKWASHED SEGREGATED
BED OF FILTRASORB 400




*For information regarding incidents involving human and environmental exposure, call (412) 787-6700 and request to speak to Regulatory and Trade Affairs.*

*For additional information, contact*
*Calgon Carbon Corporation,*
*Box 717, Pittsburgh, PA 15230-0717*
*Phone: (412) 787-6700*

CALGON

CALGON CARBON CORPORATION

# MATERIAL SAFETY DATA SHEET

DATE April 1990

PRODUCT NAME FILTRASORB 300 ACTIVATED CARBON

CALGON CARBON CORPORATION

## SECTION I

| | | | |
|---|---|---|---|
| MANUFACTURER'S NAME | Calgon Carbon Corporation | EMERGENCY TELEPHONE NO. | 412-787-6700 |
| ADDRESS | P.O. Box 717 Pittsburgh, PA 15230-0717 | | |
| CHEMICAL NAME AND SYNONYMS | Carbon | FORMULA | C |

## SECTION II HAZARDOUS INGREDIENTS

| PRINCIPAL HAZARDOUS COMPONENT (S) | CAS # | % BY WEIGHT | ORAL $LD_{50}$ | DERMAL $LD_{50}$ | TLV (Units) ACGIH | OSHA | OTHER |
|---|---|---|---|---|---|---|---|
| Chemical Name: Carbon<br>Common Name: Activated Carbon | 7440-44-0 | 100% | >10g/Kg* (rat) | -- | N/A | N/A | N/A |
| Chemical Name<br>Common Name | | | | | | | |
| Chemical Name<br>Common Name | | | | | | | |
| Chemical Name<br>Common Name | | | | | | | |
| Chemical Name<br>Common Name | | | | | | | |

*No animal mortalities during course of 14-day study.

CAUTION!! Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state, and federal regulations.

This product is non-hazardous according to the definitions for "health hazard" and "physical hazard" provided in the OSHA Hazard Communication Law (29 CFR part 1910).

## SECTION III PHYSICAL DATA

| | | | |
|---|---|---|---|
| BOILING POINT (° F) | N/A | SPECIFIC GRAVITY ($H_2O$=1) | 2.3g/cc real density |
| VAPOR PRESSURE (mmHg.) | N/A | PERCENT VOLATILE BY VOLUME (%) | N/A |
| VAPOR DENSITY (AIR=1) | N/A | pH | N/A |
| SOLUBILITY IN WATER | insoluble | OTHER packing density | 0.4 to 0.7g/cc |

APPEARANCE AND ODOR black particulate solid

While this information and recommendations set forth herein are believed to be accurate as of the date hereof, CALGON CARBON CORPORATION MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

| | |
|---|---|
| FLASH POINT (Method Used) | N/A |
| EXTINGUISHING MEDIA | If involved in fire, flood with plenty of water. |
| SPECIAL FIRE FIGHTING PROCEDURES | None |
| UNUSUAL FIRE AND EXPLOSION HAZARDS | Contact with strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc. may result in fire. |

## SECTION V HEALTH HAZARD DATA

**EFFECT OF OVEREXPOSURE**

**A. ACUTE**

**1. INGESTION**

The product is non-toxic through ingestion. The acute oral $LD_{50}$ (rat) is >10g/Kg.

**2. INHALATION**

The acute inhalation $LC_{50}$ (rat) is >64.4 mg/ℓ (nominal concentration) for activated carbon.

**3. DERMAL EXPOSURE**

**a. TOXIC**

Non-toxic

**b. IRRITATION**

The product is not a primary skin irritant. The primary skin irritation index (rabbit) is 0.

**c. SENSITIZATION**

None

4. EYE IRRITATION

The physical nature of the product may produce eye irritation.

B. SUBCHRONIC, CHRONIC, OTHER

The effects of long-term, low-level exposures to this product have not been determined. Safe handling of this material on a long-term basis should emphasize the avoidance of all effects from repetitive acute exposures.

## FIRST AID

A. EYE

Flush with plenty of water for at least 15 minutes.

B. SKIN

Wash with soap and water.

C. INGESTION

N/A

D. INHALATION

N/A

## SECTION VI REACTIVITY DATA

| | | | |
|---|---|---|---|
| ABILITY | STABLE | X | CONDITIONS TO AVOID: None |
| | UNSTABLE | | |

INCOMPATABILITY (Materials to Avoid): Strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc.

HAZARDOUS DECOMPOSITION PRODUCTS:

Carbon monoxide may be generated in the event of fire.

## SECTION VII SPILL OR LEAK PROCEDURES

REPORTABLE QUANTITIES (RQ) IN LBS OF EPA HAZARDOUS SUBSTANCES IN PRODUCT

1. N/A
2. _____
3. _____

NOTIFY EPA OF PRODUCT SPILLS EQUAL TO OR EXCEEDING N/A LBS.

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

Sweep up unused carbon and discard in refuse container or repackage.

WASTE DISPOSAL METHOD:

Dispose of unused carbon in refuse container. Dispose of in accordance with local, state, and federal regulations.

## SECTION VIII HANDLING & STORAGE

| PROTECTIVE GLOVES | EYE PROTECTION |
|---|---|
| Rubber gloves recommended | Safety glasses or goggles recommended |

OTHER PROTECTIVE CLOTHING: Not required

RESPIRATORY PROTECTION: A NIOSH approved particulate filter respirator is recommended if excessive dust is generated.

| VENTILATION | | OTHER |
|---|---|---|
| | LOCAL EXHAUST: Recommended | |
| | MECHANICAL (General): Recommended | |

STORAGE & HANDLING

CAUTION!! Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state, and federal regulations.

OTHER PRECAUTIONS:

Wash thoroughly after handling. Exercise caution in the storage and handling of all chemical substances.

PREPARED BY D. Kubeldis

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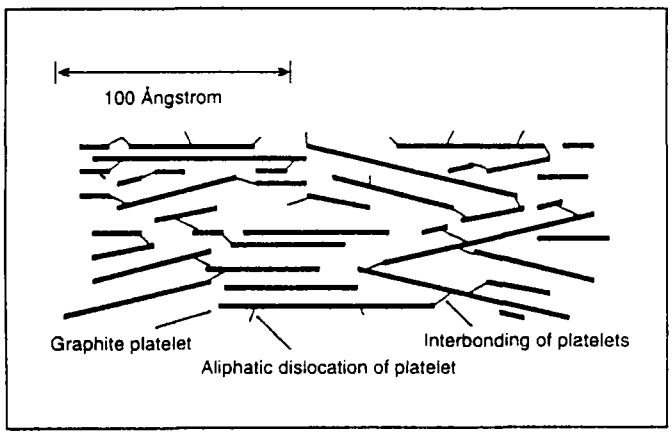
TECHNICAL INFORMATION

# ACTIVATED CARBON

## PRINCIPLES

## ACTIVATED CARBON

Activated carbon has been used to purify different products since Roman times. Carbon treatment is primarily based on a naturally occurring phenomenon called adsorption, in which molecules of a liquid or gas are trapped by either an external or internal surface of a solid. The phenomenon is somewhat similar to iron filings being held by a magnet. Activated carbon has a very high internal surface area and is thus an ideal material for adsorption. Purification of fluids with activated carbon can be located in any part of the sequence of plant operations. It is used from raw material purification to improving final product quality with the removal of trace components. Industrial effluents are also treated with activated carbon to remove undesirable organic compounds.



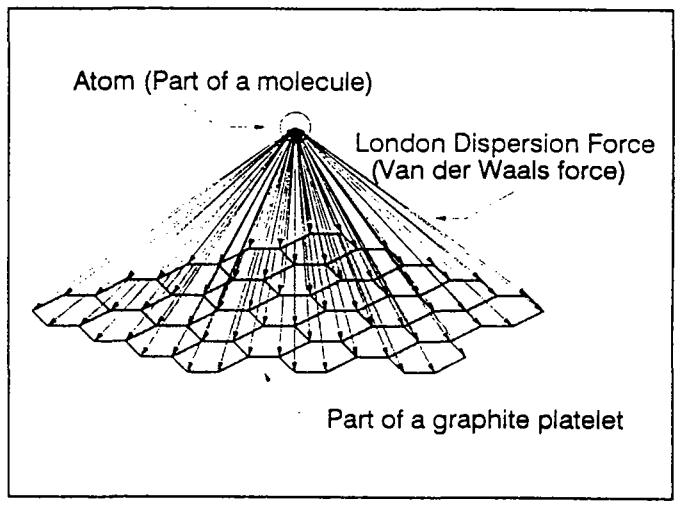

Special types of activated carbon are also produced for gas purification. Carbon has several forms in nature. The two best known crystalline structures of carbon are graphite, which is a flat hexagonal structure, and diamond which is a tetrahedral form. The following definition of activated carbon is given by Dr. M. Greenbank of Calgon Carbon Corporation:

*"Activated carbon is a crude form of graphite with a random or amorphous structure, which is highly porous over a broad range of pore sizes, from visible cracks and crevices to cracks and crevices of molecular dimensions."*

This means that activated carbon consists of a random, but locally semi-organized, number of these graphite platelets. The force that fixes the products to be adsorbed is called the London dispersion force.

This force is in fact a form of Van der Waals force, one of the four elementary forces in nature. The force is very strong, but only over short distances. The force is equal between all carbon atoms and is not dependent on outside parameters such as temperature and pressure. When considering this we can understand that adsorbate molecules will be held most strongly where they are surrounded by the most carbon atoms.

The average distance between the adsorbate molecule and the surrounding graphite platelets will govern the strength of the adsorption force. As can be seen from the picture below, some regions have a high density of graphite plates, and molecules in




these areas will be subject to very high adsorption forces. Conversely there are areas with a lower density of platelets and these will exhibit lower adsorption forces. During adsorption those areas having the highest adsorption potential are occupied first and molecules adsorbed in these regions tend to be more strongly held than molecules adsorbed in areas with a lower adsorption potential. Raw material and production processes used in the manufacture of activated carbon are the basis for the different physical properties and pore size distributions found in commercial grades of carbon.

## CARBON MANUFACTURE

Activated carbon can be manufactured from a wide variety of raw materials. The predominant qualification is that the raw material should have a high percentage of carbon content. Commonly used raw materials are coal, wood, peat, coconut shells and petroleum coke. The process of converting the raw material into the finished adsorbent may be divided into chemical and thermal processes. Furthermore, the end product may be granular, pelletized or powder.

Most of the volatile organic compounds in the raw material are removed during the carbonizing stage. For some raw material such as coconut shell, the carbonizing stage is carried out where the raw material grows, e.g. in Sri Lanka, Indonesia and the Philippines.

The char or charcoal is then shipped to the manufacturers. For other raw materials, coal for example, the carbonization step is part of the activated carbon production process.

Calgon Carbon's activated carbons used in the treatment of liquid streams, e.g. potable water supplies, are produced by thermal activation of selected grades of bituminous coals.

The activation process consists of selectively oxidizing part of the structure. The activating gases that can be used are air, water vapor and carbon dioxide. Water vapor and carbon dioxide are preferred, since the reactions with oxygen are more violent, attacking the outer surface of the granules rather than developing the inner pore structure. To accelerate the endothermic reactions between the raw material, the water vapor and carbon dioxide, temperatures between 800 and 1000°C are required. The properties of the final product are determined by the choice of raw materials as well as by the activation process, the retention time and activating conditions in the furnace. Steam activated carbons as produced by Calgon Carbon are produced by a multistage process involving the following steps:

- Preparation of the raw material
- Agglomeration, crushing and sieving to obtain granules of selected size
- Baking (oxidation + carbonization)
- Activation
- Screening

The most important stages of the production are the baking and activating steps. During baking, the raw materials are oxidized and carbonized. The process is highly exothermic and the temperature is strictly controlled. The oxidation stage starts at 150°C increasing slowly up to 500°C at the carbonization stage.

$$H_2O + C \rightarrow CO + H_2 \quad \Delta H = +117kJ$$
$$2H_2O + C \rightarrow CO_2 + 2H_2 \quad \Delta H = +75kJ$$
$$CO_2 + C \rightarrow 2\,CO \quad \Delta H = +159kJ$$
$$CO + \tfrac{1}{2}O_2 \rightarrow CO_2 \quad \Delta H = -285kJ$$
$$H_2 + \tfrac{1}{2}O_2 \rightarrow H_2O \quad \Delta H = -238kJ$$

The baker product is virtually free of volatiles and already contains some pores that are, however, too small or restricted for it to be useful as an adsorbent.

The creation of the active surface is done during the activation step. The final structure is created in such a way that the adsorbate molecules can move between the platelets, and this is achieved by reacting the baker product with oxidizing gases. Water vapor and carbon dioxide are the preferred oxidizing gases as oxygen reacts with carbon several hundred thousand times faster than carbon dioxide or water vapor. As the reactions taking place are endothermic, heat must be supplied and a temperature of 800 to 1000° is required. The energy balance is improved by burning the reaction products, hydrogen and carbon monoxide, in the furnace. The combustion of the reaction products also regenerates the oxidation gases, carbon dioxide and water vapor.

**CALGON CARBON CORP.**
P.O. Box 717
Pittsburgh, PA 15230
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800/4-CARBON
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Boulevard de la Woluwe 60, Boite 7
B-1200 Brussels, Belgium
Tel 32 2 773 02 11
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TECHNICAL INFORMATION

# GLOSSARY OF TERMS

## COMMONLY USED IN ADSORPTION

| TERMS | DEFINITIONS |
|---|---|
| **ABRASION NUMBER** | The abrasion number of granular carbon defines the resistance of the particles to degrade on handling. It is calculated by contacting a carbon sample with steel balls on a Ro-Tap machine and determining the percent ratio of the final mean particle diameter to the original mean particle diameter. |
| **ACTIVATED CARBON** | Activated carbon is a crude form of graphite, with a random or amorphous structure, which is highly porous over a broad range of pore sizes, from visible cracks and crevices to cracks and crevices of molecular dimensions. |
| **ACID-WASHED ACTIVATED CARBON** | Carbon which has been contacted with an acid solution with the purpose of dissolving ash in the activated carbon. |
| **ADSORBATE** | That which is adsorbed on the adsorbent. |
| **ADSORBENT** | Any solid having the ability to concentrate significant quantities of other substances on its surface. Activated carbon is an adsorbent. |
| **ADSORBER** | A vessel designed to hold granular carbon. |
| **ADSORPTION** | The phenomenon whereby molecules adhere to a surface with which they come in contact. |
| **ADSORPTION ISOTHERMS** | A measurement of adsorption determined at a constant temperature by varying the amount of carbon used or the concentration of impurity in contact with the carbon. |
| **ADSORPTION PORES** | The finest pores in the carbon structure. Pores which have adsorption capabilities. |
| **APPARENT DENSITY** | The weight per unit volume of activated carbon. |
| **ASH** | The mineral oxide constituents of activated carbon. It is normally defined as a weight percent basis after a given amount of sample is oxidized. |
| **BACKWASH** | An operating method used to remove suspended solids from the carbon bed. Water is pumped into the bottom of the adsorber, flows upward through the carbon bed, and exits through the backwash outlet. The upward flow expands the bed and removes the suspended solids, carbon fines, and entrained air. The percent bed expansion and time required for backwashing is a function of the backwash rate and water temperature. |

**BED DEPTH** — The amount of carbon expressed in length units, which is parallel to the flow of the stream and through which the stream must pass.

**BUTANE NUMBER** — The volume of butane adsorbed per unit weight of activated carbon after air saturated with butane is passed through a carbon bed at a given temperature and pressure.

**CARBON COLUMN** — A column filled with granular activated carbon whose primary function is the preferential adsorption of a particular type or types of molecules.

**CARBON TETRACHLORIDE ACTIVITY** — The maximum percentage increase in weight of a bed of activated carbon after air saturated with carbon tetrachloride is passed through it at a given temperature.

**CHEMI-SORPTION** — Adsorption where the forces holding the adsorbate to the adsorbent are chemical (valence) instead of physical (London's).

**COLOR BODIES** — Those complex molecules which impart color (usually undesirable) to a solution.

**COUNTER CURRENT EFFICIENCY** — The unique advantage of a carbon column that permits partially spent activated carbon to adsorb impurities before the semi-processed stream comes in contact with fresh carbon. This allows the maximum capacity of the activated carbon to be utilized.

**CRITICAL BED DEPTH** — In a carbon column the critical bed depth is the depth of granular carbon which is partially spent. It lies between the fresh carbon and the spent carbon and is the zone where adsorption takes place. In a single column system, this is the amount of carbon that is not completely utilized. See MASS TRANSFER ZONE.

**CROSS SECTIONAL BED AREA** — The area of activated carbon through which the stream flow is perpendicular.

**DEAERATION** — The process of removing air (gases) from a bed of carbon particles. In a volume of 1 $m^3$ of activated carbon, there are approximately 40 % of void space, 40 % of pore volume and 20 % of carbon skeleton.

**DESORPTION** — The opposite of adsorption. A phenomenon where an adsorbed molecule leaves the surface of the adsorbent.

**EDUCTOR** — A device with no moving parts used to force an activated carbon water slurry through pipes to the desired location.

**HEAT OF ADSORPTION** — The heat given off when molecules are adsorbed.

**HARDNESS NUMBER** — The hardness number is the resistance of a granular carbon to the degradation action of steel balls in a Ro-Tap machine. It is calculated by using the weight of granular carbon retained on a particular sieve after the carbon has been in contact with steel balls.

**IODINE NUMBER** — The iodine number is the milligrams of iodine adsorbed by one gram of carbon at a filtrate concentration of 0.02N iodine.

**MAKE UP CARBON** — Fresh granular activated carbon which must be added to a column system after a regeneration cycle or when deemed necessary to bring the total amount of carbon to specification.

**MACROPORE** — See TRANSPORT PORES

**MASS TRANSFER ZONE** — The adsorption gradient that exists in the carbon bed. It corresponds to the gradual transition of the carbon from "fresh" (or "virgin") to "spent" (or "exhausted"). Also referred to as the MTZ.

**MESH SIZE** — The particle size of granular activated carbon as determined by the U. S. Sieve Series. Particle size distribution within a mesh series is given in the specifications of the particular Calgon carbon.

**MICROPORE** — See ADSORPTION PORES

**MOLASSES NUMBER** — The molasses number is calculated from the ratio of the optical densities of the filtrate of a molasses solution treated with a standard activated carbon and the activated carbon in question.

**METHYLENE BLUE NUMBER** — The methylene blue number is the milligrams of methylene blue adsorbed by one gram of carbon in equilibrium with a solution of methylene blue having a concentration of 1.0 mg per liter.

**MOISTURE** — The percent by weight of water adsorbed on activated carbon.

**MOVING BED** — A unique application with granular carbons in which a single carbon column offers the efficiency of several columns in series. This is accomplished by the removal of spent carbon from one end of the carbon bed and the addition of fresh carbon at the other end with little or no interruption in the process.

**PARTICLE DENSITY** — The weight per unit volume of granular activated carbon not including the voids between the particles and cracks larger than 0.1 mm. It is determined by the displacement of mercury.

**PORE VOLUME** — The volume of the internal void spaces in a granule, smaller than 0.1 mm and large enough to allow access to helium. It is measured as the difference in the volumetric displacement by granular activated carbon in mercury and in helium at standard conditions.

**PULSE BED** — See MOVING BED

**REAL DENSITY** — The density of the skeleton of a carbon granule. This is determined by helium displacement.

**REACTIVATION** — The removal of adsorbates from spent granular activated carbon which will allow the carbon to be reused and recycled.

**SPECIFIC HEAT** — The quantity of heat required to raise the temperature of a unit weight of granular activated carbon through a particular interval of temperature divided by the corresponding quantity for water. For Calgon Granular Activated Carbon this value is 0.25. It should be noted that the thermal conductivity of granular activated carbon is extremely low.

**SURFACE AREA**

The surface area of granular activated carbon is empirically determined by the Brunauer, Emmett and Teller Method (BET Method), which utilizes the adsorption of nitrogen at liquid nitrogen temperature in the calculation. Surface area is usually expressed in square meters per gram of carbon. Calgon carbons range from 700 to 1,200 square meters per gram.

**TRANSPORT PORES**

Pores larger than the largest adsorption pores. They function as a diffusion path to transport adsorbates. Adsorption does not occur in these locations even at near saturated conditions.

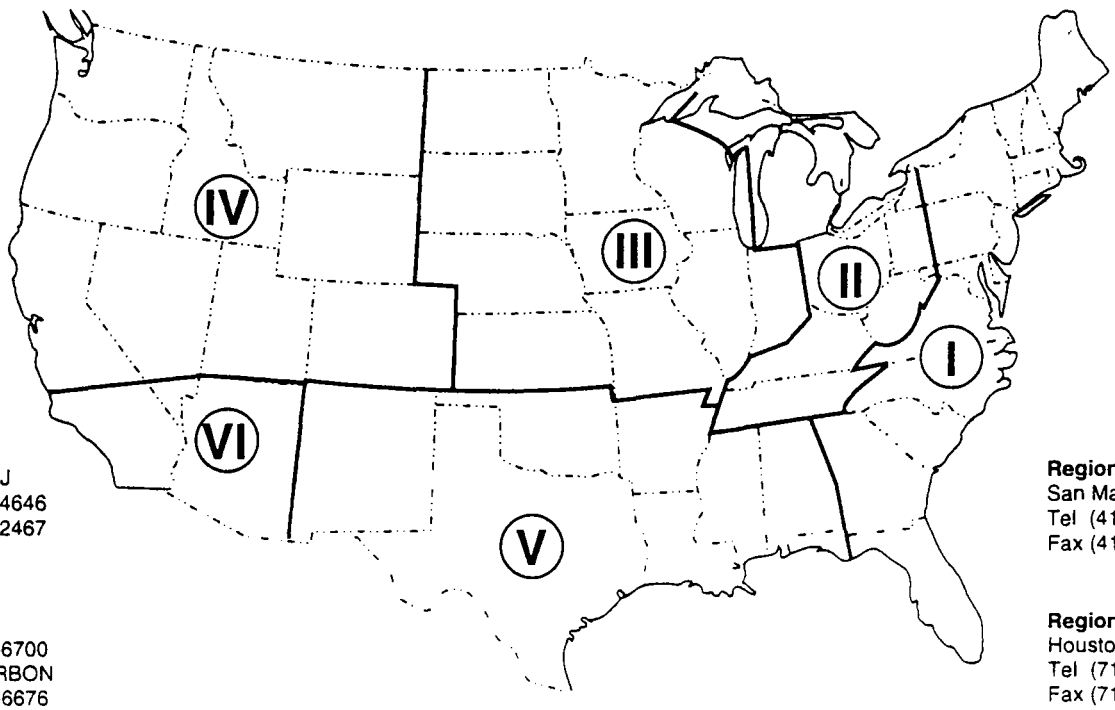
**VOIDS**

The percent by volume of the interstices to total bed volume.

**WAVE FRONT**

The carbon loading gradient that exists in the critical bed depth. It corresponds the gradual transition of the carbon from "fresh" (or "virgin") to "spent" (or "exhausted").
See MASS TRANSFER ZONE.

## SALES OFFICES




**Region I**
Bridgewater, NJ
Tel (908) 526-4646
Fax (908) 526-2467

**Region II**
Pittsburgh, PA
Tel (412) 787-6700
800/4-CARBON
Fax (412) 787-6676

**Region III**
Lisle, IL
Tel (708) 505-1919
Fax (708) 505-1936

**Latin America/ Asia Pacific**
Pittsburgh, PA
Tel (412) 787-4519
Fax (412) 787-4523

**Canada**
Calgon Carbon Canada, Inc.
Mississauga, Ontario
Tel (416) 673-7137
Fax (416) 673-8883

**Europe**
Chemviron Carbon
B-1200 Brussels, Belgium
Tel 32 2 773 02 11
Fax 32 2 770 93 94

**Region IV**
San Mateo, CA
Tel (415) 572-9111
Fax (415) 574-4466

**Region V**
Houston, TX
Tel (713) 690-2000
Fax (713) 690-7909

**Region VI**
Carlsbad, CA
Tel (619) 431-5550
Fax (619) 431-8169

If at any time our products or services do not meet your requirements or expectations, or if you would like to suggest any ideas for improvement, please call us at 1-800-548-1999. From outside the U.S. please call +1-412-787-6700.

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## ADSORPTION

There are two types of adsorption: chemical and physical.

Chemical adsorption is a chemical reaction between a molecule in a solution or vapor with the surface of an adsorbent such as activated carbon. The chemical reaction is usually irreversible. An example of chemical adsorption is chlorine removal from water. The chemical reaction of chlorine with carbon and water forms $Cl^-$ and $CO_3^=$ ions.

Physical adsorption is usually explained in terms of surface structure (or energy per unit volume) of the solid. While molecules in the interior of any solid material are subject to equal forces in all directions, the molecules on the material's surface are subjected to unbalanced forces. This results in an imbalance with inward forces toward the solids. Molecules that are either gaseous or liquid then become attracted (adsorbed) to the solid's surface.

The attractive forces, known as London Dispersion Forces, are the same forces responsible for surface tension and condensation of vapors to liquid. These forces are a type of Van der Waals force and range from very weak to moderately strong. Physical adsorption is reversible and changing the process variables in a system can cause molecules to be desorbed.

An important aspect to any adsorbent is the amount of pore volume it contains per unit volume or per net weight. Examples of adsorbents are activated carbon, silica gel, activated gel, alumina, and zeolite.

## ACTIVATED CARBON AND HOW IT WORKS

Any organic material with a high carbon content (coal, wood, peat, coconut shells, etc.) can be used as the raw material for making activated carbons of various activities and properties. When making high quality granular activated carbon from coal, the raw material is ground and a binder is added to give the end product suitable hardness. The mixture is then re-compacted and crushed to give it the desired particle size. The carbon is then activated by thermally decomposing and removing carbon from the structure in a reducing atmosphere at about 1800 F. Furnace temperature and the furnace atmosphere are controlled to produce the desired adsorption properties in the product.

The resultant product has an incredibly large internal pore volume per unit particle volume and a network of submicroscopic pores where the adsorption takes place. About

40% of the particle volume is used to contain adsorbates. One pound of activated carbon contains an effective total area of over 100 acres.

Activated carbon normally removes adsorbates (contaminants or desired products) from a solution (solute) through physical adsorption. The adsorbate would have to differ from the solute. For example, in aqueous solutions the solute should be more neutral or non-polar and have a higher molecular weight.

Many factors affect carbon adsorption in liquids, such as pH, flow rate, temperature, solubility, concentration of adsorbate, type and number of different adsorbates, viscosity, and the level of adsorbate removal required.

In any stream, there are four steps that occur in order for adsorption to take place. First, the adsorbate molecule must migrate through the bulk of solution toward the carbon particle. This is known as bulk diffusion. Second, the adsorbate penetrates the surface film to reach the exterior surface of the carbon. This is known as film diffusion. Third, the adsorbate diffuses through the transport or large pores. This is known as pore diffusion. Fourth, the adsorbate is adsorbed deep into the micropore structure of the activated carbon. In most water applications, the rate limiting step is the pore diffusion step.

In a typical fixed bed carbon system, the liquid flows down through an adsorber. Initially, the adsorbate is adsorbed onto the top most portion of the carbon. The rate of adsorption will determine the depth of carbon (mass transfer zone) that is utilized to remove the adsorbates. The varying concentration in the mass transfer zone is known as the wavefront.

Eventually, the wavefront moves through the bed and contamination breaks through into the effluent from the bed. This is known as the breakpoint. In a single or parallel adsorber system, the contaminants are usually monitored until the effluent approaches the allowable limit. The adsorber is then taken off-line and the spent carbon is removed. The adsorber is then refilled with fresh carbon and brought back on-line.

In a series mode, the mass transfer zone in the first or lead bed is allowed to pass through the adsorber into the second bed. Usually, when adsorbing multiple components, the first two or three compounds that are being monitored in the effluent from the lead bed are allowed to approach their influent levels, at which point the adsorber is taken off-line.

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## FACTORS AFFECTING ADSORPTION

Concentration: With each adsorbate, a high concentration will result in a higher adsorption capacity for that adsorbate on the carbon. For example, if an adsorbate has a one percent loading at 1 mg/l, it might have a three percent loading at 10 mg/l. However, the volume of carbon required to treat a fixed volume of solution will go up if the concentration goes up.

When the concentration of the feedstream changes dramatically, such as when a spill occurs upstream of a potable water plant intake, undesirable effects may occur. Concentrations at the intake of the plant may go up 100 to 1000 times the normal influent concentration. The activated carbon would adsorb the contamination with a higher capacity, if adsorptive capacity was available.

However, upon passage of the spill past the intake, the activated carbon may desorb some of the high level contamination to fresh carbon downstream of the mass transfer zone or into the effluent. When upsets occur, a conservative approximation is to assume that additional carbon is exhausted by the excess contaminant at the original loading rate for the normal influent level.

Another example is when the contaminant concentration in the influent decreases for a period of time. In this instance the adsorbate will start to desorb. The rate of desorption is slower than the rate of adsorption. Therefore, a conservative estimate of the overall effect is that a fixed volume at the reduced influent level will exhaust as much carbon as if the influent concentration was consistently high.

A steady feed concentration will help minimize the amount of carbon that is used in an application. A steady feed would usually be considered to be +/-25% of the average concentration. However, the carbon bed will act to average out upsets and variations, except when the bed is nearly exhausted.

Flow Rate: In many applications, the flow rate to the adsorber is varied because the flow demand changes. As the flow changes, so does the mass transfer zone (MTZ). These changes are approximated by a directly proportional relationship between MTZ length and flow rate. For example, if the MTZ is 1 foot at 250 gpm, it would be 2 feet at 500 gpm. If the flow rate is increased dramatically, the MTZ is further lengthened because some desorption may take place, resulting in less efficient operation. For the optimum carbon usage, the flow rate should be steady (if possible).

In a series configuration, increasing the flow rate usually has a minimal impact. In a parallel mode, this impact is more substantial since the carbon is usually taken off line on the basis of the effluent quality. since the MTZ is lengthened the on-stream time will be shortened.

Viscosity: As viscosity increases in a system, the time to adsorb lengthens, and thus the MTZ lengthens. In a process application the temperature of the feedstream may be raised to offset increases in viscosity, but if the temperature is raised too high degradation of product may occur or the adsorption capacity of the carbon may be reduced. In water applications, viscosity has minimal impact because it is relatively low.

Temperature: In liquid phase systems, the adsorptive capacity is usually lowered at higher temperatures because the solubility is increased.

Feedstream pH: The pH of the feedstream can impact adsorption efficiency. This impact may be substantial since the pH affects the ionization of the adsorbate. Usually, the more ionic adsorbates have less adsorption capacity. Therefore, organic acids adsorb better at lower pH levels, while organic bases adsorb better at higher pH levels.

Water Characteristics: On each start-up of fresh carbon, the pH of the effluent stream may rise. This occurs because species like sulfates, nitrates and chlorine adsorb and displace alkaline species. The pH will return to normal, depending on water characteristics, after 250 to 350 bed volumes have been treated. If this is a problem, then either acid should be added to the effluent, or the carbon should be allowed to stand in a sodium sulfate solution for 10 to 12 hours.

The carbon has a capacity for sodium sulfate of 1% by weight. Therefore, the water in contact with the carbon should contain a quantity of sodium sulfate at least equal to 2% by weight of the carbon. In a 20,000 pound adsorber this would be 400 pounds of $Na_2SO_4$ in 5,000 gallons of water.

Solubility: The water solubility of a particular compound is a very good indicator of its adsorptivity. Generally, the more soluble a compound is, the more difficult it is to be adsorbed. Also, a more water soluble compound has a longer MTZ.

Suspended Solids: Suspended solids should usually be taken out of the feedstream before the carbon adsorbers. Suspended solids (>10 microns) will usually be filtered out within the first 6" of carbon and the pressure drop across the carbon will increase. If the pressure drop increases too much, the unit should be backwashed or backflushed.

Normally, feed streams containing suspended solids of more than 50 ppm are pre-filtered.

If the suspended solids are finer than 10 microns, the solids will usually not be filtered out by the carbon. The solids would then pass through the carbon into the effluent. This condition is very undesirable because the solids often contain dissolved or attached adsorbate and premature breakthrough can appear to occur. For materials to adsorb they must be in solution, so they can diffuse into the pore structure.

Immiscible Oils and Greases: Immiscible oils and greases have to be separated from the feedstream before the carbon adsorbers. If they are not removed, they may coat the carbon particles with a fine film. The adsorbates will not be able to pass through this film, and the carbon will not be effectively utilized. Oils and grease can also behave as a suspended, immiscible solid.

Heat of Adsorption: Heat is often given off when molecules are adsorbed. The amount of heat is conservatively estimated at two (2) times the heat of vaporization. In a process stream where the solvent is an organic liquid, a heat-up potential exists if the carbon has not been previously wetted and deaerated properly. Refer to Section 3.3 of this manual for wetting procedures.

Water has too low a heat of adsorption to cause a problem for aqueous solutions.

Competitive Adsorption: In most carbon applications (process, wastewater, groundwater, and potable water), more than one adsorbing compound is in the feedstream. Some of these compounds must be adsorbed while others may be permitted to pass through the carbon bed.

Unfortunately, the activated carbon cannot tell which of the molecules must be adsorbed. All of the components in the feedstream will compete for adsorption space, making the removal of target components less efficient. Therefore, competitive adsorption can cause premature breakthrough of the target component.

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## ADDITIONAL ADSORPTION THEORY

Desorption/Displacement: Desorption is the opposite of adsorption and may occur for many reasons. Changes in the feedstream components, temperature, pH, and feedstream concentration may promote desorption. In order to minimize desorption and optimize carbon usage, the feedstream should be stable (if possible). The rate at which desorption takes place is usually much slower than the adsorption rate.

If a more strongly adsorbed organic enters the feed it will desorb the target adsorbate. This forces the target adsorbate to re-adsorb deeper in the carbon bed, and eventually breakthrough will occur.

Roll-over in Competitive Adsorption: When an adsorber system runs beyond breakthrough, the more weakly adsorbed components originally in the feedstream can be desorbed into the effluent. The resulting concentrations may exceed the inlet concentrations. This phenomenon is known as roll-over. In a properly operated column system, roll-over of key components will not be observed in the effluent.

Effect of Bacteria: Higher pressure drops can be a result of bacteria growth in some wastewater applications. This is due to bacteria slime and exhaust gasses from the bacteria. If backwashing does not get rid of the pressure drop problem, then either NaOH washing or higher temperatures will control bacteria growth. Usually, sodium hydroxide washing is used in lined vessels. Do not use biocides, chlorine, or other additives, since they will adsorb and reduce carbon life without affecting the bacteria.

Refer to Section 3.7.2 for sodium hydroxide washing procedures.

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# SPENT CARBON ACCEPTANCE PROCEDURE

CALGON CARBON CORPORATION P.O. BOX 6768 1120 ROUTE 22 EAST BRIDGEWATER, NJ 08807-2985 (908) 526-4646 (908) 526-2467 FAX NO.

In order to accept spent carbon for reactivation from an activated carbon treatment application, Calgon Carbon requires completion of the following items:

1. An Adsorbate Profile Document (APD), which provides the treated stream's components, the regulatory profile, the safety profile, and the spent carbon's RCRA/non-RCRA classification. For RCRA manifested carbon, a notarized Certificate of Generator is required in addition to the Adsorbate Profile Document.

2. Reactivation testing of a spent carbon sample, which requires submittal of two pounds of spent granular activated carbon (GAC) to our laboratory. If a carbon acceptance canister was provided with the adsorption system, and it was placed on-line, return that sample to Calgon Carbon.

Copies of the required forms are enclosed for your use. Please complete one APD for your carbon application. The APD, with the responsible party's original signature, and the Certificate of Generator (if required) should be returned to my attention at the above address. The APD may be faxed to us to expedite beginning the carbon acceptance process. These completed documents must be received before carbon reactivation testing may begin. Please do not send the spent carbon sample until you have completed and returned this documentation.

Please identify the spent carbon sample with your company name, site location and addresses. The sample should be sent to our Carbon Acceptance Laboratory in Pittsburgh. If the spent carbon from this application is RCRA manifested a Chain of Custody sticker must be placed across the top of the sample container and the corresponding Chain of Custody record shipped with the sample. You may include a copy of the APD, but please note that the original APD should be returned to me in Bridgewater, New Jersey.

Send carbon acceptance sample to:

Calgon Carbon Corporation
Reactivation Acceptance
500 Calgon Carbon Drive
Pittsburgh, PA 15205

Shipment of the sample via one or two day delivery will also expedite the carbon acceptance process.

Upon completion of the sample analysis, Calgon Carbon's Acceptance Committee will review the results to determine the suitability of the application's spent carbon for reactivation. A carbon acceptance number shall be issued for this application. Calgon Carbon will not accept any spent carbon for reactivation that has not been approved through our acceptance process. Should any carbon arrive at our plant without prior approval, it will be rejected and shipped back to the customer's site.

Carbon acceptance costs and analytical requirements vary with the application. Your technical sales representative will provide you with pricing information for this test work. Typical carbon acceptance approval requires four to six weeks. Calgon Carbon appreciates the opportunity to service your activated carbon needs. Should you have any questions, please contact your technical sales representative, or myself at the above number.

Sincerely,
Calgon Carbon Corporation

Stephanie L. Carr

# ADSORBATE PROFILE DOCUMENT
## CALGON CARBON CORPORATION

DATE _____

Return Samples To:
CALGON CARBON CORPORATION
REACTIVATION ACCEPTANCE
500 CALGON CARBON DRIVE
PITTSBURGH, PA 15205

### CUSTOMER INFORMATION

COMPANY NAME _____ PHONE NO. _____

MAILING ADDRESS _____ EPA ID # ☐☐☐☐☐☐☐☐☐☐☐☐

_____

_____ STATE ID # ☐☐☐☐☐☐☐☐☐☐☐☐

FACILITY ADDRESS _____

_____

CONTACT NAME _____ TITLE _____ PHONE NO. _____

### WASTE STREAM PROFILE

List the principal components and their concentration in the stream (wgt. %, ppm, mg/L, or other units)

| Component | Amount | Unit |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

TYPE OF STREAM

- Industrial Wastewater ☐
- Groundwater ☐
- Spill/Emergency ☐
- Superfund Site Remediation ☐
- Potable Water (surface/river) ☐
- Industrial Process ☐
- Food Process ☐
- Vapor ☐
- Other _____

Does the stream fall into one of the following specific categories ?

- Dry Cleaning Operation ☐
- Gas Station Remediation
  - Soil ☐
  - Water ☐
- Tank Venting ☐

List chemical in tank

_____

_____

Describe the waste stream. _____

How is the stream generated ? _____ Stream flow rate ____gpm or____cfm

### CARBON PROFILE

Carbon Type _____Is the carbon from one source ? _____ (y/n)
Describe how the carbon is used to treat the stream _____
Adsorption Equipment By: Customer ___ Calgon Carbon ___ Pounds Carbon On-stream _____
Method of Spent Carbon Return: Bulk Truck _____ Calgon Bins _____ Vapor Pac _____ Cyclesorb _____
Other _____ Describe _____

 CUSTOMER_____

## REGULATORY PROFILE

Is the spent carbon a hazardous waste as defined by Part 261 of the Resource Conservation and Recovery Act ? ☐ YES ☐ NO

If YES, list waste code number(s) _____

Has the spent carbon been subjected to TCLP testing ? ___ YES ___ NO If yes, please attach results.

Is the spent carbon a hazardous waste in the facility's state ? ___ YES ___ NO
If YES, list state waste code number(s) _____

Is the stream that the carbon is treating subject to the Benzene NESHAP Standard (40 CFR Part 61) ___ YES ___ NO

Does the spent carbon contain, or by definition contain, any of the following chemicals ? (Y or N)
PCB's _____ Dioxin _____ 1,2-Dibromo-3-chloropropane _____

## SAFETY PROFILE (Attach any analyses, toxicological studies, safety data, MSDS, etc. that is relevant)

Are any of the following types of compounds, materials, or conditions present in the spent carbon ?
Check YES or NO in the spaces below and describe and list amount or identify condition in the spaces to the right.

| | YES | NO | |
|---|---|---|---|
| 1) Polychlorinated Biphenyls | ☐ | ☐ | _____ |
| 2) Dioxins | ☐ | ☐ | _____ |
| 3) OSHA Regulated Carcinogens (per 29 CFR 1910.1001 - 1910.1048) | ☐ | ☐ | _____ |
| 4) Halogenated Organics | ☐ | ☐ | _____ |
| 5) Sulfur-Containing Organics | ☐ | ☐ | _____ |
| 6) Pesticides/Herbicides | ☐ | ☐ | _____ |
| 7) Highly Toxic Organics | ☐ | ☐ | _____ |
| 8) Radioactive Material | ☐ | ☐ | _____ |
| 9) Explosive (Pyrophoric/Shock) Material | ☐ | ☐ | _____ |
| 10) Biological Pathogenic or Etiologic Agents | ☐ | ☐ | _____ |
| 11) Reactive Cyanide or Sulfide | ☐ | ☐ | _____ |
| 12) SARA Title III, Section 313 Toxic Chemicals | ☐ | ☐ | _____ |
| 13) Odorous Compounds | ☐ | ☐ | _____ |
| 14) Metals (Ag, As, Ba, Cd, Cr, Co Cu, Pb, Li, Mg, Mn, Hg, Ni, Se, Sr, Zn) | ☐ | ☐ | _____ |

Physical Characteristics: pH _____

Flashpoint _____ (For DOT compliance)
(Closed Cup)

List any acute or chronic hazards associated with or alleged to be associated with human contact with or exposure to the waste or to the spent carbon resulting from the waste

_____

Are there any special specific safe handling requirements necessary for processing the spent carbon ?

_____

Will the spent carbon exhibit any of the following conditions: (Indicate YES or NO for each item)
Radiation Above Backround ___ High Salt Content ___ Contain Sand, Silt, Or Other Foreign Material ___

CUSTOMER_____

ENVIRONMENTAL AUDIT OF FACILITIES

Will it be necessary for you to perform an environmental audit at our reactivation facilities prior to return of spent carbon?

____ Yes

____ No

CERTIFICATION

To the best of my knowledge and ability the information provided is complete, accurate and true.

NAME _____

SIGNATURE _____

TITLE _____

DATE _____

CONFIDENTIALITY

Calgon Carbon Corporation as consideration of the customer's release of the above information, and any subsequent data provided, agrees to treat such information as confidential property and will not disclose such information to others except as is required by law and facility operating permits.

NAME _____

SIGNATURE _____

TITLE _____

DATE _____

# Instructions for Carbon Acceptance Canister (CAC)

1. Connect the Carbon Acceptance Canister (CAC) as shown in drawing. Start the adsorption system, according to the Operating Manual, to treat water. Influent and effluent to CAC should be closed.

2. Once clean water is obtained at the system effluent, open the top carbon fill nozzle of the CAC. Slowly open the effluent valves to the CAC to allow clean water into the bottom of the CAC. Fill the CAC with clean water and fill a five-gallon pail with water overflowing from the carbon fill nozzle. Close the effluent valve and allow the carbon fill nozzle to vent.

3. Wait 24 hours to wet the carbon.

4. Slowly open the effluent valve and backfill again with clean water from the effluent line to deaerate. Once the water flows out, close the effluent valve and the carbon fill nozzle, and open the influent and effluent valve to start the flow from the influent.

5. If the carbon adsorber is to be backwashed or shut down, close the influent and effluent valves to the CAC and open the fill nozzle and restart the unit once the adsorber is back on-line.

6. A rough guideline for how long the CAC should be left in:

   a. If the adsorption system is in a parallel mode, then the unit should be on-line about 1/10 of the anticipated bed life.

   b. If the adsorption system is in a series mode, then the unit should be on-line about 1/5 of the anticipated bed life.

Safety considerations for units are as follows:

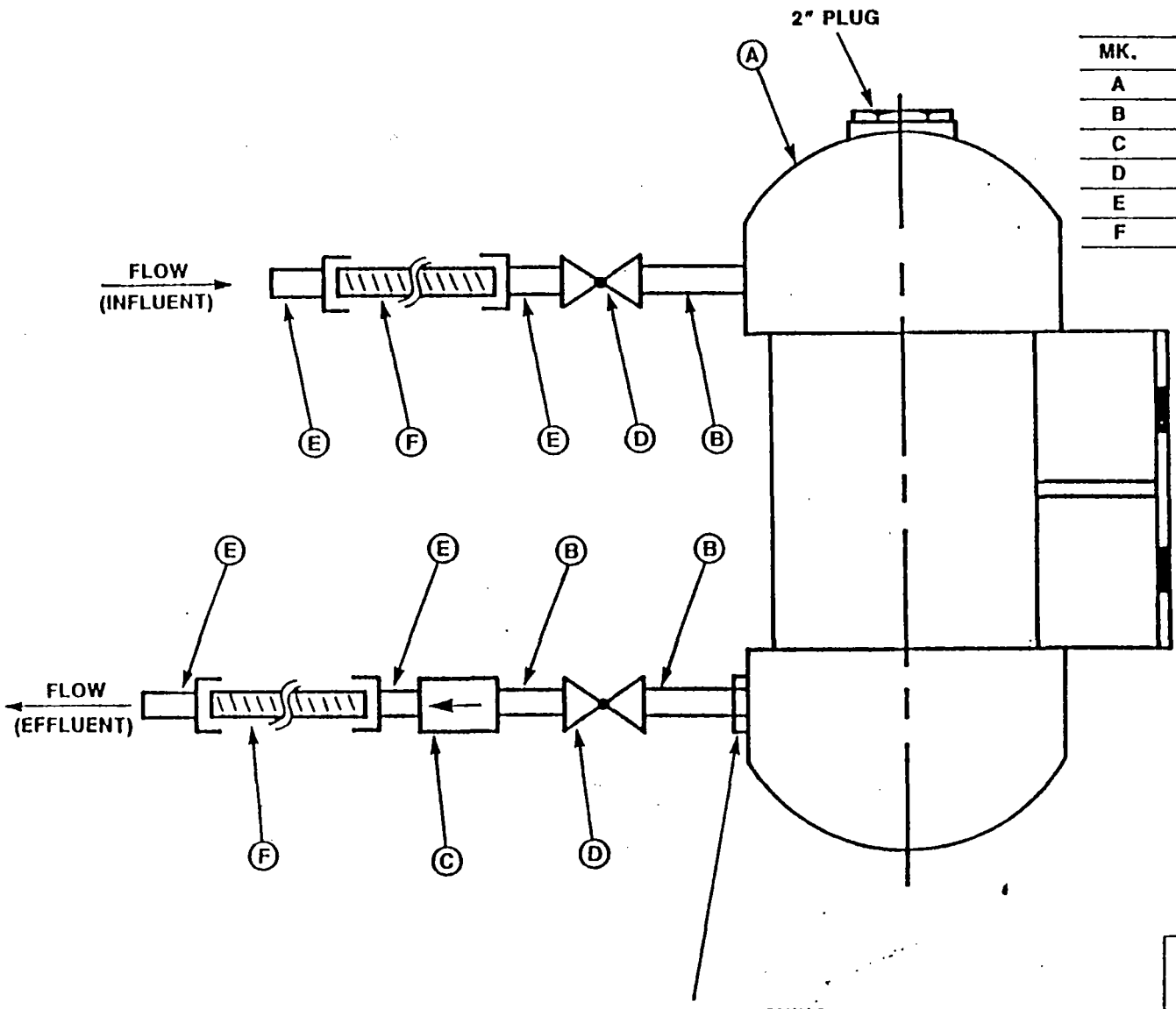
   a. The unit is rated for 150 psig.

   b. The materials of construction of the unit and piping are as follows:

| | |
|---|---|
| Septa and Body | - PVC |
| Valves | - Polypropylene |
| Tubing | - Polypropylene |
| Flow Control Valve | - Kates-316 SS with Teflon Seals |

Contact your local sales office if you have any questions.

5/1991




**BILL OF MATERIAL**

| MK. | QTY. | INVENTORY NO. | DESCRIPTION |
|---|---|---|---|
| A | 1 | B3024 | CANISTER |
| B | 3 | PINIP04XA | ½" NIPP. X 1½" LG. (TBE) |
| C | 1 | JDOLEV10G | 1 GPM DOLE VALVE |
| D | 2 | P145004 | ½" VALVE |
| E | 4 | PMCO4TO4P | ½" MNPT x ½" TUBE CONI |
| F | | JTUBINGO4 | ½" TUBING |

NOTES:

1. ALL MATERIAL TO BE PVC EXCEPT FLOW CONTROL VALVE.
2. THIS SKETCH TO BE USED AS A REFERENCE FOR ASSEMBLY OF NEW PVC CARBON ACCEPTANCE CANISTER.
3. CUSTOMER TO CHECK MATERIAL OF CONSTRUCTION COMPATIBILITY.

PLOTTED 5 - 28- 91

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E & A

CARBON ACCEPTANCE CANISTER

DETAILS — (PVC)

WE

NTS

90 - 90 - 1788

# APPENDIX D

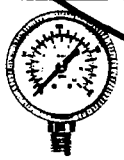
## OTHER EQUIPMENT

- **WATER METER**
- **PRESSURE GAUGES**
- **DIAPHRAGM SEALS**

# General Purpose Pressure Gauges

## Steel Case Gauges with Spiral Tube

### Accuracy: ±1.6% of Full Scale



Steel Case

**Dual relief valve/blowout disc enhances operating safety.** Phosphor bronze spiral bourdon tubes. Black enamel finish and acrylic lens. Black markings on white aluminum dial. **Connection:** ¼" MPT.

| PSI READING Total Grad. | Figure Interval | Grad. Marks | 2" DIAL BOTTOM CONN. No. | NET EACH | CTR. BACK CONN. No. | NET EACH | 2½" DIAL BOTTOM CONN. No. | NET EACH | CTR. BACK CONN No. | NET EACH |
|---|---|---|---|---|---|---|---|---|---|---|
| 1000 | 100 | 20 | 3851K23 | $8.55 | 3851K33 | $9.22 | 3851K43 | $10.09 | 3851K53 | $12.01 |
| 2000 | 500 | 50 | 3851K24 | 8.55 | 3851K34 | 9.22 | 3851K44 | 10.09 | 3851K54 | 12.01 |
| 3000 | 500 | 100 | 3851K25 | 8.55 | 3851K35 | 9.22 | 3851K45 | 10.09 | 3851K55 | 12.01 |
| 5000 | 1000 | 200 | 3851K26 | 8.55 | 3851K36 | 9.22 | 3851K46 | 10.09 | 3851K56 | 12.01 |

## Die Cast Aluminum Case Gauges

### ANSI Grade A – 1% Accuracy



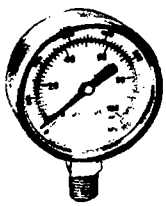
Aluminum Case

**Accuracy applies to pressure measurement in systems containing water, oil, air, and gases other than oxygen.** Phosphor bronze bourdon tube. Black enamel finish. White aluminum dial. PSI and kPa scales. 3½" dial gauges have acrylic lenses; 4½" dial gauges have glass lenses. Available in lower back connection with back flange and lower back connection with front flange for panel mounting. **Connection:** ¼" MPT.

| PSI READING Total Grad. | Figure Intervals | Grad. Marks | kPa | ¼" BACK CONNECTION 3½" DIAL No. | NET EACH | 4½" DIAL No. | NET EACH | ¼" BACK CONNECTION PANEL MOUNT 3½" DIAL No. | NET EACH | 4½" DIAL No. | NET EACH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 3 | 0.2 | 100 | 4007K41 | $61.00 | 4007K51 | $69.02 | — | — | 4007K61 | $81.98 |
| 100 | 20 | 1 | 700 | 4007K42 | 61.00 | 4007K52 | 69.02 | 4007K72 | $72.63 | 4007K62 | 81.98 |
| 300 | 50 | 5 | 2000 | 4007K43 | 61.00 | 4007K53 | 69.02 | 4007K73 | 72.63 | 4007K63 | 81.98 |
| 600 | 100 | 10 | 4000 | — | — | 4007K54 | 69.02 | 4007K74 | 72.63 | — | — |

## Drawn Brass Case Gauges

### ANSI Grade B – 2% Accuracy



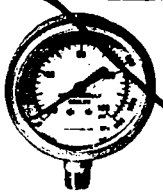
Drawn Brass

**Weather-resistant construction makes these gauges ideal for damp locations.** Phosphor bronze C-shaped bourdon tube. White coated aluminum dial with black scales. Acrylic window. Psi and kPa scales. All have bottom connection. **Connection:** ¼" MPT.

| PSI READING Total Grad. | Figure Intervals | Grad. Marks | kPa | 2" DIAL No. | NET EACH | 2½" DIAL No. | NET EACH | 3½" DIAL No. | NET EACH |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 3 | ½ | 100 | 4023K11 | $17.44 | 4023K21 | $20.50 | 4023K31 | $30.36 |
| 30 | 5 | 1 | 200 | 4023K12 | 17.44 | 4023K22 | 20.50 | 4023K32 | 30.36 |
| 60 | 10 | 2 | 400 | 4023K13 | 17.44 | 4023K23 | 20.50 | 4023K33 | 30.36 |
| 100 | 20 | 2 | 700 | 4023K14 | 17.44 | 4023K24 | 20.50 | 4023K34 | 30.36 |
| 160 | 20 | 5 | 1100 | 4023K15 | 17.44 | 4023K25 | 20.50 | 4023K35 | 30.36 |
| 200 | 40 | 5 | 1400 | 4023K16 | 17.44 | 4023K26 | 20.50 | 4023K36 | 30.36 |
| 300 | 50 | 10 | 2000 | 4023K17 | 17.44 | 4023K27 | 20.50 | 4023K37 | 30.36 |
| 400 | 50 | 10 | 2800 | 4023K18 | 17.44 | 4023K28 | 20.50 | 4023K38 | 30.36 |
| 600 | 100 | 20 | 4000 | 4023K19 | 17.44 | 4023K29 | 20.50 | 4023K39 | 30.36 |

## Stainless Steel Case Gauges

### ASNI Grade B – 2% Accuracy



Stainless Steel

**These gauges are ideal for tough, severe service conditions requiring corrosion resistance.**

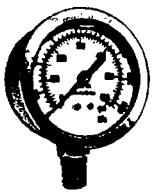
316 stainless steel socket and C-shaped bourdon tube. White coated aluminum dial with black scales and polycarbonate window. Psi and kPa scales. Hermetically sealed, waterproof and weatherproof; 304 SS case ring, and blowout disc.

**Dial Size:** 63mm (2.47"). **Connection:** ¼" MPT bottom. **Available with center back connection and panel mount front flange. Specify 4066K999, pressure range, and mounting style. Prices on request.**

| PSI READING Total Grad. | Figure Intervals | Grad. Marks | kPa | No. | NET EACH |
|---|---|---|---|---|---|
| 30 | 5 | 1 | 200 | 4066K12 | $62.71 |
| 60 | 10 | 2 | 400 | 4066K13 | 62.71 |
| 100 | 20 | 2 | 700 | 4066K14 | 62.71 |
| 160 | 40 | 5 | 1100 | 4066K15 | 62.71 |
| 200 | 40 | 5 | 1400 | 4066K16 | 62.71 |
| 300 | 50 | 10 | 2000 | 4066K17 | 62.71 |
| 400 | 100 | 10 | 3000 | 4066K18 | 62.71 |
| 600 | 100 | 20 | 4000 | 4066K19 | 75.21 |

## All Stainless Steel Gauges with Spiral Tube

### Accuracy: ±1%



Stainless Steel Spiral Tube

**Designed for use in process, petrochemical, pharmaceutical, food canning, and related industries.**

Gauges feature rugged, weatherproof 304 stainless steel construction throughout. Have an acrylic lens and white aluminum dial with black markings. The dual relief valve/blowout disc enhances operating safety. Stainless steel spiral bourdon tube.

Choose from bottom, center back, and lower back connections. The 4" gauges are equipped with an adjustable pointer. **Connections:** 2½" dial-¼" mpt; 4" dial-½" mpt.

| PSI READING Total Grad. | Figure Int. 2½"/4" | Grad. Marks 2½"/4" | 2½" DIAL BOTTOM No. | NET EACH | CENTER BACK No. | NET EACH | 4" DIAL BOTTOM No. | NET EACH | LOWER BACK No. | NET EACH |
|---|---|---|---|---|---|---|---|---|---|---|
| 1000 | 100/50 | 20/10 | 3852K12 | $45.89 | 3852K22 | $48.67 | 3852K87 | $84.53 | 3852K92 | $104.43 |
| 1500 | 100/50 | 20/10 | 3852K13 | 45.89 | 3852K23 | 48.67 | 3852K88 | 84.53 | 3852K93 | 104.43 |
| 2000 | 100/100 | 50/20 | 3852K14 | 45.89 | 3852K24 | 48.67 | 3852K89 | 84.53 | 3852K94 | 104.43 |
| 3000 | 100/100 | 50/20 | 3852K15 | 45.89 | 3852K25 | 48.67 | 3852K90 | 84.53 | 3852K95 | 104.43 |
| 5000 | 500/100 | 100/50 | 3852K16 | 45.89 | 3852K26 | 48.67 | 3852K91 | 84.53 | 3852K96 | 104.43 |

## Economy Polycarbonate Pressure Gauges

### ANSI Grade B – 2% Accuracy



Economy

**Use these gauges with air, water, oil, and other pressure media that will not deteriorate brass.** Gauges have a seamless copper alloy C-shaped bourdon tube with a brass tip and socket.

Special hard brass movement. **Standard 2" dial size.** With a dual scale that reads in both PSI and KG/cm². Dial window is plastic. Case is polycarbonate. Gauges are full scale except 4089K33, which is half scale. **Connection:** ¼" MPT bottom.

| PSI READING Total Grad. | Figure Intervals | Grad. Marks | No. | NET EACH |
|---|---|---|---|---|
| 15 | 5 | 1 | 4089K33 | $6.91 |
| 30 | 5 | 1 | 4089K34 | 6.91 |
| 60 | 10 | 2 | 4089K35 | 6.91 |
| 100 | 20 | 2 | 4089K36 | 6.91 |
| 160 | 20 | 5 | 4089K37 | 6.91 |
| 300 | 50 | 10 | 4089K38 | 6.91 |



# General Pur

## High Accuracy Pressure

**Choose the high accuracy gauge that best suits pressure measuring applications.** Bottom connection

**ALUMINUM CASE**—The white coated aluminum d
ility Case has glass window.

**ALL 316 STAINLESS STEEL**—Use where corrosion
al has black scales. Acrylic window and full blowou

| PSI READING Total Grad. | Figure Grad. Intervals | Marks | kPa | 4½" DIAL No. | NET E |
|---|---|---|---|---|---|
| **ALUMINUM CASE WITH BACK FLANGE— PHOSPHOR BRONZE C-SHAPED BOURDON TUBE** | | | | | |
| 15 | 1 | 0.1 | 100 | 4010K81 | $ |
| 30 | 3 | 0.2 | 200 | 4010K82 | 1 |
| 60 | 5 | 0.5 | 400 | 4010K83 | 1 |
| 100 | 10 | 1 | 700 | 4010K84 | 1 |
| 160 | 20 | 2 | 1,100 | 4010K85 | 1 |
| 200 | 20 | 2 | 1,400 | 4010K86 | 1 |
| 300 | 30 | 2 | 2,100 | 4010K87 | 1 |
| **ALUMINUM CASE WITH BACK FLANGE— 316 STAINLESS STEEL C-SHAPED BOURDON TUE** | | | | | |
| 30 | 3 | 0.2 | 200 | 4027K32 | $1 |
| 60 | 5 | 0.5 | 400 | 4027K33 | 1 |
| 100 | 10 | 1 | 700 | 4027K34 | 1 |
| 160 | 20 | 2 | 1,100 | 4027K35 | 1 |
| 200 | 20 | 2 | 1,400 | 4027K36 | |
| 300 | 20 | 2 | 2,100 | 4027K37 | |
| 600 | 30 | 2 | 2,100 | 4027K38 | |
| | 50 | 5 | 4,200 | | |
| **ALUMINUM CASE WITH BACK FLANGE— 4130X ALLOY STEEL C-SHAPED BOURDON TUBE** | | | | | |
| 1000 | 100 | 10 | 7,000 | 4016K11 | $ |
| 2000 | 200 | 20 | 14,000 | 4016K13 | |
| 3000 | 500 | 20 | 21,000 | 4016K14 | |
| 5000 | 500 | 50 | 35,000 | 4016K16 | |
| 5000 | 1000 | 50 | — | 4016K37 | |
| 10000 | 1000 | 100 | 70,000 | 4016K19 | |

## Digital Pressure Gauc

**Battery-operated gauges offer the latest in solid state design.** Sensing element is a strain gauge pressure transducer. Low power consumption gives battery life of over two years in continuous operation. Indicator shows when battery (included) is low. Installs as easily as mechanical dial gauges, without special tools or adapter plates. 3½ digit .56" high LCD display. 316 stainless steel case and sock-

## D

## Low Pr

| PRESSURE READING Total Grad. | Fig. Grad. Int. | Marks | kPa | 2½" DIAL No. | NET EACH |
|---|---|---|---|---|---|
| **POUNDS PER SQUARE INCH** | | | | | |
| 3 | ½ | 1/20 | 20 | 4026K26 | $28.73 |
| 5 | 1 | 1/10 | 35 | 4026K27 | 29.02 |
| 10 | 1 | 1/10 | 70 | 4026K28 | 29.91 |
| **INCHES OF WATER** | | | | | |
| 10 | 1 | 1/10 | 2.5 | 4026K18 | $31.84 |
| 15 | 3 | 1/5 | 4 | 4026K19 | 31.57 |
| 30 | 5 | ½ | 7.5 | 4026K21 | 30.66 |
| 60 | 10 | 1 | 15 | 4026K22 | 29.47 |
| 100 | 10 | 1 | 25 | 4026K88 | 28.73 |
| 160 | 20 | 2 | 40 | 4026K89 | 29.82 |
| 200 | 20 | 2 | 50 | 4026K91 | 40.05 |
| **OUNCES PER SQUARE INCH** | | | | | |
| 10 | 1 | 1/10 | 4 | 4026K11 | $31.78 |
| 15 | 3 | 1/5 | 6.5 | 4026K12 | 30.66 |
| 30 | 5 | ½ | 13 | 4026K13 | 29.54 |
| 60 | 10 | 1 | 26 | 4026K14 | 29.06 |
| 100 | 10 | 1 | 43 | 4026K81 | 29.82 |
| 160 | 20 | 2 | 65 | 4026K82 | 39.96 |

## Medium Pressure

**Designed for heavy duty service under severe operating conditions.** Use for stable, reliable service on hydraulic, pneumatic, air, and gas systems. Applications include hydraulic presses and pumps, air lines and tanks, compressors, spray equipment, and water pumps.

Built to withstand 2-g vibration and 10-g shock without damage. Gauge is enclosed in a one-piece heavy metal case and sealed with a resilient, weatherproof gasket. A glass lens protects the 2" diameter dial.

Spring brass diaphragm pressure element. **Connection:** ⅛" MPT center back. Choose back mounting or clamp mounting with studs.

# sure Gauges

## ges

### acy
### NG

| Grad. Marks | 4½" Dial No. | NET EACH | 6" Dial No. | NET EACH |
|---|---|---|---|---|
| 0.10 | 4009K12 | $166.94 | 4009K32 | $199.60 |
| 0.20 | 4009K13 | 166.94 | 4009K33 | 199.60 |
| 0.50 | 4009K14 | 166.94 | 4009K34 | 199.60 |
| 1 | 4009K15 | 166.94 | 4009K36 | 199.60 |
| 2 | 4009K18 | 166.94 | 4009K38 | 199.60 |
| 2 | 4009K19 | 166.94 | 4009K39 | 199.60 |
| 5 | 4009K21 | 223.86 | 4009K41 | 249.10 |
| 5 | 4009K22 | 260.30 | 4009K42 | 249.10 |
| .10 | 4009K24 | 302.21 | 4009K44 | 404.05 |
| .10 | 4009K25 ◆ | 326.34 | 4009K45 ◆ | 436.81 |
| .50 | 4009K27 ◆ | 276.13 | 4009K47 ◆ | 394.81 |

n tube.

## h Pressure Differential Pressure Gauges

### ccuracy: ±1% of Full Scale

**Use these gauges to indicate differential pressure between two independent pressure sources.** Gauge construction features 4½" dial with polypropylene safety turret case for flush mounting. Solid front with pressure relief back. Micrometer pointer with zero adjustment. Aluminum dial has white background and black markings with glass lens. Gauges have 316 stainless steel bourdon tube and sockets. **Connections:** two mpt at bottom. **Maximum temperature is 150° F.**

Gauges are available with ¼" mpt or ½" mpt connections in two styles:

**Style I**—Zero is located at top center of dial; pointer can move to right or left of zero, indicating whether pressure exerted is greater at the right hand or left hand connection.

**Style II**—Zero is located at 8 o'clock as with standard pressure gauges.

| Figure Intervals | Style | ¼" Connections No. | NET EACH | ½" Connections No. | NET EACH |
|---|---|---|---|---|---|
| 20 | I | 3811K17 | $546.77 | 3811K27 | $546.77 |
| 50 | I | 3811K18 | 546.77 | 3811K28 | 546.77 |
| 100 | I | 3811K19 | 546.77 | 3811K29 | 546.77 |
| 10 | II | 3811K21 | 551.22 | 3811K31 | 551.22 |
| 10 | II | 3811K22 | 551.22 | 3811K32 | 551.22 |
| 20 | II | 3811K23 | 551.22 | 3811K33 | 551.22 |
| 20 | II | 3811K24 | 551.22 | 3811K34 | 551.22 |
| 50 | II | 3811K25 | 551.22 | 3811K35 | 551.22 |
| 100 | II | 3811K26 | 551.22 | 3811K36 | 551.22 |

## ressure Gauges

nperature is 200° F. Maximum line pressure is 3000
ave 2" dial and glass lens.
drawn aluminum case with Buna-N seals for general
nless steel case with Viton seals for corrosive areas.
4" npt inline.

| Aluminum No. | NET EACH | 316 Stainless Steel No. | NET EACH |
|---|---|---|---|
| 4107K31 | $108.33 | 4107K41 | $214.00 |
| 4107K32 | 108.33 | 4107K42 | 214.00 |
| 4107K33 | 108.33 | 4107K43 | 214.00 |
| 4107K34 | 108.33 | 4107K44 | 214.00 |
| 4107K35 | 108.33 | 4107K45 | 214.00 |
| 4107K36 | 108.33 | 4107K46 | 214.00 |

## iauges

sists impact to protect dial. Case has front flange for
ections: Two ¼" mpt on lower back.
ADING

| ure vals | Grad. Marks | No. | NET EACH |
|---|---|---|---|
| 0 | 1 | 3875K24 | $404.57 |
| 0 | 1 | 3875K25 | 404.57 |
| 0 | 2 | 3875K26 | 404.57 |
| 5 | 5 | 3875K27 | 404.57 |
| 0 | 5 | 3875K28 | 404.57 |
| 0 | 5 | 3875K29 | 404.57 |
| 0 | 10 | 3875K31 | 404.57 |





## Diaphragm Seals



**Seals isolate gauges from corrosion, sludge, and other hazards of process media.** You can use standard gauges instead of expensive, corrosion-resistant models. A durable, sensitive diaphragm allows the gauge to sense process pressure without contacting the medium. **Built to handle pressures up to 2500 psi, and temperature up to 250° F.** Gauges install simply without requiring recalibration. **In order for the diaphragm seal to work promptly and maintain required accuracy, it must be filled with a fluid such as glycerine, which is compatible with the nitrile diaphragm material.** For glycerine, see page 1170. Made of cadmium-plated steel on the gauge side, and Type 316 stainless steel on the process side. Hexagonal housing is 2" across flats. Choose between the Standard model and the Easy-Clean model, which can be cleaned without losing fluid.

**FPT Connections**

| Gauge Side | Process Size | Standard No. | Standard NET EACH | Easy Clean No. | Easy Clean NET EACH |
|---|---|---|---|---|---|
| | ¼" | 3882K41 | $106.31 | 3882K44 | $148.13 |
| | ½" | 3882K42 | 106.31 | 3882K45 | 148.13 |
| | ¼" | 3882K17 | 106.31 | 3882K18 | 148.13 |
| | ½" | 3882K43 | 106.31 | 3882K46 | 148.13 |

## PVC Diaphragm Seals



**Seals allow gauges to measure pressure of corrosive fluids without coming into direct contact with the liquid.** Gauges are protected from corrosion while system purity is maintained. Line pulsations and pressure surges are also dampened. **Rated 150 psi at 80° F and 50 psi at 135° F.** Seal consists of corrosion-resistant PVC body with a Viton diaphragm separating top and bottom chambers. The diaphragm isolates the gauge from the process medium while maintaining accurate readings. Seal has spherical design for optimum pressure containment. **Supplied with and without installed gauge.** Units with a gauge have the top chamber filled with mineral oil and have a 2" dial gauge with steel case. Those without a gauge require the user to fill top chamber with mineral oil or other compatible fluid at time of installation.

| Gauge | Connections, FPT Process | No. | NET EACH |
|---|---|---|---|
| WITH 0-60 PSI GAUGE INSTALLED | | | |
| | ¼" | 4147K23 | $58.15 |
| | ½" | 4147K24 | 58.15 |
| WITH 0-160 PSI GAUGE INSTALLED | | | |
| | ¼" | 4147K27 | 58.15 |
| | ½" | 4147K28 | 58.15 |
| WITHOUT GAUGE | | | |
| | ¼" | 4147K21 | 34.90 |
| | ½" | 4147K12 | 34.90 |

## High-Accuracy Test Gauges

### ANSI Grade 4A — ±0.1% Accuracy Full Scale

**Ten-inch dia. pressure gauges are ideal for standards departments, gauge repair and calibration shops, nuclear and aerospace engineering, product testing, and production processes.** Bourdon tube is made of Ni Span C alloy for exceptional temperature stability. Gauges have zero correction adjustment. Case is dark gray aluminum with a pressure relief on back. Window is green tinted acrylic. Ring is aluminum with mirror band, black graduations and lettering on a white background. Pointer is knife-edge aluminum. **Connection:** Bottom ¼" NPT female. Pressure standards used are traceable to the National Institute of Standards and Technology and a test certificate is included with each gauge. **When ordering, specify catalog number and whether stem or panel mount.**

| Total Grad. | PSI Reading Figure Interval | Grad. Marks | No. | NET EACH |
|---|---|---|---|---|
| 10 | 0.5 | 0.01 | 31695K71 | $1315.62 |
| 15 | 1.0 | 0.01 | 31695K72 | 1315.62 |
| 30 | 2.0 | 0.02 | 31695K73 | 1315.62 |
| 60 | 2.0 | 0.05 | 31695K74 | 1478.79 |
| 100 | 2.0 | 0.1 | 31695K75 | 1478.79 |
| 150 | 5.0 | 0.1 | 31695K76 | 1478.79 |
| 200 | 10.0 | 0.2 | 31695K77 | 1478.79 |
| 300 | 10.0 | 0.2 | 31695K78 | 1478.79 |
| 400 | 20.0 | 0.2 | 31695K79 | 1478.79 |
| 500 | 20.0 | 0.5 | 31695K81 | 1478.79 |
| 1000 | 50.0 | 1.0 | 31695K82 | 1478.79 |
| 1500 | 50.0 | 1.0 | 31695K83 | 1478.79 |
| 2000 | 100.0 | 2.0 | 31695K84 | 1478.79 |
| 3000 | 100.0 | 2.0 | 31695K85 | 1478.79 |
| 4000 | 200.0 | 2.0 | 31695K86 | 1478.79 |
| 5000 | 200.0 | 5.0 | 31695K87 | 1478.79 |
| 10000 | 500.0 | 5.0 | 31695K88 | 1142.64 |
| 15000 | 500.0 | 10.0 | 31695K89 | 1142.64 |
| 20000 | 1000.0 | 10.0 | 31695K91 | 1995.15 |
| 30000 | 1000.0 | 20.0 | 31695K92 | 1995.15 |

## Diaphragm Seals with Gauges

**Only at McMaster-Carr . . . these specially-designed assemblies of gauges and diaphragm seals are supplied glycerine-filled and tested.** Ready for immediate use measuring corrosives, slurries, and viscous fluids. Diaphragms are corrosion-resistant, Type 316 stainless steel. Space between top of diaphragm and pressure element is filled with glycerine. Diaphragm movement transmits pressure changes to gauge, providing accurate measurements without exposing gauge to fluid being measured.



**DIAPHRAGM SEALS WITH 4½" PROCESS GAUGES. Seal**—Has a nickel-plated carbon steel top housing with a ¼" gauge connection. Bottom housing is made of Type 316 stainless steel with either a ½" or 1" process connection. Diaphragm is Type 316 stainless steel with Teflon coating. Ring set, bolts, and nuts are carbon steel. **Gauge**—Has a 4½" dial, turret-style phenolic case, solid front, acrylic lens, and pressure-relief back. Internal mechanism and socket are Type 316 stainless steel. Pointer has zero adjust. Gauge accuracy is ±0.5%, ANSI Grade 2A. **Maximum pressure is 2500 psi. Maximum temperature is 400° F.**

| Range, PSI | Process Connection ½" FPT No. | ½" FPT NET EACH | 1" FPT No. | 1" FPT NET EACH |
|---|---|---|---|---|
| 15 | 3812K43 | $361.92 | 3812K54 | $361.92 |
| 30 | 3812K44 | 361.92 | 3812K55 | 361.92 |
| 60 | 3812K45 | 361.92 | 3812K56 | 361.92 |
| 100 | 3812K46 | 361.92 | 3812K57 | 361.92 |
| 160 | 3812K47 | 361.92 | 3812K58 | 361.92 |
| 200 | 3812K48 | 361.92 | 3812K59 | 361.92 |
| 300 | 3812K49 | 361.92 | 3812K61 | 361.92 |
| 600 | 3812K51 | 361.92 | 3812K62 | 361.92 |
| 800 | 3812K52 | 361.92 | 3812K63 | 361.92 |
| 000 | 3812K53 | 361.92 | 3812K64 | 361.92 |



**ALL STAINLESS STEEL DIAPHRAGM SEALS WITH 2½" GAUGES. Seal**—Diaphragm and welded, tamperproof housing are Type 316 stainless steel for corrosion resistance. Available with ¼" and ½" process connection.

**Gauge**—All stainless steel case, internals, and socket. 2½" diameter dial, acrylic lens. Accuracy is ±1.5% of full scale. Connection is ¼".

**Maximum pressure is 2000 psi at 400° F. Maximum temperature is 400° F.**

| Range, PSI | Process Connection ¼" FPT No. | ¼" FPT NET EACH | ½" FPT No. | ½" FPT NET EACH |
|---|---|---|---|---|
| 100 | 3813K36 | $111.74 | 3813K46 | $111.74 |
| 160 | 3813K37 | 111.74 | 3813K47 | 111.74 |
| 200 | 3813K38 | 111.74 | 3813K48 | 111.74 |
| 300 | 3813K39 | 111.74 | 3813K49 | 111.74 |
| 600 | 3813K41 | 111.74 | 3813K51 | 111.74 |
| 1000 | 3813K42 | 111.74 | 3813K52 | 111.74 |
| 2000 | 3813K43 | 118.40 | 3813K53 | 118.40 |
| 3000 | 3813K44 | 118.40 | 3813K54 | 118.40 |



## Compact Digital Infrared Thermometers



**Just aim and shoot for accurate, on-the-spot temperature readings.** Noncontact thermometers detect heat problems early—help you avoid costly repairs, downtime, and ruined product. Ideal for finding hot spots in electrical connections, motors, and bearings. Change from °F to °C with the flick of a switch. Read temperature from the three-digit, 0.3" high LCD display.

Thermometers run on a 9V alkaline battery (included). Size is 7.7"H × 5.4"L × 1.5"W. **Accuracy:** ±2% of reading. **Temperature Range:** 0 to 750° F/−18° to −400° C. **Spectral Range:** 7-18 microns. **Target Size:** 0.8" at 6"; 16" at 10 ft. **Repeatability:** ±1% of reading, ±1 digit. **Response Time:** 500 milliseconds.

**STANDARD MODEL**—Emissivity is set at 0.95. **ADJUSTABLE MODEL**—Emissivity adjusts from 0.3 to 1.0. Unit also has an audible and visual alarm for highest temperature sensed plus it recalls the last reading (maximum or current).

| Description | No. | NET EACH |
|---|---|---|
| Standard Model | 11175K81 | $296.88 |
| Adjustable Model | 11175K82 | 495.45 |

# TOTALIZERS

## eters and Totalizers

shaft supports. For chemicals, pesticides. 800 psig
**Aluminum housing**—has nylon rotor and shaft sup
ports. For fuel and light oils. 300 psig. **Nylo
housing**—with nylon shaft supports. For chemicals
150 psig. **PVDF housing**—with PVDF rotor and shaf
supports. For chemicals, including herbicides. 150 psig
**The temperature range is 14° to 140°F.** Flowmeters
and totalizers are powered by two field-replaceable
lithium batteries for 2000 hours of operational service.
**REPLACEABLE LITHIUM BATTERIES—Pkg. of two.**
**No. 4352K95** ..... **NET/PKG. $18.10**

| minum NET EACH | No. | Nylon NET EACH | No. | PVDF NET EACH |
|---|---|---|---|---|
| 7 ....$217.13 | 4352K61 | ....$245.37 | 4352K81 | ....$343.64 |
| 8 .... 212.58 | 4352K62 | .... 236.21 | 4352K82 | .... 338.18 |
| 9 .... 515.70 | | | | |
| 7 ....$236.84 | 4352K63 | .... 272.73 | 4352K83 | .... 360.00 |
| 8 .... 233.33 | 4352K64 | .... 267.27 | 4352K84 | .... 356.36 |
| 9 .... 544.93 | | | | |

## Petroleum Products h Control and Flow Totalizers

**Meters motor oils, gear lube, and automatic transmission fluid up to SAE 40.** Four-figure non-reset totalizer registers to 9999. Hand can be re-set to zero before each delivery, but only moves forward by pumping fluid. Dial is 3½" diameter.

***Construction*—aluminum.**

***Ratings*—Maximum pressure:** 1000 psi. **Maximum temperature:** 140°F. **Accuracy:** ±1%.

Bottom inlet and side outlet are ½" female NPT.

| Total & Unit | Graduations | No. | NET EACH |
|---|---|---|---|
| 8 pints | ¼ pint | 4047K1 | $204.29 |
| 4 quarts | ¼ quart | 4047K8 | 208.00 |
| 16 quarts | ¼ quart | 4047K17 ♦ | 201.67 |

♦ Furnished with outlet in the 9 o'clock position and without totalizer.

## Petroleum Products Totalizing Meter



**Positive displacement meter registers gallon flow of most petroleum products...use with elevated gravity tanks or hand pumps.**

Totalizer registers up to 100,000 gallons. Individual deliveries register up to 100 gallons on the sub meter, which has manual reset control with positive zero stop.

***Construction*—Housing:** die cast aluminum. **Internal parts:** aluminum, stainless steel, and Delrin. **Strainer screen:** Monel mesh.

***Ratings*—Temperature range:** −20° to −165°F. **Maximum pressure:** 50 psi. **Flow rate:** 3-15 gallons per minute. **Accuracy:** ±3%.

is weatherproof and has a calibration adjustment. Fittings
male NPT. Two 1" × ¾" reducers for use with hand pumps are
d. **Note:** Do not use meter to measure liquids for resale or for
g fuel or other liquids into aircraft.
ecognized.
4K11 ..... **NET EACH $131.21**

## Totalizing Meters

cial
per
ong
ilot

ece

***Ratings*—Temperature range:** −30°F to +140°F. Precision molded diaphragm assures a long and accurate meter life. Index box is isolated from gas. Bushings are self-lubricating for the life of the meter. Capacities are at base conditions of atmospheric pressure, ½" water column pressure differential and 0.60 specific gravity gas.

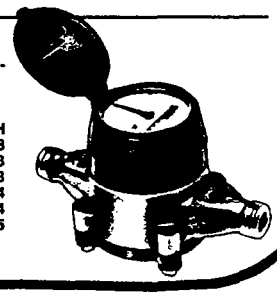
| Height | Overall Dimensions Width | Depth | No. | NET EACH |
|---|---|---|---|---|
| ..11 | ..... 8⅜" | 8¾" ..... | 4360K21 | ....$178.52 |
| ..14 | ..... 10¾" | 10" ..... | 4360K22 | .... 384.62 |
| ..23½ | ..... 14¼" | 13¼" ..... | 4360K24 | ....1090.79 |

quired.

# LIQUID FLOW TOTALIZING METERS

1205

## Cold Water Spot Flow Totalizers



**Horizontal, nonresettable totalizers register six figures.** Meter measures by positive displacement principle for high dependability. Register has large numerals and glass lens. There is a low flow indicator to detect leaks. Meters run within close tolerances and have excellent low flow accuracy. For reading convenience, the register can be mounted on the meter in any of four positions. Each meter is individually tested and calibrated to prevent waste and loss of water.

***Construction*—Main case:** cast bronze, split construction.

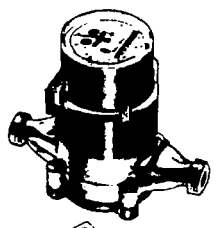
***Ratings*—Temperature range:** 32°-100°F. **Maximum pressure:** 150 psi.

Connections are male NPT.

| Pipe Size | Flow Range GPM | No. | NET EACH |
|---|---|---|---|
| ½" | ½- 20 | 4041K21 | $99.88 |
| ¾" | ½- 20 | 4041K22 | 104.63 |
| 1" | 1 - 50 | 4041K23 | 209.73 |
| 1¼" | 1 - 50 | 4041K24 | 259.74 |
| 1½" | 2 -100 | 4041K25 ♦ | 623.44 |
| 2" | 2½-160 | 4041K26 ♦ | 828.95 |

♦ Female union fittings.

## Cold Water Totalizers with Remote Readout



**Remote register allows reading where meter itself is not accessible.** Water passing through the meter drives the built-in register, which in turn generates an electric pulse for the corresponding volume of water. The pulse actuates the remote register through a 2-wire cable.

***Construction*—Meter housing:** bronze. **Pulser and remote register housings:** thermoplastic.

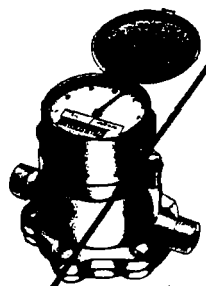
***Ratings*—Temperature range:** 32°-100°F. **Maximum pressure:** 150 psi.

Wire is not included. For distances up to 300 ft., use #22 AWG cable. Water connections are male NPT.

| Pipe Size | Flow Range GPM | No. | NET EACH |
|---|---|---|---|
| ½" | ½- 20 | 42075K91 | $170.96 |
| ¾" | ½- 20 | 42075K92 | 175.58 |
| 1" | 1 - 50 | 42075K93 | 202.23 |
| 1¼" | 1 - 50 | 42075K94 | 329.79 |
| 1½" | 2 -100 | 42075K95 ♦ | 667.02 |
| 2" | 2½-160 | 42075K96 ♦ | 884.21 |

♦ Female union fittings.

## Hot Water Spot Flow Totalizers



**Rugged units with horizontal, nonresettable totalizers register six figures.**

There is a direct shaft drive from meter to the register through the stuffing box seal. Totalizer has a gasketed glass and hinged lid.

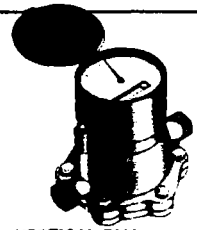
***Construction*—Housing:** galvanized cast iron. **Measuring chamber and internal gear train:** bronze.

***Ratings*—Temperature range:** 100°-225°F.

Couplings are male NPT. **Units are individually calibrated—specify No., flow rate in gallons per minute, and water temperature.**

| Pipe Size | Flow Range GPM 100°-180°F | 180°-225°F | Max. Pressure PSI@200°F | No. | NET EACH |
|---|---|---|---|---|---|
| ¾" | 1- 15 | 1- 8 | 285 | 4040K11 | $740.00 |
| 1" | 3- 20 | 1-12 | 235 | 4040K12 | 840.00 |
| 1¼" | 5- 30 | 2-15 | 235 | 4040K14 | 967.69 |
| 1½" | 7- 50 | 2-30 | 235 | 4040K15 | 1250.00 |
| 2" | 12-100 | 5-70 | 160 | 4040K16 | 1783.82 |

## Oil and Specialty Totalizing Meters



**Looking for a meter to handle special liquids?** We'll custom build a unit to handle virtually any liquid that won't corrode iron and bronze. In the measuring chamber there is only one moving part, a rugged disc and ball assembly, which assures long, problem-free performance.

Choose from three styles: **Horizontal nonresettable** dial that totalizes to six figures; a **one-hand, 6" diameter resettable vertical dial** with a five-digit totalizer; and a **two-hand (for finer resolution), 10" diameter resettable vertical dial** with a five-digit totalizer.

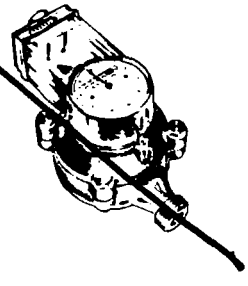
***Construction*—Case:** galvanized cast iron. **Measuring chamber, and calibration gears:** bronze.

***Ratings*—Maximum temperature:** 400°. **Accuracy:** ±1.5% over full flow range.

Meters are furnished with NPT couplings. **When ordering, specify No., liquid to be measured, pressure, temperature, approximate flow rate, and viscosity in Saybolt Seconds Universal (SSU).**

| Pipe Size | Flow Range, GPM 31-450 SSU Viscosity | 450-1000 SSU Viscosity | 1000-5000 SSU Viscosity | Maximum Pressure PSIG@300°F | HORIZONTAL DIAL No. | NET EACH | VERTICAL DIAL 6" 1-Hand No. | NET EACH | 10" 2-Hand No. | NET EACH |
|---|---|---|---|---|---|---|---|---|---|---|
| ½" | 1- 20 | 1- 15 | 1- 8 | 265 | 4042K11 | $717.91 | 4042K21 | $1056.25 | 4042K31 | $1389.71 |
| 1" | 2- 30 | 3- 20 | 1-12 | 215 | 4042K12 | 802.94 | 4042K22 | 1192.87 | 4042K32 | 1536.76 |
| 1½" | 3- 50 | 5- 30 | 2-15 | 215 | 4042K14 | 931.85 | 4042K24 | 1313.24 | 4042K34 | 1645.59 |
| 2" | 5-100 | 7- 50 | 2-35 | 215 | 4042K15 | 1231.88 | 4042K25 | 1667.85 | 4042K35 | 1997.94 |
| 2" | 8-160 | 12-100 | 5-70 | 140 | 4042K16 | 1732.86 | 4042K26 | 2041.87 | 4042K36 | 2414.29 |

## Liquid Flow Totalizers with Signal Switch



**Factory set totalizers have SPST contacts that close a 12 VAC to 250 VAC circuit when meter reaches the number of gallons on the contact setting.**

Typical uses include water softener regeneration, automatic treatment of boiler water, cooling tower water, and alarm systems. Register is calibrated in U.S. gallons and totalizes to six digits.

***Construction*—bronze.**

***Ratings*—Maximum operating temperature:** 125°F. **Maximum operating pressure:** 150 psi. **Maximum static pressure:** 300 psi. **Switch:** 10 amps up to 250 VAC. External circuit terminals are on meter cover head. Meter mounts horizontally. Couplings are furnished.

**Flow in gallons at which contacts close is factory set at one of the following:** For ⅝" up to 1" sizes — 5, 10, 20, 25, 50, 100, 200, 250, 500, and 1000. For 1½" and 2" sizes — 50, 100, 200, 250, 500, 1000, 2000, 2500, 5000, and 10,000.

**To order, specify No., flow range, and total flow in gallons at which contacts are to close.**

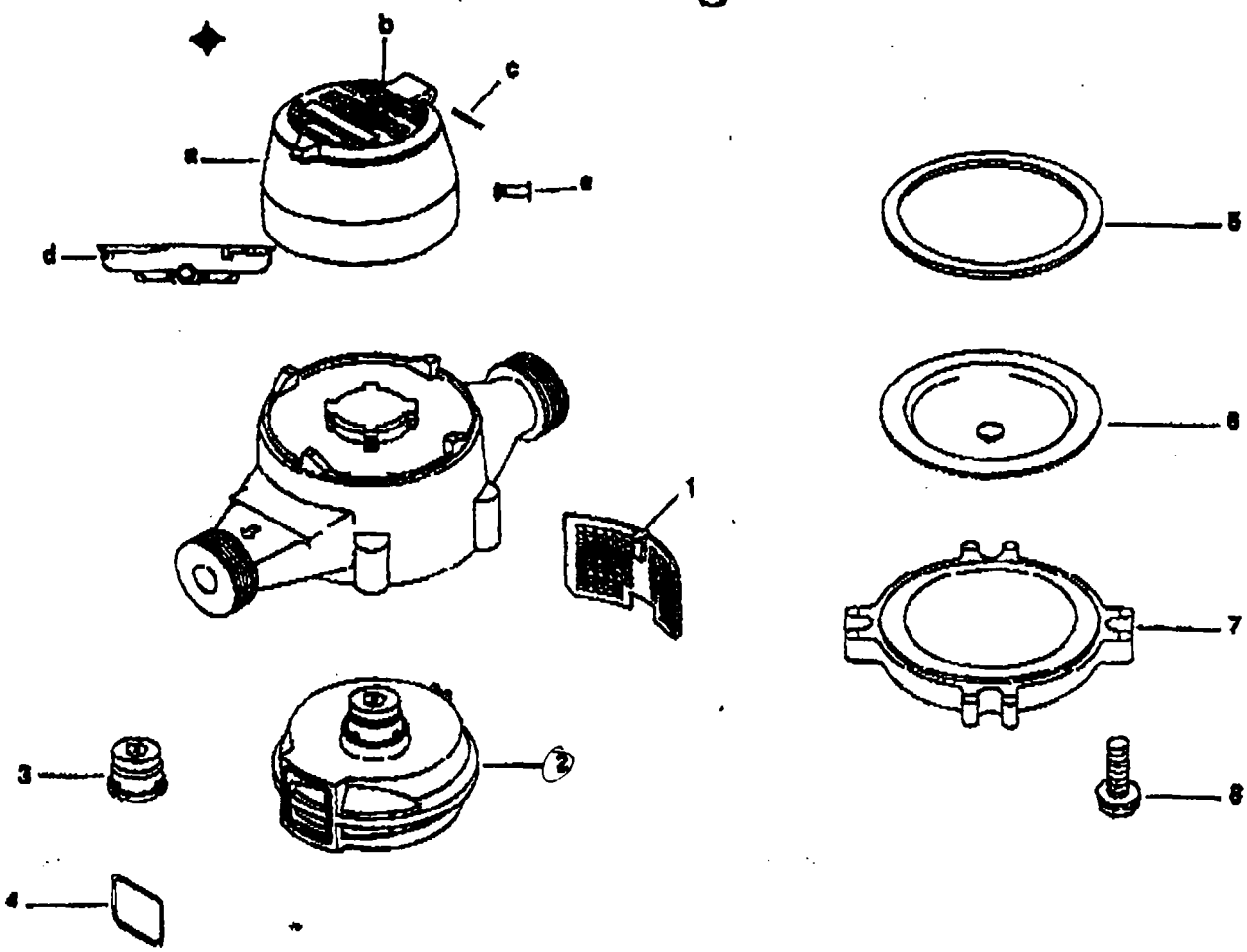
| Pipe Size NPT ♦ | Flow Range GPM | No. | NET EACH |
|---|---|---|---|
| ⅝" × ½" | ¼- 20 | 4187K41 | $241.67 |
| ⅝" × ¾" | ¼- 20 | 4187K42 | 246.67 |
| ¾" × ¾" | ½- 30 | 4187K43 | 336.67 |
| ¾" × 1" | ½- 30 | 4187K44 | 365.00 |
| 1" × 1" | ¾- 50 | 4187K45 | 458.33 |
| 1½" × 1½" | 1 -100 | 4187K47 | 691.18 |
| 2" × 2" | 1½-160 | 4187K48 | 897.06 |

♦ **Size explanation:** Example—⅝" × ½". ⅝" is inlet and outlet size. ½" is coupling size.

MCMASTER-CARR



# 5/8" through 1"




| Item No. | Description | 5/8", 5/8" x 3/4" | Part Number 3/4" | 1" |
|---|---|---|---|---|
| | Register ♦ | | | |
| 1 | Strainer | 9399-001 | 9831-001 | 9831-002 |
| 2 | Measuring Chamber Assembly | 9400-000 | 9826-000 | 9826-100 |
| 3 | Control Block Assembly | 9415-000 | 9830-000 | 9231-004 |
| 4 | O-Ring, Measuring Chamber | 9386-001 | 9386-002 | 9386-003 |
| 5 | Gasket, Bottom Cap | 8340-028 | 8340-034 | 8340-038 |
| 6 | Liner, Bottom Cap* | 9398-001 | 9832-001 | 9841-001 |
| 7 | Bottom Cap, SP | 9397-501 | — | — |
| | Bronze | 9397-002 | 9833-002 | 9842-002 |
| | Cast Iron | 9397-010 | 9833-001 | 9842-001 |
| 8 | Bolt and Washer | | | |
| | SST-302 (w/ washer) | 8353-102 | 8353-102 | 8353-102 |
| | SST-316 (w/ washer) | 8353-101 | 8353-101 | 8353-101 |

♦ Refer to back page for additional register information.

* Not required with SP or bronze bottom caps.

SEP 24 '93 9:49 FROM MC MASTER CARR TO 919148967428 PAGE.003/003

# Register Box Parts

| Item No. | Description | Bronze | Plastic | Gold Color |
|---|---|---|---|---|
| | Register Box Assembled | 9131-100 | 9131-000 | |
| a | Register Box | 9133-202 | 9133-001 | |
| b | Register Cover | 9132-202 | 9132-001 | |
| c | Hinge Pin, Register | 8313-403 | 8350-007 | |
| d | Retainer Ring | 9105-001 | 9105-001 | |
| e | Seal Pin, D/R Register | — | 9106-001 | 9106-002 |
| | Seal Pin, ARB Register | — | 9309-501 | |
| | Screw, Pulser Register | 8460-011 | — | |

# Roll-Sealed Register Assemblies

| Registration | 5/8" | 3/4" | 1" | 1 1/2" | 2" |
|---|---|---|---|---|---|
| Cu.Ft. | 9107-012 | 9107-022 | 9107-032 | 9107-042 | 9107-052 |
| Gal. | 9107-011 | 9107-021 | 9107-031 | 9107-041 | 9107-051 |
| $M^3$ | 9107-013 | 9107-023 | 9107-033 | 9107-043 | 9107-053 |

# Registers Complete

| Size | Registration | Direct Read | ARB* 4-wheel Encoder | ARB* 6-wheel Encoder | Pulser* |
|---|---|---|---|---|---|
| 5/8" | cu.ft. | R82C11 | R72C11 | R72C12 | R22C1 |
| | gal. | R82G11 | R72G11 | R72G12 | R22G1 |
| | $M^3$ | R82M11 | R72M11 | R72M12 | R22M1 |
| 3/4" | cu.ft. | R82C21 | R72C21 | R72C22 | R22C2 |
| | gal. | R82G21 | R72G21 | R72G22 | R22G2 |
| | $M^3$ | R82M21 | R72M21 | R72M22 | R22M2 |
| 1" | cu.ft. | R82C31 | R72C31 | R72C32 | R22C3 |
| | gal. | R82G31 | R72G31 | R72G32 | R22G3 |
| | $M^3$ | R82M31 | R72M31 | R72M32 | R22M3 |
| 1 1/2" | cu.ft. | R82C42 | R72C41 | R72C42 | R22C4 |
| | gal. | R82G42 | R72G41 | R72G42 | R22G4 |
| | $M^3$ | R82M42 | R72M41 | R72M42 | R22M4 |
| 2" | cu.ft. | R82C52 | R72C51 | R72C52 | R22C5 |
| | gal. | R82G52 | R72G51 | R72G52 | R22G5 |
| | $M^3$ | R82M52 | R72M51 | R72M52 | R22M5 |

* Registers do not include ARB® receptacles or Pulser remotes.

# EXHIBITS

1. Site Location / Site Plan (Figures 1-1 and 1-2)
2. Treatment System Schematic Diagram (Figure 1-3)
3. Electrical Work
4. Depression Pump Control Layout
5. Depression Pump Electrical Schematic




**Source: USGS Topo: Poughkeepsie Quadrangle 2016**

**Approximate Scale: 1" = 2000'**

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Operations and Maintenance Manual**

## SITE LOCATION MAP

**FIGURE 1-1**



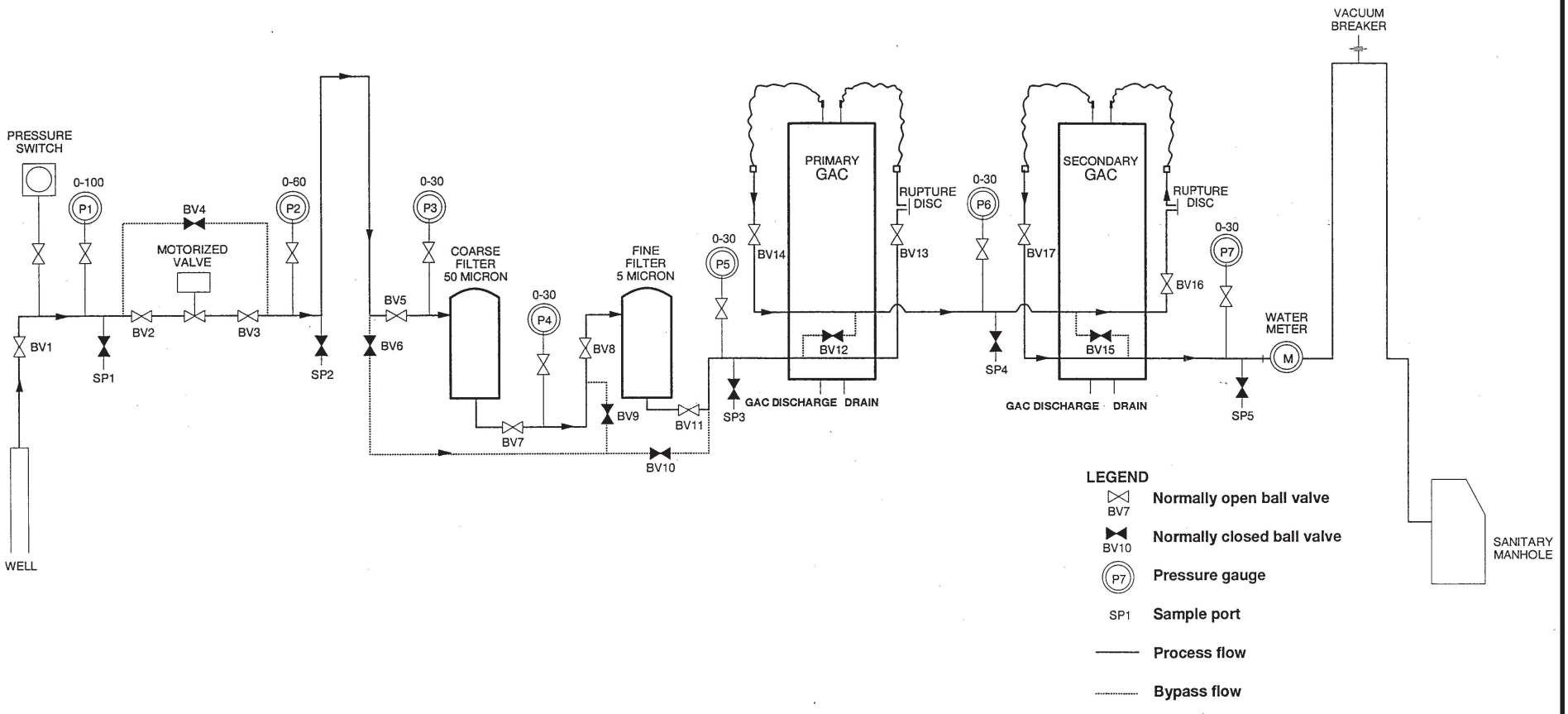

APPROXIMATE SCALE: 1" = 125'

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**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Operations and Maintenance Manual**

## SITE PLAN

**FIGURE 1-2**



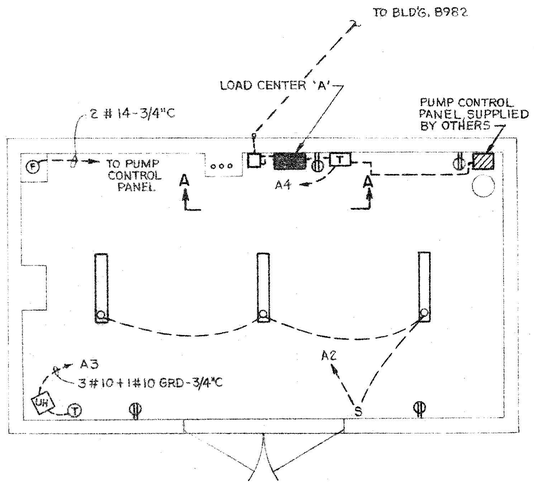

Not to Scale

D&B Engineers and Architects, P.C.

**International Business Machines Corporation**
**Former IBM B952/982 Site, Poughkeepsie, New York**
**Operations and Maintenance Manual**

# GROUNDWATER TREATMENT SYSTEM PROCESS SCHEMATIC

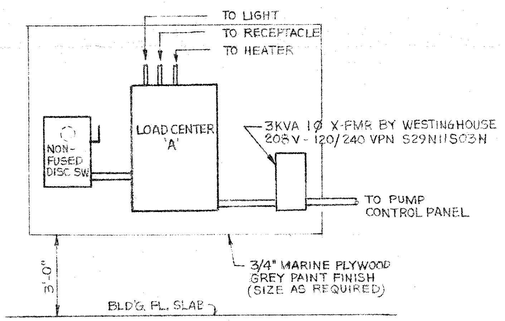
**FIGURE 1-3**




## TREATMENT BUILDING PLAN

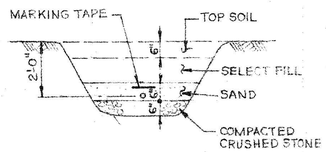
### SYMBOLS

- FLUORESCENT LIGHT FIXTURE
- DUPLEX RECEPTACLE
- UH — UNIT HEATER
- T — THERMOSTAT
- DISCONNECT SWITCH NON-FUSED
- T — TRANSFORMER
- F — FLOAT SWITCH
- CIRCUIT BREAKER (15/1 — POLES, TRIP)
- LA — LIGHTNING ARRESTOR
- NON-FUSED DISCONNECT SWITCH
- TRANSFORMER

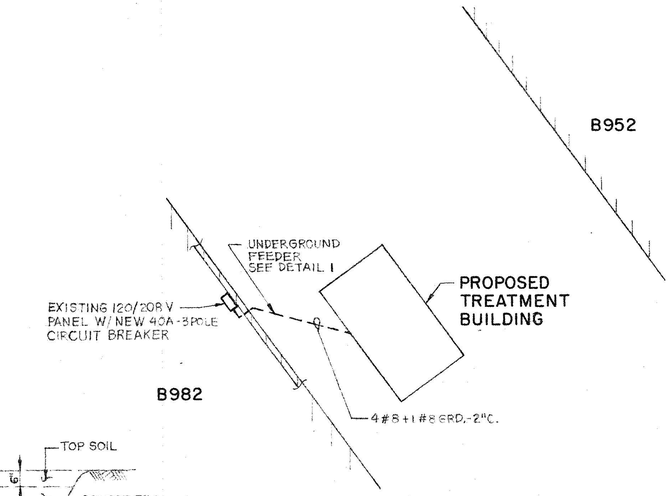



## ELEVATION A-A

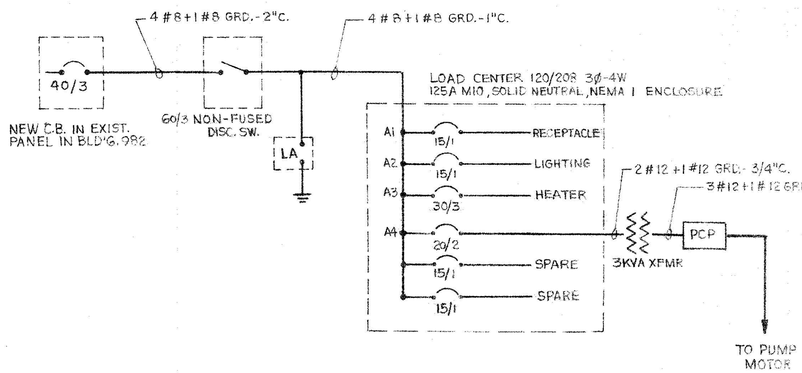
N.T.S.




## DETAIL 1




## SITE PLAN




## SINGLE LINE DIAGRAM

### GENERAL NOTES

1. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, EQUIPMENT AND SUPERVISION FOR A COMPLETE OPERATING SYSTEM AS SHOWN ON THE CONTRACT DRAWINGS AND DESCRIBED HEREIN; EXCEPT FOR OWNER FURNISHED EQUIPMENT AS NOTED.
2. INSTALL OWNER FURNISHED CONTROL PANEL.
3. PROVIDE ALL ELECTRICAL FACILITIES IN NEW TREATMENT BUILDING, INCLUDING PUMP CONNECTION TO PUMP CONTROL PANEL, FLOAT SWITCH CONNECTIONS TO PCP, LIGHTS, SWITCH AND RECEPTACLE AND PROVIDE ALL REQUIRED WIRING IN CONDUITS.
4. PROVIDE A NEW POWER FEEDER FROM THE EXISTING PANEL IN BLDG. 982 (120/208V 3ø-4W) WITH NEW 40A CIRCUIT BREAKER TO THE NEW NON-FUSED DISCONNECT SWITCH IN TREATMENT BUILDING. PROVIDE 3-PHASE SECONDARY LIGHTNING ARRESTER ON INCOMING MAIN FEEDER. ARRESTER BY G.E., JOSLYN, OR SQUARE D.
5. FURNISH AND INSTALL ALL REQUIRED JUNCTION/PULL/SPLICE BOXES. BOXES SHALL BE WATERTIGHT.
6. ALL CONDUITS SHALL BE SCHEDULE 40 PVC, EXCEPT UNDERGROUND, WHERE SCHEDULE 80 SHALL BE USED. (CARLON OR KRALOY) WITH THREADED REMOVABLE TERMINATIONS AT BOXES, NO FIELD BENDS ALLOWED. INSTALLATION SHALL BE WATERTIGHT.
7. ALL CONDUIT RUNS SHALL BE STRAIGHT AND PARALLEL TO BUILDING WALLS, DIAGONAL RUNS ARE NOT PERMITTED.
8. ALL WIRES SHALL BE COPPER CONDUCTOR 600 V. U.L. STANDARDS TYPE THWN-THHN-MTW, MIN. SIZE #12, FOR POWER LIGHTING AND CONTROLS.
9. ALL MATERIALS AND INSTALLATION SHALL CONFORM TO N.E.C. AND A.N.S.I. REQUIREMENTS. MATERIALS AND EQUIPMENT SHALL BE NEW AND IN PERFECT CONDITION, AND SHALL BE "APPROVED" OR "LISTED" BY U.S. WHERE APPROPRIATE INSTALLATION SHALL BE IN ACCORDANCE WITH BEST MODERN PRACTICE, PERFORMED BY QUALIFIED EXPERIENCED ELECTRICIANS.
10. COMPLETE SYSTEM SHALL BE TESTED, AND DEMONSTRATED TO FUNCTION PROPERLY TO THE SATISFACTION OF THE ENGINEER.
11. ALL MOUNTING AND ASSEMBLY HARDWARE SHALL BE STAINLESS STEEL.
12. THE FOLLOWING EQUIPMENT SHALL BE FURNISHED BY OWNER, INSTALLED BY CONTRACTOR:
    1. PUMP CONTROL PANEL
    2. SUMP HIGH LEVEL SWITCH
    3. WELL PUMP MOTOR WITH PROBES.
13. ALL OTHER EQUIPMENT, MATERIALS, SUPPLIES, ETC. REQUIRED FOR A COMPLETE OPERATING SYSTEM SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR.
14. ALL CIRCUIT BREAKERS SHALL BE RATED 10,000 AIC MIN.
15. RECEPTACLE SHALL BE GFCI TYPE, SPECIFICATION GRADE BY HUBBELL CAT # GF 5262.
16. EQUIPMENT:

| | |
|---|---|
| LIGHTING FIXTURES - | 1-49W, 4' FLUORESCENT, RS, CW, 120V W/THERMOPLASTIC BODY AND REFRACTOR. BALLAST SHALL BE CLASS P, HPF, CBM AND ENERGY SAVING. FIXTURE SHALL BE BY DAY-BRITE - VAPORLUME OR EQUAL. PN-R4114 I ULL. LISTED. |
| UNIT HEATER - | 7.5 KW, 3ø, 208V TYPE LUH BY CHROMALOX PN LUH-07-23 OR EQUAL. CEILING MOUNT KIT - WUH-05 THERMOSTAT KIT - LUH-TKI |
| DISCONNECT SWITCH - | 3P, 240 VAC, 60A, NEMA 1 ENCLOSURE SQUARE D OR EQUAL. |
| LOAD CENTER - | 120/208V, 3ø-4W, 125A M.L.O. 12 CIRCUIT SQUARE D OR EQUAL. |


PATRICK J. LAWLER P.E.

**Lawler, Matusky & Skelly Engineers**

Environmental Science & Engineering Consultants

One Blue Hill Plaza
Pearl River, New York 10965


DATE

Prior to submitting final invoice for work performed under this contract, the Contractor is to return to the IBM Field Coordinator, a copy of this drawing, signed by a principal of the company, which clearly indicates all changes made to the work shown hereon during the construction process, or containing a statement that no changes were made.


"THIS DOCUMENT IS THE PROPERTY OF IBM. ITS USE IS AUTHORIZED ONLY FOR RESPONDING TO A REQUEST FOR QUOTATION OR FOR THE PERFORMANCE OF WORK FOR IBM. ALL QUESTIONS MUST BE REFERRED TO THE IBM PURCHASING DEPARTMENT."

THE SPECIFIC MANUFACTURER OR MODEL NOTATIONS MENTIONED ON THESE DRAWINGS OR IN THE SPECIFICATIONS ARE FOR THE PURPOSE OF ESTABLISHING LEVELS OF QUALITY AND PERFORMANCE ONLY. EQUIVALENT MATERIALS OR EQUIPMENT MAY BE SUBSTITUTED IF WRITTEN APPROVAL IS OBTAINED FROM THE IBM ENGINEER PRIOR TO ORDERING BY THE CONTRACTOR.


IBM Poughkeepsie, N.Y.

# BUILDING 952 / 982 GROUNDWATER REMEDIATION ELECTRICAL WORK

Project 272-227 Design Check Approval

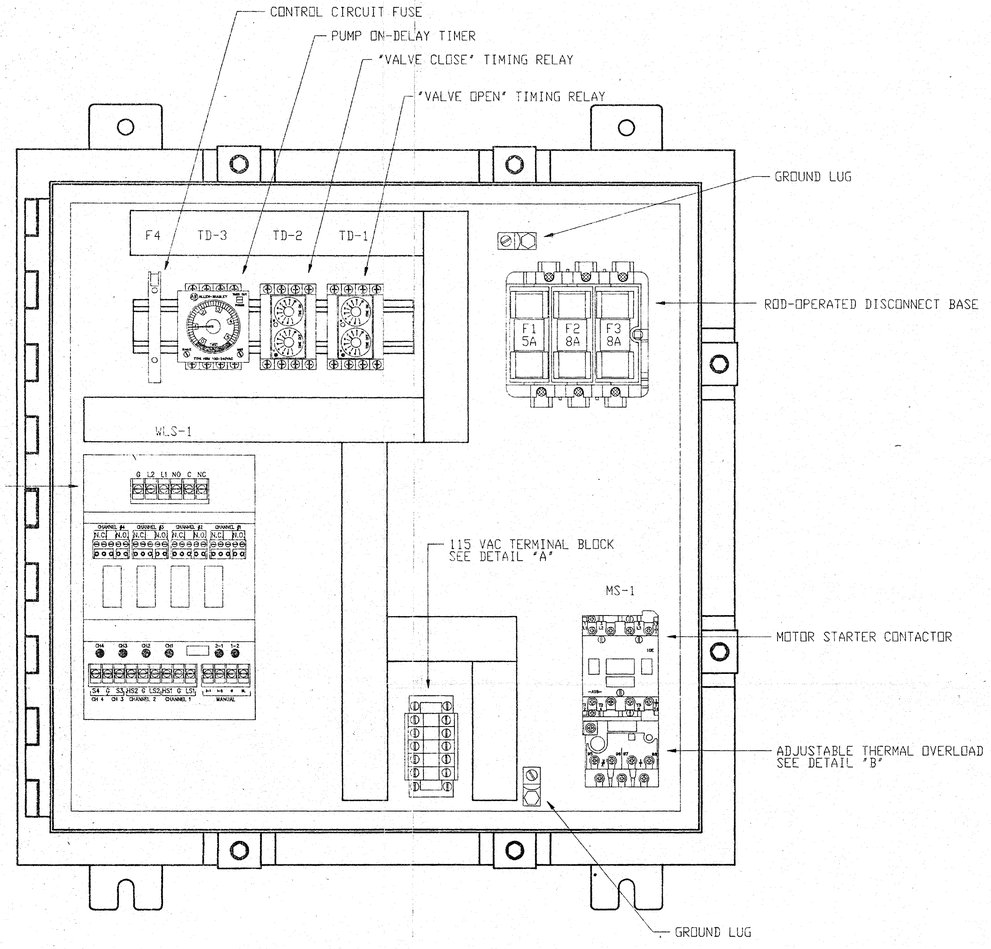
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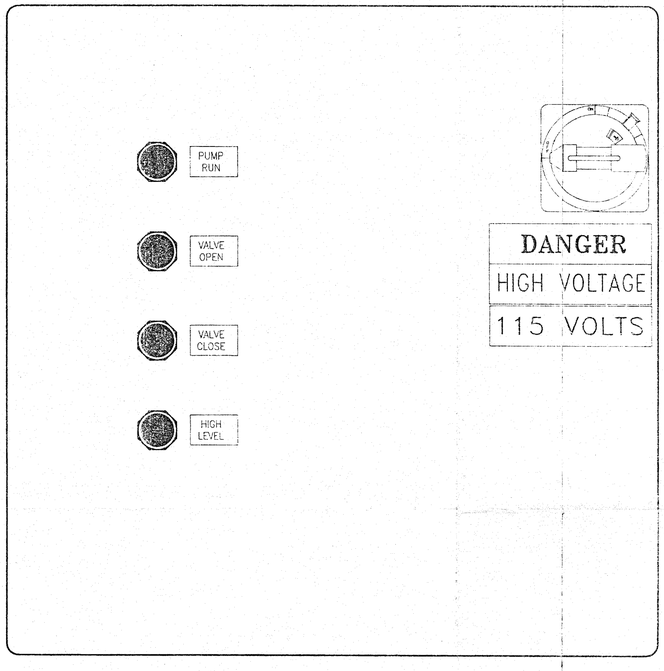
4 OF 4

| Rev. | Date | By | Description | Apprn. |
|---|---|---|---|---|

BRENNG 40-107-22476-8

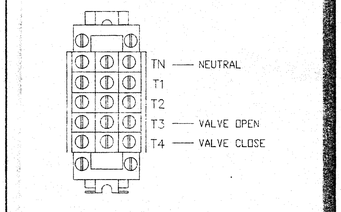
923-1640-0




## DETAIL A

*115 VAC TERMINAL BLOCK*




## DETAIL B

*ADJUSTABLE THERMAL OVERLOAD RELAY*

FOR ALLEN-BRADLEY IEC 9-30 AMP CONTACTORS

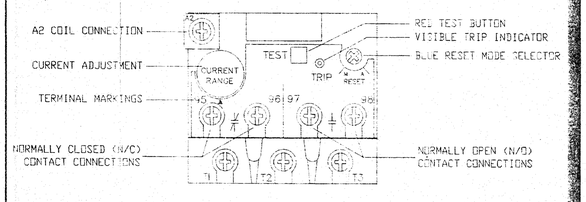
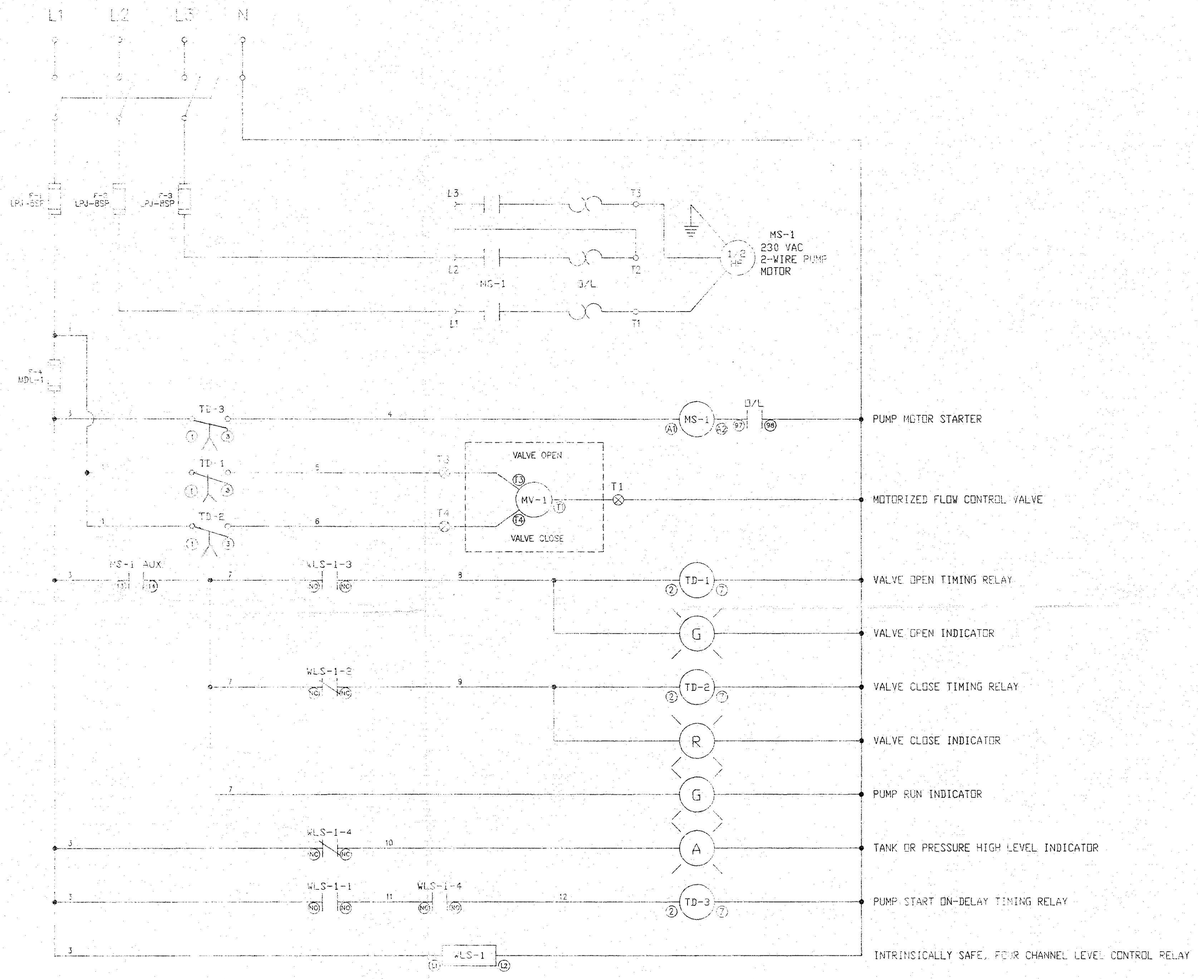


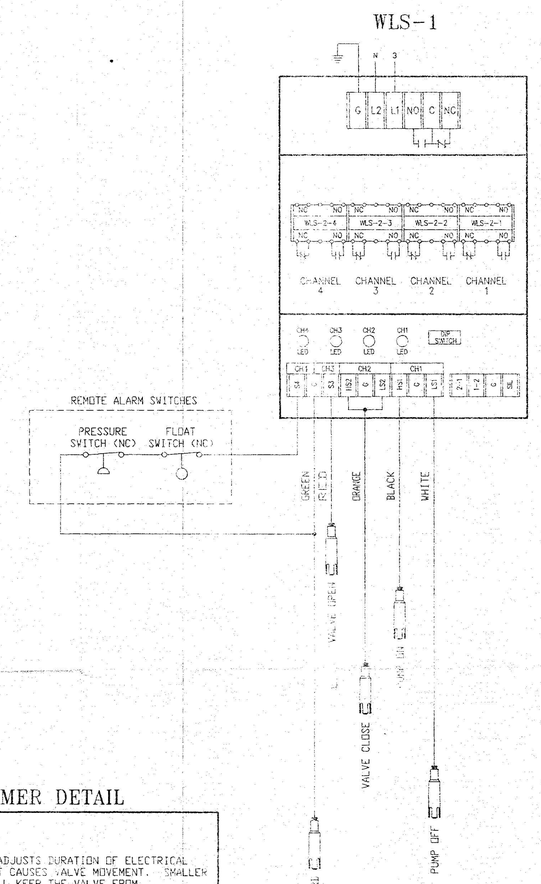

EXHIBIT 5

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Environmental Restoration Systems, Inc.**<br>9 DOGWOOD LANE<br>MIDDLETOWN, PENNSYLVANIA 17057 | rev. | date | revision description | drawn | chk. | appd. | sheet no.<br>date: 12/02/93<br>drawn: ELR<br>checked:<br>approved:<br>scale: 1"=2"<br>tolerance: | GROUNDWATER SCIENCES<br>HARRISBURG, PA<br>This drawing is the property of Environmental Restoration Systems and is not to be reproduced, copied or used to furnish information for the manufacture or sale of equipment without obtaining consent from Environmental Restoration Systems, Inc. | DEPRESSION PUMP CONTROL<br>CONTROL LAYOUT<br>drawing no. D-DP-A04639-01<br>revision no. |

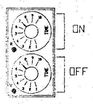
230 VAC 1Ø BY CUSTOMER




WLS-1



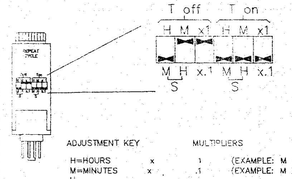

## CYCLE TIMER DETAIL



ON — TOP KNOB ADJUSTS DURATION OF ELECTRICAL PULSE THAT CAUSES VALVE MOVEMENT. SMALLER PAUSES WILL KEEP THE VALVE FROM OVER-SHOOTING THE OPTIMAL FLOW RATE.

OFF — BOTTOM KNOB ADJUSTS DURATION OF PAUSE BETWEEN ELECTRICAL PULSES. ALLOW ENOUGH TIME FOR THE WELL LEVEL TO REACT TO THE NEW FLOW RATE CAUSED BY THE PULSE.

TIMER SIDE VIEW & AVAILABLE TIME RANGES
FACTORY SETTINGS AS SHOWN 0-10 SECONDS




ADJUSTMENT KEY

H=HOURS
M=MINUTES
H/M/S=SECONDS

MULTIPLIERS

x 1 (EXAMPLE: M X 1 X DIAL NUMBER)
x .1 (EXAMPLE: M X .1 X DIAL NUMBER)

EXHIBIT 6

| Environmental Restoration Systems, Inc. | rev. | date | revision description | drawn | chk. | appd. | sheet no.: |
|---|---|---|---|---|---|---|---|
| 9 DOGWOOD LANE<br>MIDDLETOWN, PENNSYLVANIA 17057 | | | | | | | date: 11/21/93 |
| | | | | | | | drawn: ELR |
| | | | | | | | checked: |
| | | | | | | | approved: |
| | | | | | | | scale: N.T.S. |
| | | | | | | | tolerance: |

GROUNDWATER SCIENCES
HARRISBURG, PA

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DEPRESSION PUMP CONTROL
ELECTRICAL SCHEMATIC
drawing no. D-DP-A04639-02
revision no.

# Attachment 3

# 952-30R Step Drawdown Test, Long-Term Pumping Test Data

IBM - POUGHKEEPSIE
952-30R PUMP TEST

PUMP START: 10/25/93 14:30:00
PUMP STOP: 10/28/93 16:30:00
ELEVATION: 136.69 FT TO TOC

WELL: 952-30R

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) | PUMPING RATE (GPM) |
|---|---|---|---|---|---|---|---|
| 10/25/93 | 12:15:00 | -135.00 | | 43.53 | 93.16 | 0.00 | 0.0 |
| 10/25/93 | 14:30:00 | 0.00 | | 43.62 | 93.07 | 0.09 | 11.0 |
| 10/25/93 | 14:33:30 | 3.50 | | 50.96 | 85.73 | 7.43 | 11.0 |
| 10/25/93 | 14:35:00 | 5.00 | | 51.44 | 85.25 | 7.91 | 12.0 |
| 10/25/93 | 14:36:00 | 6.00 | | | | | 8.0 |
| 10/25/93 | 14:37:00 | 7.00 | | | | | 9.0 |
| 10/25/93 | 14:37:30 | 7.50 | | 52.55 | 84.14 | 9.02 | 9.0 |
| 10/25/93 | 14:38:00 | 8.00 | | | | | 9.0 |
| 10/25/93 | 14:39:00 | 9.00 | | 53.21 | 83.48 | 9.68 | 9.0 |
| 10/25/93 | 14:40:00 | 10.00 | | 53.80 | 82.89 | 10.27 | 9.0 |
| 10/25/93 | 14:42:00 | 12.00 | | 54.57 | 82.12 | 11.04 | 9.0 |
| 10/25/93 | 14:49:00 | 19.00 | | 51.75 | 84.94 | 8.22 | 9.0 |
| 10/25/93 | 14:50:00 | 20.00 | | 52.35 | 84.34 | 8.82 | 9.0 |
| 10/25/93 | 14:55:00 | 25.00 | | 53.38 | 83.31 | 9.85 | 9.0 |
| 10/25/93 | 14:57:00 | 27.00 | | 53.34 | 83.35 | 9.81 | 9.0 |
| 10/25/93 | 14:59:00 | 29.00 | | 53.26 | 83.43 | 9.73 | 9.0 |
| 10/25/93 | 15:00:00 | 30.00 | | 53.27 | 83.42 | 9.74 | 9.0 |
| 10/25/93 | 15:05:00 | 35.00 | | 53.39 | 83.30 | 9.86 | 9.0 |
| 10/25/93 | 15:12:00 | 42.00 | | 53.62 | 83.07 | 10.09 | 8.8 |
| 10/25/93 | 15:17:00 | 47.00 | | 54.18 | 82.51 | 10.65 | 8.7 |
| 10/25/93 | 15:23:00 | 53.00 | | 54.67 | 82.02 | 11.14 | 9.0 |
| 10/25/93 | 15:30:00 | 60.00 | | 55.11 | 81.58 | 11.58 | 8.8 |
| 10/25/93 | 15:39:00 | 69.00 | | 56.97 | 79.72 | 13.44 | 9.0 |
| 10/25/93 | 15:48:00 | 78.00 | | 57.46 | 79.23 | 13.93 | 9.0 |
| 10/25/93 | 15:58:00 | 88.00 | | 57.85 | 78.84 | 14.32 | 9.0 |
| 10/25/93 | 16:13:00 | 103.00 | | 58.35 | 78.34 | 14.82 | 9.0 |
| 10/25/93 | 16:20:00 | 110.00 | | 58.63 | 78.06 | 15.10 | 9.0 |
| 10/25/93 | 16:35:00 | 125.00 | | 59.24 | 77.45 | 15.71 | 9.0 |
| 10/25/93 | 16:47:00 | 137.00 | | 59.82 | 76.87 | 16.29 | 9.0 |
| 10/25/93 | 17:02:00 | 152.00 | | 60.88 | 75.81 | 17.35 | 9.0 |
| 10/25/93 | 17:18:00 | 168.00 | | 61.69 | 75.00 | 18.16 | 9.0 |
| 10/25/93 | 17:25:00 | 175.00 | | 62.11 | 74.58 | 18.58 | 9.0 |
| 10/25/93 | 17:50:00 | 200.00 | | 64.26 | 72.43 | 20.73 | 9.0 |
| 10/25/93 | 18:00:00 | 210.00 | | 64.84 | 71.85 | 21.31 | 9.0 |
| 10/25/93 | 18:10:00 | 220.00 | | 65.49 | 71.20 | 21.96 | 9.0 |
| 10/25/93 | 18:17:00 | 227.00 | | 65.65 | 71.04 | 22.12 | 9.0 |
| 10/25/93 | 18:21:00 | 231.00 | | 65.75 | 70.94 | 22.22 | 9.0 |
| 10/25/93 | 18:26:00 | 236.00 | | 65.62 | 71.07 | 22.09 | 9.0 |
| 10/25/93 | 18:32:00 | 242.00 | | 65.67 | 71.02 | 22.14 | 7.0 |
| 10/25/93 | 18:45:00 | 255.00 | | 63.33 | 73.36 | 19.80 | 7.0 |
| 10/25/93 | 18:48:00 | 258.00 | | 63.26 | 73.43 | 19.73 | 7.0 |
| 10/25/93 | 18:52:00 | 262.00 | | 63.25 | 73.44 | 19.72 | 7.0 |
| 10/25/93 | 18:57:00 | 267.00 | | 63.31 | 73.38 | 19.78 | 7.0 |
| 10/25/93 | 19:03:00 | 273.00 | | 63.45 | 73.24 | 19.92 | 7.0 |

IBM - POUGHKEEPSIE ELEVATION: 136.69 FT.
952-30R PUMP TEST

WELL: 952-30R

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) | PUMPING RATE (GPM) |
|---|---|---|---|---|---|---|---|
| 10/25/93 | 20:03:00 | 333.00 | | 64.88 | 71.81 | 21.35 | 7.0 |
| 10/25/93 | 20:29:00 | 359.00 | | 65.13 | 71.56 | 21.60 | 7.0 |
| 10/25/93 | 20:39:00 | 369.00 | | 64.88 | 71.81 | 21.35 | 6.0 |
| 10/25/93 | 20:44:00 | 374.00 | | 63.78 | 72.91 | 20.25 | 6.0 |
| 10/25/93 | 20:54:00 | 384.00 | | 63.29 | 73.40 | 19.76 | 6.0 |
| 10/25/93 | 21:22:00 | 412.00 | | 62.96 | 73.73 | 19.43 | 6.0 |
| 10/25/93 | 21:42:00 | 432.00 | | 63.02 | 73.67 | 19.49 | 6.0 |
| 10/25/93 | 22:10:00 | 460.00 | | 63.24 | 73.45 | 19.71 | 6.0 |
| 10/25/93 | 22:25:00 | 475.00 | | 63.37 | 73.32 | 19.84 | 6.0 |
| 10/25/93 | 22:43:00 | 493.00 | | 63.63 | 73.06 | 20.10 | 6.0 |
| 10/25/93 | 23:20:00 | 530.00 | | 63.98 | 72.71 | 20.45 | 6.0 |
| 10/26/93 | 00:26:00 | 596.00 | | 64.79 | 71.90 | 21.26 | 6.0 |
| 10/26/93 | 01:00:00 | 630.00 | | 65.12 | 71.57 | 21.59 | 6.0 |
| 10/26/93 | 01:34:00 | 664.00 | | 65.22 | 71.47 | 21.69 | 6.0 |
| 10/26/93 | 02:00:00 | 690.00 | | 65.78 | 70.91 | 22.25 | 5.0 |
| 10/26/93 | 02:01:00 | 691.00 | | 65.29 | 71.40 | 21.76 | 5.0 |
| 10/26/93 | 02:05:00 | 695.00 | | 64.45 | 72.24 | 20.92 | 5.0 |
| 10/26/93 | 02:10:00 | 700.00 | | 64.08 | 72.61 | 20.55 | 5.0 |
| 10/26/93 | 02:43:00 | 733.00 | | 63.15 | 73.54 | 19.62 | 5.0 |
| 10/26/93 | 04:50:00 | 860.00 | | 62.76 | 73.93 | 19.23 | 5.0 |
| 10/26/93 | 06:07:00 | 937.00 | | 63.45 | 73.24 | 19.92 | 5.0 |
| 10/26/93 | 06:47:00 | 977.00 | | 63.38 | 73.31 | 19.85 | 5.0 |
| 10/26/93 | 07:28:00 | 1018.00 | | 63.38 | 73.31 | 19.85 | 5.0 |
| 10/26/93 | 08:26:00 | 1076.00 | | 63.58 | 73.11 | 20.05 | 5.0 |
| 10/26/93 | 09:13:00 | 1123.00 | | 63.57 | 73.12 | 20.04 | 5.0 |
| 10/26/93 | 09:31:00 | 1141.00 | | 63.78 | 72.91 | 20.25 | 5.0 |
| 10/26/93 | 10:00:00 | 1170.00 | | 63.88 | 72.81 | 20.35 | 5.0 |
| 10/26/93 | 10:38:00 | 1208.00 | | 64.10 | 72.59 | 20.57 | 5.0 |
| 10/26/93 | 11:07:00 | 1237.00 | | 64.32 | 72.37 | 20.79 | 5.0 |
| 10/26/93 | 13:05:00 | 1355.00 | | 65.49 | 71.20 | 21.96 | 5.0 |
| 10/26/93 | 13:28:00 | 1378.00 | | 65.40 | 71.29 | 21.87 | 5.0 |
| 10/26/93 | 13:32:00 | 1382.00 | | 65.43 | 71.26 | 21.90 | 5.0 |
| 10/26/93 | 13:36:00 | 1386.00 | | 65.55 | 71.14 | 22.02 | 4.0 |
| 10/26/93 | 13:43:00 | 1393.00 | | 62.75 | 73.94 | 19.22 | 4.0 |
| 10/26/93 | 13:49:00 | 1399.00 | | 62.60 | 74.09 | 19.07 | 4.0 |
| 10/26/93 | 13:53:00 | 1403.00 | | 62.41 | 74.28 | 18.88 | 4.0 |
| 10/26/93 | 14:19:00 | 1429.00 | | 61.45 | 75.24 | 17.92 | 4.0 |
| 10/26/93 | 14:35:00 | 1445.00 | | 61.25 | 75.44 | 17.72 | 4.0 |
| 10/26/93 | 15:01:00 | 1471.00 | | 60.96 | 75.73 | 17.43 | 4.0 |
| 10/26/93 | 15:44:00 | 1514.00 | | 60.63 | 76.06 | 17.10 | 4.0 |
| 10/26/93 | 17:10:00 | 1600.00 | | 60.38 | 76.31 | 16.85 | 4.0 |
| 10/26/93 | 18:15:00 | 1665.00 | | 60.29 | 76.40 | 16.76 | 4.5 |
| 10/26/93 | 19:55:00 | 1765.00 | | 60.16 | 76.53 | 16.63 | 4.5 |
| 10/26/93 | 20:42:00 | 1812.00 | | 60.14 | 76.55 | 16.61 | 4.5 |

IBM - POUGHKEEPSIE ELEVATION: 136.69 FT.
952-30R PUMP TEST

WELL: 952-30R

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) | PUMPING RATE (GPM) |
|---|---|---|---|---|---|---|---|
| 10/26/93 | 22:46:00 | 1936.00 | | 60.12 | 76.57 | 16.59 | 4.5 |
| 10/27/93 | 02:12:00 | 2142.00 | | 60.57 | 76.12 | 17.04 | 4.5 |
| 10/27/93 | 04:57:00 | 2307.00 | | 60.45 | 76.24 | 16.92 | 4.0 |
| 10/27/93 | 07:32:00 | 2462.00 | | 60.57 | 76.12 | 17.04 | 4.0 |
| 10/27/93 | 11:14:00 | 2684.00 | | 60.68 | 76.01 | 17.15 | 4.0 |
| 10/27/93 | 16:17:00 | 2987.00 | | 61.06 | 75.63 | 17.53 | 4.0 |
| 10/27/93 | 18:41:00 | 3131.00 | | 61.36 | 75.33 | 17.83 | 4.0 |
| 10/27/93 | 19:51:00 | 3201.00 | | 61.51 | 75.18 | 17.98 | 4.0 |
| 10/27/93 | 23:03:00 | 3393.00 | | 62.10 | 74.59 | 18.57 | 4.0 |
| 10/28/93 | 00:01:00 | 3451.00 | | 62.24 | 74.45 | 18.71 | 4.0 |
| 10/28/93 | 03:26:00 | 3656.00 | | 62.88 | 73.81 | 19.35 | 4.0 |
| 10/28/93 | 05:03:00 | 3753.00 | | 63.64 | 73.05 | 20.11 | 4.0 |
| 10/28/93 | 08:00:00 | 3930.00 | | 63.54 | 73.15 | 20.01 | 4.0 |
| 10/28/93 | 13:00:00 | 4230.00 | | 64.03 | 72.66 | 20.50 | 4.0 |
| 10/28/93 | 13:32:00 | 4262.00 | | 64.09 | 72.60 | 20.56 | 4.0 |
| 10/28/93 | 14:04:00 | 4294.00 | | 64.18 | 72.51 | 20.65 | 4.0 |
| 10/28/93 | 16:30:00 | 4440.00 | 0.00 | 64.74 | 71.95 | 21.21 | Pump off |
| 10/28/93 | 16:31:00 | 4441.00 | 1.00 | 64.25 | 72.44 | 20.72 | |
| 10/28/93 | 16:32:00 | 4442.00 | 2.00 | 63.21 | 73.48 | 19.68 | |
| 10/28/93 | 16:33:00 | 4443.00 | 3.00 | 62.01 | 74.68 | 18.48 | |
| 10/28/93 | 16:34:00 | 4444.00 | 4.00 | 60.87 | 75.82 | 17.34 | |
| 10/28/93 | 16:35:00 | 4445.00 | 5.00 | 59.55 | 77.14 | 16.02 | |
| 10/28/93 | 16:36:00 | 4446.00 | 6.00 | 59.30 | 77.39 | 15.77 | |
| 10/28/93 | 16:37:00 | 4447.00 | 7.00 | 58.70 | 77.99 | 15.17 | |
| 10/28/93 | 16:38:00 | 4448.00 | 8.00 | 58.41 | 78.28 | 14.88 | |
| 10/28/93 | 16:39:00 | 4449.00 | 9.00 | 58.05 | 78.64 | 14.52 | |
| 10/28/93 | 16:40:00 | 4450.00 | 10.00 | 57.89 | 78.80 | 14.36 | |
| 10/28/93 | 16:41:00 | 4451.00 | 11.00 | 57.64 | 79.05 | 14.11 | |
| 10/28/93 | 16:42:00 | 4452.00 | 12.00 | 57.29 | 79.40 | 13.76 | |
| 10/28/93 | 16:43:00 | 4453.00 | 13.00 | 56.98 | 79.71 | 13.45 | |
| 10/28/93 | 16:44:00 | 4454.00 | 14.00 | 56.55 | 80.14 | 13.02 | |
| 10/28/93 | 16:45:00 | 4455.00 | 15.00 | 56.34 | 80.35 | 12.81 | |
| 10/28/93 | 16:50:00 | 4460.00 | 20.00 | 55.11 | 81.58 | 11.58 | |
| 10/28/93 | 16:55:00 | 4465.00 | 25.00 | 54.27 | 82.42 | 10.74 | |
| 10/28/93 | 17:00:00 | 4470.00 | 30.00 | 53.79 | 82.90 | 10.26 | |
| 10/28/93 | 17:10:00 | 4480.00 | 40.00 | 52.81 | 83.88 | 9.28 | |
| 10/28/93 | 17:20:00 | 4490.00 | 50.00 | 52.15 | 84.54 | 8.62 | |
| 10/28/93 | 17:30:00 | 4500.00 | 60.00 | 51.46 | 85.23 | 7.93 | |
| 10/28/93 | 17:40:00 | 4510.00 | 70.00 | 50.83 | 85.86 | 7.30 | |
| 10/28/93 | 17:50:00 | 4520.00 | 80.00 | 50.34 | 86.35 | 6.81 | |
| 10/28/93 | 18:00:00 | 4530.00 | 90.00 | 49.98 | 86.71 | 6.45 | |
| 10/28/93 | 18:30:00 | 4560.00 | 120.00 | 49.30 | 87.39 | 5.77 | |
| 10/28/93 | 20:15:00 | 4665.00 | 225.00 | 47.96 | 88.73 | 4.43 | |
| 10/28/93 | 21:15:00 | 4725.00 | 285.00 | 47.37 | 89.32 | 3.84 | |

IBM - POUGHKEEPSIE ELEVATION: 136.69 FT.
952-30R PUMP TEST

WELL: 952-30R

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) | PUMPING RATE (GPM) |
|---|---|---|---|---|---|---|---|
| 10/28/93 | 22:00:00 | 4770.00 | 330.00 | 46.89 | 89.80 | 3.36 | |
| 10/28/93 | 22:30:00 | 4800.00 | 360.00 | 46.70 | 89.99 | 3.17 | |
| 10/29/93 | 06:15:00 | 5265.00 | 825.00 | 44.47 | 92.22 | 0.94 | |
| 10/29/93 | 07:00:00 | 5310.00 | 870.00 | 44.32 | 92.37 | 0.79 | |
| 10/29/93 | 09:30:00 | 5460.00 | 1020.00 | 43.90 | 92.79 | 0.37 | |
| 10/29/93 | 10:30:00 | 5520.00 | 1080.00 | 43.80 | 92.89 | 0.27 | |
| 10/29/93 | 11:30:00 | 5580.00 | 1140.00 | 43.79 | 92.90 | 0.26 | |
| 10/29/93 | 12:30:00 | 5640.00 | 1200.00 | 43.78 | 92.91 | 0.25 | |
| 10/29/93 | 14:30:00 | 5760.00 | 1320.00 | 43.77 | 92.92 | 0.24 | |
| 10/29/93 | 17:34:00 | 5944.00 | 1504.00 | 43.79 | 92.90 | 0.26 | |

IBM - POUGHKEEPSIE ELEVATION: 134.36 FT.
952-30R PUMP TEST

WELL: 952-10RA

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) |
|---|---|---|---|---|---|---|
| 10/25/93 | 12:17:00 | -133.00 | | 41.05 | 93.31 | 0.00 |
| 10/25/93 | 14:32:00 | 2.00 | | 42.10 | 92.26 | 1.05 |
| 10/25/93 | 14:34:00 | 4.00 | | 43.08 | 91.28 | 2.03 |
| 10/25/93 | 14:37:00 | 7.00 | | 43.89 | 90.47 | 2.84 |
| 10/25/93 | 14:39:00 | 9.00 | | 44.50 | 89.86 | 3.45 |
| 10/25/93 | 14:41:00 | 11.00 | | 45.07 | 89.29 | 4.02 |
| 10/25/93 | 14:43:00 | 13.00 | | 45.41 | 88.95 | 4.36 |
| 10/25/93 | 14:45:00 | 15.00 | | 45.32 | 89.04 | 4.27 |
| 10/25/93 | 14:48:00 | 18.00 | | 45.45 | 88.91 | 4.40 |
| 10/25/93 | 14:50:00 | 20.00 | | 45.49 | 88.87 | 4.44 |
| 10/25/93 | 14:55:00 | 25.00 | | 45.78 | 88.58 | 4.73 |
| 10/25/93 | 14:57:00 | 27.00 | | 45.93 | 88.43 | 4.88 |
| 10/25/93 | 14:59:00 | 29.00 | | 46.02 | 88.34 | 4.97 |
| 10/25/93 | 15:07:00 | 37.00 | | 46.26 | 88.10 | 5.21 |
| 10/25/93 | 15:13:00 | 43.00 | | 46.52 | 87.84 | 5.47 |
| 10/25/93 | 15:19:00 | 49.00 | | 46.75 | 87.61 | 5.70 |
| 10/25/93 | 15:26:00 | 56.00 | | 47.23 | 87.13 | 6.18 |
| 10/25/93 | 15:34:00 | 64.00 | | 47.86 | 86.50 | 6.81 |
| 10/25/93 | 15:42:00 | 72.00 | | 48.87 | 85.49 | 7.82 |
| 10/25/93 | 15:50:00 | 80.00 | | 49.41 | 84.95 | 8.36 |
| 10/25/93 | 16:08:00 | 98.00 | | 50.15 | 84.21 | 9.10 |
| 10/25/93 | 16:15:00 | 105.00 | | 50.42 | 83.94 | 9.37 |
| 10/25/93 | 16:24:00 | 114.00 | | 50.85 | 83.51 | 9.80 |
| 10/25/93 | 16:48:00 | 138.00 | | 52.03 | 82.33 | 10.98 |
| 10/25/93 | 17:03:00 | 153.00 | | 52.83 | 81.53 | 11.78 |
| 10/25/93 | 17:19:00 | 169.00 | | 53.70 | 80.66 | 12.65 |
| 10/25/93 | 17:47:00 | 197.00 | | 55.66 | 78.70 | 14.61 |
| 10/25/93 | 18:01:00 | 211.00 | | 56.64 | 77.72 | 15.59 |
| 10/25/93 | 18:11:00 | 221.00 | | 57.35 | 77.01 | 16.30 |
| 10/25/93 | 18:18:00 | 228.00 | | 57.56 | 76.80 | 16.51 |
| 10/25/93 | 18:29:00 | 239.00 | | 57.92 | 76.44 | 16.87 |
| 10/25/93 | 18:49:00 | 259.00 | | 57.05 | 77.31 | 16.00 |
| 10/25/93 | 19:00:00 | 270.00 | | 57.11 | 77.25 | 16.06 |
| 10/25/93 | 20:06:00 | 336.00 | | 58.89 | 75.47 | 17.84 |
| 10/25/93 | 20:36:00 | 366.00 | | 59.39 | 74.97 | 18.34 |
| 10/25/93 | 20:52:00 | 382.00 | | 58.45 | 75.91 | 17.40 |
| 10/25/93 | 21:23:00 | 413.00 | | 57.78 | 76.58 | 16.73 |
| 10/25/93 | 21:44:00 | 434.00 | | 57.77 | 76.59 | 16.72 |
| 10/25/93 | 22:21:00 | 471.00 | | 58.57 | 75.79 | 17.52 |
| 10/26/93 | 00:53:00 | 623.00 | | 59.87 | 74.49 | 18.82 |
| 10/26/93 | 02:03:00 | 693.00 | | 60.00 | 74.36 | 18.95 |
| 10/26/93 | 04:59:00 | 869.00 | | 57.95 | 76.41 | 16.90 |
| 10/26/93 | 06:04:00 | 934.00 | | 58.68 | 75.68 | 17.63 |
| 10/26/93 | 07:30:00 | 1020.00 | | 58.55 | 75.81 | 17.50 |

IBM - POUGHKEEPSIE ELEVATION: 134.46 FT.
952-30R PUMP TEST

WELL: 952-10RA

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) |
|---|---|---|---|---|---|---|
| 10/26/93 | 08:27:00 | 1077.00 | | 58.75 | 75.61 | 17.70 |
| 10/26/93 | 09:15:00 | 1125.00 | | 58.90 | 75.46 | 17.85 |
| 10/26/93 | 09:33:00 | 1143.00 | | 59.05 | 75.31 | 18.00 |
| 10/26/93 | 10:02:00 | 1172.00 | | 59.15 | 75.21 | 18.10 |
| 10/26/93 | 10:40:00 | 1210.00 | | 59.34 | 75.02 | 18.29 |
| 10/26/93 | 11:08:00 | 1238.00 | | 59.60 | 74.76 | 18.55 |
| 10/26/93 | 13:07:00 | 1357.00 | | 60.06 | 74.30 | 19.01 |
| 10/26/93 | 13:33:00 | 1383.00 | | 60.05 | 74.31 | 19.00 |
| 10/26/93 | 13:45:00 | 1395.00 | | 58.60 | 75.76 | 17.55 |
| 10/26/93 | 13:51:00 | 1401.00 | | 58.52 | 75.84 | 17.47 |
| 10/26/93 | 14:21:00 | 1431.00 | | 57.07 | 77.29 | 16.02 |
| 10/26/93 | 14:36:00 | 1446.00 | | 56.84 | 77.52 | 15.79 |
| 10/26/93 | 15:03:00 | 1473.00 | | 56.50 | 77.86 | 15.45 |
| 10/26/93 | 15:46:00 | 1516.00 | | 56.22 | 78.14 | 15.17 |
| 10/26/93 | 17:30:00 | 1620.00 | | 55.88 | 78.48 | 14.83 |
| 10/26/93 | 20:50:00 | 1820.00 | | 55.79 | 78.57 | 14.74 |
| 10/27/93 | 00:30:00 | 2040.00 | | 55.83 | 78.53 | 14.78 |
| 10/27/93 | 04:58:00 | 2308.00 | | 56.11 | 78.25 | 15.06 |
| 10/27/93 | 07:25:00 | 2455.00 | | 56.26 | 78.10 | 15.21 |
| 10/27/93 | 11:15:00 | 2685.00 | | 56.43 | 77.93 | 15.38 |
| 10/27/93 | 17:20:00 | 3050.00 | | 56.96 | 77.40 | 15.91 |
| 10/27/93 | 19:55:00 | 3205.00 | | 57.34 | 77.02 | 16.29 |
| 10/28/93 | 03:28:00 | 3658.00 | | 58.82 | 75.54 | 17.77 |
| 10/28/93 | 08:02:00 | 3932.00 | | 59.49 | 74.87 | 18.44 |
| 10/28/93 | 13:05:00 | 4235.00 | | 59.93 | 74.43 | 18.88 |
| 10/28/93 | 13:34:00 | 4264.00 | | 59.97 | 74.39 | 18.92 |
| 10/28/93 | 14:05:00 | 4295.00 | | 59.95 | 74.41 | 18.90 |
| 10/28/93 | 16:35:00 | | 5.00 | 58.73 | 75.63 | 17.68 |
| 10/28/93 | 16:42:00 | | 12.00 | 56.39 | 77.97 | 15.34 |
| 10/28/93 | 16:46:00 | | 16.00 | 54.91 | 79.45 | 13.86 |
| 10/28/93 | 16:53:00 | | 23.00 | 53.01 | 81.35 | 11.96 |
| 10/28/93 | 16:56:00 | | 26.00 | 52.30 | 82.06 | 11.25 |
| 10/28/93 | 17:08:00 | | 38.00 | 50.65 | 83.71 | 9.60 |
| 10/28/93 | 17:16:00 | | 46.00 | 50.06 | 84.30 | 9.01 |
| 10/28/93 | 17:29:00 | | 59.00 | 49.15 | 85.21 | 8.10 |
| 10/28/93 | 17:43:00 | | 73.00 | 48.32 | 86.04 | 7.27 |
| 10/28/93 | 18:12:00 | | 102.00 | 47.30 | 87.06 | 6.25 |
| 10/28/93 | 18:36:00 | | 126.00 | 46.83 | 87.53 | 5.78 |
| 10/28/93 | 20:18:00 | | 228.00 | 45.45 | 88.91 | 4.40 |
| 10/28/93 | 21:21:00 | | 291.00 | 44.85 | 89.51 | 3.80 |
| 10/28/93 | 22:05:00 | | 335.00 | 44.39 | 89.97 | 3.34 |
| 10/29/93 | 06:20:00 | | 830.00 | 41.99 | 92.37 | 0.94 |
| 10/29/93 | 09:32:00 | | 1022.00 | 41.43 | 92.93 | 0.38 |
| 10/29/93 | 10:35:00 | | 1085.00 | 41.32 | 93.04 | 0.27 |

IBM - POUGHKEEPSIE
952-30R PUMP TEST

ELEVATION: 134.46 FT.

WELL: 952-10RA

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) |
|---|---|---|---|---|---|---|
| 10/29/93 | 12:31:00 | | 1201.00 | 41.30 | 93.06 | 0.25 |
| 10/29/93 | 17:37:00 | | 1507.00 | 41.33 | 93.03 | 0.28 |

IBM - POUGHKEEPSIE ELEVATION: 137.07 FT.
952-30R PUMP TEST

WELL: 952-31R

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) |
|---|---|---|---|---|---|---|
| 10/25/93 | 12:17:00 | -133.00 | | 44.02 | 93.05 | 0.00 |
| 10/25/93 | 14:33:00 | 3.00 | | 44.88 | 92.19 | 0.86 |
| 10/25/93 | 14:36:00 | 6.00 | | 45.37 | 91.70 | 1.35 |
| 10/25/93 | 14:38:00 | 8.00 | | 45.86 | 91.21 | 1.84 |
| 10/25/93 | 14:40:00 | 10.00 | | 46.36 | 90.71 | 2.34 |
| 10/25/93 | 14:42:00 | 12.00 | | 46.91 | 90.16 | 2.89 |
| 10/25/93 | 14:44:00 | 14.00 | | 47.28 | 89.79 | 3.26 |
| 10/25/93 | 14:47:00 | 17.00 | | 47.63 | 89.44 | 3.61 |
| 10/25/93 | 14:49:00 | 19.00 | | 47.85 | 89.22 | 3.83 |
| 10/25/93 | 14:56:00 | 26.00 | | 48.56 | 88.51 | 4.54 |
| 10/25/93 | 14:58:00 | 28.00 | | 48.75 | 88.32 | 4.73 |
| 10/25/93 | 15:00:00 | 30.00 | | 48.93 | 88.14 | 4.91 |
| 10/25/93 | 15:08:00 | 38.00 | | 49.50 | 87.57 | 5.48 |
| 10/25/93 | 15:15:00 | 45.00 | | 49.78 | 87.29 | 5.76 |
| 10/25/93 | 15:21:00 | 51.00 | | 49.97 | 87.10 | 5.95 |
| 10/25/93 | 15:28:00 | 58.00 | | 50.37 | 86.70 | 6.35 |
| 10/25/93 | 15:37:00 | 67.00 | | 50.94 | 86.13 | 6.92 |
| 10/25/93 | 15:44:00 | 74.00 | | 51.45 | 85.62 | 7.43 |
| 10/25/93 | 15:52:00 | 82.00 | | 51.94 | 85.13 | 7.92 |
| 10/25/93 | 16:11:00 | 101.00 | | 52.70 | 84.37 | 8.68 |
| 10/25/93 | 16:17:00 | 107.00 | | 52.88 | 84.19 | 8.86 |
| 10/25/93 | 16:25:00 | 115.00 | | 53.15 | 83.92 | 9.13 |
| 10/25/93 | 16:50:00 | 140.00 | | 53.88 | 83.19 | 9.86 |
| 10/25/93 | 17:05:00 | 155.00 | | 54.35 | 82.72 | 10.33 |
| 10/25/93 | 17:21:00 | 171.00 | | 54.94 | 82.13 | 10.92 |
| 10/25/93 | 17:48:00 | 198.00 | | 56.15 | 80.92 | 12.13 |
| 10/25/93 | 18:02:00 | 212.00 | | 56.69 | 80.38 | 12.67 |
| 10/25/93 | 18:12:00 | 222.00 | | 57.08 | 79.99 | 13.06 |
| 10/25/93 | 18:20:00 | 230.00 | | 57.33 | 79.74 | 13.31 |
| 10/25/93 | 18:34:00 | 244.00 | | 57.53 | 79.54 | 13.51 |
| 10/25/93 | 18:50:00 | 260.00 | | 57.08 | 79.99 | 13.06 |
| 10/25/93 | 19:02:00 | 272.00 | | 56.94 | 80.13 | 12.92 |
| 10/25/93 | 20:07:00 | 337.00 | | 57.61 | 79.46 | 13.59 |
| 10/25/93 | 20:37:00 | 367.00 | | 57.99 | 79.08 | 13.97 |
| 10/25/93 | 20:53:00 | 383.00 | | 57.81 | 79.26 | 13.79 |
| 10/25/93 | 21:24:00 | 414.00 | | 57.38 | 79.69 | 13.36 |
| 10/25/93 | 21:45:00 | 435.00 | | 57.33 | 79.74 | 13.31 |
| 10/25/93 | 22:24:00 | 474.00 | | 58.00 | 79.07 | 13.98 |
| 10/26/93 | 00:58:00 | 628.00 | | 58.85 | 78.22 | 14.83 |
| 10/26/93 | 02:04:00 | 694.00 | | 59.30 | 77.77 | 15.28 |
| 10/26/93 | 05:01:00 | 871.00 | | 57.95 | 79.12 | 13.93 |
| 10/26/93 | 07:32:00 | 1022.00 | | 60.20 | 76.87 | 16.18 |
| 10/26/93 | 08:29:00 | 1079.00 | | 60.34 | 76.73 | 16.32 |

IBM - POUGHKEEPSIE ELEVATION: 137.07 FT.
952-30R PUMP TEST

WELL: 952-31R

| DATE | CLOCK TIME | TIME SINCE PUMP STARTED (t IN MIN) | TIME SINCE PUMP STOPPED (t' IN MIN) | DEPTH TO WATER (FEET) | WATER ELEV (FEET) | DRAW-DOWN (FEET) |
|---|---|---|---|---|---|---|
| 10/26/93 | 09:16:00 | 1126.00 | | 60.42 | 76.65 | 16.40 |
| 10/26/93 | 09:35:00 | 1145.00 | | 60.43 | 76.64 | 16.41 |
| 10/26/93 | 10:05:00 | 1175.00 | | 60.49 | 76.58 | 16.47 |
| 10/26/93 | 10:42:00 | 1212.00 | | 60.65 | 76.42 | 16.63 |
| 10/26/93 | 11:09:00 | 1239.00 | | 60.82 | 76.25 | 16.80 |
| 10/26/93 | 13:09:00 | 1359.00 | | 61.90 | 75.17 | 17.88 |
| 10/26/93 | 13:34:00 | 1384.00 | | 61.89 | 75.18 | 17.87 |
| 10/26/93 | 13:47:00 | 1397.00 | | 60.76 | 76.31 | 16.74 |
| 10/26/93 | 13:52:00 | 1402.00 | | 60.51 | 76.56 | 16.49 |
| 10/26/93 | 14:22:00 | 1432.00 | | 59.39 | 77.68 | 15.37 |
| 10/26/93 | 14:38:00 | 1448.00 | | 59.18 | 77.89 | 15.16 |
| 10/26/93 | 15:05:00 | 1475.00 | | 58.89 | 78.18 | 14.87 |
| 10/26/93 | 15:48:00 | 1518.00 | | 58.57 | 78.50 | 14.55 |
| 10/26/93 | 17:32:00 | 1622.00 | | 58.23 | 78.84 | 14.21 |
| 10/26/93 | 20:52:00 | 1822.00 | | 57.99 | 79.08 | 13.97 |
| 10/27/93 | 00:35:00 | 2045.00 | | 58.16 | 78.91 | 14.14 |
| 10/27/93 | 05:00:00 | 2310.00 | | 58.51 | 78.56 | 14.49 |
| 10/27/93 | 07:34:00 | 2464.00 | | 58.64 | 78.43 | 14.62 |
| 10/27/93 | 11:17:00 | 2687.00 | | 58.75 | 78.32 | 14.73 |
| 10/27/93 | 17:22:00 | 3052.00 | | 59.15 | 77.92 | 15.13 |
| 10/27/93 | 19:57:00 | 3207.00 | | 59.49 | 77.58 | 15.47 |
| 10/28/93 | 03:30:00 | 3660.00 | | 60.65 | 76.42 | 16.63 |
| 10/28/93 | 08:04:00 | 3934.00 | | 61.35 | 75.72 | 17.33 |
| 10/28/93 | 13:07:00 | 4237.00 | | 61.78 | 75.29 | 17.76 |
| 10/28/93 | 13:35:00 | 4265.00 | | 61.83 | 75.24 | 17.81 |
| 10/28/93 | 14:06:00 | 4296.00 | | 61.90 | 75.17 | 17.88 |
| 10/28/93 | 16:40:00 | | 10.00 | 59.20 | 77.87 | 15.18 |
| 10/28/93 | 16:44:00 | | 14.00 | 58.08 | 78.99 | 14.06 |
| 10/28/93 | 16:51:00 | | 21.00 | 56.83 | 80.24 | 12.81 |
| 10/28/93 | 17:00:00 | | 30.00 | 55.61 | 81.46 | 11.59 |
| 10/28/93 | 17:09:00 | | 39.00 | 54.76 | 82.31 | 10.74 |
| 10/28/93 | 17:17:00 | | 47.00 | 54.39 | 82.68 | 10.37 |
| 10/28/93 | 17:30:00 | | 60.00 | 53.91 | 83.16 | 9.89 |
| 10/28/93 | 17:44:00 | | 74.00 | 53.53 | 83.54 | 9.51 |
| 10/28/93 | 18:14:00 | | 104.00 | 51.02 | 86.05 | 7.00 |
| 10/28/93 | 18:38:00 | | 128.00 | 49.25 | 87.82 | 5.23 |
| 10/28/93 | 20:20:00 | | 230.00 | 47.98 | 89.09 | 3.96 |
| 10/28/93 | 21:19:00 | | 289.00 | 47.46 | 89.61 | 3.44 |
| 10/28/93 | 22:07:00 | | 337.00 | 47.02 | 90.05 | 3.00 |
| 10/29/93 | 06:22:00 | | 832.00 | 44.75 | 92.32 | 0.73 |
| 10/29/93 | 09:33:00 | | 1023.00 | 44.26 | 92.81 | 0.24 |
| 10/29/93 | 10:34:00 | | 1084.00 | 44.17 | 92.90 | 0.15 |
| 10/29/93 | 12:32:00 | | 1202.00 | 44.13 | 92.94 | 0.11 |
| 10/29/93 | 17:35:00 | | 1505.00 | 44.14 | 92.93 | 0.12 |

# Attachment 4

# Groundwater Sampling/Analytical Protocols

DUTCHESS COUNTY
POUGHKEEPSIE,NEW YORK

# GROUNDWATER SAMPLING / ANALYTICAL PROTOCOLS

for the Extraction Well
at the
FORMER IBM B952/982 SITE

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
D&B Engineers and Architects, P.C.
330 Crossways Park Drive
Woodbury, New York 11797

MARCH 2017

**FORMER IBM B952/982 SITE**
**EXTRACTION WELL**
**GROUNDWATER SAMPLING / ANALYTICAL PROTOCOLS**

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## 1.0 GROUNDWATER SAMPLING / ANALYTICAL PROTOCOL

The primary objective of this sampling protocol is to specify methods which shall allow for the collection and analysis of representative groundwater samples from the extraction well at the former IBM B952/982 Site, located in Poughkeepsie, New York.

This plan reflects protocols which conform to current USEPA SW-846 regulatory guidance or accepted practice.

### 1.1 Purging the Well

The extraction well is equipped with a ½-HP pump that runs continuously, so no purging of the well is necessary (other than opening a valve and allowing it to flush for a few minutes).

### 1.2 Groundwater Sampling

#### 1.2.1 Sampling Devices

Samples shall be collected directly into the laboratory supplied sample containers from the wellhead sampling port.

#### 1.2.2 Sample Collection

Samples will be collected directly from the wellhead sampling port. Sampling shall start immediately after allowing the system to flush for a few minutes.

#### 1.2.3 Field Measurements

Immediately following sampling, field measurements of pH, temperature and specific conductance shall be obtained.

pH meters shall be calibrated daily and specific conductance shall be calibrated weekly or according to manufacturer's specifications. Calibration records shall be kept on a form which at a minimum would include the date, and initial and corrected meter readings.

The devices shall be decontaminated prior to obtaining a measurement in such a manner so as not to damage the equipment. The equipment shall be decontaminated by rinsing thoroughly with deionized water by both pouring deionized water over the sonde and cable and also spraying the sonde and cable with a spray bottle filled with deionized water.

#### 1.2.4 Sample Containers

Samples shall be placed into laboratory-prepared containers. These containers shall be prepared in accordance with the New York State Department of Environmental Conservation RCRA Quality Assurance Project Plan Guidance document dated January 19, 1990 with revisions dated March 29, 1991.

Field personnel shall collect samples in appropriate containers for the analytical method(s) as specified in Table 1-1 for the Extraction Well Groundwater Monitoring Program Sampling.

## 1.3 Documentation and Record Keeping

All field documentation will be the responsibility of the designated field sample custodian. To assure proper identification in the field and proper tracking in the laboratory, all samples must be labeled in a clear and consistent fashion.

All containers from one sample shall be labeled with a unique sample ID which reflects the sampling location or the type of sample and the sample date. Specific sampling IDs should be as follows:

**Table 1-1**
**Preservative and Sample Containers for**
**Extraction Well**
**Groundwater Monitoring Program Sampling**

| Parameter | Volume Required | Container | Preservative | Holding Time |
|---|---|---|---|---|
| Volatile Organics | (2) 40 ml | G | P-1<br>P-2 | 7 days<br>14 days |

G Glass bottle.
P-l Cool to < $4^0$ C.
P-2 Preserve with concentrated HCI; cool to < $4^0$ C.

*Groundwater (Environmental Samples)* S99999YMMDDG, such that S represents the site (e.g. N for Neptune Road); 99999 represents the location (e.g. 075GA, T104A); YMMDD is the date (e.g. 30120 is 1993, January 20); G indicates groundwater. Split samples will end in an X, duplicate samples will end in a D.

A bound Field Log Book will be maintained which will be composed of field data sheets that shall be completed at the time of environmental sampling at each location and for all QA samples. Every blank on the field data sheet must be filled in. "NA" may be used only as appropriate. The pages of the Field Log Book will be sequentially numbered.

Chain of Custody forms shall accompany all samples to the laboratory (including blanks, spikes and QC samples).

Field personnel shall record sampling activities on a Field Data sheet. Each sample shall have a corresponding Field Data sheet that includes:

Date and time
Sampler's name
Sample ID number
Weather conditions during sampling
Well location and number
Additional comments as necessary
Analysis for which sample was collected
Weather conditions during purging
Required Purge Volume (if applicable)
Volume Removed (if applicable)
Purging and Sampling Equipment (if applicable)

Each sample must have a corresponding entry on a chain of custody manifest. The manifest shall include:

- Site name
- Sample number
- Number of containers
- Sample bottom types and preservatives used
- Date and time of collection
- Parameters for which analyses are requested
- Signature of sample custodian
- Temperature of Temperature Blank upon receipt of sample cooler at the laboratory
- Condition of samples upon arrival at the laboratory

In cases where the samples leave the immediate control of the sampling team (i.e., shipment via common carrier), the shipping container shall be sealed.

## 1.4 Field QA/QC

Duplicate samples will be collected by filling multiple sampling containers from the same extraction well. A duplicate sample shall be collected during each sampling event.

A small, new bottle filled with water shall be placed in each cooler by the laboratory to serve as a temperature blank. The temperature of this blank will be checked and recorded on the Chain of Custody form upon arrival of the samples at the laboratory.

## 1.5 Laboratory QA/QC

In addition to the QA/QC protocols that are set forth in the laboratory methods, the following criteria apply:

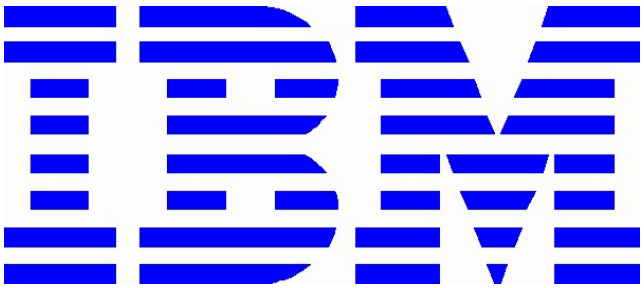
- All laboratories must be certified to perform the analyses required in this plan by the New York State Department of Health's Environmental Laboratory Approval Program (ELAP).
- All laboratory duplicate analyses and matrix spikes that are required by the approved analytical method must come from IBM's sample suite and must be identified as such in the laboratory report.
- The date the sample was analyzed must be included on all laboratory reports.

- Samples reports will be reported on Laboratory Form 1's.

- All samples that are analyzed after the approved holding time has expired or were collected, stored or transported in a manner inconsistent with this protocol shall be deemed invalid. In such cases, IBM shall re-sample the affected well(s) immediately and re-analyze the samples.

# Attachment 5

# Health and Safety Plan



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# HEALTH AND SAFETY PLAN
# EMERGENCY CONTINGENCY PLAN

for the

FORMER IBM B952/982 SITE

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
Groundwater Sciences Corporation
2601 Market Place Street, Suite 310
Harrisburg, Pennsylvania 17110

**Revised and Updated By:**
D&B Engineers and Architects, P.C.
330 Crossways Park Drive
Woodbury, New York 11797

MARCH 2017

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## 1.0 SITE DESCRIPTION

Date: March 2017
Client: IBM Corporation
Location: Former B952/982 Site
Poughkeepsie, New York

Hazards:

- Chemical – Details provided in Section 4.0 Chemical Hazard Evaluation.
- Utilities – Groundwater conveyance piping and electrical lines are exposed throughout the groundwater treatment building.
- Confined space – The building is technically a confined space and should be entered with caution.
- Biological (Insects) – Bees, wasps during spring and summer.
- Eyes – Eye protection should be worn while sampling inside the building to protect from accidental leakage and spraying of untreated groundwater.

Areas Affected: Groundwater treatment building adjacent to Building 982; well 952-30R is inside this building.

Temperature Conditions: Building is heated in winter. No A/C.

Background Information: The B952/982 Site is located near the intersection of Neptune Road and South Road (Route 9) in the Town of Poughkeepsie, Dutchess County, New York. The site had been leased by IBM Corporation. Groundwater monitoring well 952-30R is pumped as a remediation measure. A building which houses a carbon adsorption treatment system has been constructed over this well. This Health and Safety and Emergency Contingency Plan addresses activities in and around this groundwater treatment building.

## 2.0 WORK OBJECTIVES

Work objectives include sampling of influent and effluent groundwater, readings of gauges and meters, and maintenance, including changing of spent carbon, as required.

## 3.0 ON-SITE CONTROL

IBM will coordinate access control to the treatment building. Unauthorized individuals are not permitted inside the treatment building. The building must be locked at all times unless authorized personnel are present. Individuals should not enter the building alone without the knowledge of at least one other person who need not be present at the site.

## 4.0 CHEMICAL HAZARD EVALUATION

The following principal substances have been detected in untreated groundwater. The primary hazards of each are identified. Primary hazards are for the pure phase of each substance.

| Substances Involved | Typical Reported Concentrations (*u*g/l) | Primary Hazards |
|---|---|---|
| *1,2-Dichlorobenzene (12-DCBZ)* | *5,700 - 23,000* | *inhalation, absorption, ingestion, contact (Class IIIA combustible liquid)* |
| *1,3-Dichlorobenzene (13-DCBZ)* | *780 - 2,600* | *similar to 12-DCBZ* |
| *1,4-Dichlorobenzene (14-DCBZ)* | *1,300 - 4,600* | *inhalation, ingestion, contact (combustible solid)* |

12-DCBZ and 13-DCBZ have a pleasant aromatic odor. 14-DCBZ has a mothball-like odor. Hazardous substance information forms or Safety Data Sheets (SDS) for the involved substances are available. TLV-TWAs and STELs for site substances are listed below along with the response characteristics of field monitoring instruments.

**Relative Response of Field Monitoring Equipment to Selected Compounds**

| Species | IP (eV) | PID (<10.2 eV) | CGI | TLV-TWA (ppm) | IDLH (ppm) | STEL (ppm) |
|---|---|---|---|---|---|---|
| 1,2-Dichlorobenzene | 9.06 | + (E) ✔ | + | *C*50 | 1000 | NA |
| 1,3-Dichlorobenzene | 9.12 | + (E) ✔ | + | NA | NA | NA |
| 1,4-Dichlorobenzene | 8.94-9.07 | + (E) ✔ | + | 75 | 1000 | 110 |

IP = ionization potential (electron volts)
PID = photoionization detector (HNu)
CGI = combustible gas indicator
TLV-TWA = threshold limit value - 8-hour time-weighted average (ACGIH)
IDLH = concentration immediately dangerous to life and health
NA = not available
*C* = ceiling value, do not exceed (no TWA)
\+ = positive response
o = no response, not detectable
E = excellent response (relative to methane standard)

## 5.0 PERSONAL PROTECTIVE EQUIPMENT

### 5.1 Levels of Protection

Based on evaluation of potential hazards, the following levels of personal protection have been designated for the applicable work areas or tasks:

| Location | Job Function | Level of Protection |
|---|---|---|
| inside treatment building | sampling | modified D |
| inside treatment building | routine maintenance, meter readings, etc. | D |

Specific protective equipment for each level of protection is as follows:

| Level D: | Modified Level D: |
|---|---|
| ❒ Steel toe and steel shank boots | ❒ Eye protection |
| ❒ Regular work clothing | ❒ Steel toe and steel shank boots. |
| | ❒ Surgical-type gloves for sampling activities |
| | ❒ Regular work clothing or protective clothing as specified below |

Protective goggles will be kept in the treatment building. Steel toe and steel shank boots will be worn at all times. Regular work clothing includes a shirt (preferably long-sleeved) and trousers (no shorts). If the pump is pulled for maintenance, hard hats must be worn during pump pulling activities.

### 5.2 Protective Clothing

The following protective clothing materials are required when sampling:

| Substances | Clothing Material | Glove Material |
|---|---|---|
| Total chlorinated benzenes (>1000 ppb in groundwater) | Tyvek or Saranex suits may be worn as splash protection | Vinyl or latex rubber |

Protective work gloves should be worn when performing maintenance activities such as piping assembly, when operating power equipment, when lifting or moving heavy items, or when performing any task where the potential for abrasion or puncture exists.

**NO CHANGES TO THE SPECIFIED LEVELS OF PROTECTION WILL BE MADE WITHOUT THE APPROVAL OF ACCESS CONTROL PERSONNEL.**

## 6.0 EMERGENCY PROCEDURES AND EQUIPMENT

### A. Emergency Medical Care

Emergency phone numbers:

| Organization | Telephone No. |
|---|---|
| Ambulance | 911 |
| Fire Department | 911 or (845) 486-6300 |
| Police Department | 911 or (845) 485-3666 |
| Poison Control Center | (800) 222-1222 |

HOSPITALS:

Name of hospital: **Vassar Brothers Medical Center**
Phone number: 845-454-8500
Address of hospital: 45 Reade Place, Poughkeepsie
Directions to hospital: Route 9 north to Columbia Street exit, at end of exit ramp turn right, at first stop sign turn right, proceed approximately I block (follow signs for Hospital), Emergency Room entrance sign will be on right and general parking will be on left.

Name of hospital: **MidHudson Regional Hospital of Westchester Medical Center**
Phone number: 845-483-5000
Address of hospital: 241 North Rd, Poughkeepsie
Directions to hospital: Route 9 north one-half mile past Mid-Hudson Bridge, get into right lane, make right turn onto Route 9G, approximately 100 yards, sign on hill for MidHudson Regional Hospital.

First aid equipment is available at the following locations:

| | |
|---|---|
| Fire Extinguisher: | On wall inside treatment building. |
| First-aid kit: | With IBM personnel. |
| Emergency eye wash: | On wall inside treatment building. |

Emergency medical information for selected substances present (excerpted from The NIOSH Pocket Guide to Chemical Hazards):

| Substance | Exposure Symptoms | First-Aid Instructions |
|---|---|---|
| 1,2-Dichlorobenzene (12-DCBZ) | Nasal and eye irritation, liver and kidney damage, skin blisters | **Eye**: wash immediately<br>**Skin**: soap wash promptly<br>**Breath**: Respiratory support<br>**Swallow**: immediate medical attention |
| 1,3-Dichlorobenzene (13-DCBZ) | similar to 12-DCBZ | **Eye**: wash immediately<br>**Skin**: soap wash promptly<br>**Breath**: Respiratory support<br>**Swallow**: immediate medical attention |
| 1,4-Dichlorobenzene (14-DCBZ) | Headache, eye irritation and periorbital swelling, nasal inflammation, anorexia, nausea, vomiting, weight loss, cirrhosis (a NIOSH occupational carcinogen) | **Eye**: wash immediately<br>**Skin**: soap wash promptly<br>**Breath**: Respiratory support<br>**Swallow**: immediate medical attention |

## B. Environmental Monitoring

1. Combustible Gas Indicator (CGI) / Oxygen (O2) Meter will be used as needed inside the groundwater treatment building when strong solvent odors, particularly aromatic or mothball odors, are noticed in the ambient air. These odors may be emitted from the open wellhead. The CGI/O2 meter will be used to determine whether potentially explosive concentrations of gases are present and whether oxygen levels may be deficient.
2. Monitoring should be performed in the breathing zone if strong solvent odors are noticed in the ambient air. If ambient air concentrations exceed the 50-ppm ceiling time-weighted average for 12-DCBZ, then the building must be ventilated until levels drop below 50 ppm. This value (50 ppm) is a time-weighted average for a 10-hour workday and 40-hour work week and is not to be exceeded at any time.

## C. Emergency Procedures (should be modified as required for incident)

The following standard emergency procedures will be used. IBM will be notified of any on-site emergencies, including all accidents and injuries to personnel, and incidents involving damage to IBM property occurring on the job site, regardless of whether or not medical attention is required.

Personnel Injury: Upon notification of an injury, assisting personnel should evaluate the nature of the injury, and the affected person should be decontaminated, if necessary, to the extent possible prior to removal from the site. An EMT or person certified in first aid should initiate the appropriate treatment, and contact should be made for an ambulance and with the designated medical facility (if necessary). No persons will reenter the building until the cause of the injury or symptoms is determined.

Fire/Explosion: IBM Emergency Control and/or the fire department will be alerted and all personnel will be moved to a safe distance from the affected area.

Monitoring Equipment Failure: If a site worker experiences a failure or alteration of monitoring equipment which affects necessary site safety monitoring, all persons will immediately exit the building. Reentry will not be permitted until the equipment has been repaired or replaced.

Other Equipment Failure: If any other equipment on-site fails to operate properly, the appropriate maintenance personnel will be notified and then will determine the effect of this failure on continuing operations on-site. If the failure affects the safety of personnel or prevents completion of the Work Objectives, all personnel will leave the building until the situation is evaluated and corrective actions are taken.

In all situations, when an on-site emergency results in evacuation of the building, personnel will not reenter until:

1. The conditions resulting in the emergency have been corrected.

2. The hazards have been re-assessed.
3. The Site Safety Plan has been reviewed.
4. Site personnel have been briefed on any changes in the Site Safety Plan.

Eating, drinking, and smoking are not permitted at any time inside the groundwater treatment building.

## 7.0 COMMUNICATION PROCEDURES

The following standard hand signals will be used when verbal communication is not possible:

| | |
|---|---|
| Hand gripping throat | Out of air, can't breathe |
| Grip partner's wrist or both hands around waist | Leave area immediately |
| Hands on top of head | Need assistance |
| Thumbs up | OK, I am all right, I understand |
| Thumbs down | No, negative |

## 8.0 DECONTAMINATION PROCEDURES

All purge water is contained and pumped through the onsite treatment system. Spent filter bags will be stored on site until they are properly manifested for transport to the IBM MHV Poughkeepsie main site. Used protective clothing and vinyl gloves will be placed in plastic garbage bags and will be disposed of as directed by IBM.

## 9.0 ACKNOWLEDGEMENT OF PLAN

All site personnel have read the above plan and are familiar with its provisions. Site workers should have at least 24 hours of safety training under the requirements of 29 CFR 1910.120.

| (name) | (function) | (signature) |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

# Attachment 6

# Groundwater Treatment System Inspection Forms

IBM POUGHKEEPSIE
INSPECTION OF GROUNDWATER TREATMENT SYSTEM
FORMER IBM B952/982 SITE

| | | Yes | No |
|---|---|---|---|
| 1. | OVERFILL/SPILL CONTROL EQUIPMENT | | |
| 1a. | Is equipment (e.g. waste-feed cutoff systems, bypass systems and drainage s stems etc. in good working order? | | |
| 2. | ABOVE GROUND PORTIONS OF TREATMENT SYSTEM INTEGRITY | | |
| | Is treatment system tanks, piping and supports in good condition and not apt to fail and/or leak I.e. - no rusting, cracks, dents, punctures or bulges? | | |
| 3. | MONITORING EQUIPMENT AND LEAK DETECTION EQUIPMENT | | |
| 3a. | Are systems in normal operation mode with no malfunctions or alarm conditions? | | |
| 4. | SECONDARY CONTAINMENT SYSTEM INTEGRITY | | |
| 4a. | Is the secondary containment system free from damaged (i.e. coating not cracking/peeling/blistering, seams intact)? | | |
| 4b. | Is the secondary containment system clean (i.e. no signs of wet spots, free liquids and/or debris present)? | | |
| 5. | ENTRANCES/EXITS | | |
| 5a. | Are entrances/exits clear for emergency egress (at least 3-ft wide aisle space and all door areas must be clear? | | |
| 6. | WARNING SIGNS/ LABELS | | |
| 6a. | Are all required signs/labels present and legible on exterior door and treatment system? | | |
| 7. | FIRE EXTINGUISHERS | | |
| 7a. | Is fire extinguisher readily available in case of emergency? | | |

| ADDITIONAL COMMENTS: |
|---|
| |
| |
| |
| |
| |

Inspection deficiencies ( if checked "no" above) must be described in comment section. Promptly contact the Program Engineer to initiate the corrective action process.

DATE OF INSPECTION: _____ TIME: _____

SIGNATURE OF INSPECTOR: _____

PRINT NAME: _____

NOTE: ANY LEAK OR OTHER RELEASE OF WASTE MATERIAL TO THE AIR, LAND, SURFACE WATER OR GROUNDWATER SHOULD BE IMMEDIATELY REPORTED TO IBM ENVIRONMENTAL PROGRAM ENGINEERING.

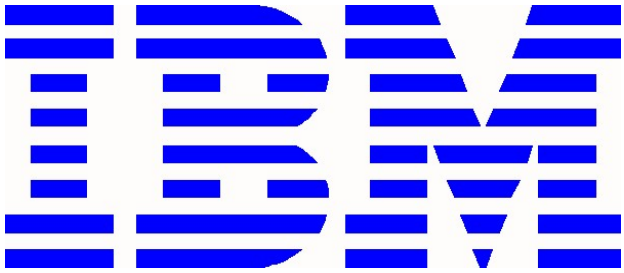
952 / 982
GROUND WATER TREATMENT SYSTEM

| INT | | DATE | TIME | TOTAL | GPM | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX E
# OPERATION AND MAINTENANCE (O&M) MANUAL FOR THE SUBSLAB DEPRESSURIZATION SYSTEM



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# OPERATION AND MAINTENANCE MANUAL

for the

SUBSLAB DEPRESURIZATION SYSTEM
at the

FORMER IBM B952/982 SITE

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
Sanborn, Head Engineering, P.C.

**Revised and Updated By:**
D&B Engineers and Architects, P.C.
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Woodbury, New York 11797

MARCH 2017

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# 1.0 INTRODUCTION

This Operations and Maintenance (O&M) Manual describes procedures and practices associated with operation, maintenance, and monitoring of the subslab depressurization system (SSDS) installed as part of the redevelopment of the former IBM leased Building 982 located in Poughkeepsie, New York (the Site). The SSDS was put into operation by IBM on December 12, 2013. Although IBM is not the owner of the Site, IBM is performing SSDS operations and maintenance activities.

## 1.1 Background and Performance Objectives

As documented in historical reports dating back to 1982, volatile organic compound (VOC) residuals from former manufacturing operations are present in the soil and groundwater beneath the building. The SSDS system is intended to intercept and remove VOC vapors from below the slab, thereby preventing VOC vapor entry into the building and potential negative impacts to indoor air quality. The design basis of the system was approved on September 18, 2013 by the New York State Department of Environmental Services (NYSDEC) and the New York State Department of Health (NYSDOH) (collectively, the Agencies). The startup and performance of the SSDS system was approved by the Agencies in an April 25, 2014 letter to IBM. Copies of these letters are provided in Attachment 6.

## 1.2 System Overview

The SSDS was designed to extract vapor from beneath approximately 49,000 square feet of floor slab and decrease the potential for VOC-containing vapor migration into the building.

Vapor is capable of being withdrawn from beneath the slab using up to six suction pits and five extraction ports connected to two vacuum blowers installed in a dedicated equipment room at the north end of the building. The SSDS is also equipped with a granular activated carbon (GAC) vapor treatment system consisting of two 700-lb vessels. The GAC vessels are operated in series

and under vacuum. The blowers discharge treated vapor to the atmosphere through a discharge stack that extends through the roof of the equipment room and above the main structure roofline.

Operation of the SSDS is controlled and monitored by a programmable logic controller (PLC) installed in the Control Panel which is mounted on the blower skid. The PLC is programmed to send a general alarm via radio signal to the main IBM Poughkeepsie facility in the event of an unscheduled shut down or emergency. The blowers are powered by variable frequency drives (VFDs) that can be adjusted to increase or decrease the blower speed, and hence the vacuum and flow, as appropriate.

## 1.3 Organization of Manual

Section 2.0 of this manual provides detailed descriptions of the components of the SSDS. Operating procedures, including steps for system startup, changeout of filters and GAC vessels, and system shut down are provided in Section 3.0. Section 4.0 describes monitoring and record keeping recommendations. Maintenance recommendations are outlined in Section 5.0.

An As-Built set of drawings is included as Attachment 1. Photographs of the system are included as Attachment 2. An Inspection and Maintenance Log Sheet prepared to support system performance monitoring is included as Attachment 3. Attachment 4 includes manufacturers' manuals for major system components. Manuals and drawings documenting the system control and power panels are included as Attachment 5. Agency correspondence records are included as Attachment 6.

## 2.0 SUBSLAB DEPRESSURIZATION SYSTEM DESCRIPTION

This section provides detailed descriptions of the major system components and their intended function.

### 2.1 Subslab Vapor Extraction Ports

The locations of the subslab vapor extraction ports (EP-01 through EP-05) are shown in Attachment 1 on Sheet M-2. The subslab portion of the extraction ports consists of a 1 ¼inch Schedule 40 slotted (0.020-inch slots) PVC pipe connected to a 1 ¼-inch pipe adapter and a 1-inch NPT x BSPP steel coupling. The slotted PVC pipe extends approximately 2 feet beneath the slab and is plugged at the bottom with a 1 ¼-inch Schedule 40 PVC pipe cap and surrounded by silica support sand. The extraction port assembly is secured in place with granular bentonite and hydraulic cement.

The extraction port risers are constructed of 2-inch Schedule 40 galvanized steel pipe secured to interior building walls. Each riser is equipped with a Swagelok® fitting for vapor sample collection, a 0 to 80 in. water column (wc) Magnahelic differential pressure gauge, and a 2-inch gate valve for manually adjusting the flow through the ports. The extraction port risers thread into the extraction ports within the slab, extend up through the dropped ceiling (where present) and are connected to the SSDS via structural ceiling mounted galvanized steel vacuum conveyance tubing.

### 2.2 Subslab Vapor Suction Pits

The locations of the six subslab vapor suction pit ports (SP-01 through SP-06) are shown in Attachment 1 on Sheet M-2. The six ports connect to 2-inch subslab Schedule 80 PVC pipe that transitions to slotted (0.020-inch) schedule 40 PVC pipe within each suction pit filled with ¾-inch crushed stone, as shown in Attachment 1 on Sheets C-1 and C-2.

The suction pit risers are constructed of 2-inch Schedule 40 galvanized steel pipe secured to interior building walls. Each riser is equipped with a Swagelok® fitting for vapor sample collection, a 0 to 80 in. wc Magnahelic differential pressure gauge, and a 2-inch gate valve for manually adjusting the flow through the ports. The risers transition from PVC to Schedule 40 galvanized pipe below the slab, extend up through the dropped ceiling (where present) and are connected to the SSDS via structural ceiling-mounted galvanized steel vacuum conveyance tubing.

## 2.3 Vapor Transmission Piping

Subslab vapor is conveyed from the extraction port risers via overhead 6-inch galvanized steel Spencer-brand vacuum conveyance tubing to the dedicated equipment room housing the GAC treatment vessels and blower skid. Spencer tubing joints under vacuum are constructed using polyolefin shrink sleeves manufactured by Spencer. Interconnecting piping between extraction and treatment equipment within the equipment room is constructed of 6-inch schedule 80 PVC pipe. Conveyance pipe under pressure (on the discharge side of the blowers) is 6-inch galvanized steel spiral duct with high temperature joint sealant that transitions to 6-inch stainless steel, pressure rated, double wall stove pipe prior to penetrating through the roof deck. The discharge pipe is capped with a no-loss stack head. Attachment 1, Sheets M-2, M-5, M-6 and M-7 show the piping layout and details.

## 2.4 Purge Air Inlet

A purge air inlet with a combination silencer and filter is located within the equipment room, upstream of the vapor liquid separator (VLS). The air inlet is used to draw fresh air through the treatment train and extraction equipment to flush out extracted vapor prior to any maintenance activities or carbon changeouts. The purge air inlet should be closed during normal system operation. A manual for the purge air inlet, including filter element, is provided in Attachment 4.2.

## 2.5 Vapor Liquid Separator

The vapor liquid separator is intended to separate water vapor that might be present from the extracted vapor stream. The VLS is a 120-gallon carbon steel tank equipped with a bottom drain, a vacuum gauge, a clear PVC sight tube (removable for cleaning), and three stem-mounted, stainless steel level control switches. A photo of the VLS is included in Attachment 2 and a drawing is provided in Attachment 4.5.

## 2.6 VLS Transfer Pump

Liquid that collects in the VLS can be transferred to a drum for proper disposal via a Goulds centrifugal pump, Model 1ST1D5D4 that is manually operated via a Hand-Off-Auto switch located on the control panel. The pump is constructed of 316 stainless steel and has a 3/4horsepower, three-phase motor. The pump manual is provided in Attachment 4.4.

## 2.7 Granular Activated Carbon Treatment

Two granular activated carbon (GAC) treatment vessels are used to adsorb VOCs from the extracted vapor. The treatment train consists of two Tetrasolv® VR-700 vessels plumbed in series, each containing 700 lbs of coconut-based GAC. Swagelok sample ports are located at the inlet, midpoint, and outlet of the treatment train for process vapor sampling. Laboratory analysis of the process samples can be used to calculate VOC mass removal and determine when the GAC vessels need to be changed out.

The SSDS is designed so extracted vapor flows through both the lead and lag vessels. Additional information regarding GAC vessel changeouts is provided in Section 3. Photos of the GAC treatment train are provided in Attachment 2.

## 2.8 In-line Particulate Filter

An in-line particulate filter is located immediately upstream of the vacuum blowers. A differential pressure gauge measures pressure drop across the filter element, and should be monitored for an increase in pressure, indicating the need to replace the filter element. The filter element should be replaced when the differential pressure reaches 5 in. wc. The filter manual, including the filter element part number, is provided in Attachment 4.2.

## 2.9 Vacuum Relief Valve

An FPZ VRL6 vacuum relief valve is located between the in-line particulate filter and the inlet to each blower (total of two vacuum relief valves). The relief valves will automatically open at approximately 80 in. wc vacuum and draw in room air to prevent the blowers from reaching maximum amperage. A data sheet for the vacuum relief valves is provided in Attachment 4.3.

## 2.10 Vacuum Blowers

Two FPZ model SCL-K08-MS-10-3, 10-horsepower, 3-phase, regenerative blowers generate vacuum for the SSDS. Each blower's speed is controlled by a dedicated VFD within the control panel. A lighted Hand-Off-Auto (HOA) switch for each blower is located on the Control Panel. Blower operational status can be determined by the lighted HOA switch, as well as indicator icons on the human-machine interface (HMI).

When the HOA switches are in the Hand position, the blowers are in manual mode and will run continuously and independently of all safety interlocks. It is imperative that the blower switches are not left in the Hand position when an operator is not physically present. When the switches are in the Auto position, safety interlocks will have the ability to stop the blowers in the event of an abnormal operating condition. When the switches are in the Off position, the blowers will not operate. Photos of the blowers and the Control Panel are included in Attachment 2. The blower manual is provided in Attachment 4.1.

## 2.11 Instrumentation

The SSDS is equipped with instrumentation to facilitate continuous and automated monitoring of system operations. The key instrumentation is described in the following subsections.

### 2.11.1 Vacuum Gauges and Transmitters

Each vapor extraction port riser is equipped with a Dwyer Magnahelic model 2080 differential pressure gauge with a range of 0 to 80 in wc (see Attachment 4.6 for the manufacturer's specification sheet). The vacuum applied to each extraction port can be manually read during system maintenance and monitoring, but is not transmitted to the system's PLC and recorded.

A Dwyer low pressure gauge model SGX-D7722N, with a range of 0 to 100 in wc, is located at the outlet of each carbon vessel (see Attachment 4.7 for the manufacturer's specification sheet). Vacuum levels at the carbon vessels can be manually recorded during maintenance and monitoring events.

The vacuum at the inlet to the lead carbon vessel (V-101) and at the combined inlet to the blowers are measured using Dwyer DH3-011 pressure indicating transmitters (see Attachment 4.11 for the manufacturer's specification sheet). The indicating transmitters provide a visual display of the pressure reading for manual recording as well as transmittal of pressure readings to the PLC for monitoring and logging purposes. These values can also be manually recorded during sampling events and system maintenance and monitoring events.

### 2.11.2 Inlet Filter Differential Pressure Indicator

A Dwyer 2030 Magnehelic differential pressure gauge, rated for 0 to 30 in. wc, is located across the inline particulate filter (see Attachment 4.8 for the manufacturer's specification sheet). The filter should be replaced once the differential pressure measured across it is at 5 in wc.

### 2.11.3 Temperature Indicators and Transmitters

AV brand temperature indicators, model 1NFY4 (see Attachment 4.12 for the manufacturer's specification sheet), are located at the following points along the treatment train: upstream of lead carbon vessel V-101, downstream of carbon vessel V-101, downstream of lag carbon vessel V-102, and downstream of the blowers. These values can be manually recorded during system maintenance and monitoring events.

TCP thermowells, model TCP3957K38 13227 100541 and Pyromation temperature transmitters, model R1T185L483-004-SL-8HN31, T-440-385U-S(0-400)F are located at the inlet of lead carbon vessel V-101, the outlet of lag carbon vessel V-102, and the combined outlet from the blowers (see Attachment 4.13 for the manufacturer's specification sheet). Temperature data measured at these locations are transmitted to the PLC for monitoring and datalogging.

An Omega model EWSE-PT100-TX temperature transmitter is mounted to the blower skid and controls the equipment room exhaust fan (EF-101) based on room temperature fluctuations (see Attachment 4.14 for the manufacturer's specification sheet). Room temperature data are transmitted by the Omega transmitter to the system's PLC.

The process and instrumentation (P&ID) drawing showing the locations of each temperature indicator is provided in Attachment 1 on Sheet IC-1.

2.11.4 Air Flow Indicator and Sensor

A Dwyer DS-300-6 inline flow sensor is located on the combined influent pipe immediately upstream of the blowers. The flow sensor is an averaging pitot tube that is connected to a differential pressure gauge. This instrument does not need to be calibrated. The extracted vapor flow rate can be calculated using the differential pressure, pipe diameter, static line pressure, and specific gravity of the vapor. Flow data should be recorded during sampling events and maintenance or monitoring work. Conversion equations are provided in the instrumentation operation and maintenance manual, included as Attachment 4.10 and as follows:

$$A = 14.7 - \frac{Blower\ Vacuum\ (in.wc)}{27.7}$$

B = Post Carbon Temperature (deg F) + 460

$$C = \frac{A * Flow\ DP\ (in.wc)}{B}$$

$$\text{Flow (cfm)} = 3273.6 * \sqrt{C}$$

2.11.5 Vapor Liquid Separator Float Switches

There are four NES/FPI L500-09 float switches within a sight tube mounted on the side of the vapor liquid separator (see Attachment 4.15 for manufacturer's specification sheets). From bottom to top, they are designated Level Low Low (LLL101), Level Switch Low (LSL-101), Level Switch High (LSH-101) and Level High High (LHH-101). When the water in the vapor liquid separator reaches the LSH-101 level, the PLC will notify and operator. If the VLS is not manually pumped out before LHH-101 is activated, the SSDS will shut down, the PLC will notify an operator, and the "System Alarm" lamp on the control panel will be illuminated.

A Gems Model LS-15208 float switch is located in the secondary containment basin beneath the VLS and transfer pump and is designated LSH-102 (see Attachment 4.16 for manufacturer's specification sheet). When the float switch is activated, indicating a possible liquid

leak from the VLS tank, conveyance pipe, or transfer pump, the SSDS is automatically shut off and the PLC will notify an operator.

## 2.12 Power and Control Panels

The skid mounted Power Panel (PP-300) houses a main power disconnect switch and two Square D variable frequency drives (VFDs), one for each blower, manufactured by Schneider Electric. The disconnect and VFD keypads are mounted on the front of PP-300.

The Main Control Panel (MCP-100) is located on the blower skid and houses an Automation Direct microprocessor-based control unit. The front of the Control Panel is equipped with a Hand/Off/Auto (HOA) switch for each blower, the transfer pump, and the room exhaust fan, as well as an On/Off switch for the control power, a reset pushbutton, and alarm lamps. The alarm lamps are summarized in the following table. A schematic of the Control Panel is provided in Attachment 5.

| Lamp ID | Activated when… |
|---|---|
| System Alarm (See Screen) | A system alarm is activated. See the HMI for alarm description |
| Alarm (Spare) | Not active. For potential future use |
| Emergency Stop Active | The system has been shut off by the Emergency Off pushbutton |

### 2.12.1 Automation Direct Unit

The Automation Direct Programmable Logic Controller (PLC) Model P3-550 unit is a microprocessor-based system which continuously monitors and controls the operation of the SSDS. The PLC monitors system operations via input signals from field instrumentation (e.g., float switches, or vacuum and temperature transmitters) and controls the system by issuing commands, or output signals, to equipment (e.g., VFD). The input/output (I/O) signals and commands associated with the PLC are listed in Table 1.

Alarm and operating setpoints can be adjusted using the HMI screen mounted on the outside of MCP-100. The VFD keypads mounted on the outside of PP-300 can be used to monitor VFD/blower performance as well as change VFD settings. VFD settings should not be changed unless warranted by changes in the operation of the system.

The primary operator adjustable set points controlled by the PLC include the following:

| Description | Setpoint |
|---|---|
| Blower 101 speed | 45 Hz |
| Blower 102 speed | 45 Hz (off) |
| Carbon vessel low vacuum alarm (VIT-101) | 5 in wc |
| Blower high vacuum alarm (VIT-102) | 90 in wc |
| Carbon vessel high temperature alarm (TT-102 – TT-101) | 10°F |
| Blower high temperature alarm (TT-103) | 180°F |
| Exhaust fan (EF-101) On | 80°F |
| Exhaust fan (EF-101) Off | 70°F |
| Equipment room high temperature alarm (TT-104) | 105°F |
| Equipment room low temperature alarm (TT-104) | 40°F |

The above set-points may be modified depending on future changes to operating conditions or evaluation of performance monitoring data.

The PLC is programmed to monitor and control system operations based on the setpoints and the signals received from instrumentation devices. Under normal, automatic operation, the PLC has been programmed to complete the following key functions:

- Shut down the blowers in the event of a VFD alarm/fault;
- Shut down the blowers in the event of a VLS high-high level;
- Shut down the blowers in the event of a high secondary containment level;
- Shut down the blowers in the event of a high temperature alarm (either carbon vessel differential or blower discharge);
- Shut down the blowers in the event of a high room temperature alarm;
- Shut down the blowers in the event of a high vacuum alarm;
- Send a warning notification to a system operator if the VLS high level switch is activated;

- Send a warning notification to a system operator if a low vacuum alarm is activated;
- Send a warning notification to a system operator if a low room temperature alarm is activated.

The PLC program file was prepared by the equipment vendor, NES, and provided to IBM's operator upon equipment delivery.

### 2.12.2 Square D Variable Frequency Drives

Each Schneider Electric SquareD Altivar 312 VFD adjusts its corresponding vacuum blower motor speed based on operator input at the HMI mounted on MCP-100. The VFD operating parameters were programmed at system startup and should not require further adjustment. For additional information regarding the VFD operations, refer to the Altivar manual provided in Attachment 5. The VFD speed should not be adjusted unless system performance data suggests a change is appropriate to maintain subslab vacuum.

### 2.12.3 Control Power Switch

An On/Off switch labeled "Control Power" is located on the front of the Control Panel. To operate the system, the switch must be turned to the On position. When the switch is in the On position, the PLC, VFD, and ancillary electrical devices will be powered.

### 2.12.4 Blower HOA Switches

The blower HOA switches (labeled B-101 SSDS Blower and B-102 SSDS Blower) are located on the front of MCP-100. For normal SSDS operation, the switches should be toggled to the Auto position. When switched to the Off position, the SSDS will shut down and the automatic startup capabilities will be disabled. When switched to the Hand position, the blowers will remain on and all automatic safety interlocks will be disabled. The blowers should not be left unsupervised if the switches are toggled to the Hand position.

When the blower switches are toggled to Auto or Hand, the VFD will control the blower motor speed. The speed of the blowers can be adjusted by changing the Hz setpoint for each blower on the HMI setpoint screen. The B-101 VFD is set to operate continuously at a set-point of 45 Hz (B-102 is Off). As the blower motor speed increases, the vacuum generated increases, and vice versa. The VFD settings should not be changed without prior verification that a change is appropriate.

### 2.12.5 Transfer Pump HOA Switch

The transfer pump HOA switch labeled "P-101 Pump" is located on the front of MCP100. The switch should be in the Off position at all times unless the VLS is being manually pumped out. An operator should be present at all times when the pump is in the Hand position. The current programming configuration does not allow for automatic operation when the switch is toggled to Auto. If in the future the pump is plumbed to a facility capable of treating the liquid waste stream, the pump can be configured to operate in Auto mode.

### 2.12.6 Room Exhaust Fan HOA Switch

The room exhaust fan HOA switch labeled "EF-101 Exhaust Fan" is located on the front of MCP-100. The switch should be in the Auto position during system operation to allow the fan to start and stop depending on the room temperature. Temperature setpoints controlling the operation of the exhaust fan can be adjusted on the HMI setpoint screen. When the exhaust fan turns on, an actuated damper mounted to a louvered pass-through on an adjacent wall will activate and open to allow cross-ventilation air flow. When switched to the Off position, the exhaust fan will not turn on and the actuated damper will remain closed. During maintenance activities (e.g. carbon changeouts), the exhaust fan should be toggled to the Hand position to actively exchange room air independent of room temperature. To avoid unnecessary continuous operation, the exhaust fan should not be left in the Hand position, but should be returned to the Auto position upon completion of maintenance activities.

### 2.12.7 System Reset Pushbutton

A system reset pushbutton labeled "Reset" is located on the front of MCP-100. Resetting the SSDS will clear all system alarms and initiate the startup sequence if the condition that initiated the alarm has been corrected.

### 2.12.8 Emergency Off Button

A red emergency shutdown button labeled "Emergency Stop" is located on the front of MCP-100. Pressing this button will shut down the SVE system, notify the building SCADA system, and illuminate the alarm lamp located on the front of MCP-100.

## 2.13 Equipment Room Utilities

Utilities within the equipment room include a fire suppression sprinkler system and a space heater. The sprinkler system within the equipment room is connected to the building-wide fire suppression system which is maintained by the building owner. The 15,000-watt space heater is mounted to the underside of the roof deck and operated by a wall mounted thermostat. It is critical that the space heater remain operational during the winter months to prevent freezing of the sprinkler system. A low temperature alarm will notify personnel if the room temperature drops below the low temperature alarm setpoint. The low temperature alarm setpoint can be adjusted on the HMI setpoint screen.

# 3.0 OPERATIONS

This section describes the operating procedures for the SSDS, including startup procedures, changeout procedures for particulate filters and GAC units, and shutdown procedures.

## 3.1 Normal Operation Overview

The SSDS is designed for continuous operation, and under normal conditions, day-to-day adjustment or maintenance should not be required. During normal operation, the blower HOA switches should be in the Auto position (unless one of the blowers has been intentionally turned Off), the transfer pump switch should be in the Off position, and the exhaust fan switch should be in the Auto position.

During normal operation, all switches and transmitters are continuously monitored by the PLC for alarm conditions. Transmitters (temperature and vacuum) provide continuous analog signals that are logged by the PLC and available for review via the HMI or download through direct connection to the PLC with a laptop.

## 3.2 Procedures

This sub-section provides procedures for operation of the SSDS. Startup steps for normal, automatic operation are presented first. Procedures for changing out the particulate filters and granular activated carbon treatment units are also provided.

### 3.2.1 Startup and Automatic Operation

The steps for starting up the system for automatic operations are as follows:

1. Confirm that the valves on the extraction port and suction pit risers are open.
2. Confirm that the pipe network isolation valve is open (see photo 2 in Attachment 2).
3. Confirm that the purge air inlet valve is closed (see photo 2 in Attachment 2).

4. Confirm that the inlet valve to the blower(s) that will be operated is open.
5. Confirm that the outlet valve from the blower(s) that will be operated is open.
6. Verify that the valves to and from the VLS transfer pump are closed.
7. Confirm that all sample taps are closed.
8. Turn the Control Power switch on.
9. Turn the Blower HOA switch(es) to Auto. The system should start up as programmed and the VFD should reach the setpoint frequency within 30 seconds.
10. Visually review the treatment system piping for evidence of leaks or defects and review the analog pressure gauges and differential pressure readouts for evidence of abnormal operating conditions.
11. Check the Control Panel to verify that no alarm lights are illuminated and the blower(s) are operating at their intended speed.

### 3.2.2 Particulate Filter Changeout

Particulate filter change-out is required when the differential pressure across the filter reaches 5 in wc. A Solberg CT-275P-600C is used in the SSDS treatment system. The filter maintenance manual is included in Attachment 4.2. The steps to change-out the particulate filter are as follows:

1. Open the purge air inlet valve and close the pipe network isolation valve (See photo 2 in Attachment 2).
2. Let the blower(s) run for approximately 2 minutes with the purge air valve open and the pipe network isolation valve closed.
3. Turn the blower HOA switch(es) to the Off position.
4. Isolate the filter in need of a changeout by closing the valves immediately upstream and downstream of the filter.
5. Disconnect the canister top from the canister base by loosening the wing nuts.
6. Remove the hex head/wing-nut and washer from the element and then remove the element.
7. Clean the sealing surfaces of the housing, top & base plates, and element end caps.
8. Place the new/cleaned element evenly on the base plate.
9. Place top plate (if necessary) on the element by centering on tap bolt.
10. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Do not over tighten.
11. Wipe down all surfaces. Place the canister top back on the canister base. Hold the canister housing against the clean o-ring on the main filter head. Re-fasten wing nut assemblies.
12. Open the isolating valves immediately upstream and downstream of the filter.
13. Turn the blower HOA switch(es) to Auto.
14. Open the pipe network isolation valve and close the purge air inlet valve.

### 3.2.3 GAC Vessel Change-out

The steps to changeout the GAC media are as follows:

1. Open the purge air inlet valve and close the pipe network isolation valve (See photo 2 in Attachment 2).
2. Let the blower(s) run for approximately 2 minutes with the purge air valve open and the pipe network isolation valve closed.
3. Turn the blower HOA switch(es) to the Off position.
4. Turn the exhaust fan HOA switch to Hand and confirm the fan is operating.
5. Remove the flange plates from the ports located on at the top of the GAC vessels,
6. Transfer the spent carbon to drums using a vacuum vented outdoors.
7. Fill the vessels with fresh GAC.
8. Place the flange plates back on top of the ports and tighten.
9. Return the exhaust fan HOA switch to Auto.
10. Return the blower HOA switch(es) to Auto and confirm operation of the blower(s).
11. Open the pipe network isolation valve and close the purge air inlet valve.
12. Visually inspect the flange plate connections for evidence of leakage and review the analog pressure gauges (on the system and at extraction ports) and differential pressure readouts for evidence of abnormal operating conditions.

## 3.3 Shut Down Procedures

To shut down the system, turn the blower HOA switches to the OFF position. The system shall not be shut down for an extended period of time without prior review and approval from appropriate IBM personnel.

**CAUTION: If shutting down the system for maintenance/repair, lockout/tagout procedures should be implemented in accordance with IBM's site safety protocols.**

# 4.0 MONITORING AND RECORD KEEPING

Monitoring and logging requirements of the SSDS operation and performance are summarized below. The data generated are used to support periodic evaluation of system performance.

## 4.1 Operations Monitoring

The SSDS equipment room should be inspected at a minimum of once per month and certain operating parameters should be recorded on the Operations Monitoring Logsheet included as Attachment 3.1. The system's setpoints should be recorded at a minimum of once per month on the Setpoint Monitoring Logsheet included as Attachment 3.2.

## 4.2 Performance Monitoring

The effectiveness of the SSDS performance was evaluated during system startup activities, and again during system operating adjustments. Figure 1 shows the locations of extraction ports (EP), suction pit ports (SP), and subslab monitoring ports (SSV) within the building. Figure 2 shows the vacuums applied at each extraction and suction pit port and the resulting subslab pressure response. The extraction port vacuums and subslab pressure response should be monitored twice per year to verify effectiveness. The subslab pressure should be -0.004 in wc or less (greater vacuum) at each subslab monitoring point. SSDS performance monitoring should be recorded on the Performance Monitoring Logsheet included as Attachment 3.3.

## 5.0 MAINTENANCE

The SSDS treatment system should require limited and infrequent maintenance. The primary maintenance tasks include inspecting the system piping for leakage and changing out the particulate filters and GAC vessels. The maintenance tasks associated with the SSDS treatment system operation and their recommended frequency are summarized below. System maintenance should be recorded on the System Maintenance Logsheet included in Attachment 3.

| Item | Action | Frequency | Comments |
|---|---|---|---|
| Vacuum Blowers | Inspect/cycle | Quarterly | 1. Verify tightness of nuts/bolt securing blowers in place.<br>2. Verify that all pipe fittings are secure.<br>3. If only one blower is in use, alternate which blower is operating so one blower doesn't sit un-used longer than one quarter. |
| System Piping | Inspect | Monthly | 1. Review for evidence of leakage. |
| Transfer Pump | Inspect | Quarterly | 1. Verify tightness of nuts/bolts securing pump in place.<br>2. Verify that all pipe fittings are secure. |
| Extraction Ports | Inspect | Semiannual | 1. Review pipe/connections for evidence of leakage.<br>2. Check instrument connections.<br>Confirm the vacuum applied to each port is within the operating range as shown on the Performance Monitoring Logsheet. |
| Equipment Room | Clean and Inspect | Quarterly, or as needed | 1. Wipe clean piping and electrical enclosures. Sweep floor.<br>2. Confirm the exhaust fan and heaters are operational. |

# TABLES

**Controller Input/Output List**
**Subslab Depressurization System**
**Former IBM Building 982**

| Device ID | Location | Description | Function/Programming |
|---|---|---|---|
| | | | |
| **Discrete Inputs from:** | | | |
| Emergency Stop | Control Panel | Emergency Stop button | -Initiate system shutdown sequence,display alarm on HMI screen, send remote alarm notification, create an event log |
| LHH-101 | Vapor Liquid Separator | High-high liquid level switch | -Blowers B-101 and B-102 off, display alarm on HMI screen, activate manual reset button on control panel, send remote alarm notifications, create an event log |
| LSH-101 | Vapor Liquid Separator | High liquid level switch | -Display warning on HMI screen, send remote warning notification, and create an event log |
| LSL-101 | Vapor Liquid Separator | Low liquid level switch | -Manual operation of pump only, currently no function |
| LLL-101 | Vapor Liquid Separator | Low-low liquid level switch | -Manual operation of pump only, currently no function |
| LSH-102 | Vapor Liquid Separator Secondary Containment | Secondary containment high liquid level switch | -Turn off blowers B-101/B-102 and turn off pump P-101, display alarm on HMI screen, activate manual reset button, |
| B-101 HOA Switch | Control Panel | Blower B-101 operation switch in Auto | -Turn On/Off blower B-101 |
| B-102 HOA Switch | Control Panel | Blower B-102 operation switch in Auto | -Turn On/Off blower B-102 |
| B-101 VFD Fault | Control Panel | General VFD Fault | -Turn off blower B-101, display alarm on HMI screen, activate manual reset button, send remote alarm notification, create an event log |
| B-102 VFD Fault | Control Panel | General VFD Fault | -Turn off blower B-102, display alarm on HMI screen, activate manual reset button, send IBM remote notification, create an event log |
| P-101 HOA Switch | Control Panel | Liquid transfer pump not in Auto | -Manual operation of pump in Hand only |
| EF-101 HOA Switch | Control Panel | Exhaust Fan in Auto | -Run the exhaust fan if the room high temperature exceeds operator set point |
| EF-101 Run Confirmation | Exhaust Fan 101 | Switch confirming operation of EF-101 | -Turn EF-101 Off if run confirmation not received |
| **Discrete Outputs to:** | | | |
| EF-101 | Equipment Building | Exhaust Fan Run/Stop | -Turn On/Off Exhaust Fan EF-101 |
| B-101 | Blower Skid | Blower 101 Run/Stop | -Turn On/Off Blower B-101 |
| B-102 | Blower Skid | Blower 102 Run/Stop | -Turn On/Off Blower B-102 |
| P-101 | VLS Skid | Pump 101 Run/Stop | -Turn On/Off Pump P-101 |
| System Alarm Light | Control panel | System Alarm Light | -Illuminate panel mounted System Alarm light |
| Emergency Stop Alarm Light | Control panel | Emergency Stop Active Light | -Illuminate panel mounted Emrgency Stop Active light |
| Reset Button | Control panel | Reset Alarm Notifications | -Reset alarm notifications if alarm condition has been resolved |
| **Analog Inputs from:** | | | |
| FIT-101 | Transfer pump P-101 outlet | Measure flow rate from transfer pump | -Datalog flow rate and volume transferred by pump P-101 |
| TT-101 | Lead carbon vessel inlet manifold | Measure influent vapor temperature | -Create datalog of temperature information |
| TT-102 | Lag carbon vessel manifold | Measure lag carbon effluent temperature | -Create datalog of temperature information |
| TT-103 | Blower outlet | B-101/B-102 combined vapor effluent temperature | -Turn off blowers B-101/B-102 if temperature exceeds operator high set point, display alarm on HMI screen, activate manual reset button, send remote alarm notification, and create an event log. |
| TT-104 | Blower skid | Ambient temperature transmitter | -If room temperature exceeds high temperature set point, display alarm on HMI screen, send remote warning notification, and create an event log |
| | | | -If room temperature is below low temperature set point, display warning on HMI screen, activate manual reset button, send remote warning notification, and create an event log |
| | | | -If room temperature exceeds operator exhaust fan temperature set point, turn exhaust fan EF-101 On |
| | | | -If room temperature is below operator exhaust fan temperature set point, turn exhaust fan EF-101 Off |
| VIT-101 | | | -If the pre-carbon vacuum is below the operator low vacuum set point, display a warning message on the HMI screen, send a remote warning notification, and create an event log. |
| VIT-102 | | | -If the post-carbon vacuum is above the operator high vacuum set point, turn blowers B-101/B-102 Off, display alarm message on HMI screen, activate manual reset button, send a remote alarm notification, and create an event log. |
| TT-102 - TT-101 | Carbon vessel manifold | Carbon differential temperature | -If TT-102 minus TT-101 exceeds the operator high differential temperature set point, turn blowers B-101/B-102 Off, display alarm message on HMI Screen, activate manual reset button, send a remote alarm notification, and create an event log. |
| **Analog Outputs to:** | | | |
| B-101 VFD Speed | Control panel | Blower speed control | -Run the blower at the operator set point |
| B-102 VFD Speed | Control panel | Blower speed control | -Run the blower at the operator set point |

**FIGURES**

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Figure 1

# Building Layout and Subslab Port Plan

SSDS Operations & Maintenance Manual

Former Building 982 - Neptune Road
Poughkeepsie, New York

Drawn By: E. Wright
Designed By: T. White
Reviewed By: B. Green/ D. Shea
Project No: 3623.00
Date: September 2014

## Figure Narrative

This figure shows the layout of former building 982 with the floor plan for the property owner's redevelopment of the building. In addition, subslab port locations used as part of monitoring activities are depicted.

## Notes

1. The subslab port locations were surveyed by Berger Engineering and Land Surveying, PLLC.

2. Proposed building layout details were provided by the site owner (Neptune Capital Investors, LLC).

## Legend

- EP-05 — Extraction port location
- SP-05 — Suction pit port location
- EP-03 — Extraction port not in use
- SSV-1001 — Subslab monitoring location
- SSV-1028 — Subslab monitoring location destroyed/inaccessible

N W E S

10' 5' 0 10' 20' Feet

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Figure 2

# Applied Vacuum and Subslab Pressure Response

SSDS Operations & Maintenance Manual

Former Building 982 - Neptune Road
Poughkeepsie, New York

Drawn By: E. Wright
Designed By: B. Green/ D. Shea
Reviewed By: D. Shea
Project No: 3623.00
Date: September 2014

## Figure Narrative

This figure shows the vacuums (in.wc) applied by the subslab depressurization system (SSDS) at suction pit and extraction ports and the resultant pressure response beneath the slab on the date indicated. Subslab pressure was measured using a digital manometer referenced to indoor air. Negative values indicate subslab pressure less than indoor pressure.

## Legend

- EP-05 / SP-01 — Extraction port/Suction pit connected to SSDS vacuum piping
- EP-03 — Extraction port not in use
- SSV-1001 — Subslab monitoring location
- SSV-1028 — Subslab monitoring location destroyed/inaccessible
- -0.28 — Differential pressure (in.wc) recorded on July 23, 2014 with blower B-101 operating at 45 Hz.
- Subslab suction pit with associated vacuum pipe trench
- SP-06 / -46 — Location name / Applied vacuums (in.wc)

N W E S

10' 5' 0 10' 20' Feet

SANBORN HEAD ENGINEERING

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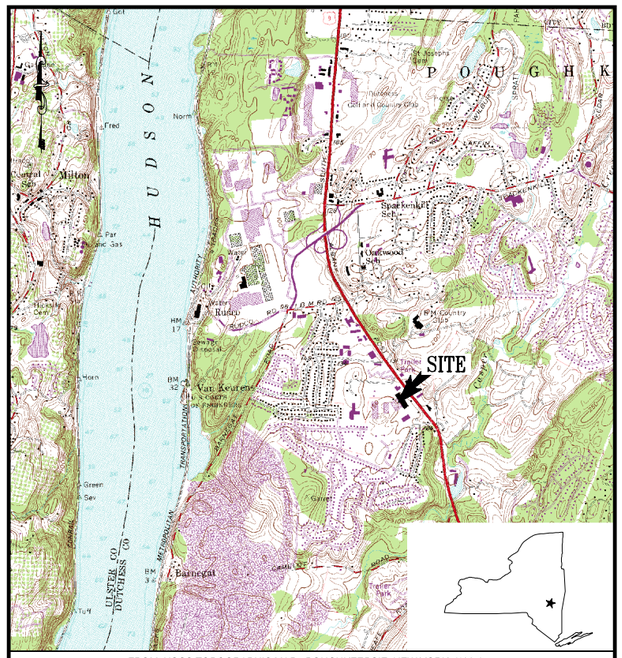
# Attachment 1

# As-Built Drawings

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# RECORD (AS-BUILT) DRAWINGS
# FORMER BUILDING 982
# SUBSLAB DEPRESSURIZATION SYSTEM

## POUGHKEEPSIE, NEW YORK
## SEPTEMBER 2014




FROM: USGS TOPOGRAPHIC MAP - POUGHKEEPSIE, NEW YORK, (1995)

**LOCUS PLAN**

SCALE: 1:24,000

## SHEET INDEX


| | |
|---|---|
| SHEET C-1 | VAPOR SUCTION PIT AND CONVEYANCE PIPE TRENCH LAYOUT |
| SHEET C-2 | VAPOR SUCTION PIT AND PIPE TRENCH SECTIONS |
| SHEET M-1 | PROCESS FLOW DIAGRAM |
| SHEET M-2 | OVERHEAD VACUUM HEADER PIPE LAYOUT |
| SHEET M-3 | VAPOR SUCTION PIT PORT RISER DETAILS |
| SHEET M-4 | SUBSLAB VAPOR EXTRACTION PORT RISER DETAILS |
| SHEET M-5 | EQUIPMENT LAYOUT |
| SHEET M-6 | MECHANICAL ELEVATIONS I |
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| SHEET E-4 | SSDS EQUIPMENT ROOM ELECTRICAL LAYOUT |
| SHEET IC-1 | PIPING AND INSTRUMENTATION DIAGRAM |
| SHEET IC-2 | INSTRUMENTATION LAYOUT |


***PREPARED FOR:***

IBM

POUGHKEEPSIE
POUGHKEEPSIE, NEW YORK

***PREPARED BY:***

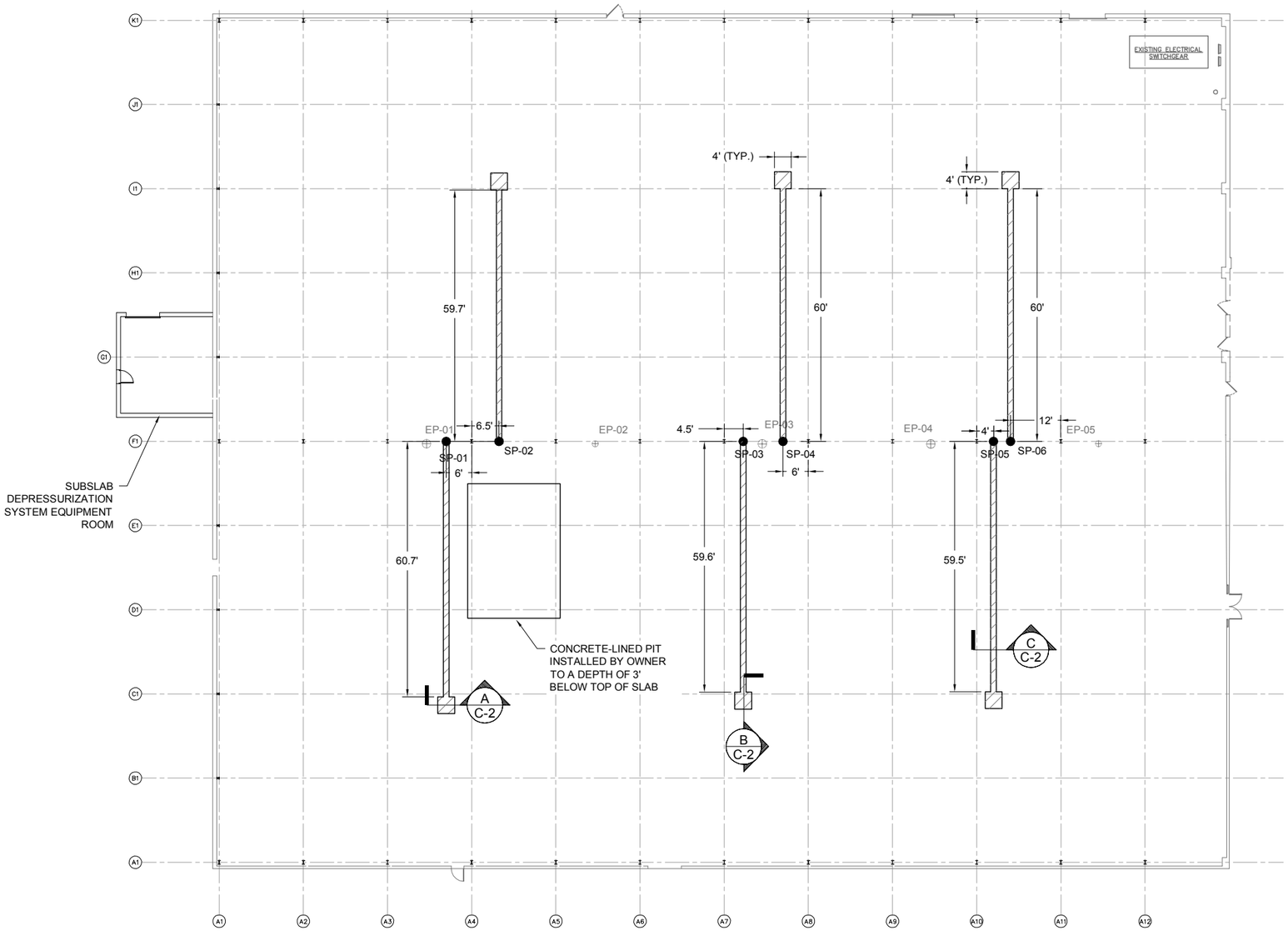
SANBORN HEAD ENGINEERING

20 FOUNDRY STREET, CONCORD, NEW HAMPSHIRE 03301
(603) 229-1900

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LEGEND:

- 4'x4' SUBSLAB VAPOR SUCTION PIT WITH CONVEYANCE PIPE TRENCH
- EP-01 ⊕ SUBSLAB EXTRACTION PORT CONNECTED TO VACUUM HEADER PIPE
- SP-01 ● SUCTION PIT RISER CONNECTED TO VACUUM HEADER PIPE




SANBORN HEAD ENGINEERING

GRAPHICAL SCALE
15' 8' 0' 15' 30'

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 9/2014 | RECORD (AS-BUILT) DRAWING SET | SHPC |

DRAWN BY: R.HIRTLE
DESIGNED BY: S.SOOS
REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

SUBSLAB DEPRESSURIZATION SYSTEM
FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

VAPOR SUCTION PIT AND CONVEYANCE PIPE TRENCH LAYOUT

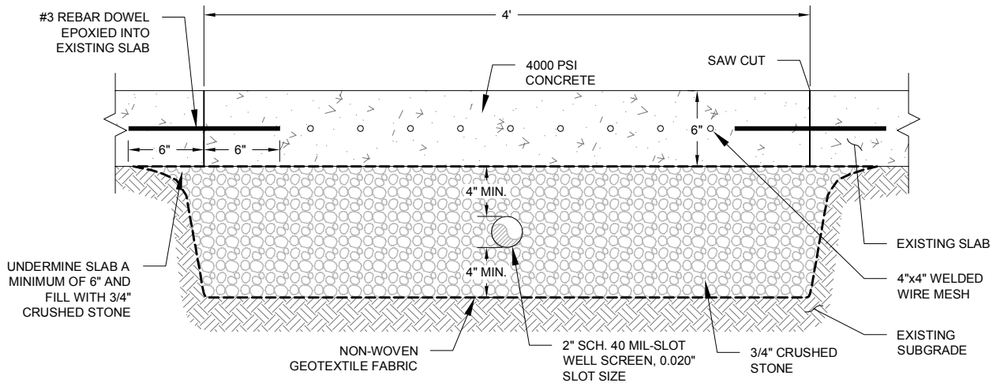
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SHEET NUMBER: C-1

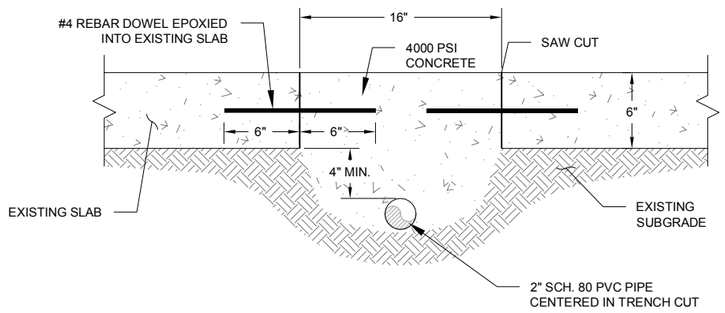
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NOTES:

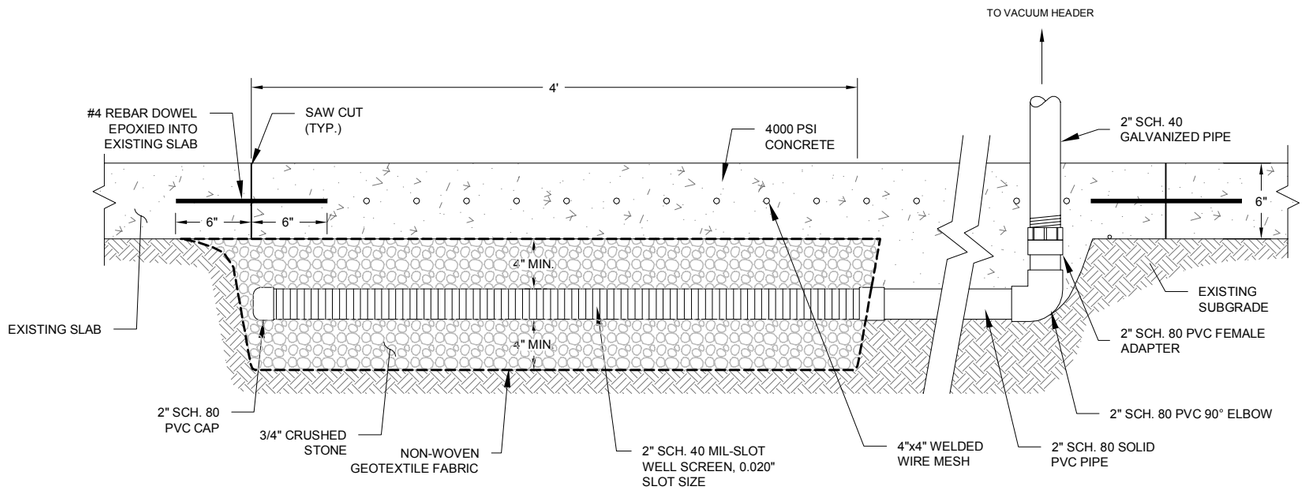
1. DOWEL SPACING IS NO GREATER THAN 18" ON CENTER ALONG ALL EDGES OF THE TRENCH AND SUMP OPENINGS.




A TYPICAL SUCTION PIT SECTION A




C TYPICAL CONVEYANCE PIPE TRENCH SECTION




B TYPICAL SUCTION PIT SECTION B

SANBORN HEAD ENGINEERING

NOT TO SCALE

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 9/2014 | RECORD (AS-BUILT) DRAWING SET | SHPC |

DRAWN BY: R.HIRTLE
DESIGNED BY: S.SOOS
REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

SUBSLAB DEPRESSURIZATION SYSTEM
FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

PROJECT NUMBER: 3623.00

VAPOR SUCTION PIT AND CONVEYANCE PIPE TRENCH SECTIONS

SHEET NUMBER: C-2

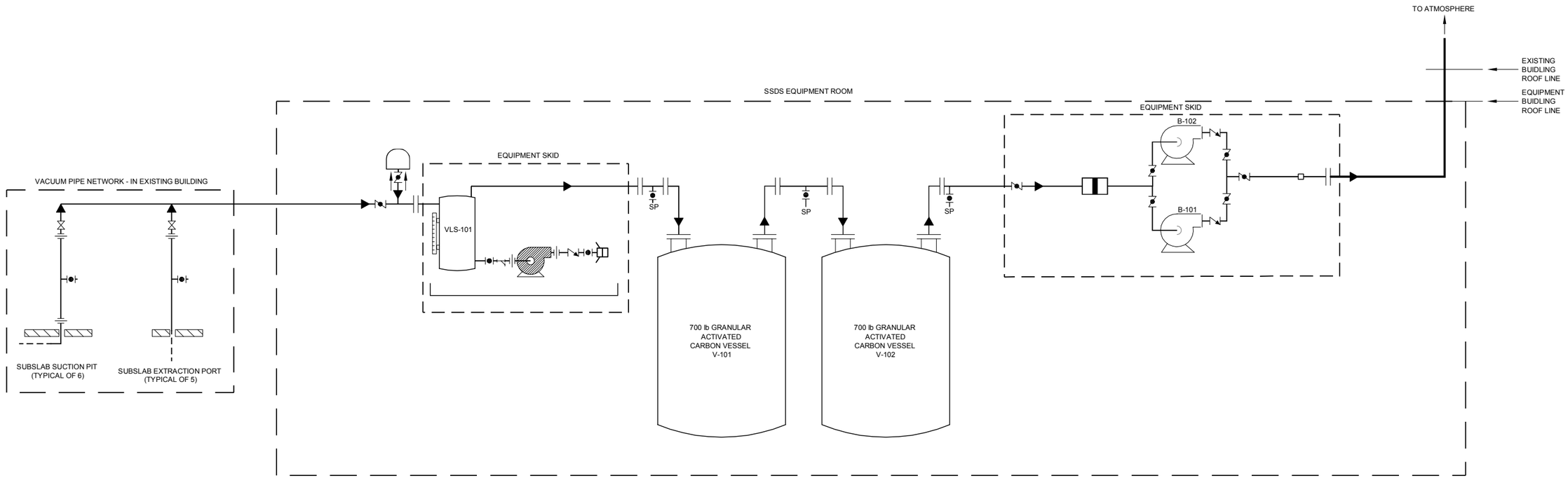
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NOTES:

1. THIS DRAWING IS FOR GENERAL INFORMATION ONLY. REFER TO OTHER DRAWINGS FOR ALL REQUIRED COMPONENTS.
2. REFER TO THE PIPING AND INSTRUMENTATION DIAGRAMS FOR ADDITIONAL DETAILS.

LEGEND:

- BALL VALVE
- CHECK VALVE OR DAMPER
- GATE VALVE
- VACUUM RELIEF VALVE
- Y-STRAINER
- BUTTERFLY VALVE
- UNION
- SP — SAMPLE PORT
- FLANGE
- CAM LOCK QUICK CONNECT
- RIGID CONVEYANCE PIPE
- RIGID CONVEYANCE PIPE WITH INSULATION AND INSULATION JACKET
- SECONDARY CONTAINMENT
- REGENERATIVE BLOWER (B-101)
- CENTRIFUGAL PUMP (P-101)
- IN-LINE PARTICULATE FILTER
- AIR INLET FILTER
- VLS — VAPOR LIQUID SEPARATOR




SANBORN HEAD ENGINEERING

NOT TO SCALE

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 9/2014 | RECORD (AS-BUILT) DRAWING SET | SHPC |

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DESIGNED BY: S.SOOS
REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

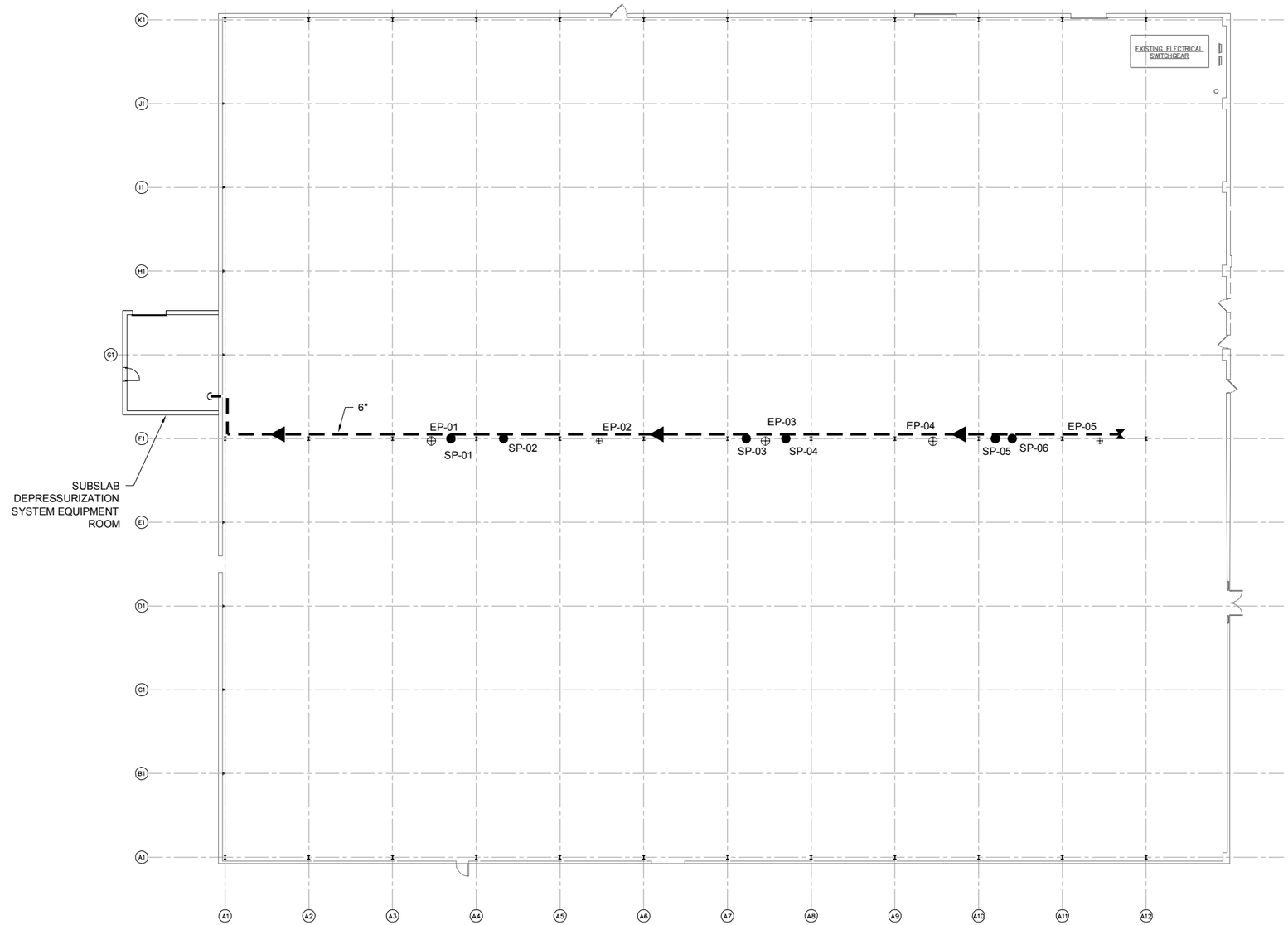
SUBSLAB DEPRESSURIZATION SYSTEM
# FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

PROJECT NUMBER: 3623.00

## PROCESS FLOW DIAGRAM

SHEET NUMBER: M-1

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LEGEND:

- SPENCER TUBING CAP
- NEW SPENCER TUBING VACUUM HEADER PIPE WITH NOMINAL SIZE AND FLOW DIRECTION
- EP-01 ⊕ SUBSLAB EXTRACTION PORT CONNECTED TO VACUUM HEADER PIPE
- SP-01 ● SUCTION PIT RISER CONNECTED TO VACUUM HEADER PIPE
- GATE VALVE

SANBORN HEAD ENGINEERING

GRAPHICAL SCALE
15' 8' 0' 15' 30'

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|---|---|---|---|
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SUBSLAB DEPRESSURIZATION SYSTEM
# FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

## OVERHEAD VACUUM HEADER PIPE LAYOUT

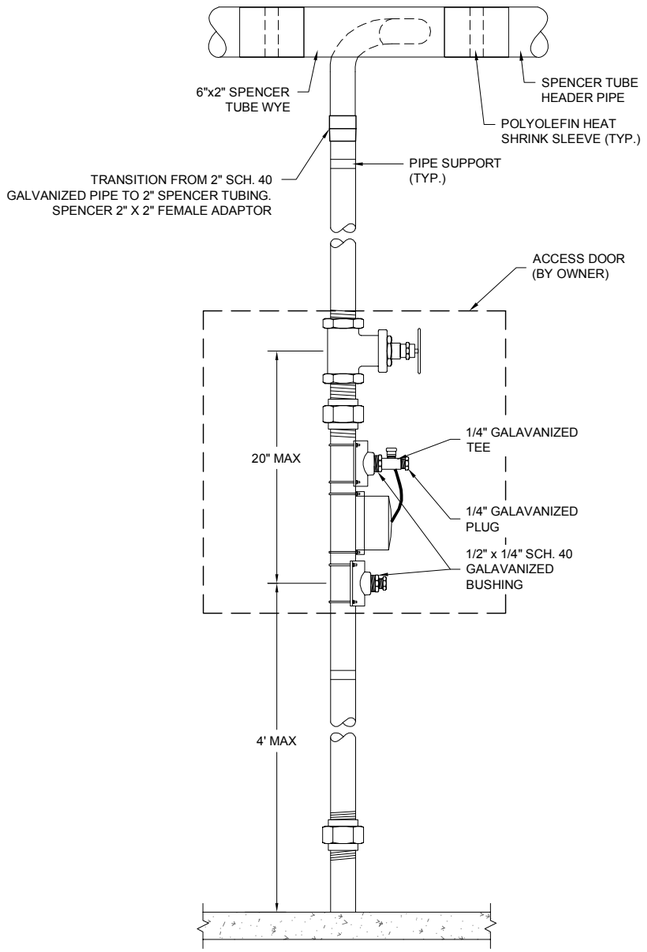
PROJECT NUMBER: 3623.00

SHEET NUMBER: M-2

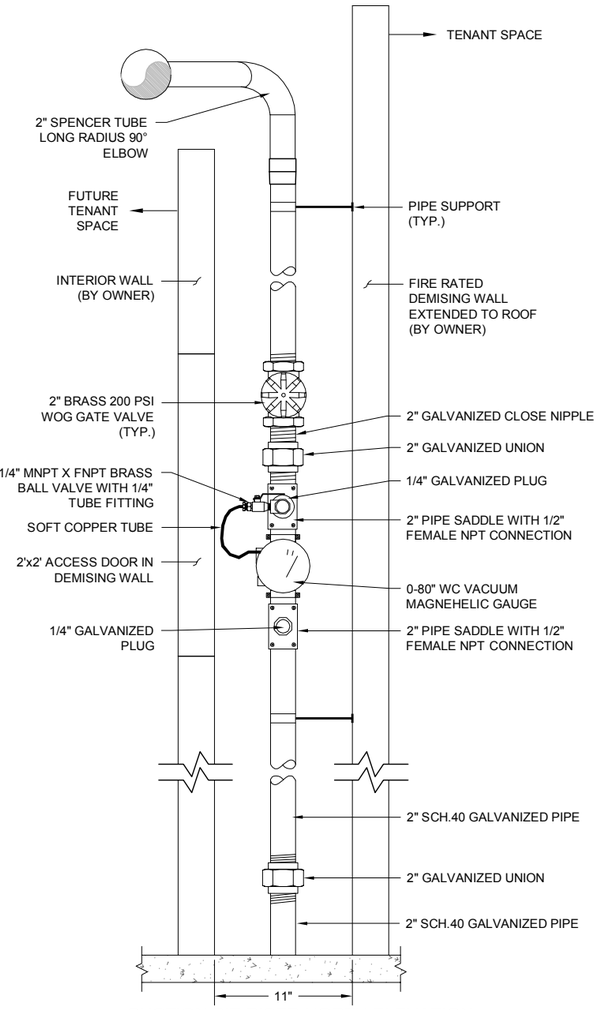
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NOTES:

1. VACUUM MAGNEHELIC GAUGES ARE DWYER INSTRUMENTS MODEL #2080, AND INCLUDE A-610 PIPE MOUNT KIT, A-310A VENT VALVE ON VACUUM SIDE, AND PRESSURE GAUGE SNUBBER WITH 0.5 MICRON FILTERING DISC ON HIGH PRESSURE PORT.
2. SPENCER TUBING AND FITTINGS ARE JOINED WITH POLYOLEFIN SHRINK SLEEVES.
3. THREADED JOINTS ARE MADE WITH TEFLON THREAD SEALANT TAPE THAT IS VACUUM AND/OR PRESSURE TIGHT.




A SUCTION PIT RISER EAST ELEVATION




B SUCTION PIT RISER NORTH ELEVATION

SANBORN HEAD ENGINEERING

NOT TO SCALE

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
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PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

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FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

VAPOR SUCTION PIT RISER DETAILS

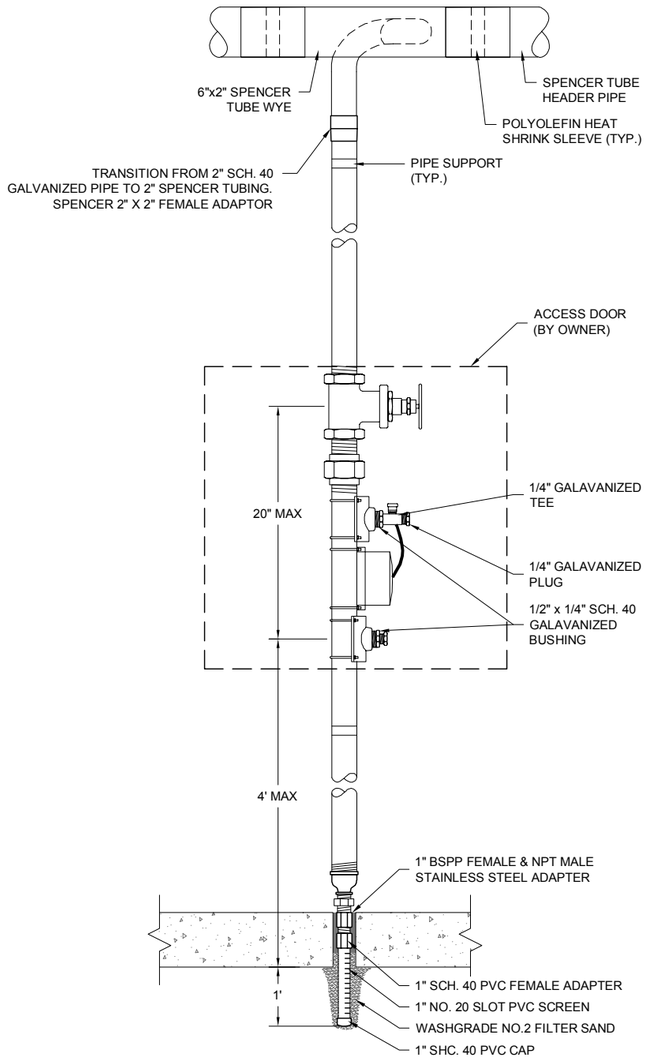
PROJECT NUMBER: 3623.00

SHEET NUMBER: M-3

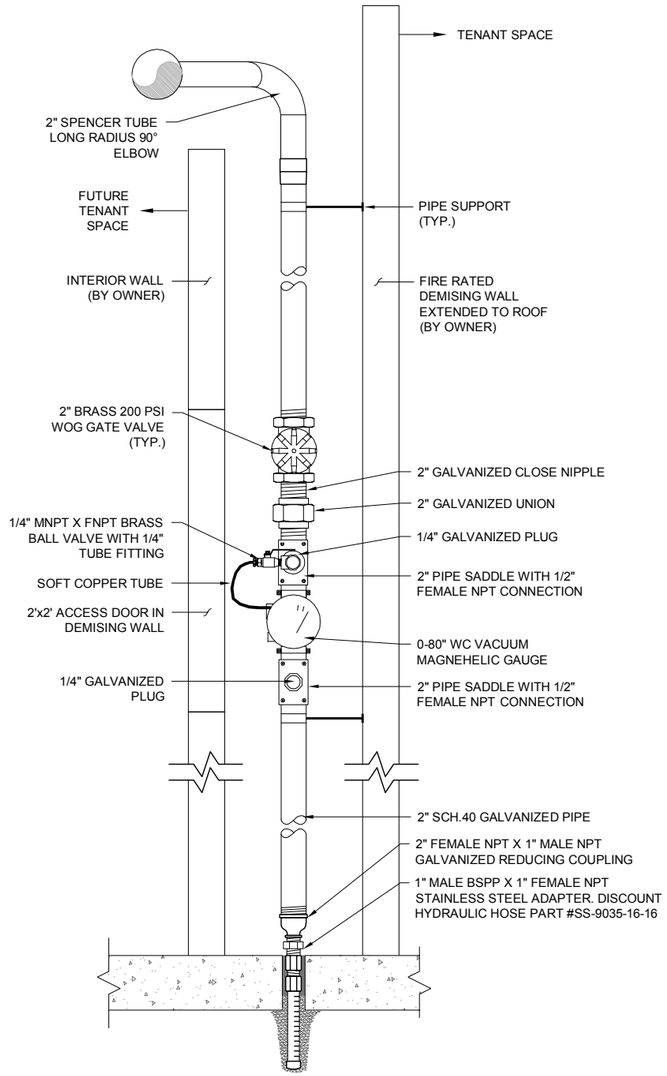
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NOTES:

1. VACUUM MAGNEHELIC GAUGES ARE DWYER INSTRUMENTS MODEL #2080, AND INCLUDE A-610 PIPE MOUNT KIT, A-310A VENT VALVE ON VACUUM SIDE, AND PRESSURE GAUGE SNUBBER WITH 0.5 MICRON FILTERING DISC ON HIGH PRESSURE PORT.
2. SPENCER TUBING AND FITTINGS ARE JOINED WITH POLYOLEFIN SHRINK SLEEVES.
3. THREADED JOINTS ARE MADE WITH TEFLON THREAD SEALANT TAPE THAT IS VACUUM AND/OR PRESSURE TIGHT.




A SUBSLAB EXTRACTION PORT RISER EAST ELEVATION




B SUBSLAB EXTRACTION PORT RISER NORTH ELEVATION

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NOT TO SCALE

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|---|---|---|---|
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PIC: D.SHEA
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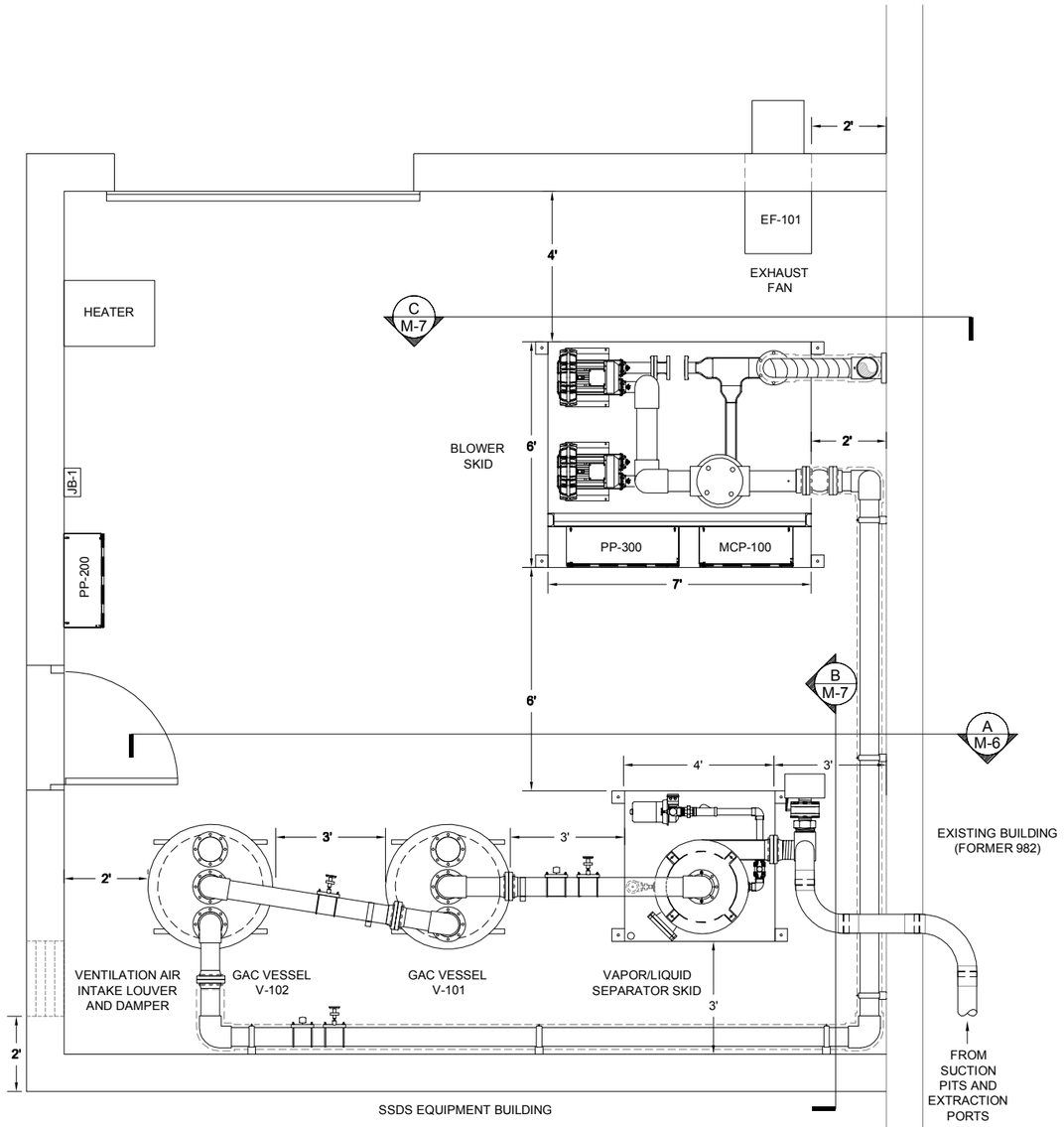
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PROJECT NUMBER: 3623.00

SUBSLAB VAPOR EXTRACTION PORT RISER DETAILS

SHEET NUMBER: M-4

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NOTES:

1. SPENCER TUBE JOINTS UNDER VACUUM ARE CONSTRUCTED USING POLYOLEFIN SHRINK SLEEVES MANUFACTURED BY SPENCER.
2. THE UTILITY HEATER IS McMASTER CARR MODEL #2022K4 MOUNTED APPROXIMATELY 10 FEET ABOVE THE SLAB. A THERMOSTAT IS MOUNTED TO THE ADJACENT WALL

SANBORN HEAD ENGINEERING

GRAPHICAL SCALE
2' 1' 0' 2' 4'

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 9/2014 | RECORD (AS-BUILT) DRAWING SET | SHPC |

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PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

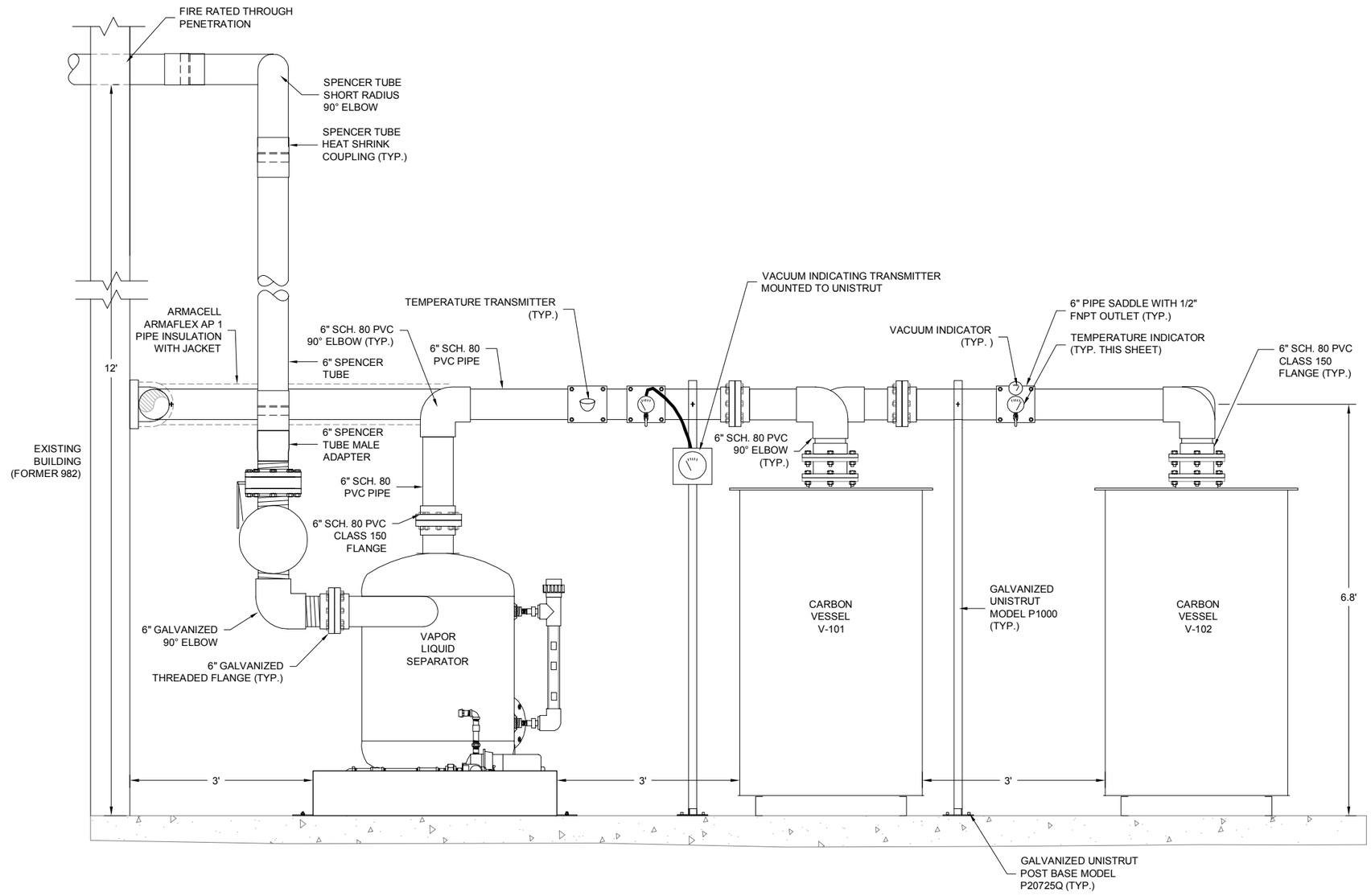
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EQUIPMENT LAYOUT

PROJECT NUMBER: 3623.00

SHEET NUMBER: M-5

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A SECTION A

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NOT TO SCALE

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REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

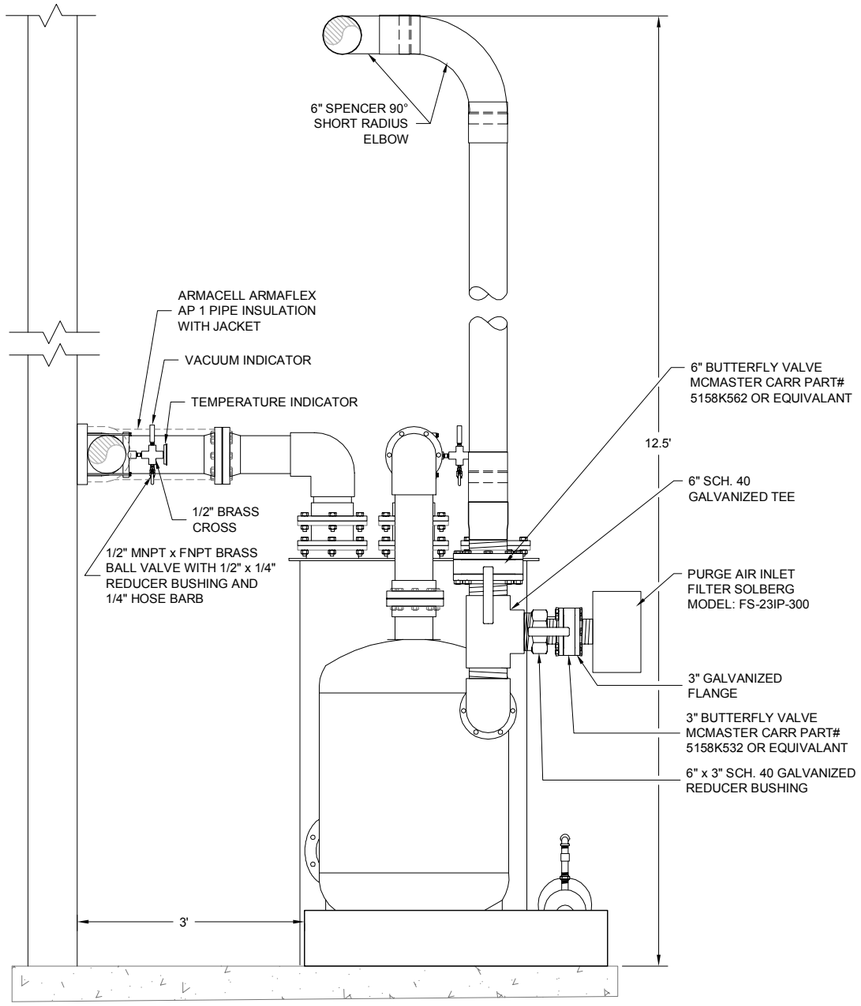
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MECHANICAL ELEVATIONS I

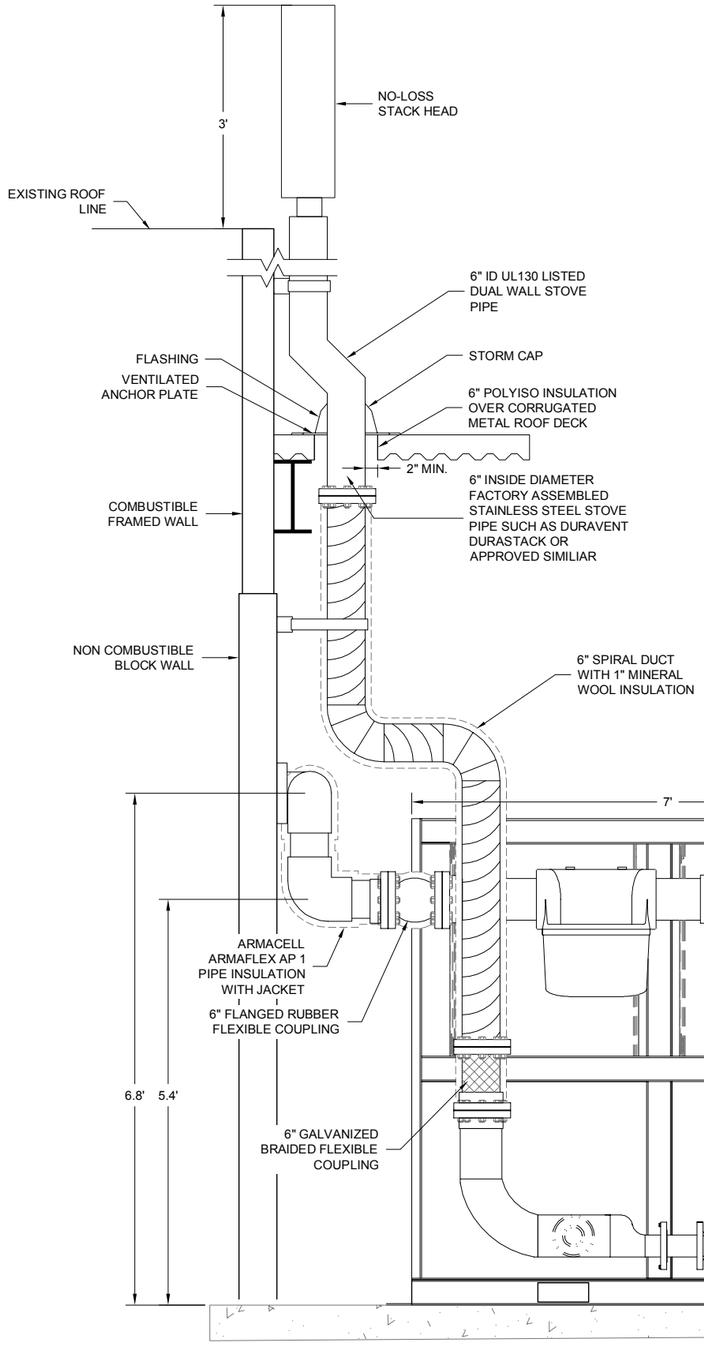
PROJECT NUMBER: 3623.00

SHEET NUMBER: M-6

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B SECTION B




C SECTION C

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|---|---|---|---|
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REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

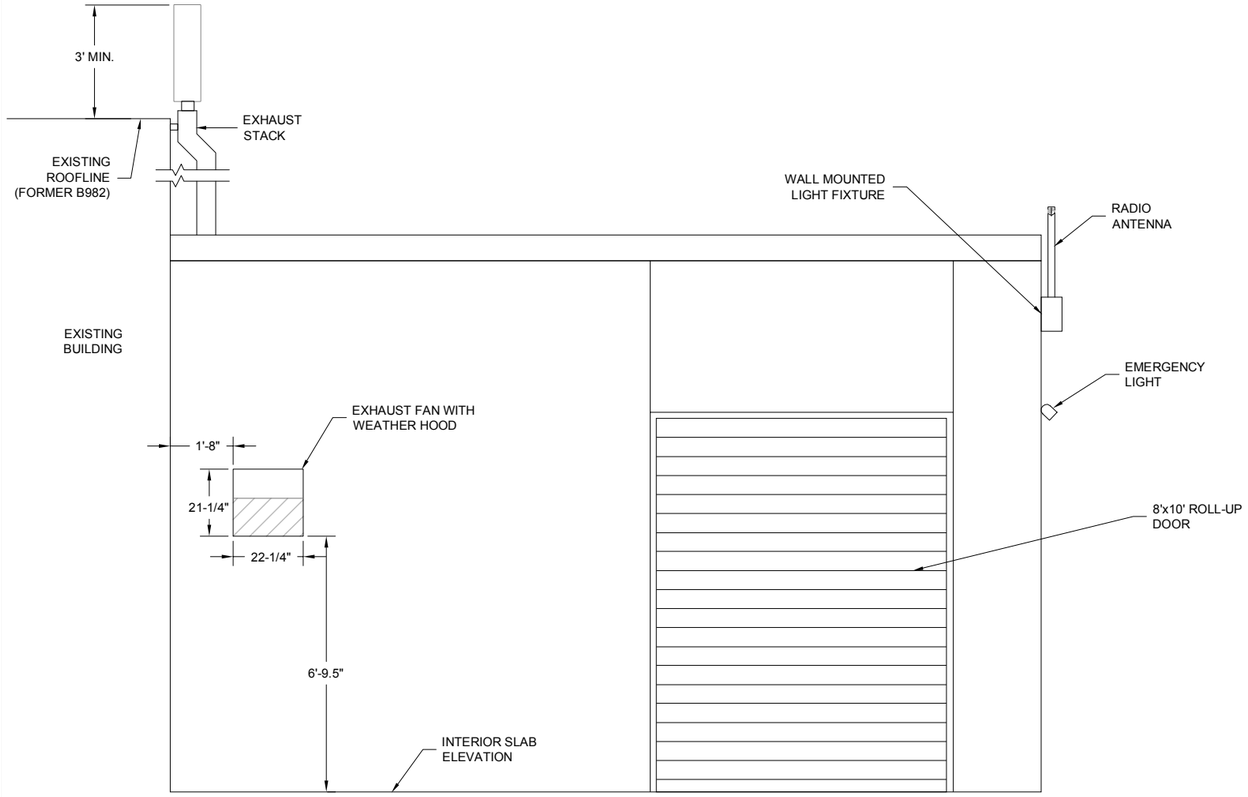
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FORMER BUILDING 982
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MECHANICAL ELEVATIONS II

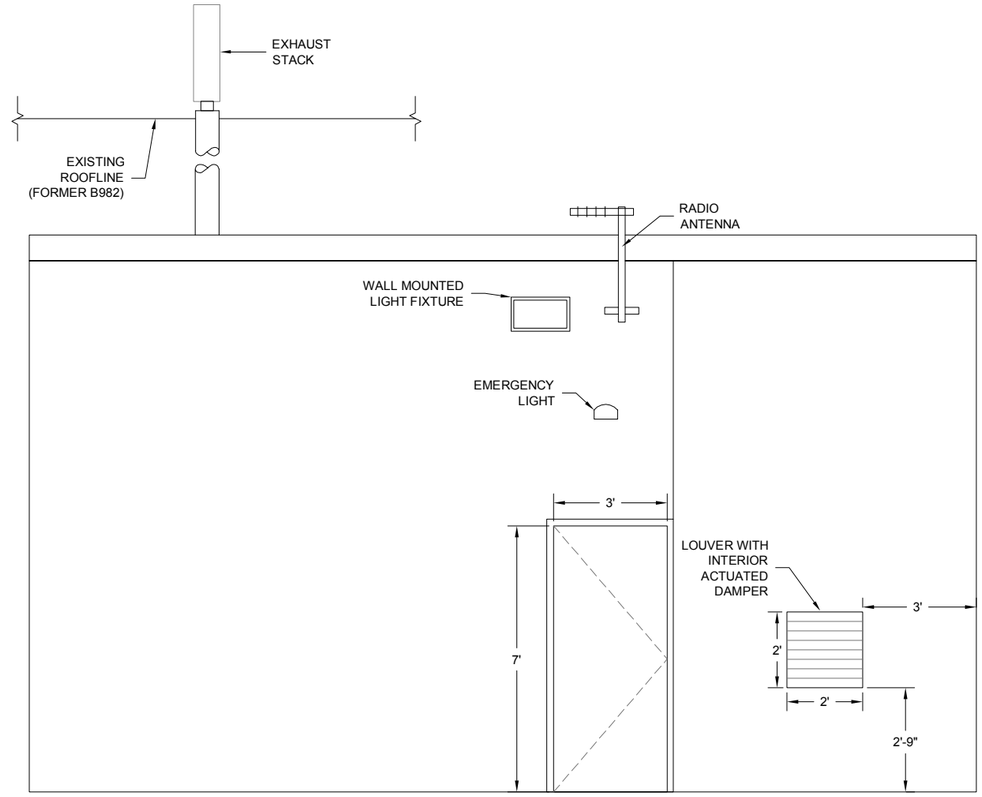
PROJECT NUMBER: 3623.00

SHEET NUMBER: M-7

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A EAST ELEVATION




B NORTH ELEVATION

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GRAPHICAL SCALE
2' 1' 0' 2' 4'

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|---|---|---|---|
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REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

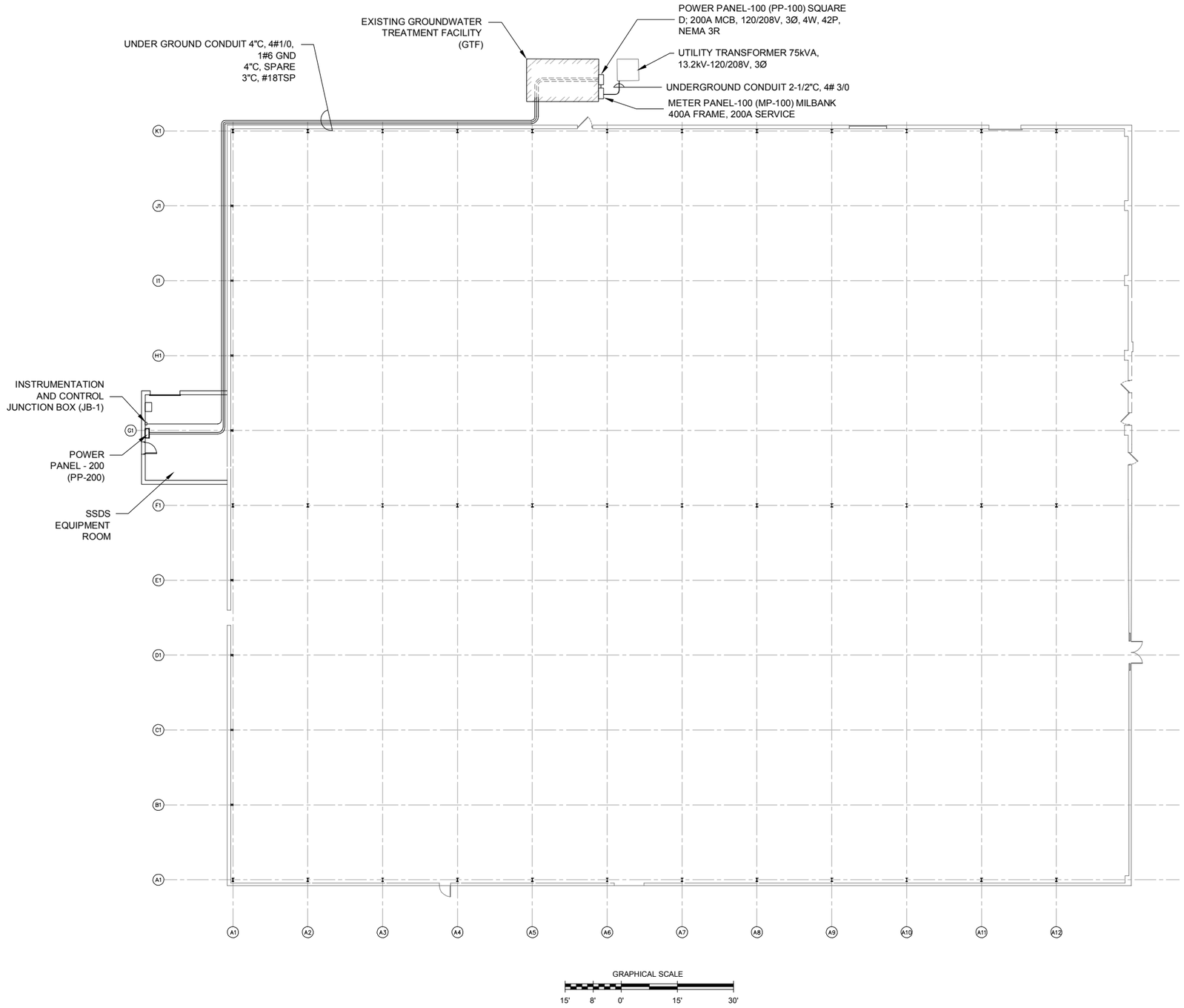
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# FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

## SSDS BUILDING ELEVATIONS

PROJECT NUMBER: 3623.00

SHEET NUMBER: M-8

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## ABBREVIATIONS

| | |
|---|---|
| ø | PHASE |
| 3P | 3 POLE |
| A | AMPERE |
| C | CONDUIT |
| GND | GROUND |
| MCB | MAIN CIRCUIT BREAKER |
| MP | METER PANEL |
| P | POLE |
| PP | POWER PANEL |
| TSP | TWISTED SHIELDED PAIR |
| V | VOLTS |
| W | WIRE |

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DESIGNED BY: K.SULLIVAN
REVIEWED BY: K.SULLIVAN
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

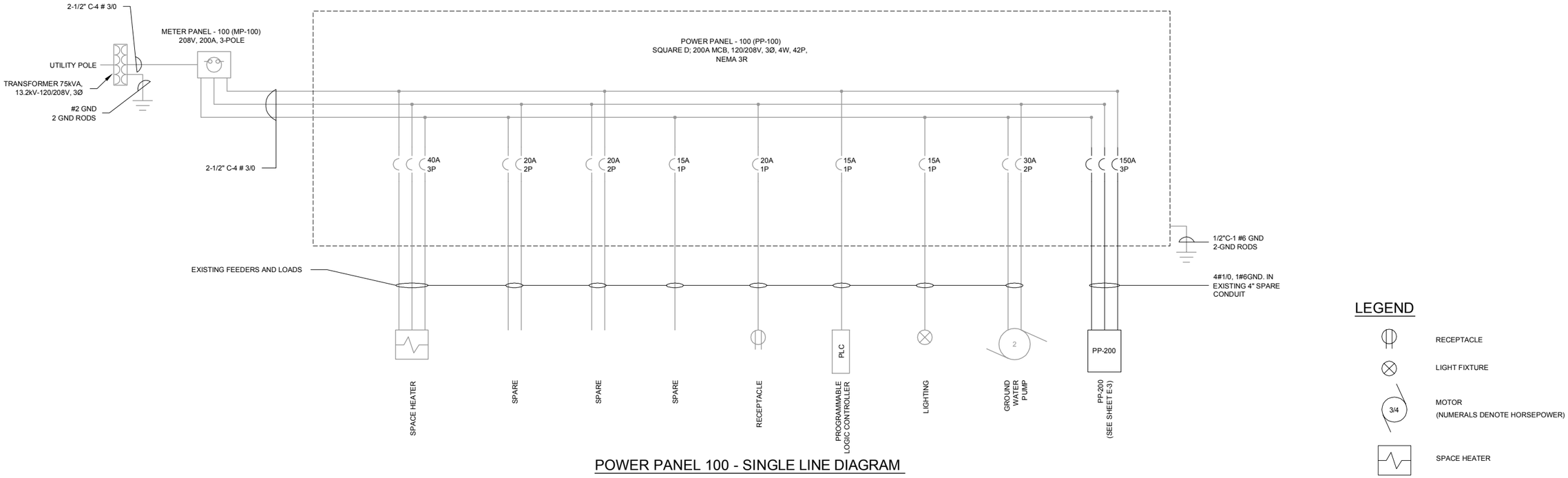
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# FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

PROJECT NUMBER: 3623.00

## ELECTRICAL LAYOUT

SHEET NUMBER: E-1

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## POWER PANEL 100 - SINGLE LINE DIAGRAM

## LEGEND

- RECEPTACLE
- LIGHT FIXTURE
- MOTOR (NUMERALS DENOTE HORSEPOWER) — 3/4
- SPACE HEATER

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DESIGNED BY: K.SULLIVAN
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PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

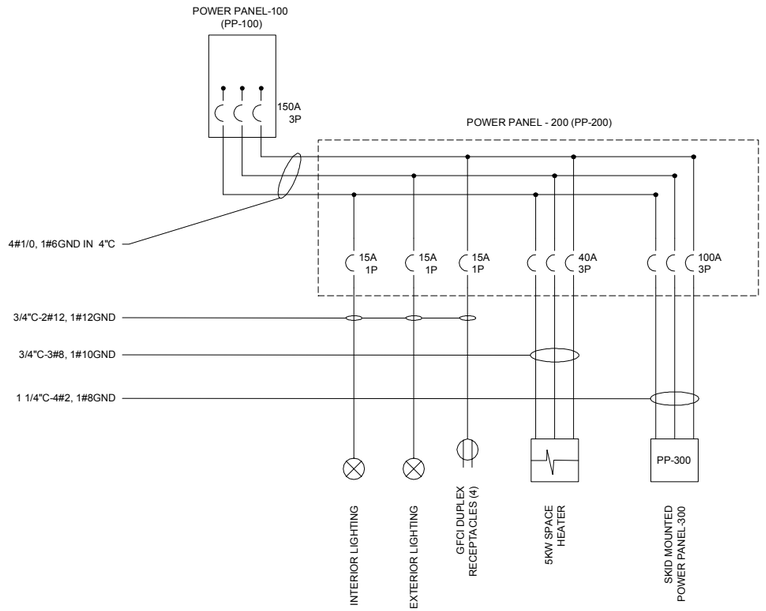
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FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

PROJECT NUMBER: 3623.00

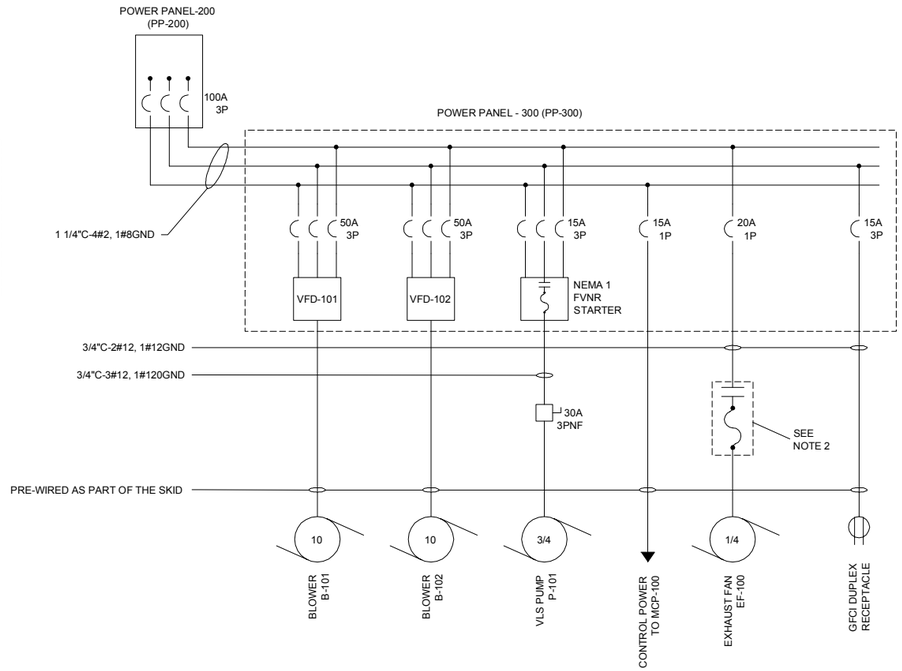
POWER PANEL 100
ELECTRICAL LINE DIAGRAM

SHEET NUMBER: E-2

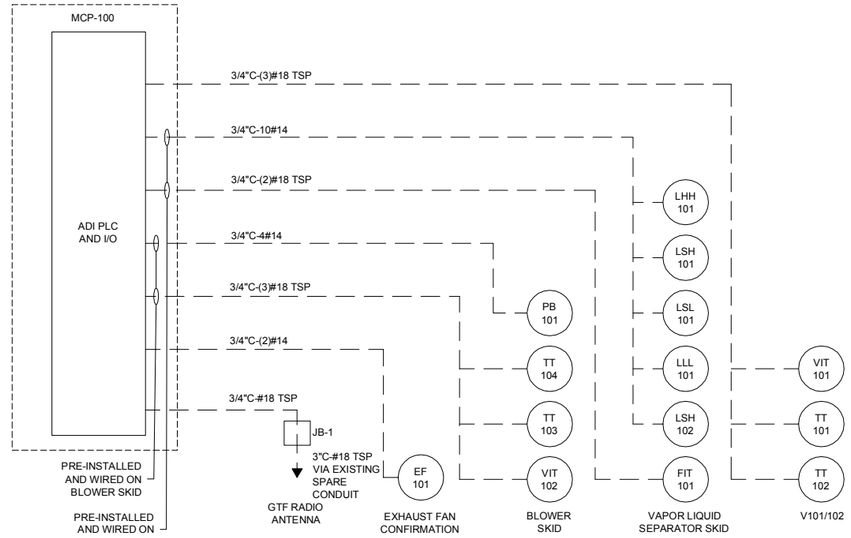
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## POWER PANEL-200 SINGLE LINE DIAGRAM

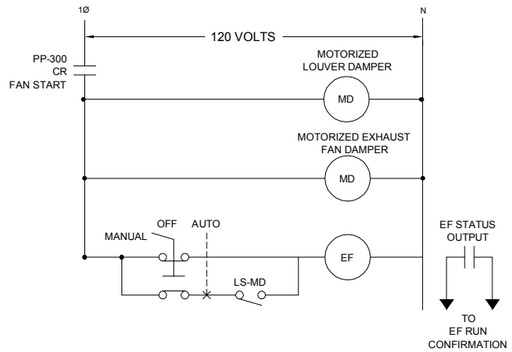



## POWER PANEL-300 SINGLE LINE DIAGRAM




## INSTRUMENTATION & CONTROL WIRING DIAGRAM

(SEE DRAWING IC-2 FOR DEVICE LOCATIONS)




## EXHAUST FAN WIRING DIAGRAM

## LEGEND

| | |
|---|---|
| MCP | MAIN CONTROL PANEL |
| PP | POWER PANEL |
| VFD | VARIABLE FREQUENCY DRIVE |
| 30A NF | DISCONNECT - SUBSCRIPT DENOTES AMPERAGE - "NF" NON-FUSED SWITCH RATING |
| | MOTOR START SIZED AS INDICATED |
| FIT | FLOW INDICATOR/TRANSMITTER |
| PB | PUSH BUTTON |
| PS | PRESSURE SWITCH |
| VIT | VACUUM INDICATING TRANSMITTER |
| TT | TEMPERATURE TRANSMITTER |
| LSL | LEVEL SWITCH LOW |
| LSH | LEVEL SWITCH HIGH |
| LHH | LEVEL HIGH HIGH |
| LLL | LEVEL LOW LOW |
| VFD | VARIABLE FREQUENCY DRIVE |
| | DUPLEX CONVENIENCE RECEPTACLE, GFCI |
| 3/4 | MOTOR (NUMERALS DENOTE HORSEPOWER) |
| | SIGNAL/CONTROL WIRING |
| | AC LINE VOLTAGE |
| | WIRING HOME RUN |

## ABBREVIATIONS

| | |
|---|---|
| A | AMPERE |
| C | CONDUIT |
| GND | GROUND |
| 3P | 3 POLE |
| TSP | TWISTED SHIELDED PAIR |

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REVIEWED BY: K.SULLIVAN
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

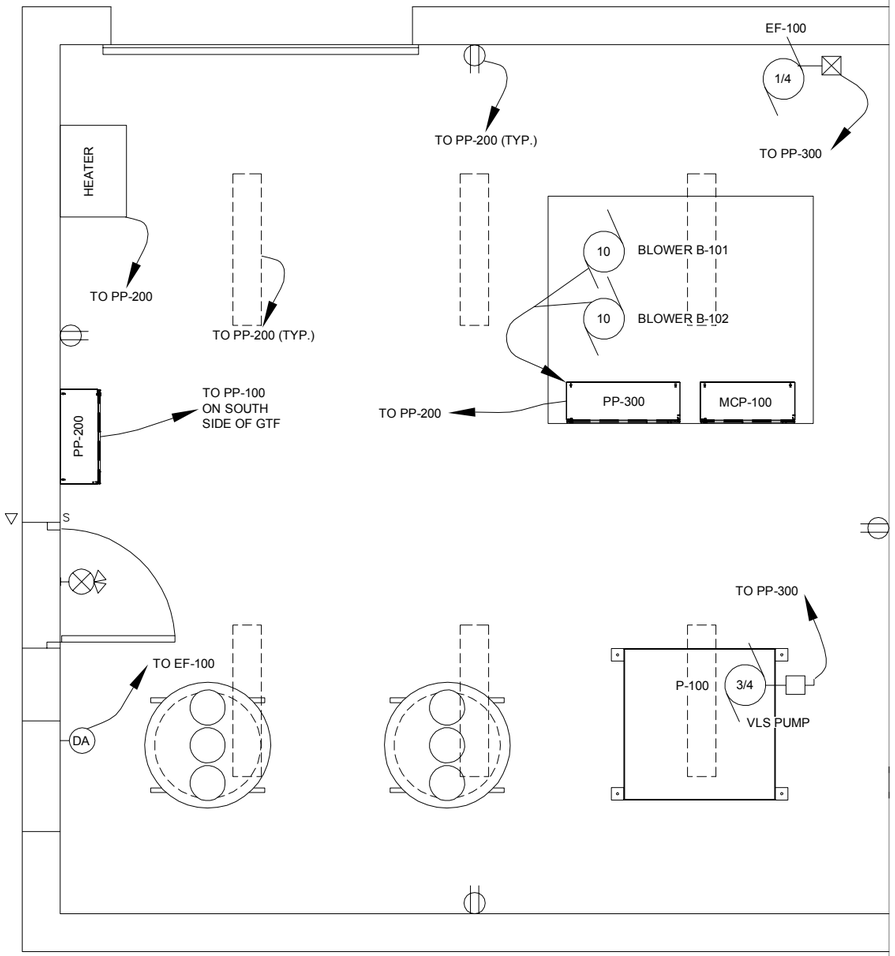
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FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

PROJECT NUMBER: 3623.00

ELECTRICAL LINE DIAGRAMS AND WIRING SCHEMATIC

SHEET NUMBER: E-3

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## LEGEND

| | |
|---|---|
| S | SINGLE-POLE TOGGLE SWITCH, 20A, 125V. MOUNTED 48" AFF. |
| 30A NF | DISCONNECT - SUBSCRIPT DENOTES AMPERAGE - 'NF' NON-FUSED SWITCH RATING |
| | PENDANT MOUNTED FLUORESCENT LIGHT FIXTURE AND OUTLET BOX. DAYBRITE #V2PB232-120-1/2-EB MOUNTED 12'-0" AFF. |
| | WALL MOUNTED EXIT SIGN EMERGENCY BATTERY UNIT COMBINATION. PHILLIPS #CCTXLR-1RW-H. |
| | WALL MOUNTED WEATHERPROOF REMOTE EMERGENCY HEAD. PHILLIPS #CCRHP. |
| | WIRING HOME RUN |
| | DUPLEX CONVENIENCE RECEPTACLE, GFCI |
| DA | DAMPER ACTUATOR |

GRAPHICAL SCALE

2' 1' 0' 2' 4'

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PIC: D.SHEA
DATE: SEPTEMBER 2014

SUBSLAB DEPRESSURIZATION SYSTEM
FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

SSDS EQUIPMENT ROOM
ELECTRICAL LAYOUT

PROJECT NUMBER: 3623.00

SHEET NUMBER: E-4

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LEGEND:

- RIGID CONVEYANCE PIPE
- EFFLUENT STACK (ES-101)
- RIGID CONVEYANCE PIPE WITH INSULATION AND JACKET
- FLOW DIRECTION
- BALL VALVE
- GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- VACUUM RELIEF VALVE
- FLANGE
- UNION
- Y-STRAINER
- SP — SAMPLE PORT
- ELECTRIC ACTUATOR
- CAM LOCK

- VT — VACUUM INDICATING TRANSMITTER
- VI — VACUUM INDICATOR
- TT — TEMPERATURE TRANSMITTER
- TI — TEMPERATURE INDICATOR
- FI — FLOW INDICATOR
- FIT — FLOW INDICATING TOTALIZER
- LHH — HIGH HIGH LEVEL SWITCH
- LSH — HIGH LEVEL SWITCH
- LSL — LOW LEVEL SWITCH
- LLL — LOW LOW LEVEL SWITCH

- DPI — DIFFERENTIAL PRESSURE INDICATOR
- PI — PRESSURE INDICATOR
- PB — PUSH BUTTON
- BINARY SIGNAL INPUT TO PLC
- BINARY SIGNAL OUTPUT FROM PLC
- ANALOG OR PULSE SIGNAL INPUT TO PLC
- ANALOG SIGNAL OUTPUT FROM PLC
- ETHERNET COMMUNICATION
- INTERNAL SYSTEM LINK
- ELECTRICAL POWER

- H O A — HAND - OFF - AUTO SELECTOR SWITCH
- R — STATUS LIGHT/ALARM (RED)
- VFD — VARIABLE FREQUENCY DRIVE
- H — HOUR METER
- MS — MOTOR STARTER
- CR — CONTROL RELAY
- DA — DAMPER ACTUATOR

- REGENERATIVE BLOWER (B-101)
- CENTRIFUGAL PUMP (P-101)
- EXHAUST FAN (EF-101)
- SECONDARY CONTAINMENT TRAY
- AIR INLET FILTER
- LOUVER WITH ACTUATED DAMPER

- CARBON VESSEL (V-101)
- VAPOR LIQUID SEPARATOR (VLS-101) WITH SIGHT GLASS
- TANK (T-101) WITH SIGHT GLASS
- IN-LINE PARTICULATE FILTER

| Extraction/ Suction Port | Vacuum Indicator |
|---|---|
| EP-01 | VI-1001 |
| SP-01 | VI-1002 |
| SP-02 | VI-1003 |
| EP-02 | VI-1004 |
| SP-03 | VI-1005 |
| EP-03 | VI-1006 |
| SP-04 | VI-1007 |
| EP-04 | VI-1008 |
| SP-05 | VI-1009 |
| SP-06 | VI-1010 |
| EP-05 | VI-1011 |

VACUUM PIPE NETWORK

VI-* (SEE TABLE)

SP

FLOOR SLAB

SUBSLAB SUCTION PIT (TYPICAL OF 6)

SUBSLAB EXTRACTION PORT (TYPICAL OF 5)

EQUIPMENT SKID

VI 101, LHH 101, LSH 101, LSL 101, LLL 101, VLS-101, P-101, PI 101, FIT 101, LSH 102, TI 101, TT 101, VIT 101, SP

700 lb GRANULAR ACTIVATED CARBON VESSEL V-101

700 lb GRANULAR ACTIVATED CARBON VESSEL V-102

VI 102, TI 102, SP

VI 103, TI 103, TT 102, SP

EQUIPMENT SKID

B-102, B-101, FI 101, DPI 101, VIT 102, TI 104, TT 103, TT-104, PB 101

TO ATMOSPHERE

EXISTING BUIDLING ROOF LINE

EFFLUENT STACK (ES-101)

EQUIPMENT BUILDING ROOF LINE

EF-101, MS, DA

R, R, R, RESET

EMERGENCY OFF ALARM

SYSTEM ALARM

SPARE ALARM

RESET

LHH-101 LEVEL HIGH HIGH

LSH-101 LEVEL SWITCH HIGH

LSL-101 LEVEL SWITCH LOW

LLL-101 LEVEL LOW LOW

MS

P-101 RUN/STOP

H O A

FIT-101 FLOW TRANSMITTER

P-101 SWITCH POSITION

LSH-102 LEVEL SWITCH HIGH

TT-101 TEMPERATURE TRANSMITTER

VIT-101 VACUUM TRANSMITTER

TT-102 TEMPERATURE TRANSMITTER

TT-104 ROOM TEMPERATURE TRANSMITTER

VIT-102 VACUUM TRANSMITTER

H, VFD

B-101 HOA NOT IN AUTO

B-101 VFD FAULT

B-101 SPEED CONTROL

B-101 RUN/STOP

B-102 HOA NOT IN AUTO

B-102 VFD FAULT

B-102 SPEED CONTROL

B-102 RUN/STOP

TT-103 TEMP TRANSMITTER

PB-101 EMERGENCY OFF - ALL MOTORS

CR

EF-101 RUN/STOP

EF-101 CONFIRMATION

EF-101 SWITCH POSITION

CONTROL PANEL DOOR

CONTROL PANEL INTERIOR

PLC

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 9/2014 | RECORD (AS-BUILT) DRAWING SET | SHPC |

SANBORN HEAD ENGINEERING

NOT TO SCALE

DRAWN BY: R.HIRTLE
DESIGNED BY: S.SOOS
REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

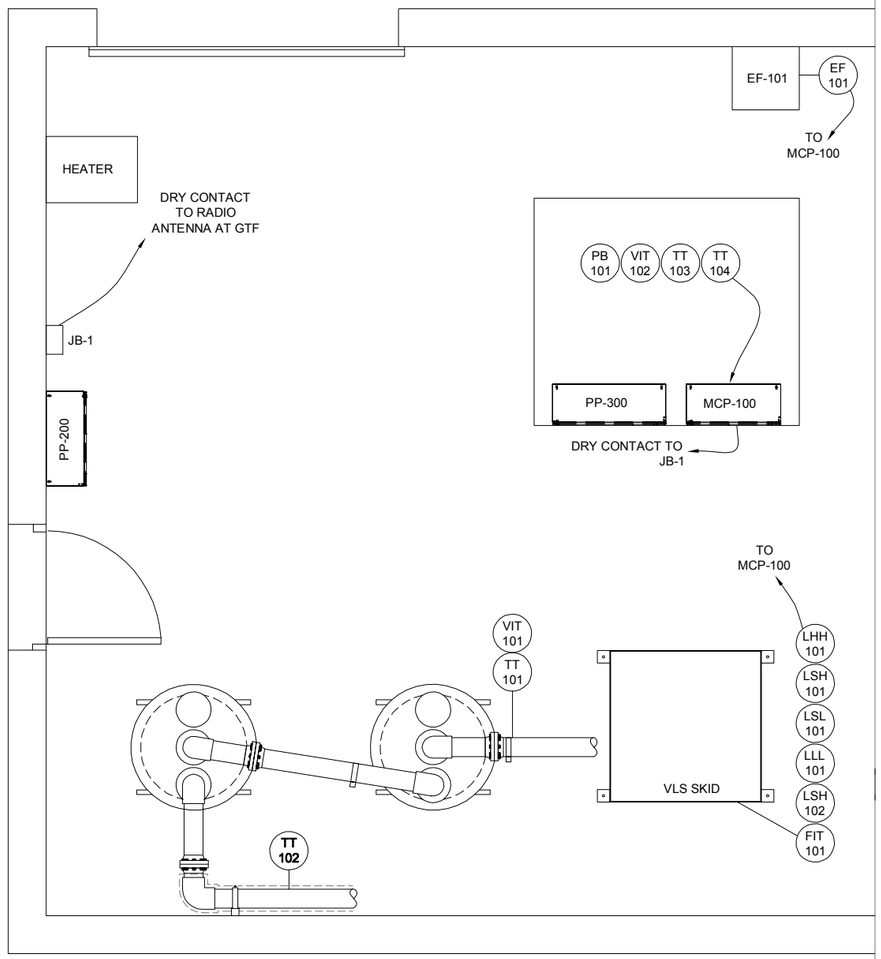
SUBSLAB DEPRESSURIZATION SYSTEM
# FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

PROJECT NUMBER: 3623.00

# PIPING AND INSTRUMENTATION DIAGRAM

SHEET NUMBER: IC-1

©2013 SANBORN, HEAD ENGINEERING, P.C.




GRAPHICAL SCALE

2' 1' 0' 2' 4'

SANBORN HEAD ENGINEERING

GRAPHICAL SCALE

2' 1' 0' 2' 4'

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 9/2014 | RECORD (AS-BUILT) DRAWING SET | SHPC |

DRAWN BY: R.HIRTLE
DESIGNED BY: S.SOOS
REVIEWED BY: D.SHEA
PROJECT MGR: S.SOOS
PIC: D.SHEA
DATE: SEPTEMBER 2014

SUBSLAB DEPRESSURIZATION SYSTEM
FORMER BUILDING 982
POUGHKEEPSIE, NEW YORK

INSTRUMENTATION LAYOUT

PROJECT NUMBER: 3623.00

SHEET NUMBER: IC-2

# Attachment 2

# SSDS Treatment System Photos

# APPENDIX B
# SSDS SYSTEM
# PHOTOGRAPHS

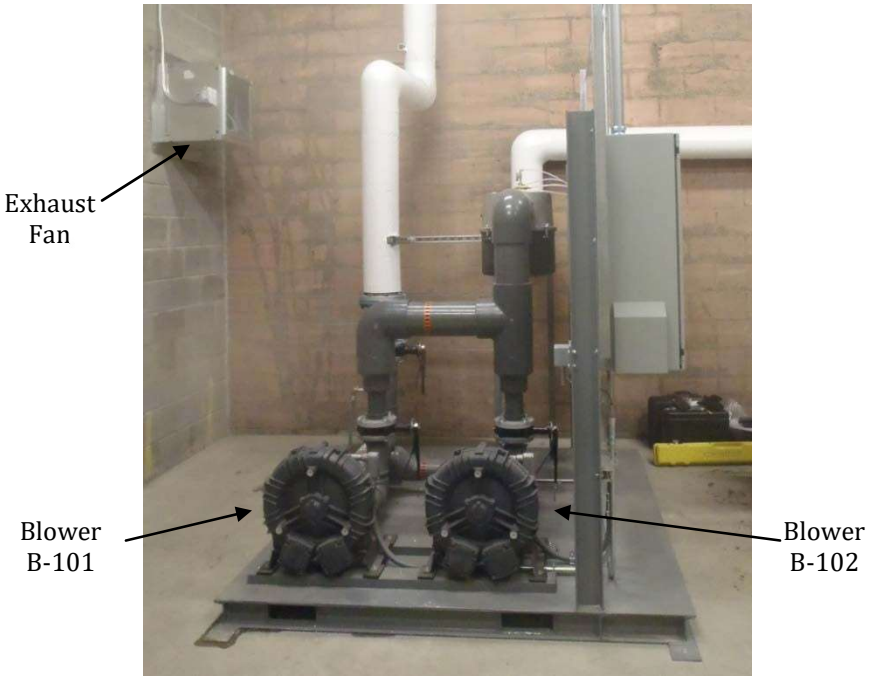



Photo 1: Blowers B-101 and B-102, and Exhaust Fan

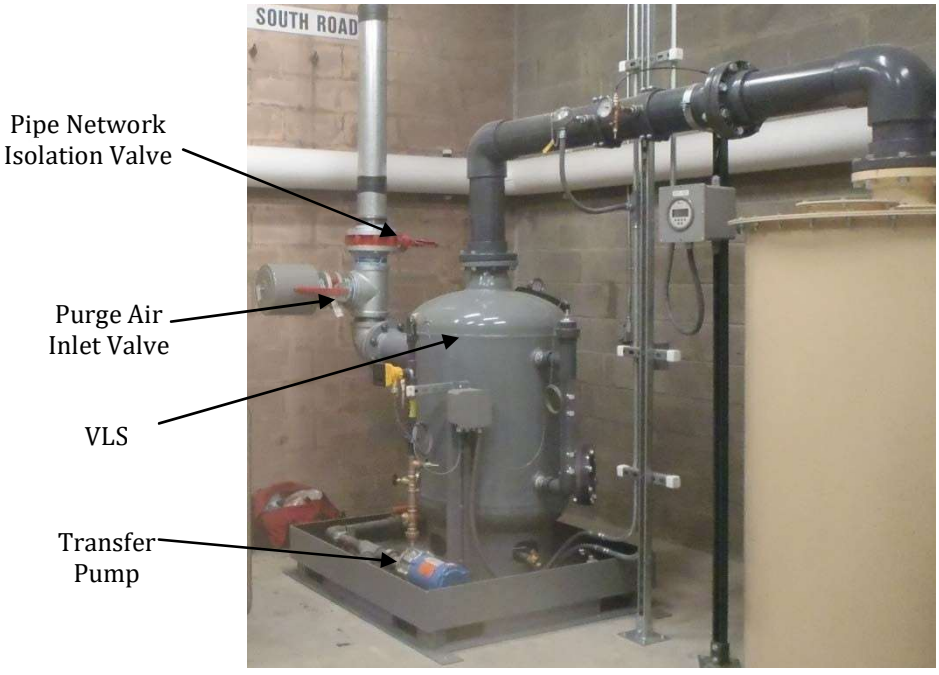



Photo 2: Vapor Liquid Separator (VLS), Transfer Pump (P-101), and Air Inlet Dilution Valve




Photo 3: GAC Vessels and conveyance piping




Photo 4: Skid mounted power (PP-300) and control (MCP-100) panels

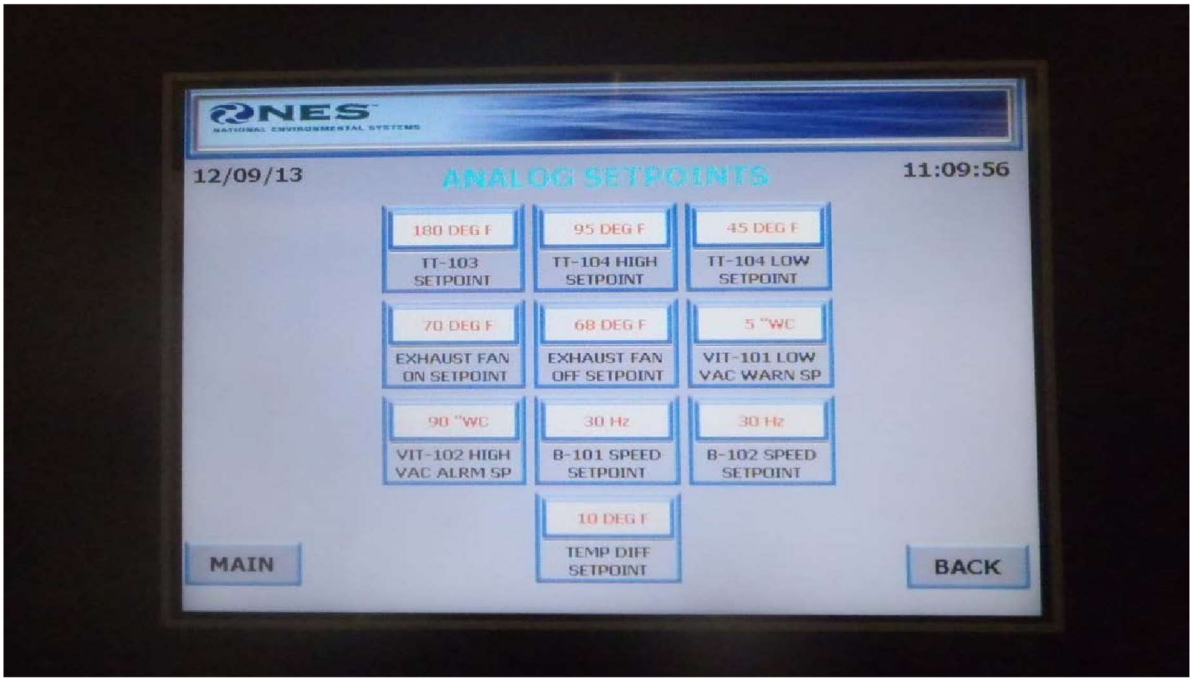



Photo 5: Touch Screen for System Settings (system setpoints shown)

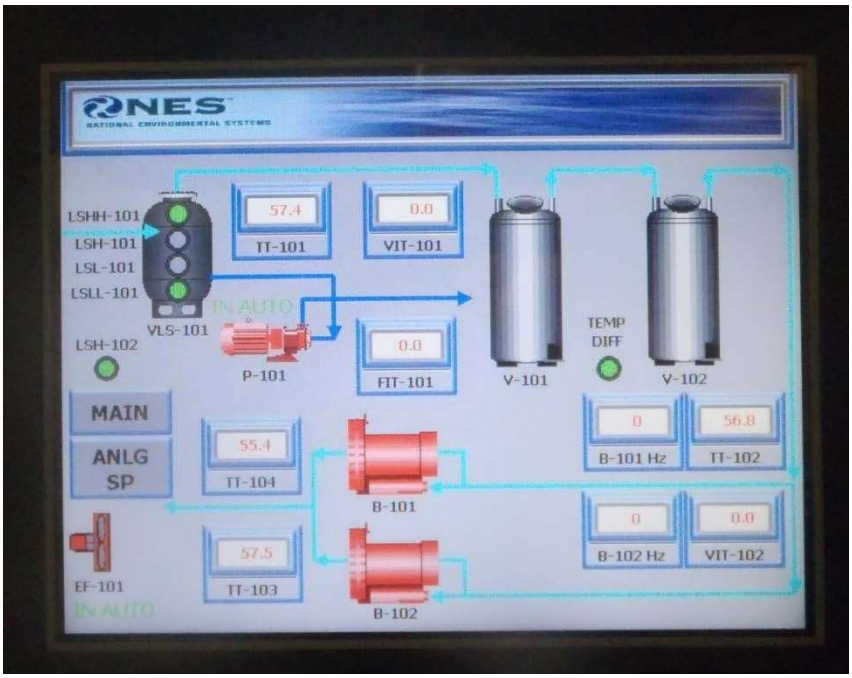



Photo 6: Touch Screen for System Settings (process flow and operating conditions shown)

**Attachment 3**

**O&M Logsheets**

**Former IBM B952/982 Site SSDS - Vapor Extraction System**

**Operations Monitoring Logsheet**

| HMI | Reading | Comments |
|---|---|---|
| **Sub Slab System** | | |
| **Main Screen** | | |
| B-101 Hz | | |
| B-102 Hz | | |
| TT-101 Pre-Carbon Temp | | |
| TT-102 Post Carbon Temp | | |
| TT-103 Post Blower Temp | | |
| TT-104 Room Temp | | |
| VIT 101 Pre-Carbon Vacuum | | |
| VIT 102 Post Carbon Vacuum | | |
| FI 101 Flow Differential Pressure | | |

$$A = 14.7 - \frac{Blower\ Vacuum\ (in.wc)}{27.7}$$

B = Post Carbon Temperature (deg F) + 460

$$C = \frac{A * Flow\ DP\ (in.wc)}{B}$$

$$Flow\ (cfm) = 3273.6 * \sqrt{C}$$

Calculated Flow (cfm): _____

Date: _____ Time: _____ Name: _____

**Former IBM B952/982 Site SSDS - Vapor Extraction System**

**Setpoint Monitoring Logsheet**

| ALARM / SYSTEM SET POINTS | Set Point | Comments |
|---|---|---|
| **Sub Slab System** | | |
| IT-103 (180 DEG)) | | |
| IT-104 HIGH SETPOINT (105 DEG) | | |
| IT-104 LOW SETPOINT (40 DEG.) | | |
| EXHAUST FAN ON SETPOINT (80 DEG.) | | |
| EXHAUST FAN OFF SETPOINT (70 DEG.) | | |
| VIT-101 LOW WARN SP (5" WC) | | |
| VIT-102 HIGH VAC ALARM SP (90" WC) | | |
| B-101 SPEED SETPOINT (45 Hz) | | |
| B-102 SPEED SETPOINT (45 Hz) | | |
| TEMP DIFF SETPOINT (10 DEG) | | |

Date: _____ Time: _____ Operator: _____

# Former IBM B952/982 Site SSDS - Vapor Extraction System
# Performance Monitoring Logsheet

**Date:** _____

**Time:** _____

**Personnel:** _____

**System Operating Data**

| Pre-Carbon Vacuum VIT-101 (in. wc) | Pre-Carbon Temp TT-101 (°F) | Post-Carbon Vacuum VIT-102 (in. wc) | Post-Carbon Temp TT-102 (°F) | Flow DP FI-101 (in. wc) | Calculated Flow (See Formula Below) | Blower B-101 Motor Speed (Hz) | Blower B-102 Motor Speed (Hz) | Blower Discharge Temp TT-103 (°F) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**Extraction Port (EP)/Suction Pit (SP)* Vacuum (in. wc) with Typical Operating Range**

| EP-01 | SP-01 | SP-02 | EP-02 | SP-03 | EP-03 | SP-04 | EP-04 | SP-05 | SP-06 | EP-05 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | -40 to -45 | -40 to -45 | 0 | -40 to -45 | 0 | -40 to -45 | 0 | -40 to -45 | -42 to -47 | -5 to -10 |
| | | | | | | | | | | |

**Subslab Vapor Implant (SSV) Vacuum (in. wc)***

| SSV-1001 | SSV-1002 | SSV-1003 | SSV-1004 | SSV-1006 | SSV-1008 | SSV-1009 | SSV-1010 | SSV-1012 | SSV-1016 | SSV-1017 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **SSV-1018** | **SSV-1019** | **SSV-1020** | **SSV-1021** | **SSV-1024** | **SSV-1025** | **SSV-1026** | **SSV-1027** | **SSV-1030** | **SSV-1031** | **SSV-1032** |
| | | | | | | | | | | |

| SSV-1033 | SSV-1028R | SSV-1029R | N. Brass | S. Brass |
|---|---|---|---|---|
| | | | | |

A = 14.7 - (Blower Vacuum (in.wc))/27.7

B = Post Carbon Temperature (deg F) + 460

C = (A*Flow DP (in.wc))/B

Flow (cfm) = 3273.6 * √C

Notes:

* See Figure 1 for EP, SP, and SSV locations.

# Attachment 4

# Equipment and Instrumentation Manuals

**FPZ, Inc**
150 N. Progress Drive
Saukville, WI 53080 - **U.S.A.**
Tel. (262) 268-0180
Fax (262) 268-0415
E-mail usa@fpz.com

REGENERATIVE BLOWERS - **VACUUM**

# SCL K07 K08 / K09 / K10 / K11 / K12

## MS SERIES - MOR RANGE



### TECHNICAL CHARACTERISTICS

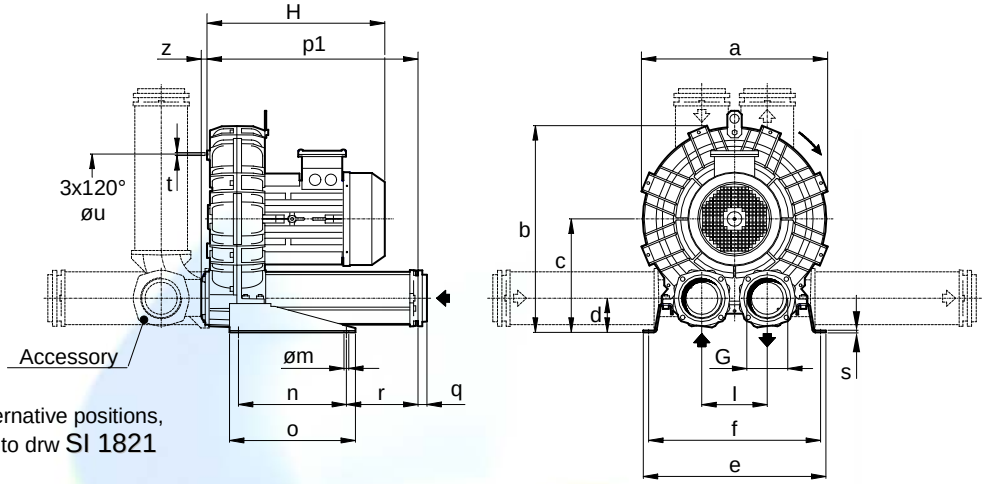
- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - **cURus** motor

### OPTIONS

- Special voltages (IEC 38)
- Surface treatments

### ACCESSORIES

- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors




Possible alternative positions, please refer to drw SI 1821

Dimensions in inches.
Dimension for reference only.

| Model | a | b | c | d | e | f | G | l | m | n | o | p1 | q | r | s | t | u | z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K07-MS | 16.69 | 18.84 | 10.59 | 3.23 | 18.43 | 17.24 | 3" NPT | 6.10 | 0.51 | 11.81 | 13.78 | 20.16 | 0.98 | 5.39 | 0.20 | M8 | 11.61 | 0.63 |
| K08-MS | 17.99 | 19.61 | 10.59 | 3.23 | 18.82 | 17.64 | 3" NPT | 6.10 | 0.51 | 11.81 | 13.78 | 20.16 | 0.98 | 5.39 | 0.20 | M8 | 12.2 | 0.63 |
| K09-MS | 19.37 | 22.09 | 12.40 | 3.78 | 20.00 | 18.82 | 4" NPT | 7.17 | 0.51 | 11.81 | 13.78 | 23.07 | 0.98 | 7.83 | 0.20 | M8 | 14.17 | 0.63 |
| K10-MS | 20.31 | 22.56 | 12.40 | 3.78 | 20.00 | 18.82 | 4" NPT | 7.17 | 0.51 | 11.81 | 13.78 | 23.07 | 0.98 | 7.83 | 0.20 | M8 | 14.17 | 0.63 |
| K11-MS | 21.34 | 23.74 | 13.07 | 3.58 | 21.26 | 20.00 | 4" NPT | 7.87 | 0.51 | 11.81 | 13.78 | 23.46 | 0.98 | 8.03 | 0.20 | M8 | 15.35 | 0.63 |
| K12-MS | 21.57 | 23.82 | 13.07 | 3.58 | 21.26 | 20.00 | 4" NPT | 7.87 | 0.51 | 11.81 | 13.78 | 23.58 | 0.98 | 8.03 | 0.20 | M8 | 15.35 | 0.51 |

| Model | Maximum flow cfm | | Installed power Hp | | Maximum differential pressure Dp ( In Hg ) | | Noise level Lp dB (A) (1) | | Overall dimensions H | Weight |
|---|---|---|---|---|---|---|---|---|---|---|
| | 60 Hz 3500 rpm | *50 Hz 2900 rpm* | 60 Hz 3500 rpm | *50 Hz 2900 rpm* | 60 Hz 3500 rpm | *50 Hz 2900 rpm* | 60 Hz 3500 rpm | *50 Hz 2900 rpm* | Inches | Lbs |
| K07-MS | 294 | *243* | 4 | *4* | 3.7 | *4.6* | 77.7 | *75.7* | 15.45 | 103.00 |
| | | | 5 ½ | *5 ½* | 5.6 | *6.3* | 78.0 | *76.0* | 15.45 | 107.10 |
| | | | 7 ½ | *7 ½* | 9.6 | *8.9* | 78.3 | *76.3* | 18.37 | 145.70 |
| | | | 10 | - | 11.1 | - | 78.6 | - | 18.37 | 154.50 |
| K08-MS | 381 | *316* | 5 ½ | *5 ½* | 2.9 | *3.8* | 78.8 | *76.8* | 15.45 | 115.70 |
| | | | 7 ½ | *7 ½* | 5.0 | *6.6* | 79.1 | *77.1* | 18.37 | 154.30 |
| | | | 10 | *10* | 8.5 | *9.2* | 79.4 | *77.4* | 18.37 | 163.10 |
| | | | 15 | - | 11.1 | - | 79.7 | - | 19.15 | 184.00 |
| K09-MS | 471 | *390* | 7 ½ | *7 ½* | 3.7 | *4.6* | 79.3 | *77.3* | 18.84 | 166.50 |
| | | | 10 | *10* | 5.9 | *7.0* | 79.6 | *77.6* | 18.84 | 175.10 |
| | | | 15 | *15* | 10.3 | *10.4* | 80.1 | *78.1* | 19.63 | 196.20 |
| | | | 20 | - | 11.1 | - | 80.4 | - | 23.74 | 269.00 |
| K10-MS | 556 | *460* | 7 ½ | *7 ½* | 2.7 | *3.8* | 79.4 | *77.4* | 18.84 | 170.90 |
| | | | 10 | *10* | 4.7 | *5.9* | 79.7 | *77.7* | 18.84 | 179.50 |
| | | | 15 | *15* | 8.8 | *9.9* | 80.2 | *78.2* | 19.63 | 200.60 |
| | | | 20 | - | 11.1 | - | 80.5 | - | 23.74 | 273.40 |
| K11-MS | 650 | *539* | 10 | *10* | 2.9 | *3.9* | 82.0 | *80.0* | 19.04 | 194.90 |
| | | | 15 | *15* | 6.0 | *7.1* | 82.5 | *80.5* | 19.83 | 216.00 |
| | | | 20 | *20* | 11.1 | *10.4* | 83.0 | *81.0* | 23.94 | 288.80 |
| K12-MS | 726 | *602* | 15 | *15* | 3.8 | *6.6* | 83.5 | *81.5* | 19.95 | 223.70 |
| | | | 20 | *20* | 6.3 | *9.6* | 84.3 | *82.3* | 24.06 | 296.50 |
| | | | 25 | - | 10.3 | - | 87.2 | - | 24.92 | 320.80 |

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

**FPZ, Inc**
150 N. Progress Drive
Saukville, WI, 53080 - **U.S.A.**
Tel. (262) 268-0180
Fax (262) 268-0415
E-mail usa@fpz.com



**TECHNICAL**
# Three Phase Electric Motors
SS 0904

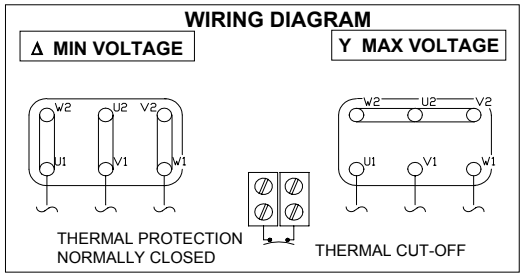
## 3-PHASE MOTOR

### GENERAL SPECIFICATIONS:

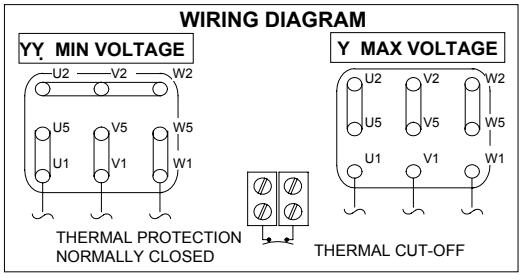
1- ***Type:*** **3-phase AC MOTOR - IEC 60034**
2- ***Marks:*** **cURus, CE**
3- ***Poles:*** **2**
4- ***Frequency:*** **60 Hz / 50 Hz**
5- ***Insulation Class:*** **F**
6- ***Enclosure:*** **TEFC**
7- ***Protection:*** **IP 55**
8- ***Thermal Protector:*** **KLIXON 150 °C**
9- ***Service Factor:*** **1.15**
10- ***Max. Ambient:*** **40°C**
11- ***Duty:*** **Cont.**
12- ***Construction:*** **Aluminium frame**

| POWER | | | 60 HZ | | | 50 HZ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| HP | KW | SIZE | VOLTAGE | FLA 208 / 460 | POWER FACTOR cos φ | VOLTAGE | FLA 230 / 400 (200 V) | POWER FACTOR cos φ | STARTING CURRENT RATIO | CABLE ENTRY |
| 0.33 | 0.25 | 63 | 208-230/460 | 1.5 / 0.7 | 0.75 | 230/400 | 1.4 / 0.8 | 0.70 | 3.9 | M16 |
| 0.5 | 0.37 | 63 | 208-230/460 | 2.3 / 1.0 | 0.79 | 230/400 | 2.1 / 1.2 | 0.73 | 3.6 | M16 |
| 0.75 | 0.55 | 71 | 208-230/460 | 2.7 / 1.2 | 0.85 | 230/400 | 2.6 / 1.5 | 0.78 | 3.8 | M16 |
| 1 | 0.75 | 80 | 208-230/460 | 3.3 / 1.5 | 0.84 | 230/400 | 3.5 / 2.0 | 0.78 | 5.0 | M20 |
| 1.5 | 1.1 | 80 | 208-230/460 | 5.0 / 2.3 | 0.86 | 230/400 | 4.5 / 2.6 | 0.82 | 5.6 | M20 |
| 2 | 1.5 | 90 | 208-230/460 | 6.3 / 2.9 | 0.82 | 230/400 | 6.1 / 3.5 | 0.82 | 5.0 | M20 |
| 3 | 2.2 | 90 | 208-230/460 | 9.0 / 4.1 | 0.87 | 230/400 | 8.5 / 4.9 | 0.81 | 7.1 | M20 |
| 4 | 3.0 | 90 | 208-230/460 | 11.2 / 5.9 | 0.80 | 230/400 | 11.8 / 6.8 | 0.80 | 7.0 | M20 |
| | | 100 | 208-230/460 | 12.9 / 6.1 | 0.85 | 230/400 | 11.6 / 6.7 | 0.85 | 6.0 | M25 |
| 5.5 | 4.0 | 100 | 208-230/460 | 17.5 / 8.1 | 0.88 | 230/400 | 14.0 / 8.1 | 0.88 | 6.2 | M25 |
| 7.5 | 5.5 | 112 | 208-230/460 | 20.0 / 9.5 | 0.86 | 230/400 | 19.4 / 11.2 | 0.85 | 7.6 | M25 |
| | | 132 | 208-230/460 | 19.7 / 11.4 | 0.82 | 230/400 | 19.7 / 11.4 | 0.82 | 7.0 | M32 |
| 10 | 7.5 | 112 | 208-230/460 | 26.0 / 12.5 | 0.88 | 230/400 | 25.6 / 14.8 | 0.87 | 8.2 | M25 |
| | | 132 | 208-230/460 | 26.5 / 15.3 | 0.87 | 230/400 | 26.5 / 15.3 | 0.87 | 6.4 | M32 |
| 15 | 11.0 | 132 | 208-230/460 | 40.0 / 21.7 | 0.84 | 230/400 | 37.5 / 21.7 | 0.84 | 6.9 | M32 |
| 20** | 15.0 | 132** | 208-230/460 | 54.0 / 26.0 | 0.86 | 200/400 | (61.0) / 30.5 | 0.82 | 7.0 | M32 |
| | | 160 | 208-230/460 | 54.0 / 29.8 | 0.85 | 230/400 | 51.6 / 29.8 | 0.85 | 8.1 | M40 |
| 25 | 18.5 | 160 | 208-230/460 | 63.0 / 34.8 | 0.87 | 230/400 | 60.0 / 34.8 | 0.87 | 8.5 | M40 |

*** FLA x Starting current ratio = starting current**




**6 LEADS MOTORS.**
208-230/460 V - 60 Hz
230/400 V - 50 Hz




** **9 LEADS MOTOR**. APPLICABLE TO 20Hp SIZE 132
208-230/460 V - 60 Hz
200/400 V - 50 Hz

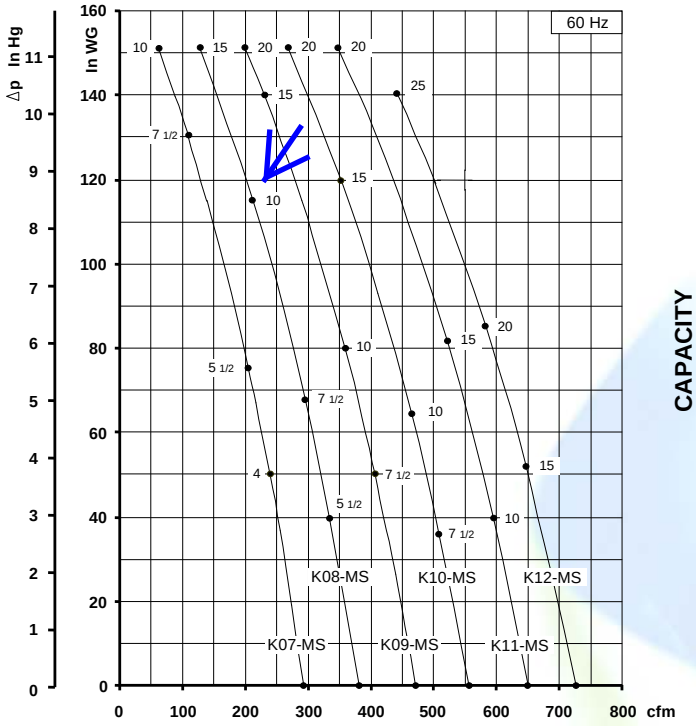
REGENERATIVE BLOWERS - **VACUUM**

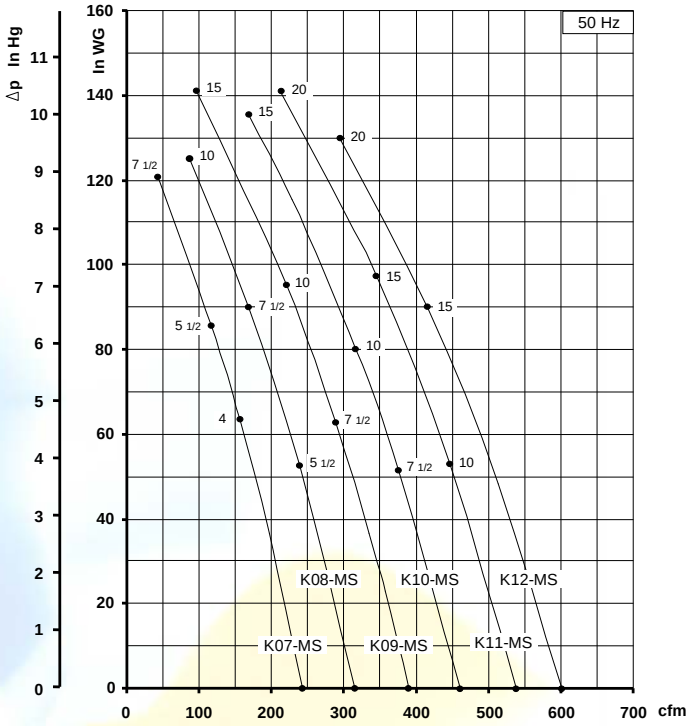
# SCL K07 / K08 / K09 / K10 / K11 / K12

## MS SERIES - MOR RANGE

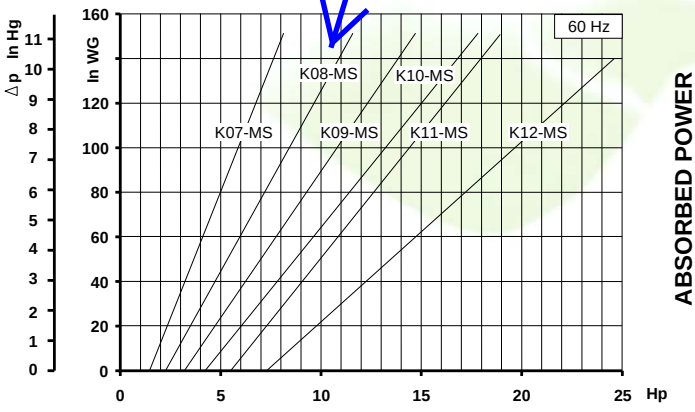
SN 1810-15 2/2

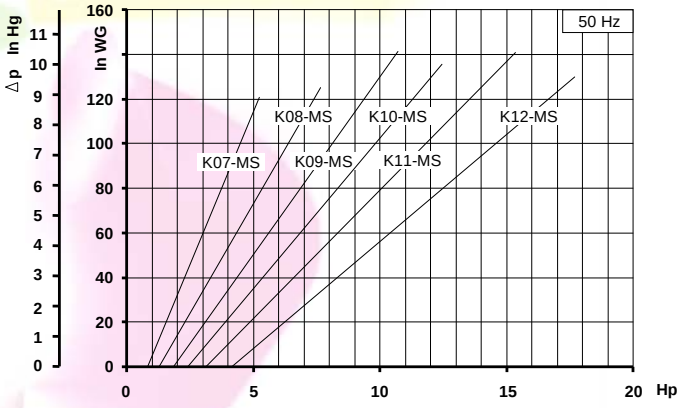
**CAPACITY**



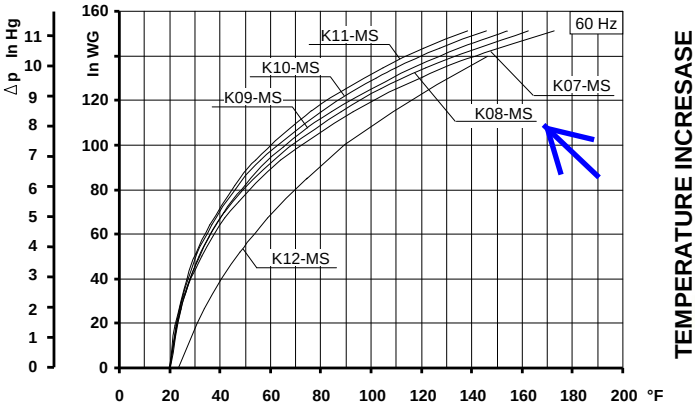



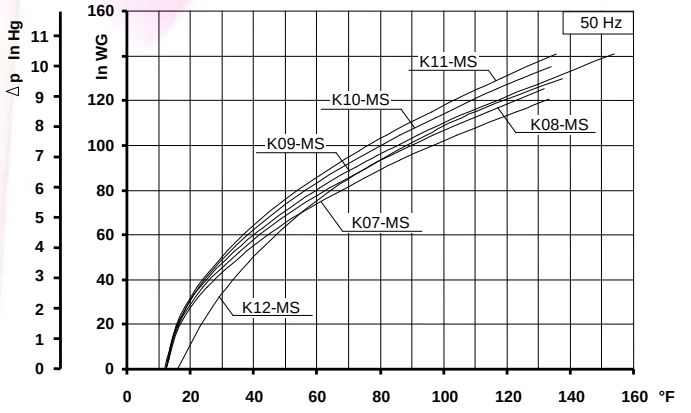

**ABSORBED POWER**




**TEMPERATURE INCRESASE**




Curves refer to air at 68° F temperature, measured at inlet port and 29.92 In Hg atmospheric backpressure (abs).
Values for flow, power consumption and temperature rise: +/-10% tolerance.
Data subject to change without notice.

**FPZ S.p.A.**
Via F.lli Cervi 16
20049 Concorezzo - (MB) - **ITALIA**
Tel. +39 039 69 09 811
Fax +39 039 60 41 296
www.fpz.com

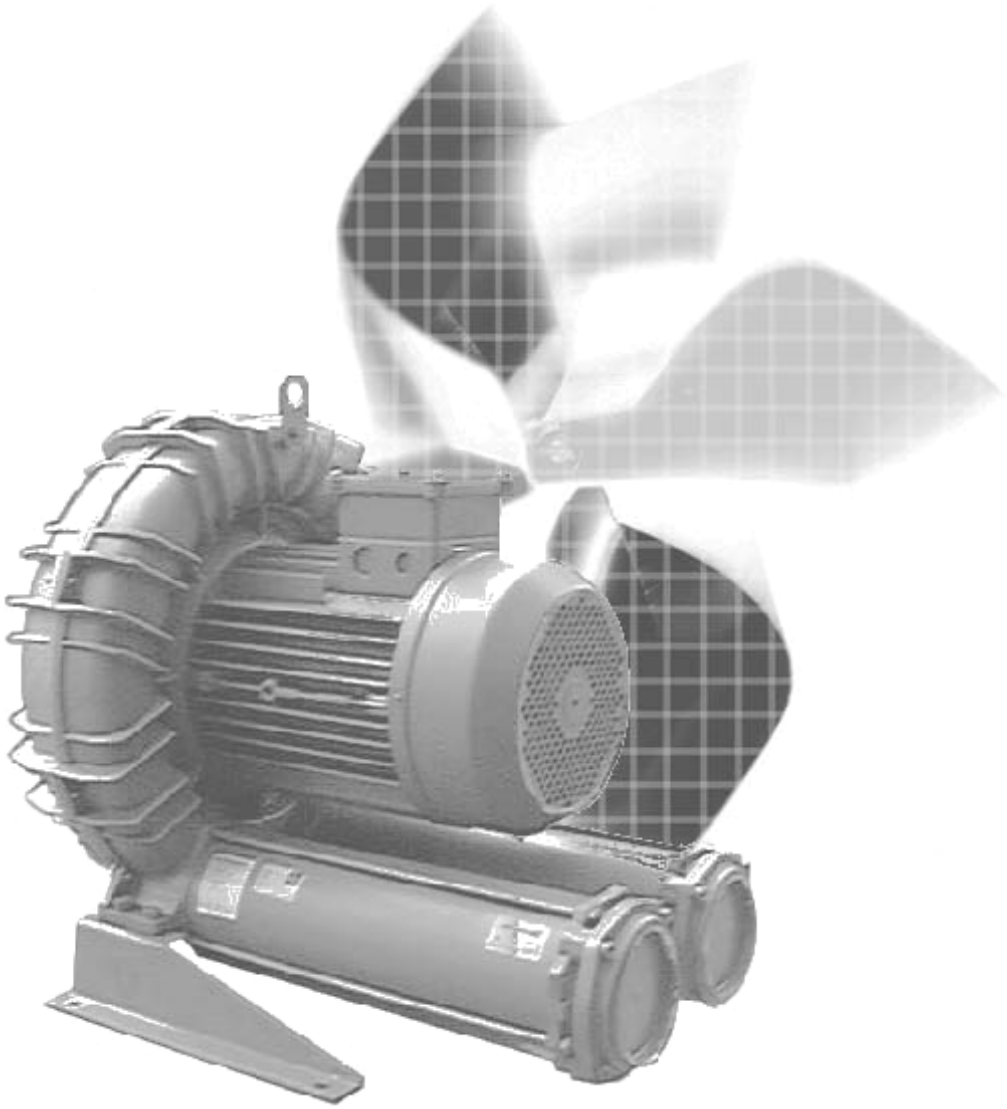
CE

| | |
|---|---|
| **COMPRESSORI - ASPIRATORI A CANALE LATERALE** | **ISTRUZIONI I** |
| **LATERAL CHANNEL BLOWERS – EXHAUSTERS** | **INSTRUCTIONS GB** |
| **COMPRESSEURS - ASPIRATEURS A CANAL LATERAL** | **INSTRUCTIONS F** |
| **SEITENKANALVERDICHTER - VAKUUMPUMPEN BAUREIHE** | **BETRIEBSANLEITUNG D** |
| **COMPRESORES - ASPIRADORES DE CANAL LATERAL** | **INSTRUCCIONES E** |

*LEGGERE ATTENTAMENTE TUTTE LE ISTRUZIONI E CONSERVARLE I*
*PLEASE READ CAREFULLY ALL INSTRUCTIONS AND KEEP THEM FOR FUTURE REFERENCE GB*
*LIRE ATTENTIVEMENT TOUTES LES INSTRUCTIONS ET LES CONSERVER F*
*ALLE ANLEITUNGEN SIND SORGFÄLTIG ZU LESEN UND AUFZUBEWAHREN! D*
*SIRVASE LEER CUIDADOSAMENTE TODAS LAS INSTRUCCIONES Y CONSERVARLAS PARA FUTURA REFERENCIA E*

**SN 1968-6**

# SCL K07 / K75 / K08 / K09 / K10 / K11 / K12
# MS - MOR



AZIENDA CON SISTEMA DI GESTIONE PER LA QUALITÀ CERTIFICATO DA DNV =UNI EN ISO 9001:2000=

## DICHIARAZIONE DI CONFORMITÁ ALLA DIRETTIVA MACCHINE
## *DECLARATION OF CONFORMITY TO THE MACHINERY DIRECTIVE*

Unità tipo - *Unit type*

**SCL K07-MS MOR**
**SCL K75-MS MOR**
**SCL K08-MS MOR**
**SCL K09-MS MOR**
**SCL K10-MS MOR**
**SCL K11-MS MOR**
**SCL K12-MS MOR**

1. L'unità è in conformità con:
   - DIRETTIVA MACCHINE CE 2006/42;
   - DIRETTIVA COMPATIBILITA' ELETTROMAGNETICA (EMC) 2004/108;
   - DIRETTIVA BASSA TENSIONE 2006/95/CE.

   È tuttavia vietata la messa in servizio prima che la macchina in cui sarà incorporata sia dichiarata conforme con le citate Direttive.
2. Sottoposta a collaudo funzionale è risultata conforme alle caratteristiche richieste.
3. Il Fascicolo tecnico elaborato secondo Allegato VII della direttiva CE 2006/42 viene conservato presso la sede della società FPZ SpA a Concorezzo (MB), via F.lli Cervi 16.

1. *The unit conforms to the:*
   - *MACHINERY DIRECTIVE CE 2006/42;*
   - *ELECTROMAGNETIC COMPATIBILITY (EMC) CE 2004/108;*
   - *LOW VOLTAGE DIRECTIVE (LVD) 2006/95/CE;*

   *Nevertheless it is forbidden to put the unit in service before the machine in which will be incorporated is declared in conformity with the above Directives.*
2. *The unit has been tested and meets its operating performances.*
3. *FPZ SpA in Concorezzo (ITALY), Via F.lli Cervi 16, store the Technical Files developed according Annex VII of Machinery Directive CE 2006/42*

**Concorezzo (MB)**, *data 16.04.2010*

Amministratore Delegato
*Managing Director*

Sergio Ferigo

Direttore Tecnico
*Technical Manager*

Luis Sagastegui

**DATI CARATTERISTICI I**
**PERFORMANCE TABLE GB**
**CARACTÉRISTIQUES TECHNIQUES F**
**LEISTUNGDATEN D**
**DATOS CARACTERISTICOS E**

**SI - Unità / Units / Unités / Einheiten / Unidades**

| Modello<br>Model<br>Modèle<br>Modell<br>Modelo | Potenza installata<br>Installed power<br>Puissance installé<br>Installierte Motorleistung<br>Potencia instalada | | Pressione massima differenziale<br>Maximum differential pressure<br>Pression différentielle maxi<br>Druckdifferenz<br>Presión diferencial máxima | | Rumorosità massima<br>Max noise level<br>Max niveau sonore<br>Max Schalldruckpegel<br>Rumorosidad máxima | | Pressione massima assoluta<br>Maximum absolute pressure<br>Pression absolute maxi<br>Maximal absoluter druck<br>Presión absoluta máxima | Massa<br>Weight<br>Masse<br>Gewicht<br>Peso |
|---|---|---|---|---|---|---|---|---|
| | **kW** | | **hPa** ( mbar ) | | **Lp / Lw** (1) **dB (A)** | | **Ps** max A | **M** |
| | 50 Hz<br>2900 $min^{-1}$ | *60 Hz*<br>*3500 $min^{-1}$* | 50 Hz<br>2900 $min^{-1}$ | *60 Hz*<br>*3500 $min^{-1}$* | 50 Hz<br>2900 $min^{-1}$ | *60 Hz*<br>*3500 $min^{-1}$* | **MPa** (bar) | **kg** |
| **SCL K07-MS** | **2.2** | ***2.55*** | **- 130 / + 130** | ***- 100 / + 100*** | **76.4** | ***78.4*** | **0.28 (2.8)** | **46.5** |
| | **3.0** | ***3.45*** | **- 200 / + 200** | ***- 175 / + 175*** | **76.7** | ***78.7*** | **0.28 (2.8)** | **47.5** |
| | **4.0** | ***4.6*** | **- 280 / + 280** | ***- 250 / + 250*** | **77.0** | ***79.0*** | **0.28 (2.8)** | **51.0** |
| | **5.5** | ***6.3*** | **- 325 / + 400** | ***- 375 / + 375*** | **77.3** | ***79.3*** | **0.28 (2.8)** | **61.5** |
| **SCL K75-MS** | **4.0** | ***4.6*** | **- 150 / + 150** | ***- 100 / + 100*** | **77.4** | ***79.4*** | **0.28 (2.8)** | **51.5** |
| | **5.5** | **6.3** | **- 250 / + 250** | **- 200 / + 200** | **77.7** | ***79.7*** | **0.28 (2.8)** | **62.0** |
| | **7.5** | **8.7** | **- / + 325** | **- 300 / + 300** | **78.0** | ***80.0*** | **0.28 (2.8)** | **67.0** |
| **SCL K08-MS** | **3.0** | ***3.45*** | **- 125 / + 125** | ***- 100 / + 100*** | **77.4** | ***79.4*** | **0.28 (2.8)** | **49.0** |
| | **4.0** | ***4.6*** | **- 180 / + 180** | ***- 150 / + 150*** | **77.7** | ***79.7*** | **0.28 (2.8)** | **52.5** |
| | **5.5** | ***6.3*** | **- 275 / + 275** | ***- 250 / + 250*** | **78.0** | ***80.0*** | **0.28 (2.8)** | **63.0** |
| | **7.5** | ***8.7*** | **- 350 / + 400** | ***- 375 / + 375*** | **78.3** | ***80.3*** | **0.28 (2.8)** | **68.0** |
| | **9.2** | ***10.6*** | **- / + 450** | ***- / + 450*** | **78.6** | ***80.6*** | **0.28 (2.8)** | **77.5** |
| **SCL K09-MS** | **4.0** | ***4.6*** | **- 130 / + 130** | ***- 85 / + 85*** | **78.0** | ***80.0*** | **0.28 (2.8)** | **62.0** |
| | **5.5** | ***6.3*** | **- 210 / + 210** | ***- 150 / + 150*** | **78.2** | ***80.2*** | **0.28 (2.8)** | **72.5** |
| | **7.5** | ***8.7*** | **- 290 / + 290** | ***- 250 / + 250*** | **78.5** | ***80.5*** | **0.28 (2.8)** | **77.5** |
| | **9.2** | ***10.6*** | **- 350 / + 350** | ***- 325 / + 325*** | **78.7** | ***80.7*** | **0.28 (2.8)** | **87.0** |
| | **11** | ***12.7*** | **- / + 450** | ***- 375 / + 400*** | **79.0** | ***81.0*** | **0.28 (2.8)** | **87.5** |
| **SCL K10-MS** | **5.5** | ***6.3*** | **- 160 / + 160** | ***- 115 / + 115*** | **78.1** | ***80.1*** | **0.28 (2.8)** | **75.0** |
| | **7.5** | ***8.7*** | **- 250 / + 250** | ***- 200 / + 200*** | **78.5** | ***80.5*** | **0.28 (2.8)** | **80.0** |
| | **9.2** | ***10.6*** | **- 300 / + 300** | ***- 270 / + 270*** | **79.0** | ***81.0*** | **0.28 (2.8)** | **89.5** |
| | **11** | ***12.7*** | **- 350 / + 400** | ***- 375 / + 375*** | **79.4** | ***81.4*** | **0.28 (2.8)** | **90.0** |
| | **15** | ***17.4*** | **- / + 500** | ***- / + 500*** | **79.6** | ***81.6*** | **0.28 (2.8)** | **95.0** |
| **SCL K11-MS** | **7.5** | ***8.7*** | **- 175 / + 175** | ***- 130 / + 130*** | **80.0** | ***82.0*** | **0.28 (2.8)** | **83.5** |
| | **9.2** | ***10.6*** | **- 230 / + 230** | ***- 175 / + 175*** | **80.5** | ***82.5*** | **0.28 (2.8)** | **93.0** |
| | **11** | ***12.7*** | **- 300 / + 300** | ***- 250 / + 250*** | **81.0** | ***83.0*** | **0.28 (2.8)** | **93.5** |
| | **15** | ***17.4*** | **- 350 / + 400** | ***- 350 / + 350*** | **81.8** | ***83.8*** | **0.28 (2.8)** | **98.5** |
| | **18.5** | ***21.5*** | **- / + 500** | ***- / + 500*** | **83.6** | ***85.6*** | **0.28 (2.8)** | **128.5** |
| **SCL K12-MS** | **9.2** | ***10.6*** | **- 150 / + 150** | ***- 100 / + 100*** | **81.0** | ***83.0*** | **0.28 (2.8)** | **96.5** |
| | **11.0** | ***12.7*** | **- 200 / + 200** | ***- 150 / + 150*** | **81.5** | ***83.5*** | **0.28 (2.8)** | **97.0** |
| | **15.0** | ***17.4*** | **- 300 / + 300** | ***- 275 / + 275*** | **82.3** | ***84.3*** | **0.28 (2.8)** | **102.0** |
| | **18.5** | ***21.5*** | **- 325 / + 425** | ***- 350 / + 375*** | **85.2** | ***87.2*** | **0.28 (2.8)** | **132.0** |

(1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, según la Normativa ISO 3744.

**DATI CARATTERISTICI I**
**PERFORMANCE TABLE GB**
**CARACTÉRISTIQUES TECHNIQUES F**
**LEISTUNGDATEN D**
**DATOS CARACTERISTICOS E**

**US - Unità / Units / Unités / Einheiten / Unidades**

| Modello<br>Model<br>Modèle<br>Modell<br>Modelo | Potenza installata<br>Installed power<br>Puissance installé<br>Installierte Motorleistung<br>Potencia instalada | | Pressione massima differenziale<br>Maximum differential pressure<br>Pression différentielle maxi<br>Druckdifferenz<br>Presión diferencial máxima | | Rumorosità massima<br>Max noise level<br>Max niveau sonore<br>Max Schalldruckpegel<br>Rumorosidad máxima | | Pressione massima assoluta<br>Maximum absolute pressure<br>Pression absolute maxi<br>Maximal absoluter druck<br>Presión absoluta máxima | Massa<br>Weight<br>Masse<br>Gewicht<br>Peso |
|---|---|---|---|---|---|---|---|---|
| | **Hp** | | **In Hg / In WG** | | **Lp / Lw** (1) **dB (A)** | | **Ps** max | **M** |
| | 60 Hz<br>3500 rpm | *50 Hz*<br>*2900 rpm* | 60 Hz<br>3500 rpm | *50 Hz*<br>*2900 rpm* | 60 Hz<br>3500 rpm | *50 Hz*<br>*2900 rpm* | **In Hg** | **lbs** |
| **SCL K07-MS** | **4** | **4** | **- 3.7 / + 50** | ***- 4.6 / + 63*** | ***78.7*** | **76.7** | **82.7** | **103.00** |
| | **5 ½** | **5 ½** | **- 5.6 / + 75** | ***- 6.3 / + 86*** | ***79.0*** | **77.0** | **82.7** | **107.10** |
| | **7 ½** | **7 ½** | **- 9.6 / + 130** | ***- 8.9 / + 138*** | ***79.3*** | **77.3** | **82.7** | **145.70** |
| | **10** | **10** | **- 11.1 / + 181** | ***- / + 161*** | ***79.6*** | **77.6** | **82.7** | **154.50** |
| **SCL K08-MS** | **5 ½** | **5 ½** | **- 2.9 / + 40** | ***- 3.8 / + 52*** | ***79.7*** | **77.7** | **82.7** | **115.70** |
| | **7 ½** | **7 ½** | **- 5.9 / + 80** | ***- 6.6 / + 90*** | ***80.0*** | **78.0** | **82.7** | **154.30** |
| | **10** | **10** | **- 8.5 / + 115** | ***- 9.2 / + 125*** | ***80.3*** | **78.3** | **82.7** | **163.10** |
| | **15** | **15** | **- 11.1 / + 181** | ***- / + 181*** | ***80.6*** | **78.6** | **82.7** | **184.10** |
| **SCL K09-MS** | **7 ½** | **7 ½** | **- 3.7 / + 50** | ***- 4.6 / + 63*** | ***80.2*** | **78.2** | **82.7** | **166.50** |
| | **10** | **10** | **- 5.9 / + 80** | ***- 7.0 / + 95*** | ***80.5*** | **78.5** | **82.7** | **175.10** |
| | **15** | **15** | **- 10.3 / + 140** | ***-10.4 / + 155*** | ***81.0*** | **79.0** | **82.7** | **196.20** |
| | **20** | **20** | **- 11.1 / + 181** | ***- / + 181*** | ***81.3*** | **79.3** | **82.7** | **269.00** |
| **SCL K10-MS** | **7 ½** | **7 ½** | **- 2.7 / + 36** | ***- 3.8 / + 51*** | ***80.1*** | **78.1** | **82.7** | **170.90** |
| | **10** | **10** | **- 4.7 / + 64** | ***- 5.9 / + 80*** | ***80.5*** | **78.5** | **82.7** | **179.50** |
| | **15** | **15** | **- 8.8 / + 120** | ***- 9.9 / + 135*** | ***81.0*** | **79.0** | **82.7** | **200.60** |
| | **20** | **20** | **- 11.1 / + 167** | ***- / + 191*** | ***81.4*** | **79.4** | **82.7** | **273.40** |
| | **25** | **25** | **- / + 211** | ***- / + 201*** | ***81.6*** | **79.6** | **82.7** | **298.70** |
| **SCL K11-MS** | **10** | **10** | **- 2.9 / + 40** | ***- 3.9 / + 53*** | ***82.0*** | **80.0** | **82.7** | **194.90** |
| | **15** | **15** | **- 6.0 / + 82** | ***- 7.1 / + 97*** | ***82.5*** | **80.5** | **82.7** | **216.00** |
| | **20** | **20** | **- 9.2 / + 125** | ***- 10.4 / + 141*** | ***83.0*** | **81.0** | **82.7** | **288.80** |
| | **25** | **25** | **- 11.1 / + 162** | ***- / + 201*** | ***85.6*** | **83.6** | **82.7** | **313.10** |
| **SCL K12-MS** | **15** | **15** | **- 3.8 / + 52** | ***- 6.6 / + 90*** | ***83.5*** | **81.5** | **82.7** | **223.70** |
| | **20** | **20** | **- 6.3 / + 85** | ***- 9.6 / + 130*** | ***84.3*** | **82.3** | **82.7** | **296.50** |
| | **25** | **25** | **- 8.8 / + 120** | ***- / + 160*** | ***87.2*** | **84.1** | **82.7** | **320.80** |

(1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, seg+ún la Normativa ISO 3744.

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## 1 SAFETY STANDARDS

This operating manual:

- Applies to “K” series side channel compressors-vacuum pumps in an “MOR” single block version.
- Contains instructions for transporting, installation, commissioning, operating, storing, and maintenance of “K” series side channel compressors-vacuum pumps in an “MOR” format.
- Must be read carefully and understood fully before doing any work using the unit.
- Must be complied with fully.
- Must be to hand at all times at the workstation at which the unit is used.

Failure to comply with the safety standards may result in serious injury to people – even with fatal consequences – as well as damage to materials and the environment.

### 1.1 NOTES FOR THE USER’S SAFETY

The safety standards referred to in this operating manual are marked by a danger symbol. Next to this symbol there is wording indicating the seriousness of the danger. You are kindly requested to fully comply with the procedures described in order to avoid any danger to people or property!



This **Danger** symbol indicates dangers that may result in **injury to people** with consequences including **death or serious injury** if the necessary precautions are not taken.

The term “**WARNING**” indicates dangers that may result in **damage to property**.

“**USER’S NOTES**” are intended to allow the unit to be used in the best way to achieve best performance, in safety and respecting the environment.

### 1.2 GENERAL SAFETY WARNINGS

**WARNING!**

The “K” series of side channel compressors-vacuum pumps in an “MOR” format are designed and built for use in industrial plants are fitted with three-phase or single-phase electric motors of an asynchronous bipolar type, in compliance with IEC 34-1.



**Any use other than the intended use of the unit may cause serious injury and even death!**

- The unit may only be started:
  In conformity with the use, transport, and handling purposes indicated in “INTENDED USE”.
  According to the values indicated in the “CHARACTERISTIC DATA” table on page 3/4.
- All transportation, assembly, installation, starting up, and maintenance operations are only to be carried out by qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.



**When the unit us working there is a danger of injury due to shearing, crushing, entanglement, and burns!**

Transportation, assembly, installation, starting up, and maintenance operations are to be carried out wearing adequate **personal protective clothing** (protective gloves and safety glasses, safety shoes, and a hardhat).

Do not wear loose-fitting garments, long laces, or other items that may get entangled in the machine.

Long hair must be gathered up.



**Electrical danger!**

Inappropriate behaviour may result in serious injury and even death!

Work on electrical equipment (installation and maintenance) is only to be done by qualified, authorised electricians!

Before starting to work on the unit or plant, the following precautions must be taken:

Switch off the mains power supply.

Adopt measures to prevent it being switched on again.

Only open the terminal box after checking that the power is off altogether!



**Danger due to rotating components (cooling fan for the electric motor, impeller, and shaft): Cutting or shearing of limbs, entanglement or trapping of hair or clothing.**

**Danger due to excess pressure and vacuum: Sudden ejection of process gases (injury to the skin and eyes), and sudden sucking in of hair and clothing!**

**Danger due to process gases that come out and cause burns!**

- The unit may only be started and operated under the following conditions:

  The unit must be fully assembled and whole (not damaged).

  Piping must be connected to the silencers using fixings, connections, pipes, pipe fittings, and tanks that are watertight and sufficiently strong to withstand the pressures that develop.

  Connections to the suction and delivery silencers must not be closed, clogged, or dirty.

  Regularly check that the seatings for fixings, connections, piping, pipe fittings, and tanks are firmly secured!
- Before starting maintenance work on the unit, the following safety precautions must be taken:

  Put the unit out of order and ensure that it cannot be switched on again.

  Put a sign on the plant’s controls and on the control units that reads: “DANGER! Maintenance work on the compressor-vacuum pump in progress! Do not switch on!”

  Wait until the unit has stopped completely, that is, until the impeller has stopped rotating.

  Allow the unit to cool down!

  Make sure that there is no pressure or vacuum in the unit or in the piping to be disconnected.

  Make sure that no fluid can flow out of the unit and/or plant!



**Danger due to rotating impeller: Cutting or shearing of limbs!**

The impeller can be accessed while it is rotating by opening the suction and delivery silencers!

Never put your hands or any item into these openings.

Fit the suction and/or delivery silencers with additional silencers or additional pipes sufficiently long to prevent access to the impeller.

**Danger due to burns caused by contact with hot surfaces on the unit!**

When operating in compliance with the values indicated in the “CHARACTERISTIC DATA” table on page 3/4 the compressors-vacuum pumps can reach high surface temperatures of up to 160°C (+320°F).

Fit the unit with adequate protection against the risks of involuntary contact with hot surfaces.

Do not touch the unit’s surfaces on purpose when it is running!

Before doing any work after having switched off the unit, allow it to cool!

**Danger resulting from the impeller seizing due to the performance values being exceeded: Vacuum and/or pressure exceeding the declared values!**

Do not allow the unit to operate with the suction and/or delivery openings obscured for any reason.

Install a safety valve that can prevent excessive vacuum and/or pressure, and that makes it possible to comply with the values indicated among the “CHARACTERISTIC DATA” given on page 3/4 of this manual.

In order to limit the formation of layers of dust on the surfaces, which may compromise natural exchanging of heat between the unit and the environment, regularly clean and remove all dust using suitable equipment.

Suction and/or delivery piping must not be dirty or clogged!

**If any anomalous noises are heard, which may be a warning that the impeller is about to seize, switch off the unit and move away from it immediately.**

**Danger due to the impeller seizing due to use in an unsuitable place and/or due to conveying fluids that are not suitable: Unsuitable ambient and suction temperatures!**

Check that the ambient and suction temperatures for the gas conveyed are between: -15°C (+5°F) and +40°C (+104 °F).

Check that good ventilation is provided for the unit.

Use a filter on the suction side to filter particles 25 µm or larger, which will make it possible to limit the entry of any solids into the unit, thereby avoiding possible breakage of the impeller blades, making the fragments projected out of the delivery opening dangerous!

During installation and when the unit is running, check for load losses due to the use of this filter: The maximum load loss allowed is 30 mbar. This value must be subtracted from the maximum admissible pressure indicated in the “CHARACTERISTIC DATA” table on page 3/4 of this manual.

**If any anomalous noises are heard, which may be a warning that the impeller is about to seize, switch off the unit and move away from it immediately.**

### 1.3 OTHER HAZARDS

**Danger due to rotating components: Cooling fan for the electric motor!**

There is an immediate danger of hair and clothing becoming entangled in the cooling fan in the electric motor’s cowling via the cowling itself!

**Protective steps to be taken:**

Do not wear loose-fitting garments, long laces, or other items that may get entangled in the machine.

Long hair must be gathered up.

**Danger due to hot surfaces – up to 160°C (+320°F)!**

Under operating conditions there is a possibility of burns due to contact with the unit’s surfaces.

**Protective steps to be taken:**

Fit the unit with adequate protection against the risks of involuntary contact with hot surfaces.

Do not touch the unit’s surfaces on purpose when it is running!

Before starting with any work, wait for the unit to cool down after switching it off!

**Danger due to noise emitted by the unit!**

When the compressors-vacuum pumps are running they emit noise that may exceed 80 dB(A)!

**Protective steps to be taken:**

Mark the area around the unit using warning signs.

Wear personal protective equipment for hearing.

If necessary, fit additional silencers on the suction and/or delivery silencers.

From time to time use noise tests to check the efficiency of the soundproofing panels in the suction and delivery silencers. The reference values are indicated in the “CHARACTERISTIC DATA” table on page 3/4 of this manual.

## 2 INTENDED USE

The “K” series of side channel compressors-vacuum pumps in an “MOR” format are made to generate vacuums and pressures, and for conveying air and gas that is not explosive, not inflammable, not poisonous, and not aggressive, for continuous operation in a non-explosive environment.

The “K” series of side channel compressors compressors-vacuum pumps in an “MOR” format are designed and built for use in industrial plants are fitted with three-phase or single-phase electric motors of an asynchronous bipolar type, in compliance with IEC 34-1.

### 2.1 TYPICAL EXAMPLES OF IMPROPER USE

**Any use other than the intended use of the unit may cause serious injury and even death!**

Failure to comply with the prohibitions / obligations indicated may result in technical faults, damage to the plant, or injury!

Danger of very serious injury!

<u>THE FOLLOWING ARE STRICTLY FORBIDDEN:</u>

- Using the unit in non-industrial installations, unless all the necessary precautions or protective measures have been taken (e.g. protection against contact to safeguard children).
- Using the unit in places in which there are explosive dust and/or gas or where these may form.
- Sucking up and conveying explosive, inflammable, aggressive, corrosive, and/or harmful fluids.
- Using the unit under conditions that differ from those indicated in the “CHARACTERISTIC DATA” table on page 3/4.
- Using the unit without having installed a suction filter.
- Operating with the suction and/or delivery openings closed.

- Making modifications to the unit or transforming it, or making repairs or doing maintenance based on your own initiative. Maintenance works are only to be carried out as described in this operating manual by qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.
- Starting the unit up again after a fault, unless it has been repaired by qualified personnel.

THE FOLLOWING ARE OBLIGATORY:

- Doing maintenance work as indicated in chapter 6.
- Carrying out preliminary and periodic checks as indicated in the "STARTING UP" chapter.

## 3 STORAGE AND TRANSPORT



**Danger due to loads that fall over or fall down!**

Heavy loads that fall over or down may cause crushing, resulting in injuries to people and even death!

Do not put loads on top of the packing.



**Danger due to lifting heavy loads!**

Heavy loads that fall over or down may cause crushing, resulting in injuries to people and even death!

Before undertaking handling operations (lifting, moving, transporting, and putting down) look at the unit's mass (M) shown in the "CHARACTERISTIC DATA" table on page 3/4 and determine the best way to work in maximum safety.

In this regard all the prevention measures must be applied, including any local and/or specific regulations that make it possible to carry out the handling operations:

Using qualified personnel that have specific skills and adequate training, using suitable equipment.

Organising the work in such a way that it poses the least risk possible and is done under safe, healthy, conditions.

Using safe, stable support surfaces.

Use of suitable working clothes and adequate personal protective equipment (protective gloves and safety glasses, safety shoes and a hardhat).

Working in an area with sufficient space, level floors, no obstructions.

Avoiding impacts, jolting, and shaking.

Units with a mass that exceeds 25 kg (55 lbs) are fitted with lugs to be used for handling.

**WARNING!**

Lifting the unit is any way other than that indicated is strictly forbidden. Use the lug provided on the blower unit or motor.

Store in a dry place, keeping the packing if possible. Do not remove the covers over the openings.

## 4 INSTALLATION

### 4.1 SCL K COMPRESSOR – VACUUM PUMP



**Any use other than the intended use of the unit may cause serious injury and even death!**

- This operating manual:

  MUST be read carefully and understood fully before doing any work using the unit.

  MUST be complied with fully.

  MUST be to hand at all times at the workstation at which the unit is used.

- Remember that installation operations are only to be carried out by qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.



**Danger due to a lack of a clear view of the place in which the unit is installed!**

Make sure that the unit installed is always under control when doing anything in the installation area.

The controls must be positioned in such a way as to be able to see the unit installed.

Danger of very serious injury!

**WARNING!**

If the flow rate has to be reduced, use a draw-off valve rather than throttling back the suction or delivery lines.

#### 4.1.1 WORKING CONDITIONS

The "K" series of side channel compressors-vacuum pumps in an "MOR" format are made to generate vacuums and pressures, and for conveying air and gas that is not explosive, not inflammable, not poisonous, and not aggressive, for continuous operation in a non-explosive environment.

If installed outdoors, protect the unit against exposure to sunlight.

The maximum pressure differentials allowed are indicated in the "CHARACTERISTIC DATA" table on page 3 of this manual and must never be exceeded. Only the following conditions are valid:

As a compressor:
Gas intake temperature 20°C (+68°F) and atmospheric pressure 1013 mbar (abs) (29,92 in Hg) measured at the suction opening.

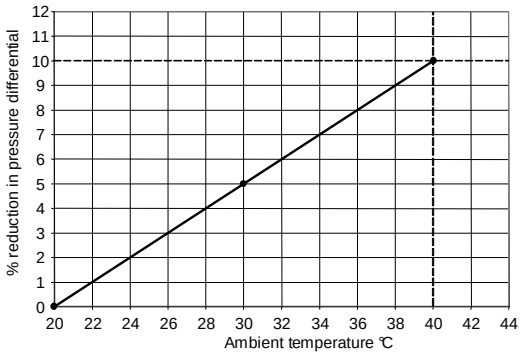
As a vacuum pump:
Gas intake temperature 20°C (+68°F) measured at the suction opening and atmospheric back pressure 1013 mbar (abs) (29,92 in Hg).

The ambient temperature and the intake temperature of the gas conveyed is allowed within the -15°C (+5°F) to + 40 °C (+104°F) range, with the following provisions:

- If the ambient temperature is +30°C (+86°F) **reduce** the maximum pressure differentials indicated in the "CHARACTERISTIC DATA" table on page 3/4 by 5%.

- If the ambient temperature is +40°C (+104°F) **reduce** the maximum pressure differentials indicated in the "CHARACTERISTIC DATA" table on page 3/4 by 10%.

The graph to be used to reduce the maximum pressure differentials when the ambient temperature is between +21°C (+70°F) and +40°C (+104°F) is given below.




### 4.1.2 INSTALLATION CONDITIONS

For installation exceeding 1000 m (3300 ft) contact FPZ for assistance as installations at higher altitudes will affect blower performance.

The support surfaces for the unit must be flat, strong, stable, and as level as possible.

It is important that the unit be installed on a structure that does not transmit significant vibrations back to the blower.

Under all conditions, do not install units on structures that can transmit or amplify noise (tanks, steel plating, etc.).

The unit must always be installed using anti-vibration supports.

**Danger due to vibrations!**

Regularly check that the points at which the unit is fixed to the support structure are tight.

Excess vibration of the unit can cause damage to balance, resulting in injury to people and even death!

The unit must be installed in such a way that the motor's ventilation is not impeded by obstacles put in the immediate vicinity.
To this end a minimum gap must be kept between the motor's fan guard and any other structure of at least 50 mm (2 in.).

**WARNING!**

To guarantee that the unit is well ventilated after installation, proceed as follows:

The air intake on the motor's fan guard must be kept free.

Intake fresh air only. Avoid recirculation and / or ingestion of contaminated / hot air from other sources.

If the unit is installed in a closed space, guarantee a good flow of cooling air by using an extractor / fan and correct air intake for cooling the motor.

**Any use other than the intended use of the unit may cause serious injury and even death!**

To avoid overloading due to pressure fluctuations, fit a safety valve on the suction pipe if used as a vacuum pump and on the delivery pipe if used as a compressor.

**Danger due to foreign bodies and dirt getting into the unit!**

Any foreign bodies, even very small in size, getting into the unit causes serious damage and probable breakage of the impeller, and a danger that broken bits may be projected outwards!

Foreign bodies include: Dust, sand, lime scale, impurities in the pipes, cutting or threading burrs, welding drops or slag, metal burrs or residue of sealing products used when connecting up the pipework.

Protect the suction pipe using a suitable filter with a maximum degree of filtration of 25µm and a maximum load loss of ΔP=20mbar (8" wg).

Replace filters regularly!

**WARNING!**

Size piping and choose accessories that cause the minimum load losses, and so:

Do not fit pipes of a diameter smaller than that of the machine's openings.

When installing a number of machines in parallel, size the manifold and main line accordingly.

Do not use elbows, but large radius bends.

Do not fit valves with a passage smaller than the nominal size and non-return valves with a spring-loaded shutter (the non-return valve that causes the smallest load loss is one with a lightened shutter).

When using for aeration, choose diffusers with a low passage resistance (low load loss) and do not forget that the diffusers and porous sieves can clog over time and increases load.

**WARNING!**

Avoid the possibility of standing water, especially when installing the unit with its axis vertical.

**See the INSTALLATION DIAGRAMS in chapter 8.**

### 4.1.3 HORIZONTAL INSTALLATION

The unit is ready for installation in a horizontal position, suitably fixed to the bracket / brackets.

The bracket has fixing holes. Use all the holes and suitable bolt types.

See point 4.1.2 for the INSTALLATION CONDITIONS.

Remove the covers over the openings before checking the direction of rotation and before final connection.

**WARNING!**

Check the direction of rotation in the motor.

(See point 4.2.3 ROTATION DIRECTION)

When connecting the unit cabin to the ducting, do so using the flanges on the silencer housings and form suitable connections using flexible hoses. Avoid rigid connections that may impose loads and give rise to harmful vibrations.

Fit the flanges on the silencer housings complete with gaskets again, and tighten.

### 4.1.4 INSTRUCTIONS FOR REPOSITIONING THE SILENCER HOUSINGS

**Danger due to rotating components: Impeller!**

There may be a danger of shearing due to the impeller rotating even when the machine is switched off, if it is started manually.

Suitable working clothes and personal protective equipment must therefore be used.

The SCL K-MS series is designed to provide maximum flexibility in positioning the silencer housings, to allow for various installation configurations.

The blower comes with the silencers positioned as shown in fig 1.

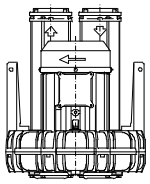


fig.1

If this layout has to be modified, proceed to identify the layout of the silencer housings required.
The possible solutions are shown in fig 2, fig 3, and fig 4 below.

fig 2

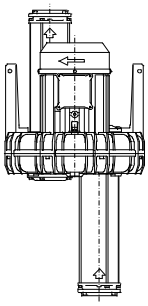
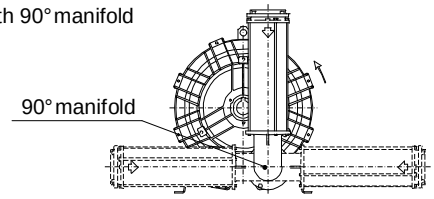


fig 2 with 90° manifold




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fig 3

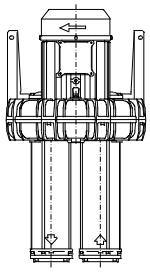


fig 3 with 90° manifolds

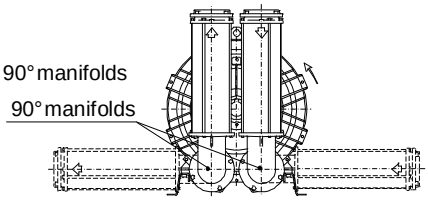



fig 4

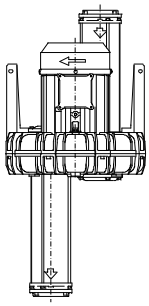
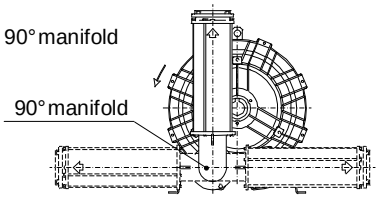


fig 4 with 90° manifold




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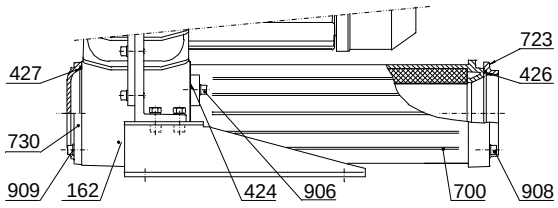
Position the unit in a horizontal position with the brackets on a flat, stable surface.

**Disassembling the silencer housing:**

- Remove the bolts (908) and remove the flange (723) with the O-Ring (426).
- Remove the bolts (906).
- Remove the silencer (700) with its gasket (424).

**Fitting the blank flange (730):**

- Remove the bolts (909) and the flange (730) with the O-Ring (427).




Fit everything again in reverse order, not forgetting gaskets 424, 426, and 427.

**USING THE (accessory) CK TYPE 90° MANIFOLD KIT**

The 90° manifold can only be fitted for 162 cover o penings and as shown in fig 2, fig 3, and fig 4 above there are a number of installation configurations that are possible.

The CK type 90° manifold kit comprises:

N°1 manifold
N°1 gasket and
N°4 M8x25 UNI 5739 bolts

**To assemble the 90° manifold proceed as follows:**

- Remove the silencer housing as described before.
- Put the gasket between the cover (162) and the 90° manifold, and tighten the M8x25 UNI 5739 bolts.
- Assemble the silencer housing, following the instructions in reverse order and not forgetting gasket 424 and 426.

#### 4.1.5 VERTICAL INSTALLATION ON THE COVER

For installing in a vertical position, fit the anti-vibration supports supplied with the unit on the cover, and then fix the whole structure to the support.

See point 4.1.2 for the INSTALLATION CONDITIONS.

**Any use other than the intended use of the unit may cause serious injury and even death!**

When installing vertically DO NOT use the bracket supplied with the unit as this is only suitable for horizontal installations.

Remove the covers over the openings before checking the direction of rotation and before final connection.

**NOTE FOR THE USER**

A bracket for fitting the unit in a vertical position on the cover is available as an accessory.

The bracket has fixing holes. Use all the holes and suitable bolt types.

**WARNING!**

Check the direction of rotation in the motor.

(See point 4.2.1 ROTATION DIRECTION)

When connecting the unit to the ducting, do so using the flanges on the silencer housings and form suitable connections using flexible hoses. Avoid rigid connections that may impose loads and give rise to harmful vibrations.

Fit the flanges on the silencer housings complete with gaskets again, and tighten.

### 4.2 ELECTRIC MOTOR

**Electrical danger!**

- Improper installation may result in serious injury and even death!
- Work on electrical equipment (installation and maintenance) is only to be done by qualified, authorised electricians!
- Before starting to work on the unit or plant, the following precautions must be taken:

  Make sure that the line is NOT switched on.

  Adopt measures to prevent it being switched on again.

  Only open the terminal box after checking that the power is off altogether!
- The terminal box must not contain:

  Foreign bodies

  Impurities

  Moisture.

Close the cover on the terminal box and seal the openings in the cable glands in order to prevent dust, water, and moisture to penetrate.

Check the seals periodically.

- Should you touch a defective unit there may be a danger of electric shock!

  Fit a motor trip-switch.

  Have the unit's electrical system checked by an electrician on a regular basis.

The electric motor is sized to work at an ambient temperature between -15°C (+5°F) and +40°C (+104°F), and a maxi mum altitude of 1000 m (3300 ft) above sea level.

Under other conditions the motor cannot be used at full load and so difficulties may arise for starting, particularly with a single-phase power supply for the motors.

**WARNING!**

A maximum of n° 6 evenly distributed starts per hou r, is allowed.

Failure to comply with this may seriously damage the unit.

#### 4.2.1 CONNECTION

**WARNING!**

Connecting the motor incorrectly may seriously damage the unit.

The power supply for the motor and any auxiliary equipment must be provided using cables of suitable section to avoid abnormal overheating and great voltage drops.

Check that the details on the nameplate are compatible with the line voltage and frequency.

A voltage tolerance of ±10% compared to the nominal value is admissible.

Connect the motor's earth cable to the relevant terminal marked with this symbol ⏚ always before connecting to the mains supply and check the dispersion capacity.

The earth cable can be recognised by its colour (yellow/green).

This connection to the main supply must be formed as shown in the wiring diagram contained in the terminal box.

Use the cable gland openings to allow power supply cables to pass into the terminal box.

Proceed to tighten the power supply cables, taking the section of the electrical cables into account each time.

The terminal block connections must be tightened properly to avoid high contact resistances and resulting overheating.

Check that the insulation gaps between the various conductors are not in contact with other surfaces, as indicated in the standards.

All the screws used to close the terminal board must be tightened properly. Damaged screws must be replaced immediately, using screws of the same or better quality.

The connection must guarantee:

- that it will maintain integrity over time.
- that no wire ends are sticking out.

Fuses do not constitute protection for the motor, but merely protect against short-circuits.

Size the fuses according to the peak currents, especially when using direct starting.

Protection with a (thermal or amperometric) trip switches is essential to deal with risks of overloading, a loss of one phase in the mains supply, excessive voltage fluctuations, or the rotor getting stuck.

Set the motor trip switch using the current value shown on the nameplate as a maximum.

#### 4.2.2 INVERTER POWERED ELECTRIC MOTOR

**WARNING!**

A maximum of n° 6 evenly distributed starts per hou r, is allowed.

Failure to comply with this may seriously damage the unit.

**WARNING!**

The unit's nominal pressure or vacuum characteristics for service at mains frequency cannot be maintained if the unit is powered via an inverter.

If an inverter is used for the power supply the installer is responsible for the checks and any steps necessary to comply with the immunity and emission limits laid down by the standards.

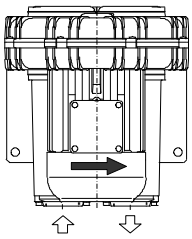
When using the unit with a motor powered via an inverter, follow the wiring instructions supplied by the inverter manufacturer carefully.

**WARNING!**

The performance of the unit powered via an inverter is shown in the relevant tables that can be requested from FPZ's assistance service.

#### 4.2.3 ROTATION DIRECTION

The SCL K compressors–vacuum pumps must be used with the rotation direction shown by the arrow on the fan guard for the electric motor (see figure below).



To check the direction of rotation, switch on the motor very briefly. If the rotation direction is incorrect, switch the position of two of the three power supply conductors on the terminals.

## 5 STARTING UP

**Any use other than the intended use of the unit may cause serious injury and even death!**

The unit may only be started:

After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" and "INSTALLATION").

In conformity with the purposes laid down under "INTENDED USE".

According to the values indicated in the "CHARACTERISTIC DATA" table on page 3/4.

**Danger due to rotating components (electric motor fan, impeller, and shaft): Cutting or shearing of limbs, entanglement or trapping of hair or clothing!**

**Danger due to excess pressure or vacuum: Sudden ejection of process gases (injury to the skin and eyes), and sudden sucking in of hair and clothing!**

**Danger due to process gases that come out and cause burns!**

**Danger due to burns caused by contact with hot surfaces on the unit!**

**Electrical danger!**

**Danger due to the impeller seizing due to use in an unsuitable place and/or due to conveying fluids that are not suitable: Unsuitable ambient and suction temperatures!**

**Danger resulting from the impeller seizing due to the performance values being exceeded: Vacuum and/or pressure exceeding the declared values and/or openings closed!**

**Danger due to noise emitted by the unit!**

- CHECK THAT ALL THE SAFETY GUARDS HAVE BEEN FITTED CORRECTLY.

**WARNING!**

A maximum of n° 6 evenly distributed starts per hour, is allowed.

Failure to comply with this may seriously damage the unit.

### 5.1 PRELIMINARY CHECKS

Before finally starting up, carry out the following preliminary checks:

- If a lot of time has passed since the unit was last started up, check its condition and check for and if necessary remove dust deposited on the external surfaces.
- Deactivate/open any closing elements on the piping (closing valves, solenoid valves, etc.) before starting the unit.

  **Do not allow the unit to be started and operate with the suction and/or delivery openings obscured for any reason!**
- Check that the ambient and suction temperatures for the gas conveyed are between: -15°C (+5°F) and +40°C (+104°F).
- Check the rotation direction as indicated previously in the "INSTALLATION" chapter.
- Check that the setting for the motor trip switch corresponds to the motor's nominal current shown on the nameplate.
- Check that the safety valve is working correctly.

### 5.2 OPERATION

Having carried out all the preliminary checks, you can start with final starting of the unit.

Start the unit by switching on the power supply to the electric motor.

Check the operating pressure or vacuum and compare them to the values indicated in the "CHARACTERISTIC DATA" table on page 3/4. Load losses on the pipes are often underestimated but are determining factors for the operating pressure differential.

Measure the motor's absorption and check against the nameplate value.

**Any use other than the intended use of the unit may cause serious injury and even death!**

The unit may only be used:

- After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" and "INSTALLATION").
- In conformity with the purposes laid down under "INTENDED USE".
- According to the values indicated in the "CHARACTERISTIC DATA" table on page 3/4.

#### 5.2.1 ROUTINE CHECKS

It is important that the units be checked routinely while running by qualified personnel, using inspections to avoid faults that may cause damage directly or indirectly.

**When the unit is running, routinely carry out the following checks:**

- Delivery temperature
- Operating pressure and/or vacuum
- Electric motor current absorption
- Vibrations
- State of the filter and related load loss.

Variations in normal working conditions (increases in power absorbed, anomalous noise, vibrations, excess overheating of the service fluid) indicate that the unit is not working correctly.

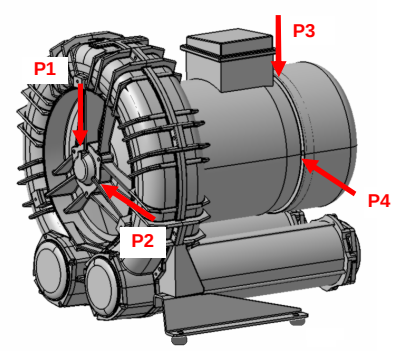
Also compare the values measured with those indicated in the "CHARACTERISTIC DATA" table on page 3/4.

**See chapter 9 "TROUBLESHOOTING" for preventing possible breakage or faults.**

**Measuring vibrations**

Measurements to determine vibration speed [mm/s] must be carried out using an electronic vibration meter at the points indicated below (see the figure below).

- **Points P1** and **P2 (front bearing):** The vibration meter must be put on the cover near the bearing seating, and the highest value must be recorded.
- **Points P3** and **P4 (back bearing):** The vibration meter must be put on the electric motor casing near the bearing seating (not on the fan guard), and the highest value must be recorded.




The results must be evaluated by comparing the maximum speed value measured with the limits laid down for the zones (A, B) shown in the table below, in compliance with ISO 14694.

| Effective vibration speed value [mm/s] | ***Class I*** (≤ 15kW) |
|---|---|
| 1.8 | ***A*** |
| 4.5 | ***B*** |

| Effective vibration speed value [mm/s] | ***Class II*** (> 15kW) |
|---|---|
| 2.8 | ***A*** |
| 7.1 | ***B*** |

**Legend:**

Machine classification:

***Class I*** = SCL with electric motor power ≤ 15 kW
***Class II*** = SCL with electric motor power > 15 kW

Evaluation zones:

***Zone A*** = SCL with vibrations within this zone are considered acceptable for long-term service.

***Zone B*** = SCL with vibrations within this zone are considered unsuitable for continuous long-term service. Under these conditions the machine can be operated for a limited period, until the opportunity arises for suitable corrective work to be done.

**Danger resulting from the impeller seizing due to excessive vibrations!**

Vibration values exceeding zone B (table of effective vibration speed values) are considered NOT admissible and may cause damage to the machine and resulting serious injury and even death!

- If any anomalous noises and/or vibrations are detected, these may be a warning that the impeller is about to seize, switch off the unit and move away from it immediately.

**When the unit is stopped, routinely carry out the following checks:**

- Dust deposits: Check and , if necessary, use suitable equipment to remove deposits on the external surfaces of the unit that may impede correct heat exchanging.
- Suction filter: Every 8-10 days check and if necessary clean or replace the filter cartridge. In very dusty environments, change the filter more frequently. A dirty cartridge creates extensive resistance at the suction, resulting in an increase in: the pressure differential, the power absorbed, and the operating temperature. The load loss must not exceed 30 mbar.

**Electrical danger!**

- Before doing anything else, make sure that the power supply is NOT switched on.

**Danger due to burns caused by contact with hot surfaces on the unit!**

When operating the compressors-vacuum pumps can reach high surface temperatures of up to 160°C (+320°F).

- Before starting with any work, wait for the unit to cool down after switching it off!

## 6 MAINTENANCE

**Any use other than the intended use of the unit may cause serious injury and even death!**

Maintenance may only be carried out on the unit:

If the maintenance instructions, parts list, and section/exploded view of the relevant unit are available.

After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" "STORAGE AND TRANSPORT" and "INSTALLATION").

In conformity with the purposes laid down under "INTENDED USE".

By qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.

**Danger due to burns caused by contact with hot surfaces on the unit!**

When operating the compressors-vacuum pumps can reach high surface temperatures of up to 160°C (+320°F).

- Before starting with any work, wait for the unit to cool down after switching it off!

**Electrical danger!**

- Before doing anything else, make sure that the power supply is NOT switched on.

**Any use other than the intended use of the unit may cause serious injury and even death!**

**The user is not authorised to make repairs or do maintenance work that involves restoring seized surfaces.**

**In these cases contact FPZ's assistance service or an authorised dealer.**

After seizing the components involved may undergo deformation that makes the components unsuitable for being used again. Seized components must be analysed by FPZ before being reused or replaced.

- **Using unsuitable components may cause the impeller blades to break, giving rise to dangerous ejected fragments.**

**Danger due to rotating components: Impeller!**

There may be a danger of shearing due to the impeller rotating even when the machine is switched off, if it is started manually.

- **Suitable working clothes and personal protective equipment must therefore be used.**

### 6.1 INSTRUCTIONS FOR INTERNAL CLEANING

**Should it be necessary to clean the inside of the unit, proceed as follows:**

See fig. 1

1. Position the unit in a vertical position with the fan guard cowling on a flat, stable surface.
2. Remove screws (915) and (902) in order from the cover (162).
3. Remove the cover (162) by using the two threaded holes placed on cover itself
4. Remove the screws (900) and washer (365).
5. Remove the bearing (321) and bearing cover (360) working through the extractor.

N.B.: The shims washers (935) are included when necessary to accomodate the axial clearance. Be careful not to misplace.

6. Remove the impeller (230) through the extractor if necessary.

Clean and reassemble following the instructions in reverse order, and forming the seal (423) using Loctite 5970 or a similar product after having carefully cleaned the surfaces previously sealed.

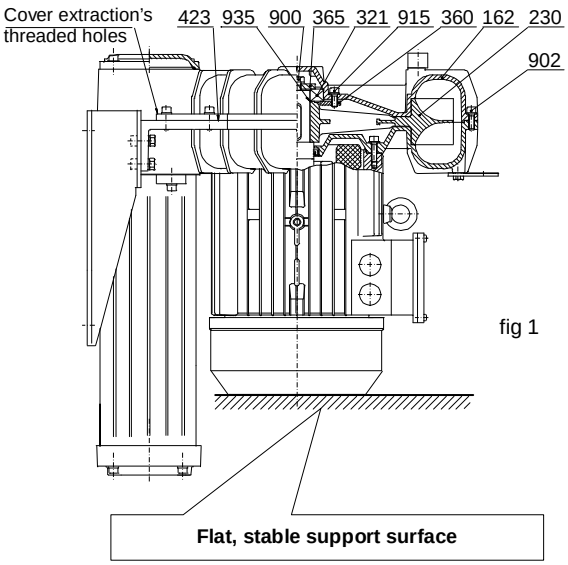



fig 1

**If it becomes necessary to replace the soundproofing in the silencers, proceed as follows:**

See fig. 2

1. Position the unit in a horizontal position with its bracket on a flat, stable surface.
2. Remove the bolts (906).
3. Remove the silencers (700) from the unit, being careful not to lose the gaskets (424).
4. Remove the soundproofing (720) from the silencer housings.
5. Retrieve the support mesh (710).

Replace the soundproofing (720) and reassemble the unit following the instructions in reverse order and not forgetting the gaskets (424).

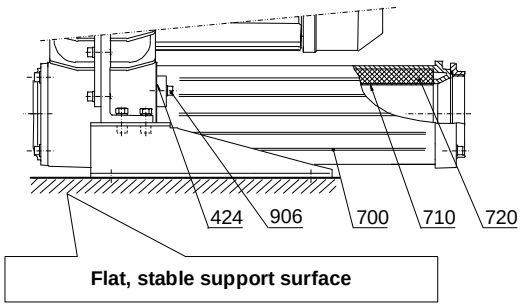



fig 2

### 6.2 LIFESPAN OF BEARINGS

Under normal operating conditions (values shown in CHARACTERISTIC DATA – page 3/4) the machine's bearings have to be replaced after a maximum of 25,000 working hours or not more than 4 years.

**Any use other than the intended use of the unit may cause serious injury and even death!**

The bearings may only be replaced:

If the instructions, parts list, and section/exploded view of the relevant unit are available.

After having carefully read, fully understood, and complied with this operating manual ("SAFETY STANDARDS" "STORAGE AND TRANSPORT" and "INSTALLATION").

In conformity with the purposes laid down under "INTENDED USE".

By qualified personnel, that is, personnel whose training, instruction, experience, knowledge of standards, regulations, accident prevention procedures, and operating and service conditions, makes them capable of carrying out all the works necessary, while being aware of and avoiding any possible danger and/or damage.

## 7 COMMERCIAL CONDITIONS

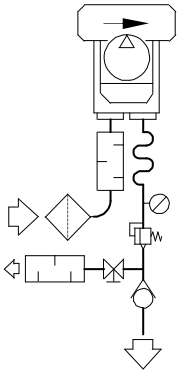
**All undertakings, agreements, or legal relations are governed by the relevant sales contract. These are in no way limited by the contents of this manual.**

**The quality of the materials and workmanship is guaranteed, as indicated in the general sales conditions.**

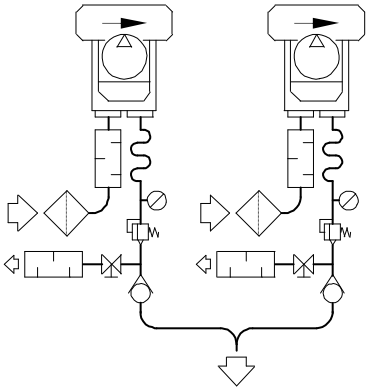
**Guarantees are regulated by the general conditions of sale.**

## 8. INSTALLATION DIAGRAMS

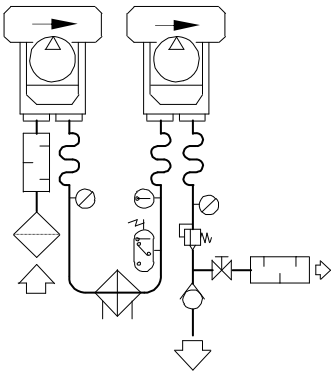
8.1 PRESSURE SERVICE



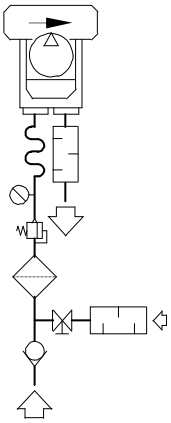
8.2 PARALLEL PRESSURE SERVICE



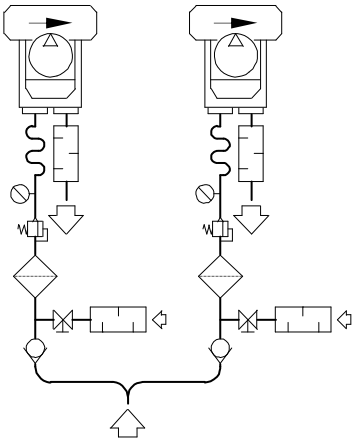
8.3 SERIES PRESSURE SERVICE



8.4 VACUUM SERVICE



8.5 PARALLEL VACUUM SERVICE



8.6 LIST ACCESSORIES

| Item | | Denomination | Item | | Denomination |
|---|---|---|---|---|---|
| 1 |  | Filter – Inline filter | 7 |  | Non return valve |
| (2) |  | Silencer | 8 |  | Valve |
| 3 |  | Flexible coupling | (9) |  | Cooler |
| 4 |  | Pressure – Vacuum gauge | (10) |  | Thermometer |
| 5 |  | Pressure – Vacuum switch | (11) |  | Temperature switch |
| 6 |  | Safety valve | (x) IF NECESSARY | | |

## 9 TROUBLESHOOTING

| Problem | Cause | Solution |
|---|---|---|
| **The unit does not start** | Electrical wiring incorrect | Get the operator to check the electrical connection against the wiring diagram contained in the terminal board box. |
| | Power supply voltage unsuitable | Check that the power supply voltage, measured at the motor's terminals, is within +/- 10% of the nominal voltage. |
| | The impeller is stuck | Get the operator to repair the unit |
| **No or insufficient air flow** | The suction filter is clogged | Get the operator to clean or replace the cartridge |
| | Frequency wrong (for units powered via an inverter) | Correct the frequency |
| | Profile of the impeller blades modified (due to deposits on the profile) | Get the operator to clean the impeller, check if it is worn and, if necessary, replace it. |
| **No or insufficient pressure differential** | Incorrect rotation direction | Get the operator to invert the rotation direction by switching two of the electrical power supply conductors. |
| | Leaks in the plant | Identify the leak and seal |
| **Current absorption exceeding the admissible value** | Electrical wiring incorrect | Get the operator to check the electrical connection against the wiring diagram contained in the terminal board box. |
| | Drop in mains supply voltage | Get the operator to reinstate the power supply voltage at the terminals at the admissible values |
| | The suction filter is clogged | Get the operator to clean or replace the cartridge |
| | The unit has accumulated deposits inside | Get the operator to clean the inside of the unit |
| | The unit is operating at a pressure and/or vacuum that exceeds the admissible value | Adjust the system and/or the regulating valve to lower pressure differentials. |
| **High delivery air temperature** | The unit is operating at a pressure and/or vacuum that exceeds the admissible value | Adjust the system and/or the regulating valve to lower pressure differentials. |
| | The suction filter is clogged | Get the operator to clean or replace the cartridge |
| | The unit has accumulated deposits inside | Get the operator to clean the inside of the unit |
| | Suction and/or delivery piping obstructed. | Get the operator to remove any obstructions |
| | Suction air temperature exceeds 40°C (+104°F) | Use heat exchangers to reduce the suction air temperature |
| **Anomalous noise** | The soundproofing is damaged | Get the operator to replace the soundproofing |
| | The impeller scrapes against the casing.<br>- The unit is operating at a pressure and/or vacuum that exceeds the admissible value | Reduce the pressure differentials in the plant |
| | - Reduction of assembly play due to internal deposits (dust, impurities in the pipes, process residues, etc.) | Get the operator to clean the inside of the plant |
| | Bearing worn | Get the operator to replace the bearing |
| | Unit's installation position unsuitable | Do not fit structures (tanks, steel plating, etc.) on the unit that can transmit or amplify noise |
| **Abnormal vibrations** | The impeller is damaged | Get the operator to replace the impeller |
| | The impeller has accumulated deposits | e uniGet the operator to clean the inside of th t |
| | Unit fixing without anti-vibration supports | Get the operator to fix the unit with anti-vibration supports |
| | Rigid connection to the plant | Get the operator to fit flexible hoses between the unit and the piping |
| | Bearing on the blower or motor side defective | Get the operator to replace the bearing |
| **Leaks in the unit** | Defective silencer gaskets | Get the operator to clean or replace the gaskets |
| | Defective cover gaskets | Get the operator to clean or replace the gaskets |

The term "operator" means: A qualified person appointed to install, operate, set, clean, repair or move a unit or to carry out maintenance work on it.

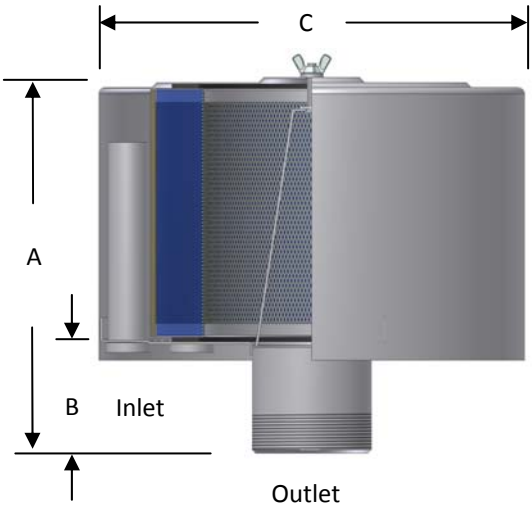
# Compact Filter Silencers
## FS Series 1/2” - 6” MPT, Flange





## Features

- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tubes are positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish & powder coated weatherhood




## Technical Specifications

- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H2O over initial Δ P
- Pressure drop graphs available upon request
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

## Options

- 1/8” tap holes available for 3” and larger connections
- Pressure drop indicator (See page 3-11)
- Various media for different environments
- Stainless steel construction
- Epoxy coated finish
- Special connections
- Side Access Silencer Filters (LQB Series) for space restricted enclosures (select models)

***Tidbit***: Charlie Solberg Sr. “Senior” designed our first filter silencer in 1966. The FS-15 size filter was created for small air compressors.


www.solbergmfg.com • sales@solbergmfg.com • Sales: 630.773.1363 • Fax: 630.773.0727

## Outlet Connections

| MPT Outlet | Assembly SCFM Rating | Assembly Part Number Polyester | Assembly Part Number Paper | Dimensions - inches A | B | C | No. of Silencing Tubes | Approx. Wt. lbs | Replacement Element Part No. Polyester | Replacement Element Part No. Paper | Element SCFM Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2" | 10 | FS-15-050 | FS-14-050 | 4 | 1 1/2 | 6 | 1 | 2 | 15 | 14 | 35 |
| 3/4" | 25 | FS-15-075 | FS-14-075 | 4 | 1 1/2 | 6 | 2 | 2 | 15 | 14 | 35 |
| 1" | 35 | FS-15-100 | FS-14-100 | 4 | 1 1/2 | 6 | 3 | 2 | 15 | 14 | 35 |
| 1" | 55 | FS-19P-100 | FS-18P-100 | 6 5/8 | 1 5/8 | 6 | 3 | 3 | 19P | 18P | 100 |
| 1 1/4" | 70 | FS-19P-125 | FS-18P-125 | 6 5/8 | 1 5/8 | 6 | 5 | 3 | 19P | 18P | 100 |
| 1 1/2" | 85 | FS-19P-150 | FS-18P-150 | 6 5/8 | 1 5/8 | 6 | 5 | 4 | 19P | 18P | 100 |
| 2" | 135 | FS-31P-200 | FS-30P-200 | 7 1/4 | 2 1/4 | 10 | 5 | 8 | 31P | 30P | 195 |
| 2" | 135 | FS-231P-200 | FS-230P-200 | 12 1/4 | 2 1/4 | 10 | 5 | 14 | 231P | 230P | 300 |
| 2 1/2" | 195 | FS-31P-250 | FS-30P-250 | 7 1/2 | 2 1/2 | 10 | 5 | 8 | 31P | 31P | 195 |
| 2 1/2" | 195 | FS-231P-250 | FS-230P-250 | 12 1/2 | 2 1/2 | 10 | 9 | 15 | 231P | 230P | 300 |
| 3" | 300 | FS-231P-300 | FS-230P-300 | 13 | 3 | 10 | 9 | 15 | 231P | 230P | 300 |
| 3" | 300 | FS-235P-300 | FS-234P-300 | 13 | 3 | 16 | 9 | 29 | 235P | 234P | 570 |
| 3" | 300 | FS-275P-300 | FS-274P-300 | 13 | 3 | 16 | 9 | 33 | 275P | 274P | 1100 |
| 4" | 520 | FS-235P-400 | FS-234P-400 | 14 | 4 | 16 | 9 | 30 | 235P | 234P | 570 |
| 4" | 520 | FS-275P-400 | FS-274P-400 | 14 | 4 | 16 | 9 | 34 | 275P | 274P | 1100 |
| 5" | 800 | FS-245P-500 | FS-244P-500 | 14 | 4 | 16 | 14 | 33 | 245P | 244P | 880 |
| 5" | 800 | FS-275P-500 | FS-274P-500 | 14 | 4 | 16 | 14 | 36 | 275P | 274P | 1100 |
| 6" | 1100 | FS-275P-600 | FS-274P-600 | 15 | 5 | 16 | 18 | 38 | 275P | 274P | 1100 |

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

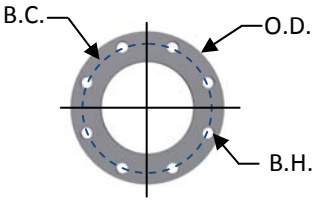
## Flange Outlet Connections

| Flange Outlet | Assembly SCFM Rating | Assembly Part Number Polyester | Assembly Part Number Paper | Dimensions - inches A | B | C | No. of Silencing Tubes | Approx. Wt. lbs | Replacement Element Part No. Polyester | Replacement Element Part No. Paper | Element SCFM Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4" | 520 | FS-235P-400F | FS-234P-400F | 14 | 4 | 16 | 9 | 33 | 235P | 234P | 570 |
| 4" | 520 | FS-275P-400F | FS-274P-400F | 14 | 4 | 16 | 9 | 39 | 275P | 274P | 1100 |
| 5" | 800 | FS-245P-500F | FS-244P-500F | 14 | 4 | 16 | 14 | 38 | 245P | 244P | 880 |
| 5" | 800 | FS-275P-500F | FS-274P-500F | 14 | 4 | 16 | 14 | 41 | 275P | 274P | 1100 |
| 6" | 1100 | FS-275P-600F | FS-274P-600F | 15 | 5 | 16 | 18 | 42 | 275P | 274P | 1100 |

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance ± 1/4”

| 125/150# Pattern Flg | Dimensions - inches O.D. | B.C. | B.H. | No. of Holes | Flange Thickness |
|---|---|---|---|---|---|
| 4" | 9 | 7 1/2 | 0.75 | 8 | 0.38 |
| 5" | 10 | 8 1/2 | 0.88 | 8 | 0.38 |
| 6" | 11 | 9 1/2 | 0.88 | 8 | 0.38 |

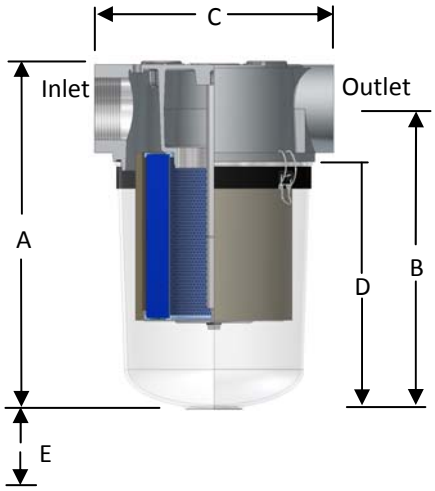



O.D.: Outside Dimension
B.C.: Bolt Circle
B.H.: Bolt Hole

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

# ”T” Style Vacuum Filters
## ST/CT Series 1” – 6” FPT






## General Features

- Compact design for space restrictions; min. service area
- Inlet above element for extended element life & maintenance intervals
- Cast, corrosion resistant aluminum top with machined connections: - Integrated baffle design
  - 4 M12 taps for mounting brackets: 2” to 6”
- ”T” style design minimizes piping requirements
- 1/4” differential gauge ports: 2” to 6”

### ST Series Specifications

- See-through bucket made from polycarbonate material
- Bucket has a high tensile strength for dimensional stability
- Temp ratings: - Complete assembly max: 220°F (104°C)
  - See-through bucket only max: 257°F (125°C)
- Increased holding capacity

## Technical Specifications

- Vacuum Rating: Gas tight seal
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H2O over initial Δ P
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

## Options

- Swing bolts for heavy duty environments
- 1” to 1-1/2” housings have dimples for optional gauge ports & mounting bracket taps
- Epoxy coated housings
- Drain ports
- Spool piece extender on select models
- ISO flange connections: NW25, NW40 (select models)

| FPT Inlet & Outlet | Assembly SCFM Rating | Assembly Part Number | | Dimensions - inches | | | | Suggested Service HT. | Approx. Weight | Replacement Element Part No. | | Element SCFM Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Polyester | Paper | A | B | C | D | E | lbs. | Polyester | Paper | |
| 1" | 40 | ST-897-100C | ST-896-100C | 13 3/8 | 11 15/16 | 7 | 10 3/8 | 9 | 11 | 897 | 896 | 115 |
| 1-1/4" | 60 | ST-897-125C | ST-896-125C | 13 3/8 | 11 15/16 | 7 | 10 3/8 | 9 | 11 | 897 | 896 | 115 |
| 1-1/2" | 80 | ST-897-150C | ST-896-150C | 13 3/8 | 11 15/16 | 7 | 10 3/8 | 9 | 10 | 897 | 896 | 115 |
| 2" | 175 | ST-851/1-200C | ST-850/1-200C | 16 1/4 | 14 1/4 | 9 | 12 1/2 | 9 | 15 | 851/1 | 850/1 | 290 |
| 2-1/2" | 210 | ST-851/1-250C | ST-850/1-250C | 16 1/4 | 14 1/4 | 9 | 12 1/2 | 9 | 14 | 851/1 | 850/1 | 290 |
| 3" | 300 | ST-235P-300C | ST-234P-300C | 19 3/4 | 17 | 13 1/2 | 14 | 9 | 29 | 235P | 234P | 570 |
| 4" | 520 | ST-235P-400C | ST-234P-400C | 19 3/4 | 17 | 13 1/2 | 14 | 9 | 25 | 235P | 234P | 570 |

Dimension tolerance ± 1/4”

### CT Series Specifications

- Carbon steel black enamel drop down bucket
- Swing bolts standard on 6” housings

| FPT Inlet & Outlet | Assembly SCFM Rating | Assembly Part Number | | Dimensions - inches | | | | Suggested Service HT. | Approx. Weight | Replacement Element Part No. | | Element SCFM Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Polyester | Paper | A | B | C | D | E | lbs. | Polyester | Paper | |
| 1" | 40 | CT-897-100C | CT-896-100C | 13 3/8 | 11 13/16 | 7 | 10 3/8 | 9 | 12 | 897 | 896 | 115 |
| 1-1/4" | 60 | CT-897-125C | CT-896-125C | 13 3/8 | 11 13/16 | 7 | 10 3/8 | 9 | 12 | 897 | 896 | 115 |
| 1-1/2" | 80 | CT-897-150C | CT-896-150C | 13 3/8 | 11 13/16 | 7 | 10 3/8 | 9 | 11 | 897 | 896 | 115 |
| 2" | 175 | CT-851-200C | CT-850-200C | 13 | 10 7/8 | 9 | 9 | 9 | 16 | 851 | 850 | 290 |
| 2-1/2" | 210 | CT-851-250C | CT-850-250C | 13 | 10 7/8 | 9 | 9 | 9 | 15 | 851 | 850 | 290 |
| 3" | 300 | CT-235P-300C | CT-234P-300C | 18 5/8 | 16 1/8 | 13 1/2 | 13 | 9 | 30 | 235P | 234P | 570 |
| 4" | 520 | CT-235P-400C | CT-234P-400C | 18 5/8 | 16 1/8 | 13 1/2 | 13 | 9 | 26 | 235P | 234P | 570 |
| 6" | 1100 | CT-275P-600C | CT-274P-600C | 18 1/4 | 14 1/2 | 19 | 9 7/8 | 10 | 45 | 275P | 274P | 1100 |

Note CT 2” & 2-1/2” models: Element seals on the base of the housing

See Vacuum Filter Technical Data section for sizing guidelines.

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

SOLBERG



# Inlet Vacuum Filters
# Maintenance Manual

## www.solbergmfg.com

*Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA*
*Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web:* www.solbergmfg.com
*Rev: MMVF-910*

Note: Please read the maintenance instructions given by the OEM for the machinery first. The OEM's manual should be adhered to in order to protect the equipment. Solberg Manufacturing, Inc has made every effort to make sure that these instructions are accurate but is not responsible for any typos, slight variations or for human errors that may occur.

# Maintenance Manual

## *SOLBERG Inlet Vacuum Filters*

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**For Further Information Please Call: 630-773-1363*



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*Rev: MMVF-910*

# Section A

***INTRODUCTION***

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet vacuum filters.

## *WARNING*

**This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.**

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the vacuum inlet filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will exceed your application requirements.

# Section B

***GENERAL INFORMATION***

**1. Identification of Solberg Vacuum Inlet Filters.**

All Solberg inlet vacuum air filters should have an identification label/nameplate that gives the following information:

**Assembly Model #**
**Replacement Element #**

(The exception is OEM supplied units. In this case please enter the OEM part numbers below.)

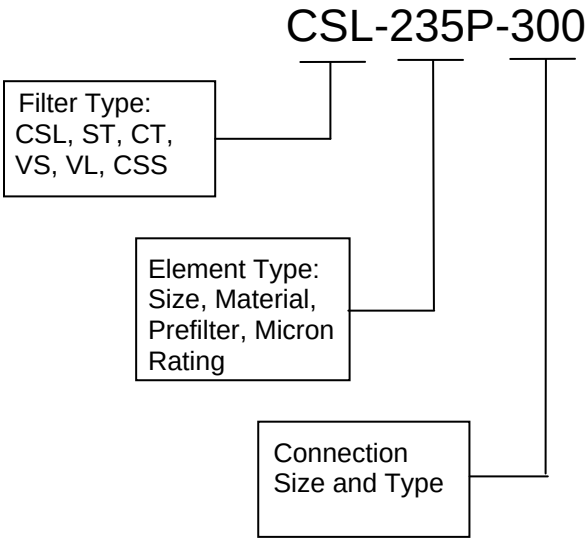

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*Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web:* www.solbergmfg.com

Fill in the actual nameplate data from your new Solberg inlet filter(s):

| No. | Filter Model Number | Replacement Element |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

Table 1

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'CSL' design filter with a 235 element with prefilter and 3" MPT connection size:




## 2. Filtration Rules of Thumb

**General:** For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary


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goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

**Rule of Thumb #1:** Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

**Rule of Thumb #2:** Always ask or specify a filter based on a micron rating **with** filtration efficiencies. As an example, stating a requirement for a 1-micron filter is misleading because no efficiency rating has been specified. A 1-micron filter at 95-% efficiency may be less efficient than a 5-micron filter at 99% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99% filtration efficiency at 5 microns is required.

**Rule of Thumb #3:** Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.

| **Filtration Efficiency Requirements (99+% efficiency)** | **Environmental Conditions** | **Air to Media Ratio** | |
|---|---|---|---|
| *Industrial Grade* 2-micron **Paper** | Industrial Duty (clean, office/warehouse-like) | 30 CFM/$ft^2$ | $(51m^3/h)/cm^2$ |
| | Severe Duty (workshop, factory-like) | 15 CFM/$ft^2$ | $(25.5m^3/h)/cm^2$ |
| | Extreme Duty (Foundry, Construction-like) | 10 CFM/$ft^2$ | $(17m^3/h)/cm^2$ |
| *Industrial Grade* 5-micron **Polyester** | Industrial Duty (clean, office/warehouse-like) | 50 CFM/$ft^2$ | $(85m^3/h)/cm^2$ |
| | Severe Duty (workshop, factory-like) | 40 CFM/$ft^2$ | $(68m^3/h)/cm^2$ |
| | Extreme Duty (Foundry, Construction-like) | 25 CFM/$ft^2$ | $(42.5m^3/h)/cm^2$ |
| *Industrial Grade* 1-micron **Polyester** | Severe Duty (Foundry, Construction-like) | 10 CFM/$ft^2$ | $(17m^3/h)/cm^2$ |
| *Industrial Grade* 0.3-micron **HEPA** Glass @ 99.97% efficiency | Industrial Duty (clean office/warehouse-like) | 10 CFM/$ft^2$ | $(17m^3/h)/cm^2$ |
| | Severe Duty (workshop, factory-like) | 7 CFM/$ft^2$ | $(12m^3/h)/cm^2$ |
| | Extreme Duty (Foundry, Construction-like) | 5 CFM/$ft^2$ | $(8.5m^3/h)/cm^2$ |

Table 2

**Rule of Thumb #4:** Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" / 250-380mm $H_2O$ from the original reading.

**Rule of Thumb #5:** The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200$m^3$/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

| Pipe Size (inches) | Max Airflow | | Pipe Size (inches) | Max Airflow | | Pipe Size (inches) | Airflow | |
|---|---|---|---|---|---|---|---|---|
| 1/4" | 6 CFM | 10$m^3$/h | 1 ¼" | 60 CFM | 102$m^3$/h | 6" | 1,100 CFM | 1870$m^3$/h |
| 3/8" | 8 CFM | 14$m^3$/h | 1 ½" | 80 CFM | 136$m^3$/h | 8" | 1,800 CFM | 3060$m^3$/h |
| 1/2" | 10 CFM | 17$m^3$/h | 2" | 135 CFM | 230$m^3$/h | 10" | 3,300 CFM | 5610$m^3$/h |
| 3/4" | 20 CFM | 34$m^3$/h | 2 ½" | 195 CFM | 332$m^3$/h | 12" | 4,700 CFM | 7990$m^3$/h |
| 1" | 35 CFM | 60$m^3$/h | 3" | 300 CFM | 510$m^3$/h | 14" | 6,000 CFM | 10200$m^3$/h |
| | | | 4" | 520 CFM | 884$m^3$/h | | | |
| | | | 5" | 800 CFM | 1360$m^3$/h | | | |

Table 3 **Note: This information is for general use only. A qualified engineer must properly design each system.*

## 3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C
Filter Change-Out Differential: 10" to 15" / 250-380mm $H_2O$ Over Initial Delta P

| Media | Micron Rating |
|---|---|
| Standard Paper | 99+% @ 2 micron |
| Standard Polyester | 99+% @ 5 micron |
| "S" Series Wire Mesh | Epoxy Coated Wire Mesh |
| "Z" Series Polyester | 99+% @ 1 micron |
| "HE" Series HEPA | 99.97% @ 0.3 microns |
| "U" Series Polyester | 99+% @ 25 micron |
| "W" Series Polyester | 99+% @ 100 micron |
| "S2" Series | Stainless Steel Wire Mesh |
| "AC" & "ACP" Series | N/A |
| "Y" Series Polypropylene | 99+% @ 5 micron |

Table 4


*Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA*
*Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web:* www.solbergmfg.com
*Rev: MMVF-910*

SOLBERG

Temperature Range: -15° to 385°F / -26° to 196°C
Filter Change-Out Differential: 10” to 15” / 250-380mm $H_2O$ Over Initial Delta P

| Media | Micron Rating |
|---|---|
| “MX” & “MXD” Series – Nomex Cloth | 99+% @ 5 micron |

Table 5

4. **Element Cleaning - Inlet Filtration**

Solberg elements should be cleaned or replaced, once the pressure drop reaches 15 to 20-inches water column (380 - 500mm WC) above the initial pressure drop of the installation.

The decision to clean the element rather than replace it is left to the discretion of the operator. Any damage which results from by-pass or additional pressure drop created by element cleaning is the sole responsibility of the operator.

# *WARNING*

The overall performance of a filter element is altered once cleaned.

The initial pressure drop after cleaning will be greater than the original, clean pressure drop of the element.

After each subsequent cleaning, the initial pressure drop will continue to increase.

Under all circumstances, the initial pressure drop of the element needs to be maintained at less than 20-inches water column (500mm WC).

Cleaned elements that exceed 20-inches water column (500mm WC) at start-up should be replaced with new elements.

With many types of equipment, the maximum pressure drop allowed will be dictated by the ability of the equipment to perform to its rated capacity. Under all

circumstances, the operator should avoid exceeding the manufacturer's recommended maximum pressure drop for their specific equipment.

A. ***Polyester Element***: The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element should be dry before reinstallation. The element should be replaced after a maximum of three cleanings.
B. ***Paper Element***: The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.
C. ***Polyurethane Prefilter***: The prefilter may be washed as a sponge or replaced to give the element a longer service life.
D. ***Epoxy Coated Wire Mesh and Stainless Steel Wire Mesh Elements***: Cleaning instructions similar to polyester, except mild solvents may be used.
E. ***Activated Carbon Element***: Not cleanable
F. ***Polypropylene Element***: Cleaning instructions similar to polyester
G. ***Nomex Cloth Element***: Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wing nuts and washers can be supplied upon request.

# Section C

***PROCEDURES***

**1. Installation.**

A. Maximum inlet gas stream temperature for most Solberg inlet vacuum filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers.

B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on inlet and outlet ports.

C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

**2. Disconnecting canister top from canister base.**

A. ST/CT/Small CSL: Release wire-form clips or loosen wing nut on "claw" bolts.

B. Large CSL: Loosen wing nut or hex head on T-bolts.

C. CSS: Twist upper housing to release.

D. VS/VL: Remove V-clamp by loosening Hex Nut or T-bolt and releasing.

E. Lift off canister top.

**3. Removing element for service/maintenance.**

A. Remove retaining hex head/wing-nut and washer carefully, and then remove element. Some elements will have a top plate that should also be removed.

B. Clean sealing surfaces of housing, top & base plates, and element endcaps so that they are free of dirt or any other particulate.

# *WARNING*

**Failure to comply with these instructions may result in system or pump contamination.**

**4. Securing Element.**

A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces.

B. Place top plate (if necessary) on element by centering on tap bolt.

C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: DO NOT over tighten!

# *WARNING*

**Defective installation may cause system or pump contamination. Use only genuine Solberg replacement parts.**

**5. Securing canister top to canister base.**

A. Make sure all surfaces are free from dust and other particulate.


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B. Hemisphere o-ring must rest evenly along canister/casting base o-ring groove.

C. ST/CT/Small CSL: Hold canister housing against o-ring or sealing ring on main filter head. Re-fasten wire-form clips or “claw” bolts.

D. Large CSL: Replace housing top plate. Feed T-bolts into corresponding slots and tighten evenly around perimeter. Note: Do NOT over tighten!

E. VS/VL: Secure V-clamp by disconnecting hex nut or T-bolt portion and placing V-clamp along the diameter of canister o-ring groove. Fasten T-bolt and secure tightly. V-CLAMP LEGS MUST REST UNIFORMLY ALONG ENTIRE O-RING GROOVE.

F. CSS: Reassemble top housing to bottom housing by aligning tabs and turning into place.

# Section D

***MAINTENANCE RECOMMENDATIONS***

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10” to 15” / 250-380mm $H_2O$ higher pressure drop above the initial reading. Refer to page 4 for instructions.

2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change from Solberg specified parts!

3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.

4. Operate only when a proper seal exists.

5. VS/VL: Never operate without absolute assurance that V-clamp is secured correctly along entire diameter of canisters. Check along V-clamp for wear. Replace if any distortion occurs due to handling and usage.

**SPARE PARTS**

Contact your Solberg Representative for spare part model numbers.


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*Rev: MMVF-910*

® **FPZ S.p.A.**
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Fax +39 039 60 41 296
www.fpz.com

**I – GB – F – D – E** **SN 1701-7**

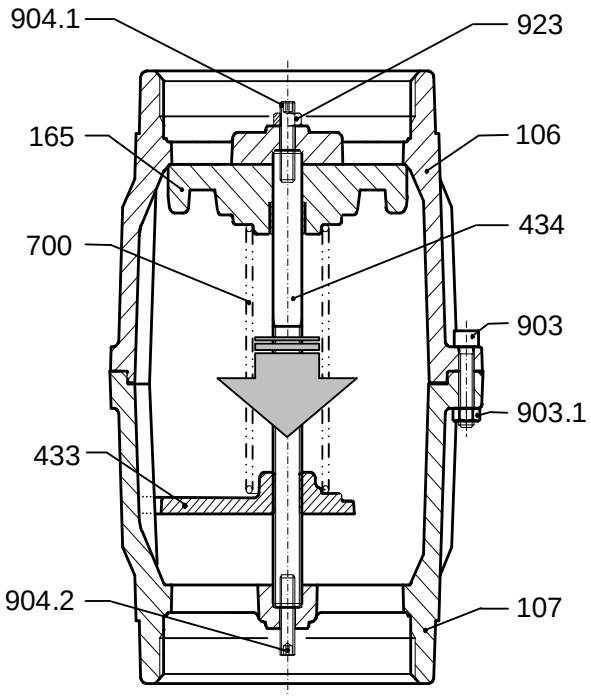
# VALVOLA DI SICUREZZA VRL
# SAFETY VALVE VRL
# SOUPAPE DE SECURITE VRL
# SICHERHEITSVENTIL VRL
# VALVULA DE SEGURIDAD VRL

## ISTRUZIONI D'USO
## USE INSTRUCTIONS
## INSTRUCTIONS D'UTILISATION
## ANWENDUNGSHINWEISE
## INSTRUCCIONES PARA EL USO

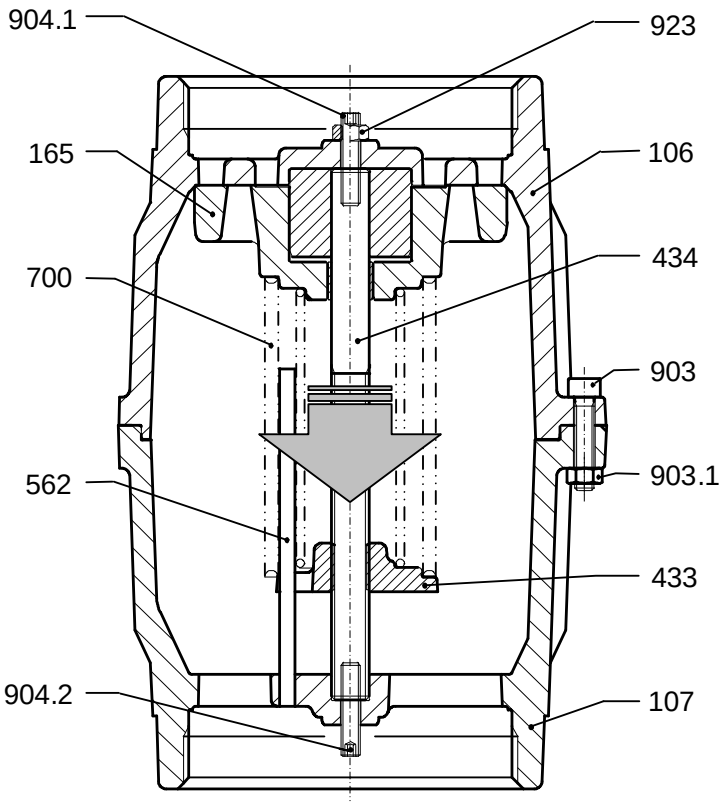
**ATTENZIONE! LA VALVOLA E' FORNITA NON TARATA**
**CAUTION! THE VALVE IS SUPPLIED NOT CALIBRATED**
**ATTENTION ! LA SOUPAPE EST FOURNIE NON TAREE**
**ACHTUNG ! DAS VENTIL IST WERKSEITIG NICHT GEEICHT**
**ATENCION ! LA VALVULA NO ESTA GRADUADA**



*LEGGERE ATTENTAMENTE TUTTE LE ISTRUZIONI E CONSERVARLE*
*PLEASE READ CAREFULLY ALL INSTRUCTIONS AND KEEP THEM FOR FUTURE REFERENCE*
*LIRE ATTENTIVEMENT TOUTES LES INSTRUCTIONS ET LES CONSERVER*
*ALLE ANLEITUNGEN SIND SORGFÄLTIG ZU LESEN UND AUFZUBEWAHREN!*
*LEER ATENTAMENTE LAS INSTRUCCIONES Y CONSERVARLAS*




**VRL6**
Fig. 1a




**VRL8 - VRL9**
Fig. 1b

| ITEM | Denominazione - *Description* - Désignation - *Description* - Descripciòn |
|---|---|
| 106 | Corpo - *Housing* - Corps supérieur - *Gehäuse* - Cuerpo |
| 107 | Coperchio - *Cover* - Couvercle - *Abdeckung* - Cubierta |
| 165 | Otturatore - *Shutter* - Obturateur - *Verschluss* - Obturador |
| 433 | Piattello guida molla - *Spring guide disc* - Guide ressort - *Federführungsscheibe* - Disco guìa muelle |
| 434 | Asta - *Shutter guide* - Tige - *Schließführung* - Vastago |
| 562 | Spina cilindrica - Dowel pin -Goupille cylindrique - *Führungsstift* - Pin |
| 700 | Molla - *Spring* - Ressort - *Feder* - Muelle |
| 903 | Vite - *Screw* - Vis - *Schraube* - Tornillo |
| 903.1 | Dado - *Nut* - Ecrou - *Schraubenmutter* - Tuerca |
| 904.1 | Grano superiore - *Upper grub screw* - Tige de réglage supérieure – *Obere Einstellschraube* - Espàrrago superior |
| 904.2 | Grano inferiore - *Lower grub screw* - Tige de réglage inférieure - *Untere Einstellschraube* - Espàrrago inferior |
| 923 | Dado di fermo - *Nut* - Ecrou de blocage -*Schraubenmutter* - Contratuerca |

## I CONDIZIONI D'UTILIZZO

- **LE VALVOLE VRL SONO ADATTE AL CONVOGLIAMENTO DI ARIA E GAS NON ESPLOSIVI, NON INFIAMMABILI, NON AGGRESSIVI, IN ATMOSFERA NON ESPLOSIVA. LA TEMPERATURA DEL FLUIDO CONVOGLIATO È AMMESSA NEL CAMPO DI -15 A +160 °C.**
- **VALVOLE PROGETTATE E FABBRICATE PER LA LIMITAZIONE NEL CAMPO DELLE BASSE PRESSIONI / DEPRESSIONI, PER UN UTILIZZO SPECIFICO SU SOFFIANTI, ASPIRATORI E COMPRESSORI A BASSE PRESSIONI;**
- **NON SOPPORTANO PRESSIONI INTERNE ELEVATE, COMUNQUE NON SUPERIORI A 2.8 bar A;**
- **SONO SOGGETTE A PICCOLE PERDITE DEL FLUIDO CONVOGLIATO;**
- **CORPI SOLIDI ANCHE DI PICCOLE DIMENSIONI E SPORCIZIA POSSONO PROVOCARE GRAVI DANNI, VANNO QUINDI SEPARATI DAL FLUSSO MEDIANTE ADEGUATI FILTRI IN ASPIRAZIONE.**

## GB *CONDITIONS OF USE*

- ***THE VRL VALVES ARE DESIGNED FOR THE HANDLING OF AIR OR NON-EXPLOSIVE, NON-HAZARDOUS AND NON-FLAMMABLE GASES IN NON-EXPLOSIVE ENVIRONMENTS. THE GAS INLET TEMPERATURE MUST BE IN THE RANGE OF -15 TO +160 °C.***
- ***RELIEF VALVES ARE DESIGNED AND MANUFACTURED TO LIMIT THE OPERATING PRESSURE IN LOW PRESSURE/VACUUM APPLICATIONS. THEY ARE FOR USE SPECIFICALLY ON LOW PRESSURE BLOWERS AND VACUUM PUMPS ONLY;***
- ***THE VALVE CANNOT WITHSTAND HIGH INTERNAL PRESSURE, DESIGN MAXIMUM OF 2.8 bar A;***
- ***THERE IS SMALL LOSS OF THE AIR/GAS BEING HANDLED;***
- ***SOLID PARTICULES, HOWEVER SMALL, INCLUDING DIRT CAN CAUSE SERIOUS DAMAGE; THEREFORE IT IS ESSENTIAL THAT SUCH SUBSTANCES SHOULD BE REMOVED FROM THE GAS BY SUITABLE FILTERS UPSTREAM OF THE INLET.***

## F CONDITIONS D'UTILISATION

- **LES SOUPAPES VRL SONT ADAPTÉS À L'ACHEMINEMENT D'AIR ET DE GAZ NON EXPLOSIFS, ININFLAMMABLES, NON AGRESSIFS, DANS UNE ATMOSPHÈRE NON EXPLOSIVE. LA TEMPÉRATURE DU FLUIDE ACHEMINÉ EST ADMISE DANS UN ÉVENTAIL DE -15 À +160 °C.**
- **CES SOUPAPES ONT ETÉ DÉVELOPPÉES ET CONSTRUITES AFIN DE LIMITER LES VALEURS MAXIMALES VIDE/PRESSION ET LEUR UTILISATION EST SPÉCIFIQUEMENT RESERVÉE AUX ASPIRATEURS ET COMPRESSEURS BASSES PRESSION;**
- **NE SUPPORTENT PAS DES PRESSIONS INTERNES ÉLEVÉES, C'EST-À-DIRE DES PRESSIONS SUPÉRIEURES À 2.8 bar A;**
- **SONT SUJETTES À DE PETITES PERTES DU FLUIDE ACHEMINÉ;**
- **DES CORPS SOLIDES MÊME DE PETITES DIMENSIONS ET LÉGÈREMENT SALES PEUVENT PROVOQUER DE GRAVES DOMMAGES, ILS SONT PAR CONSÉQUENT SÉPARÉS DU FLUX PAR DES FILTRES ADÉQUANTS EN ASPIRATION.**

## D *EINSATZBEDINGUNGEN*

- ***DIE VENTILE DER SERIE VRL SIND FÜR DEN DAUERBETRIEB IN NICHT-EXPLOSIVER UMGEBUNG ZUM ANSAUGEN UND VERDICHTEN VON LUFT ODER NICHT-EXPLOSIVEN, NICHT-BRENNBAREN UND NICHT-AGGRESSIVEN GASEN GEEIGNET. DIE ZULÄSSIGE ANSAUGTEMPERATUREN LIEGT ZWISCHEN -15 BIS +160 °C.***
- ***DIE SPEZIELL FÜR DEN NIEDERDRUCK- BZW. NIEDERVAKUUMBEREICH ENTWICKELTEN VENTILE SIND FÜR DIE SPEZIFISCHE ANWENDUNG IN VAKUUMPUMPEN UND KOMPRESSOREN GEEIGNET;***
- ***DIE GEHÄUSE WIDERSTEHEN KEINEN HOHEN INNENDRÜCKEN. UNTER KEINEN UMSTÄNDEN DARF DER MAX. BETRIEBSDRUCK VON 2.8 bar A ÜBERSCHRITTEN WERDEN;***
- ***DIE VENTILE SIND NICHT VOLLSTÄNDIG GASDICHT;***
- ***FREMDKÖRPER, AUCH GERINGER GRÖßE, UND VERUNREINIGUNGER KÖNNEN SCHWERE SCHÄDEN VERURSACHEN. SIE MÜSSEN DAHER AUS DEM FÖRDERMEDIUM MIT GEEIGNETEN ANSAUGFILTERN ENTFERNT WERDEN.***

## E CONDICONES DE USO

- **LAS VALVULAS VRL SON ADAPTAS PARA EL MOVIMIENO DE AIRE O GASES NO EXPLOSIVOS, NO PELIGROSOS Y NO INFLAMABLES Y PARA SERVICIO EN AMBIENTES NO EXPLOSIVOS. LA TEMPERATURA DE ENTRADA DEL GAS DEBE ESTAR ENTRE LOS –15 Y +160 °C.**
- **VALVULAS PROYECTADAS Y FABRICADAS PARA LA LIMITACION EN EL SECTOR DE LAS BAJAS PRESIONES / VACIOS, PARA UN UTILIZO SOBRE ASPIRADORES, COMPRESORES A BAJAS PRESIONES.**
- **LA VALVULA NO PUEDE CONTENER PRESIONES INTERNAS ALTAS, NO MAYORES QUE 2.8 bar A;**
- **HAY UNA PECHEÑA PERDIDA DE FLUIDO MANEJADO;**
- **LAS PARTICULAS SOLIDAS, AUNQUE PEQUEÑAS, INCLUIDO EL POLVO, PUEDEN CAUSAR SERIOS DAÑOS. POR LO TANTO ES ESENCIAL QUE DICHAS SUSTANCIAS SEAN ELIMINADAS DEL GAS MEDIANTE FILTROS APROPIADOS ANTES DE LA ENTRADA.**

**DIAGRAMMA DI SELEZIONE - *SELECTION DIAGRAM***
***SCHÉMA DE SÉLECTION – AUSWAHLDIAGRAMM***
***DIAGRAMA DE SELECCION***

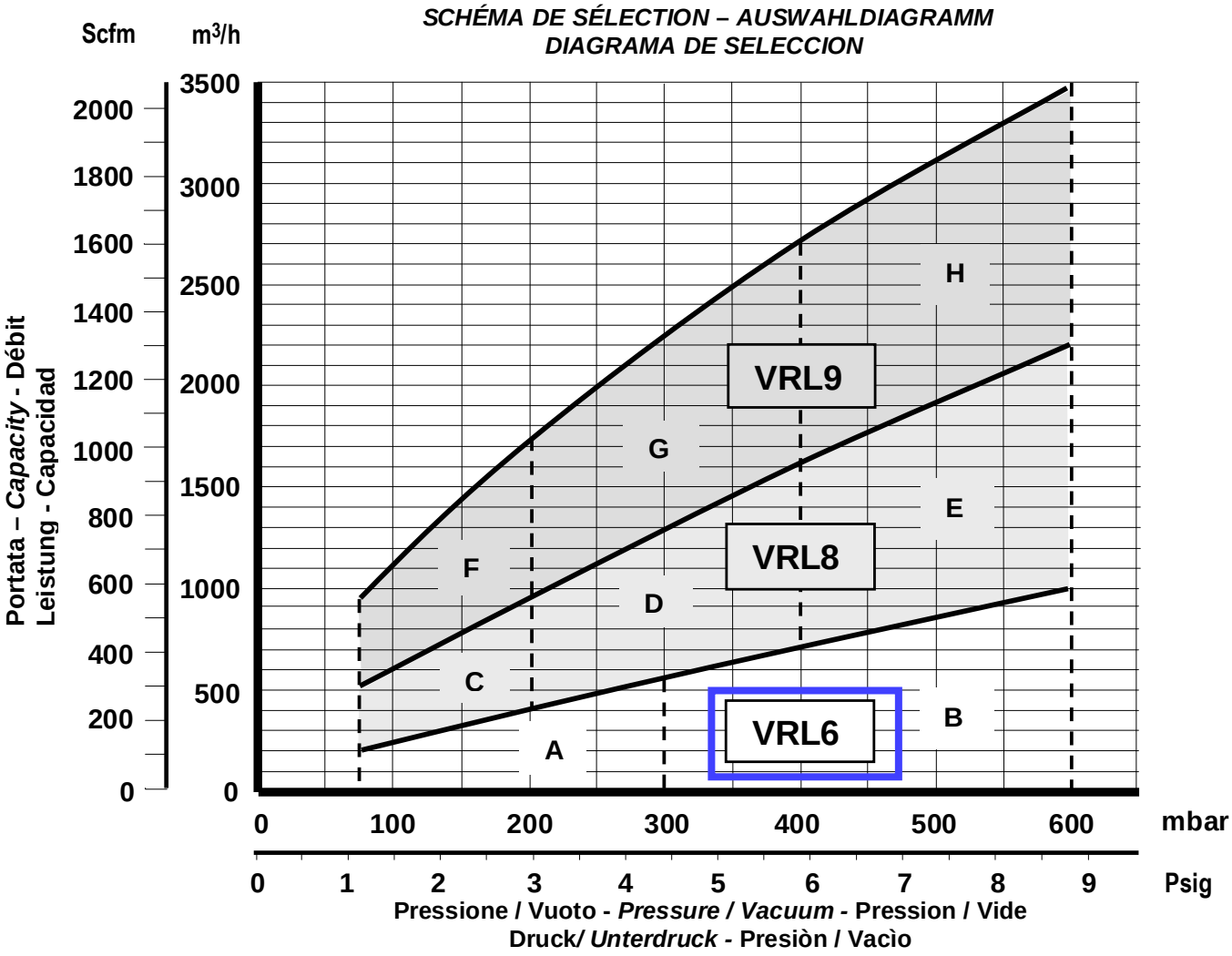



**TABELLA DI SELEZIONE MOLLA - *SPRING SELECTION CHART* - TABLEAU DE SÉLECTION RESSORT**
***UEBERSICHTSTABELLE FEDERN* - TABLA DE SELECCION MUELLE**

| RANGE | MOLLA *SPRING* RESSORT *FEDER* MUELLE N° | Pressione / Vuoto *Pressure / Vacuum* Pression / Vide *Druck / Underdruck* Presiòn / Vacìo MIN [mbar] | MIN [psig] | Pressione / Vuoto *Pressure / Vacuum* Pression / Vide *Druck / Underdruck* Presiòn / Vacìo MAX [mbar] | MAX [psig] | Colore di identificazione *Colour of identification* Couleur d' identification *Farbidentifizierung* Color de identificaciòn |
|---|---|---|---|---|---|---|
| **VRL6** | | | | | | |
| A | I | 75 | 1.102 | 300 | 4.408 | - |
| B | II | 300 | 4.408 | 600 | 8,820 | VERDE - *GREEN* - VERT - *GRÜN* - VERDE |
| **VRL8** | | | | | | |
| C | I | 75 | 1.102 | 200 | 2.940 | - |
| D | II | 200 | 2.940 | 400 | 5.880 | VERDE – *GREEN* VERT - *GRÜN* - VERDE |
| E | I + II | 400 | 5.880 | 600 | 8,820 | - |
| **VRL9** | | | | | | |
| F | I | 75 | 1.102 | 200 | 2.940 | VERDE - *GREEN* - VERT - *GRÜN* - VERDE |
| G | II | 200 | 2.940 | 400 | 5.880 | - |
| H | I + II | 400 | 5.880 | 600 | 8,820 | - |

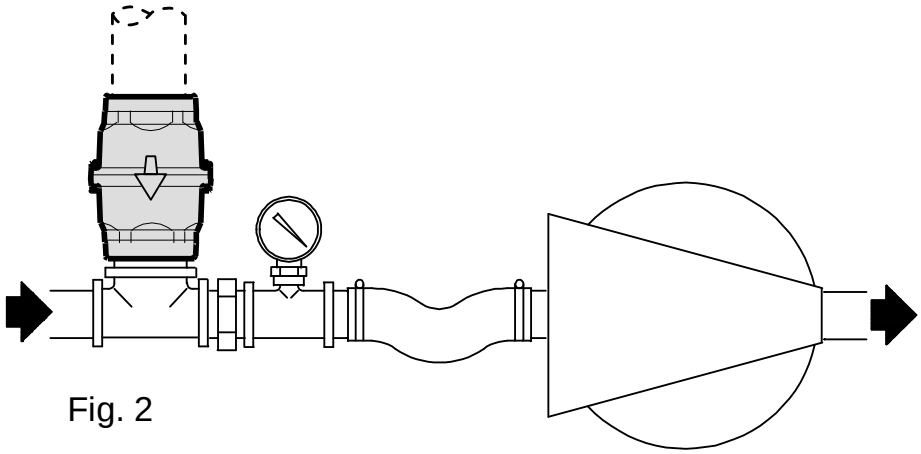


Fig. 2

SCHEMA DI INSTALLAZIONE – VALVOLA LIMITATRICE DI VUOTO
INSTALLATION SKETCH – VACUUM RELIEF VALVE
INSTALLATIONSSCHEMA – VAKUUMVENTIL
SCHÉMA DE INSTALLATION – SOUPAPE CASSE VIDE
ESQUEMA DE INSTALATIÒN – VALVULA LIMITADORA DE VACIO

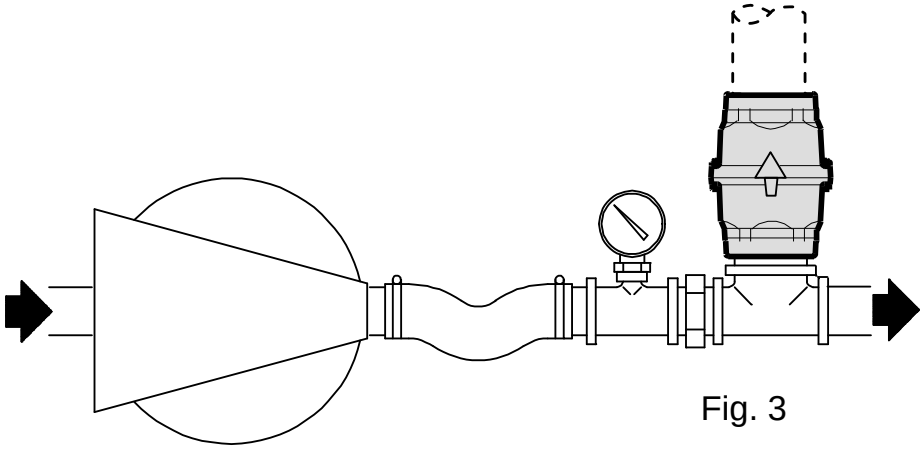


Fig. 3

SCHEMA DI INSTALLAZIONE – VALVOLA LIMITATRICE DI PRESSIONE
INSTALLATION SKETCH – PRESSURE RELIEF VALVE
INSTALLATIONSSCHEMA – DRUCKVENTIL
SCHÉMA DE INSTALLATION – SOUPAPE DE SÉCURITÉ
ESQUEMA DE INSTALATIÒN – VALVULA LIMITADORA DE PRESION

## 1. CHOICE OF SPRING

The valve is supplied with 2 different springs; each spring is to be used within a specific pressure-vacuum operating range. For the VRL8 and VRL9 there is the possibility to use both springs working in parallel.
Referring to the SELECTION DIAGRAM, check that the valve is correctly sized and depending where the operating point (area A, B,…H) is located, choose one or two springs according to SPRING SELECTION CHART.
The valve is supplied with spring # I installed. If spring needs to be replaced or a supplementary spring is needed to be added (for VRL8 / VRL9), proceed to point # 2 otherwise, adjust valve as per point #3.

## 2. INSTRUCTIONS FOR SPRING REPLACEMENT (OR MOUNTING ADITIONAL SPRING FOR VRL8 / VRL9)

- Remove the two plastic caps on valve.
- **Ensure stop-nut 923 is locked on the upper housing 106.**
- Unscrew screw 903 from nut 903.1.
- Remove cover 107 from housing 106.
- Unscrew spring guide disc 433 taking it out from shutter guide 434.
- Remove spring 700 (only in case of replacement).
- Install the appropriate spring into shutter 165.
- Compress spring and screw spring guide disc 433 on shutter guide 434 for at least 20 full thread terms.
- Check that both ends of the spring are properly positioned within their seats.
- Install the cover 107 on the housing 106 inserting:
  - for VRL6: the sliding guide on the slot in spring guide disc 433.
  - for VRL8 and VRL9: dowel pin 562 on the slot in spring guide disc 433.
- Tighten screw 903 on nut 903.1.

## 3. VALVE SETTING

### A) Setting-up at allowed vacuum level

- Remove the two plastic caps on valve, if any.
- Position valve on the suction by-pass and connect a vacuum gage as close as possible to the exhauster inlet (Fig. 2).
- Unscrew nut 923.
- Relieve spring tension by backing off upper grub screw 904.1 with the fit key.
- Turn on exhauster. Induce highest attainable vacuum by throttling air intake upstream relief valve (normally reducing throttle to fully-closed).
- Adjust upper grub screw 904.1 until maximum allowable vacuum level is reached.
- Tighten nut 923 keeping blocked upper grub screw 904.1.
- Open suction line.

***Double-check vacuum gauge to ensure no additional losses are induced by pipes or filters installed upstream relief valve.***

### B) Setting-up at allowed pressure level

- Remove the two plastic caps on valve, if any.
- Remove nut 923 from upper grub screw 904.1 and place it on to the lower grub screw 904.2. Do not tighten.
- Position valve on the discharge by-pass and connect a pressure gage as close as possible to the blower outlet (Fig. 3).
- Relieve spring tension by backing on lower grub screw 904.2 with the fit key.
- Turn on blower. Induce highest attainable pressure by throttling air discharge downstream of the valve (normally reducing throttle to fully-closed).
- Unscrew lower grub screw 904.2 until maximum allowable pressure level is reached.
- Tighten nut 923 keeping blocked lower grub screw 904.2.
- Open discharge line.

***Double-check pressure gauge to ensure no additional losses are induced by pipes or filters installed downstream the valve***

**TECHNICAL BROCHURE**
BNPE



# NPE

## 316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
*BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE*

GOULDS
WATER TECHNOLOGY
a xylem brand

## A FULL RANGE OF PRODUCT FEATURES
## *UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO*

**Superior Materials of Construction:** Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

**High Efficiency Impeller:** Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

**Casing and Adapter Features:** Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

**Mechanical Seal:** Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

**Motors:** NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

***Materiales Superiores de Construcción:*** *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

***Impulsor de Eficiencia Superior:*** El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

***Características de la Carcasa y del Adaptador:*** *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

***Sello Mecánico:*** *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

***Motores:*** *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

*Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.*

## NPE PRODUCT LINE NUMBERING SYSTEM
## *LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN*

1ST1D5D4

**Example Product Code,**
***Ejemplo Código del Producto***

1 ST 2 C 1 A 4 F

**Seal Vent/Flush Option,**
***Opción de Sello Válvula/ChorroSeal Ven***

**Mechanical Seal and O-ring**
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

***Sello Mecánico y Anillo 'O'***
*4 = Estándar aprobado*
*Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.*

**John Crane Type 21 Mechanical Seal (⅝" seal),**
***Sello Mecánico John Crane Tipo 21 (sello de ⅝")***

| Seal Code, *Código del Sello* | Rotary, *Rotativo* | Stationary, *Estacionario* | Elastomers, *Elastómeros* | Metal Parts, *Partes Metálicas* | Part No., *Pieza Número* |
|---|---|---|---|---|---|
| 2 | Carbon | Silicon Carbide | EPR | 316 SS | 10K18 |
| 4 | | | Viton | | 10K55 |
| 5 | Silicon Carbide | | EPR | | 10K81 |
| 6 | | | Viton | | 10K62 |

**Impeller Option . . . No Adder Required**
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

***Código del Impulsor Opcional***
*Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.*

| Impeller Code, *Código del Impulsor* | Pump Size, *Tamaño de la Bomba* | | |
|---|---|---|---|
| | 1 x 1¼ - 6 | 1¼ x 1½ - 6 | 1½ x 2 - 6 |
| | Diameter | Diameter | Diameter |
| K | – | 6⅛ | – |
| G | – | 5 15/16 | 5⅜ |
| H | – | 5½ | 5 |
| A | 6⅛ | 5¼ | 4¾ |
| B | 5¾ | 5 1/16 | 4⅝ |
| C | 5 3/16 | 4⅞ | 4⅜ |
| D | 4¾ | 4⅝ | 4 1/16 |
| E | 4 7/16 | 4¼ | 3⅝ |
| F | 4 1/16 | 3⅞ | – |

**Driver, *Conductor***
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

**HP Rating, *HP Potencia***
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

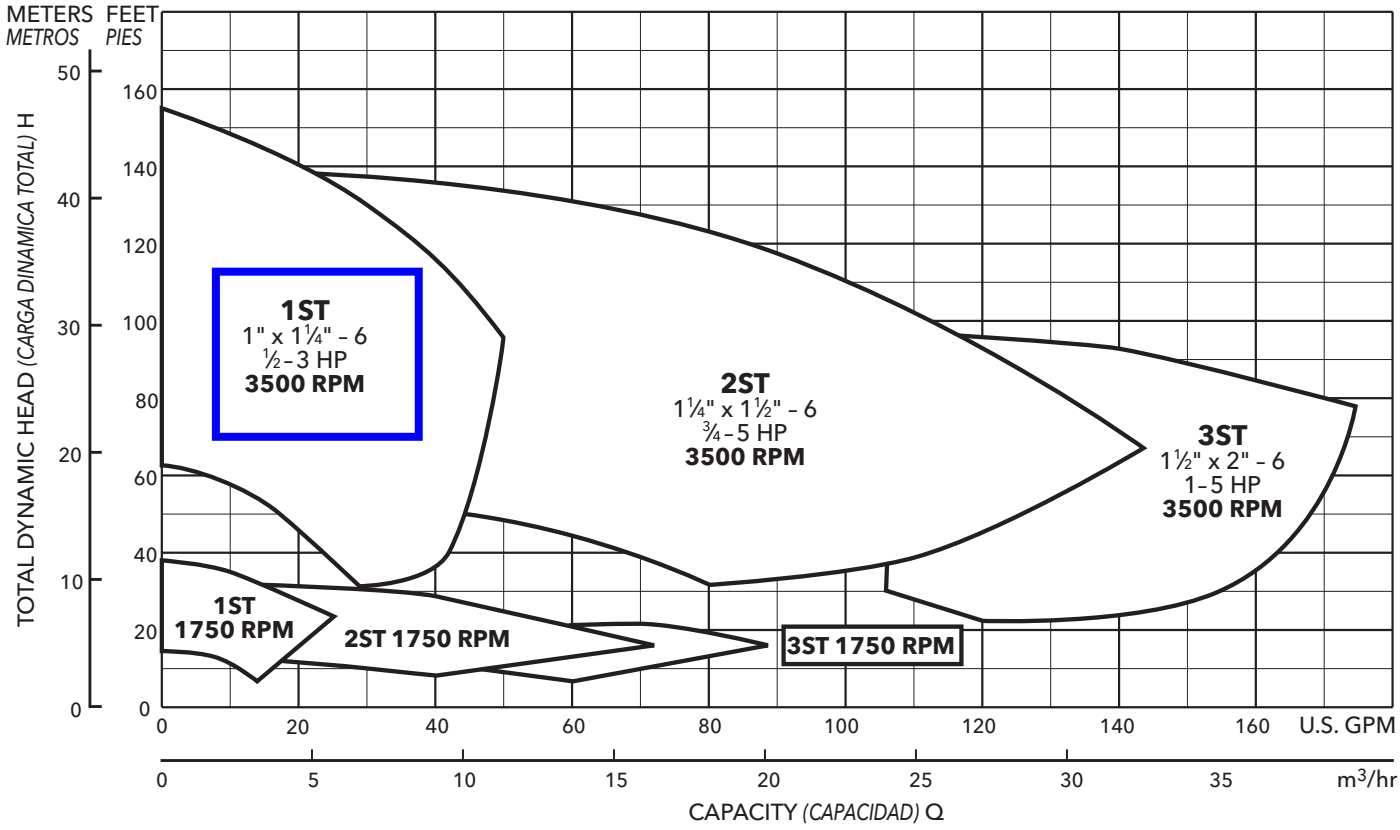
**Driver: Hertz/Pole/RPM,**
***Conductor: Hercios/Polo/RPM***
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
*Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.*

**Material**
ST = Stainless steel, *Acero inoxidable*

**Pump Size, *Tamaño de la Bomba***
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

## PERFORMANCE COVERAGE (60 HZ)
## *ALCANCE DE FUNCIONAMIENTO (60 HZ)*




**NOTES:**
Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

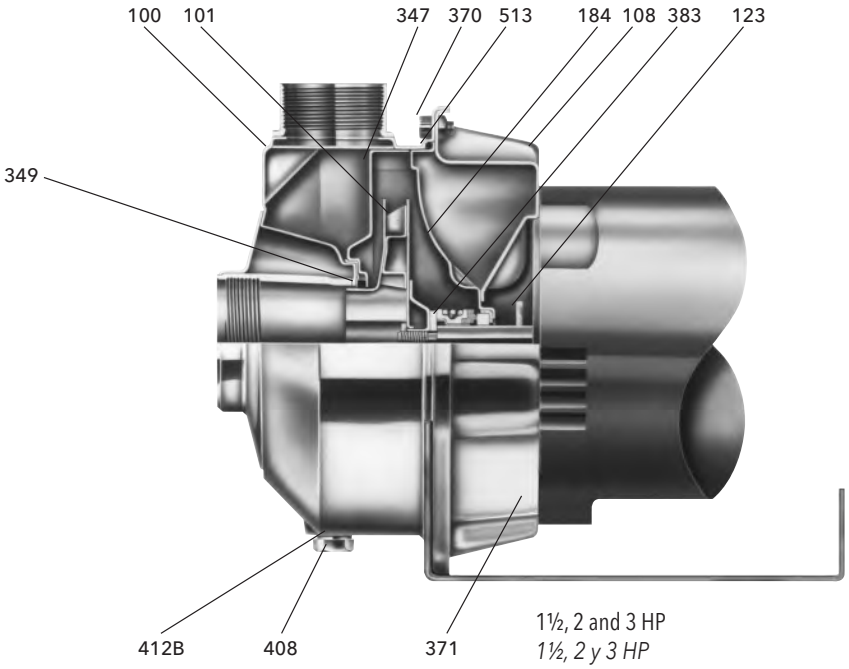
***NOTAS:***
*No se recomienda para funcionamiento superior al impreso en la curva H-Q.*

*Para condiciones de aplicaciones críticas consultar con la fábrica.*

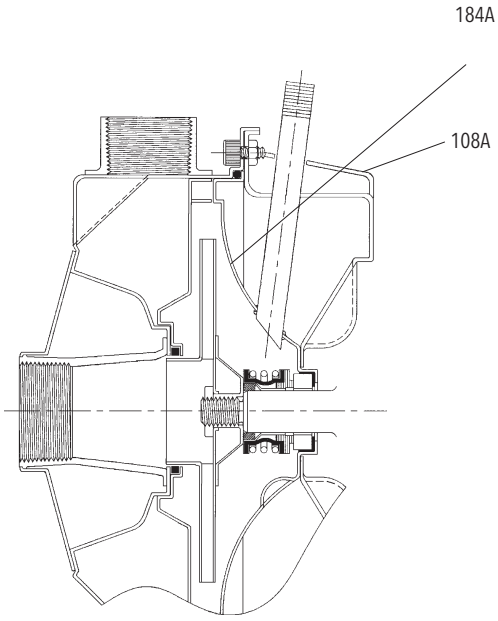
*No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.*

*Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.*

## NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
## *BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN*

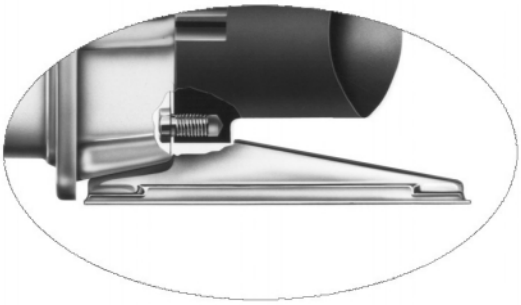



1½, 2 and 3 HP
*1½, 2 y 3 HP*




Seal Face Vent/Flush Option,
*Opción Cara del Sello Válvula/Chorro*

| Item No., *Parte No.* | Description, *Descripción* | Materials, *Materiales* |
|---|---|---|
| 100 | Casing; *Carcasa* | AISI 316L SS; *AISI 316L Acero inoxidable* |
| 101 | Impeller; *Impulsor* | |
| 108 | Motor adapter; *Adaptador del motor* | |
| 108A | Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor* | |
| 123 | Deflector; *Deflector* | BUNA-N |
| 184 | Seal housing; *Alojamiento del sello* | AISI 316L SS; *AISI 316L Acero inoxidable* |
| 184 A | Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello* | |
| 347 | Guidevane; *Difusor* | |
| 349 | Seal ring, guidevane; *Anillo del sello, difusor* | Viton |
| 370 *able* | Socket head screws, casing; *Encajes cabezas de tornillos, carcasa* | AISI 410 SS; *AISI 410 Acero inoxid-* |
| 371 | Bolts, motor; *Tornillos, motor* | Plated steel; Acero chapeado |
| 383 | Mechanical seal; *Sello mecánico* | **see chart, *ver tabla* |
| 408 *able* | Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa* | AISI 316L SS; *AISI 316L Acero inoxid-* |
| 412B | O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula* | Viton (Standard, *estándar*) EPR (Optional, *Opcional*) |
| 513 | O-ring, casing; *Anillo 'O', carcasa* | |
| Motor *Motor* | NEMA standard, 56J flange; *NEMA estándar, brida 56J* | |

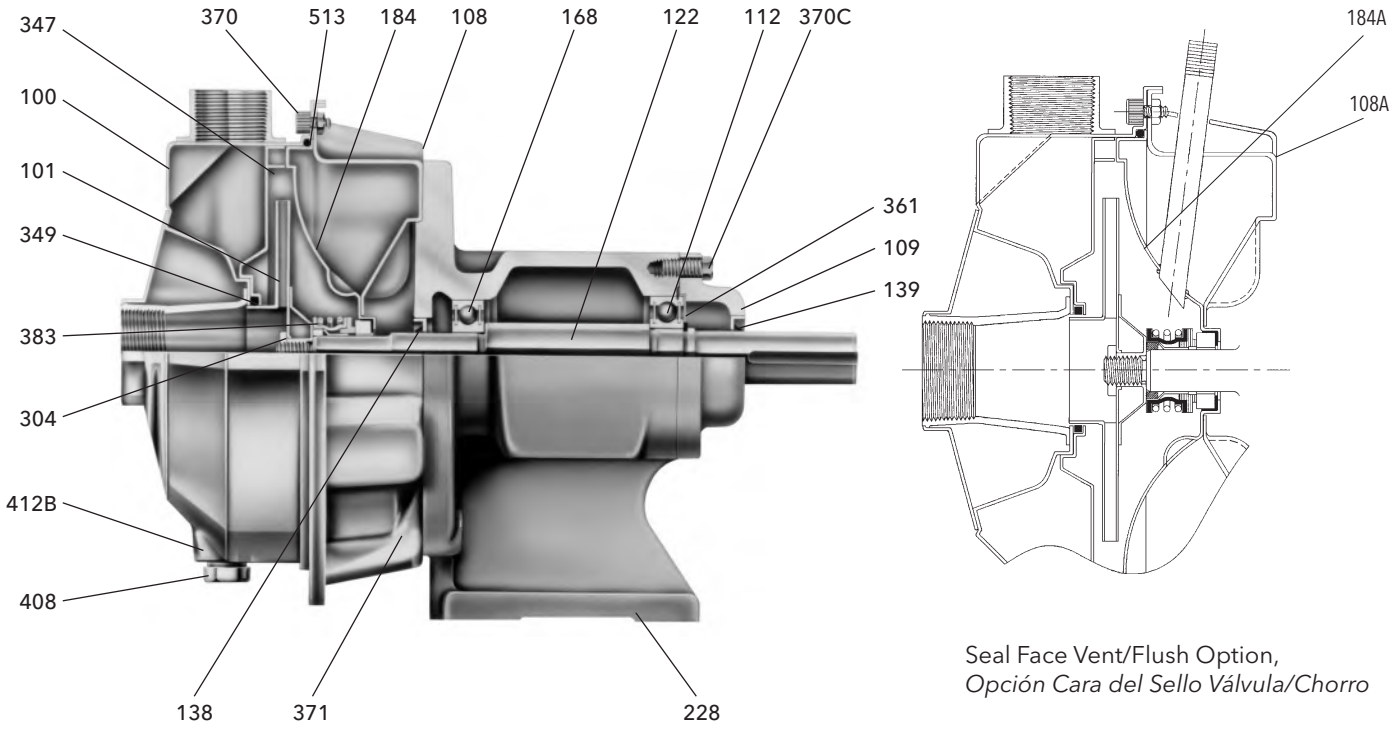


½, ¾ and 1 HP
*½, ¾ y 1 HP*

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

*Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.*

## NPE FRAME MOUNTED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
## *BOMBA NPE DE ARMAZÓN MONTADO COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN*

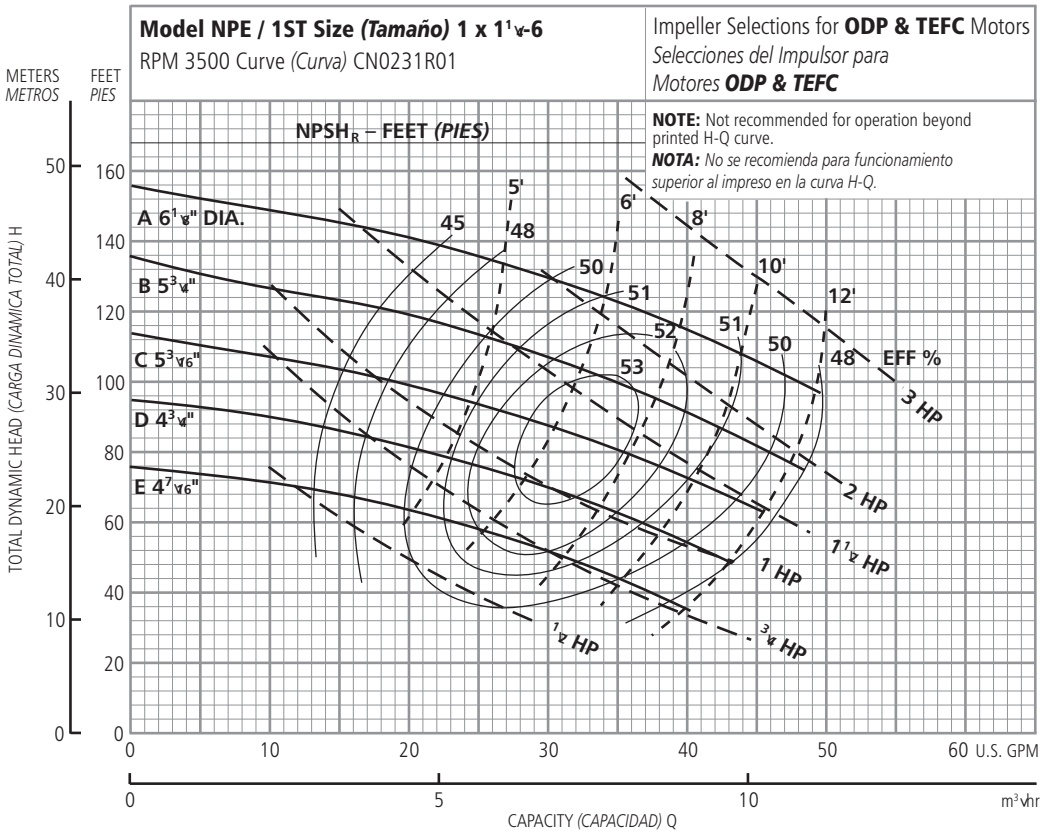



Seal Face Vent/Flush Option,
*Opción Cara del Sello Válvula/Chorro*

| Item No., *Parte No.* | Description, *Descripción* | Materials, *Materiales* |
|---|---|---|
| 100 | Casing; *Carcasa* | AISI 316L SS; *AISI 316L Acero inoxidable* |
| 101 | Impeller; *Impulsor* | |
| 108 | Adapter; *Adaptador* | |
| 108A | Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor* | |
| 109 | Bearing cover; *Cubierta de balineras* | Cast iron; *Hierro fundido* |
| 112 | Ball bearing (outboard); *Balineras de bolas (exterior)* | Steel; *Acero* |
| 122 | Shaft; *Eje* | AISI 316 SS; *AISI 316 Acero inoxidable* |
| 138 | Lip-seal (inboard); *Sello cubierto (interior)* | BUNA/steel; *BUNA/acero* |
| 139 | Lip-seal (outboard); *Sello cubierto (exterior)* | BUNA/steel; *BUNA/acero* |
| 168 | Ball bearing (inboard); *Balineras de bolas (interior)* | Steel; *Acero* |
| 184 | Seal housing; *Alojamiento del sello* | AISI 316L SS; *AISI 316L Acero inoxidable* |
| 184 A | Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello* | |
| 228 | Bearing frame; *Armazón de balineras* | Cast iron, *Hierro fundido* |

| Item No., *Parte No.* | Description, *Descripción* | Materials, *Materiales* |
|---|---|---|
| 304 | Impeller locknut; *Contratuerca del impulsor* | AISI 316 SS; *AISI 316 Acero inoxidable* |
| 347 | Guidevane; *Difusor* | |
| 349 | Seal ring, guidevane; *Anillo del sello, difusor* | Viton |
| 361 | Retaining ring; *Anillo de retención* | Steel; Acero |
| 370 | Socket head screws, casing; *Encaje cabeza del tornillo, carcasa* | AISI 410 SS; *AISI 410 Acero inoxidable* |
| 370C | Hex head screw, bearing cover; *Tornillo de cabeza hexagonal, cubierta de balineras* | Plated steel; *Acero chapeado* |
| 371 | Hex head screw, bearing frame; *Tornillo de cabeza hexagonal, armazón de balineras* | Plated steel; *Acero chapeado* |
| 383 | Mechanical seal; *Sello mecánico* | **see chart; ver tabla |
| 400 | Shaft key; *Llave del eje* | Steel; Acero |
| 408 | Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa* | AISI 316 SS; *AISI 316 Acero inoxidable* |
| 412B | O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula* | Viton (Standard, *estándar*) EPR (Optional, *Opcional*) |
| 513 | O-ring, casing; *Anillo 'O', carcasa* | |

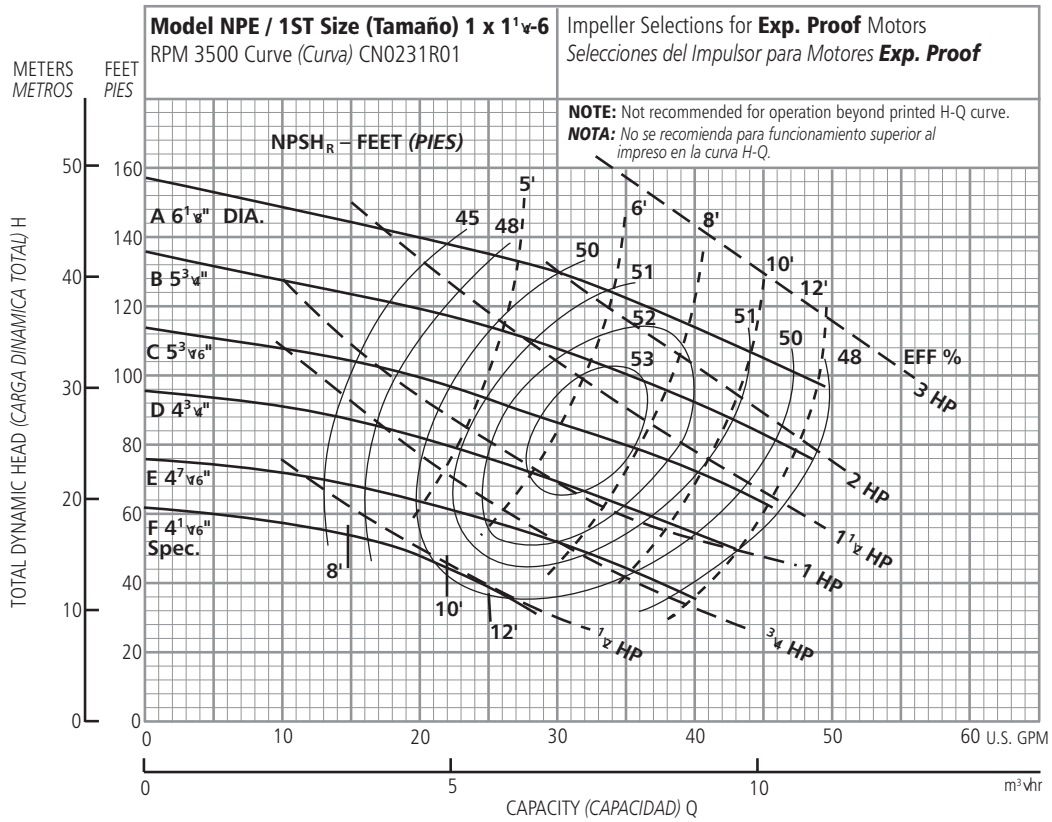
## PERFORMANCE CURVES – 60 HZ, 3500 RPM
## *CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM*




| Ordering Code, *Código de Pedido* | Standard HP Rating, *Estándar HP Potencia* | Imp. Dia. |
|---|---|---|
| E | ½ | 4 7/16" |
| D | ¾ | 4¾ |
| C | 1 | 5 3/16 |
| B | 1½ | 5¾ |
| A | 2 | 6⅛ |

**NOTE:** Although not recommended, the pump may pass a 1/16" sphere.

***NOTA:*** *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*



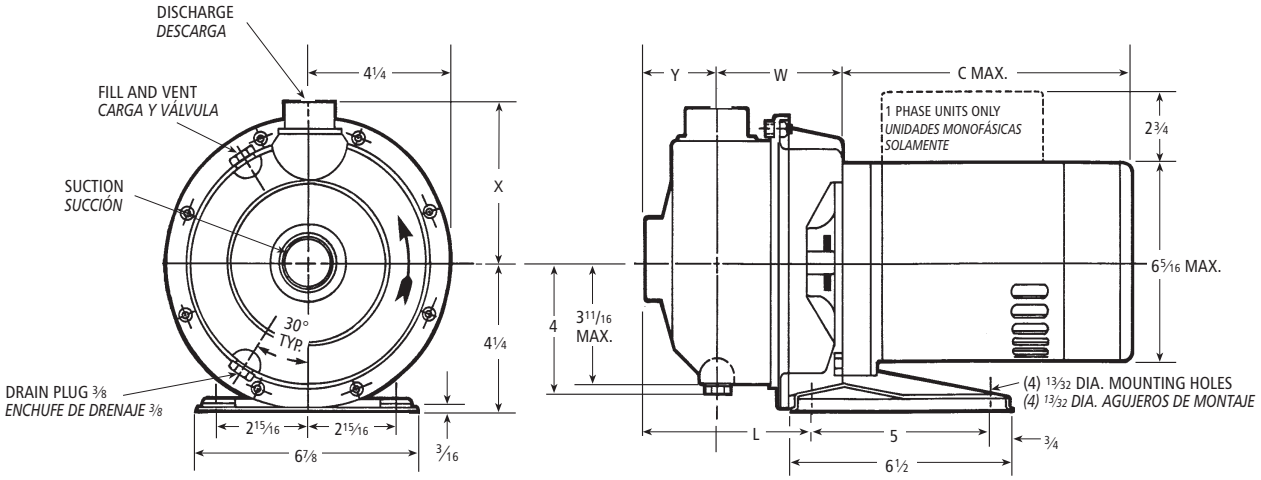

| Ordering Code, *Código de Pedido* | Standard HP Rating, *Estándar HP Potencia* | Imp. Dia. |
|---|---|---|
| F | ½ | 4 1/16" spec. |
| E | ¾ | 4 7/16 |
| D | 1 | 4¾ |
| C | 1½ | 5 3/16 |
| B | 2 | 5¾ |
| A | 3 | 6⅛ |

**NOTE:** Although not recommended, the pump may pass a 1/16" sphere.

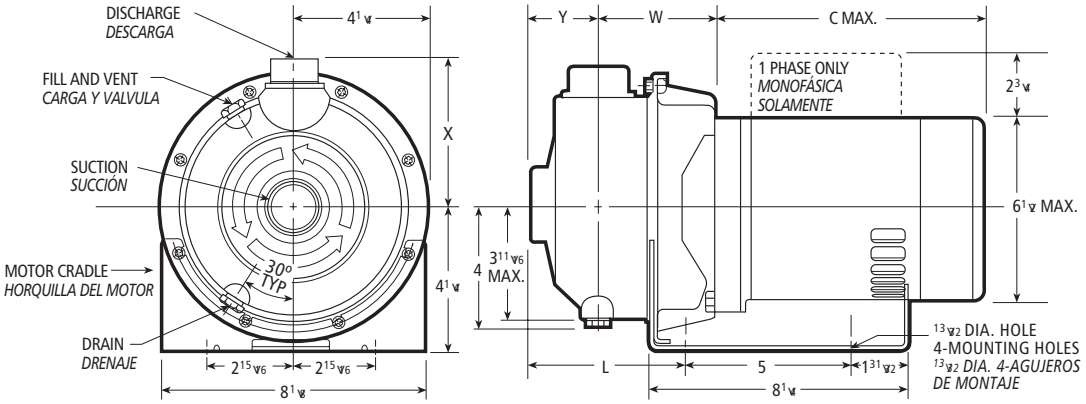
***NOTA:*** *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

## NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
## *NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES*

**Clockwise Rotation Viewed from Drive End**
***Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor***




**ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)***




**ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)***

## SPECIFICATIONS - *ESPECIFICACIONES*

**Capacities to:**
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

**Heads to:**
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

**Working pressures to:**
125 PSIG (9 bars)

**Maximum temperatures to:** 250° F (121° C)

**Direction of rotation:**
Clockwise when viewed from motor end.

**Motor specifications:**
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

**Single phase:** Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

**Three phase:** Voltage 208-230/460 ODP, TEFC and EX PROOF.

**NOTE:** For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

***Capacidades:***
*85 GPM (322L/min) a 1750 RPM*
*170 GPM (643L/min) a 3500 RPM*

***Cargas:***
*39 pies (12 m) a 1750 RPM*
*150 pies (46 m) a 3500 RPM*

***Presión de trabajo:***
*125 PSIG (9 baras)*

***Temperatura máxima:***
*250 ° F (121° C)*

***Dirección de rotación:***
*En dirección de las agujas del reloj visto desde el extremo final del motor.*

***Motores:***
*Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.*

***Monofásicos:*** *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

***Trifásicos:*** *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

***NOTA:*** *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

**INSTRUCTION MANUAL**
IM013



# Model NPE/NPE-F

**INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS**

GOULDS
WATER TECHNOLOGY
a xylem brand

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## Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Dealer: _____

Dealer Phone No.: _____

Date of Purchase: _____

Date of Installation: _____

Current Readings at Startup:

| 1 Ø | 3 Ø | L1-2 | L2-3 | L3-1 |
|---|---|---|---|---|
| Amps: _____ | Amps: _____ | _____ | _____ | _____ |
| Volts: _____ | Volts: _____ | _____ | _____ | _____ |

## SAFETY INSTRUCTIONS

**TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.**

**THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.**

This is a SAFETY ALERT SYMBOL. When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

**⚠ DANGER** Warns of hazards that WILL cause serious personal injury, death or major property damage.

**⚠ WARNING** Warns of hazards that CAN cause serious personal injury, death or major property damage.

**⚠ CAUTION** Warns of hazards that CAN cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

**⚠ WARNING**



Hazardous fluids can cause fire, burns or death.

UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

### DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

### 1. IMPORTANT:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

**⚠ CAUTION** Always disconnect electrical power when handling pump or controls.

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

| | |
|---|---|
| Liquid Temperature: | 250º F (120º C) |
| Pressure: | 125 PSI |
| Starts Per Hour: | 20, evenly distributed |

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

### 2. INSTALLATION:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

**⚠ CAUTION** Never draw piping into place by forcing the pump suction and discharge connections.

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units

2.2.1. Units may be installed horizontally, inclined or vertically.

**⚠ CAUTION** Do not install with motor below pump. Any leakage or condensation will affect the motor.

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.

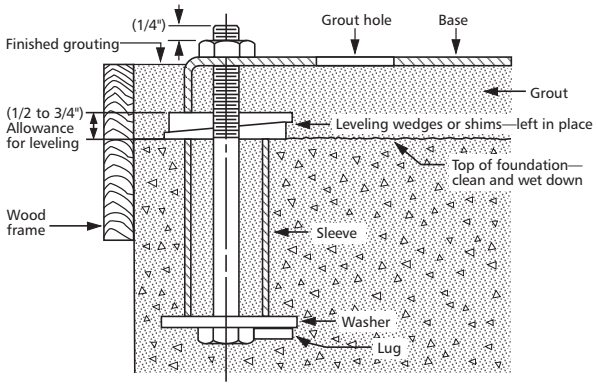



Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

## 3. SUCTION PIPING:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

**⚠ CAUTION** Do not use suction isolation valve to throttle pump.

3.5. Installation with pump above source of supply

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

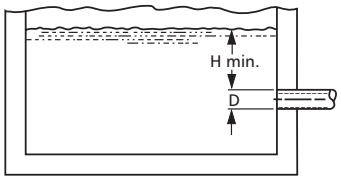



Figure 2

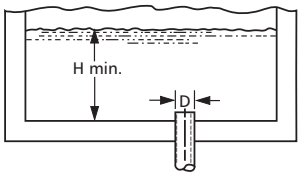



Figure 3

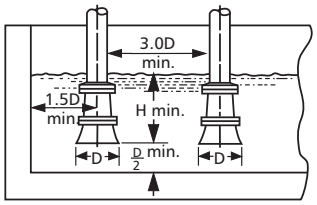



Figure 4

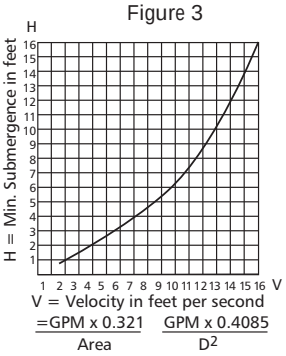



Figure 5

## 4. DISCHARGE PIPING:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

## 5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.

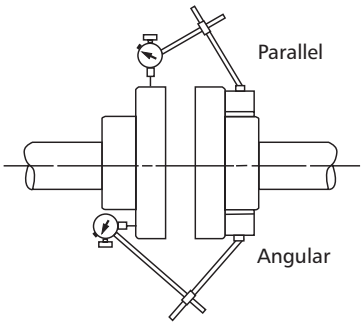



Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

**⚠ CAUTION** Always recheck both alignments after making any adjustment.

## 6. ROTATION:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

## 7. OPERATION:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

**⚠ CAUTION** Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

## 8. MAINTENANCE:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

## 9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

**⚠ CAUTION** Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

**⚠ CAUTION** Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 and 168).

## 10. REASSEMBLY:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame.

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end.

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

**⚠ CAUTION** Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

## 11. TROUBLE SHOOTING CHART:

MOTOR NOT RUNNING:
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

## NPE STANDARD REPAIR PARTS LIST

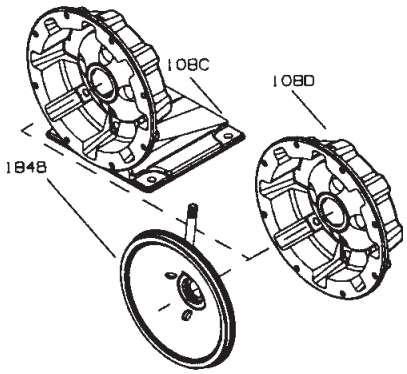
| Item No. | Description | Materials of Construction |
|---|---|---|
| 100 | Casing | AISI 316L Stainless Steel |
| 101 | Impeller | |
| 108A | Motor adapter with foot | |
| 108B | Motor adapter less foot | |
| 108C | Motor adapter with foot and flush | |
| 108D | Motor adapter less foot with flush | |
| 123 | Deflector | BUNA-N |
| 184A | Seal housing std. | AISI 316L S.S. |
| 184B | Seal housing with seal flush | |
| 240 | Motor support | 300 S.S. |
| | Rubber channel | Rubber |
| 304 | Impeller locknut | AISI 316 S.S. |
| 347 | Guidevane | AISI 316L S.S. |
| 349 | Seal-Ring, guidevane | Viton (standard) |
| | | EPR |
| | | BUNA |
| 370 | Socket head screw, casing | AISI 410 S.S. |
| 371 | Bolts, motor | Steel/plated |
| 383 | Mechanical seal | |
| 408 | Drain and vent plug, casing | AISI 316 S.S. |
| 412B | O-Ring, drain plugs | Viton (standard) |
| | | EPR |
| | | BUNA |
| 513 | O-Ring, casing | Viton (standard) |
| | | EPR |
| | | BUNA |

## MECHANICAL SEAL APPLICATION CHART

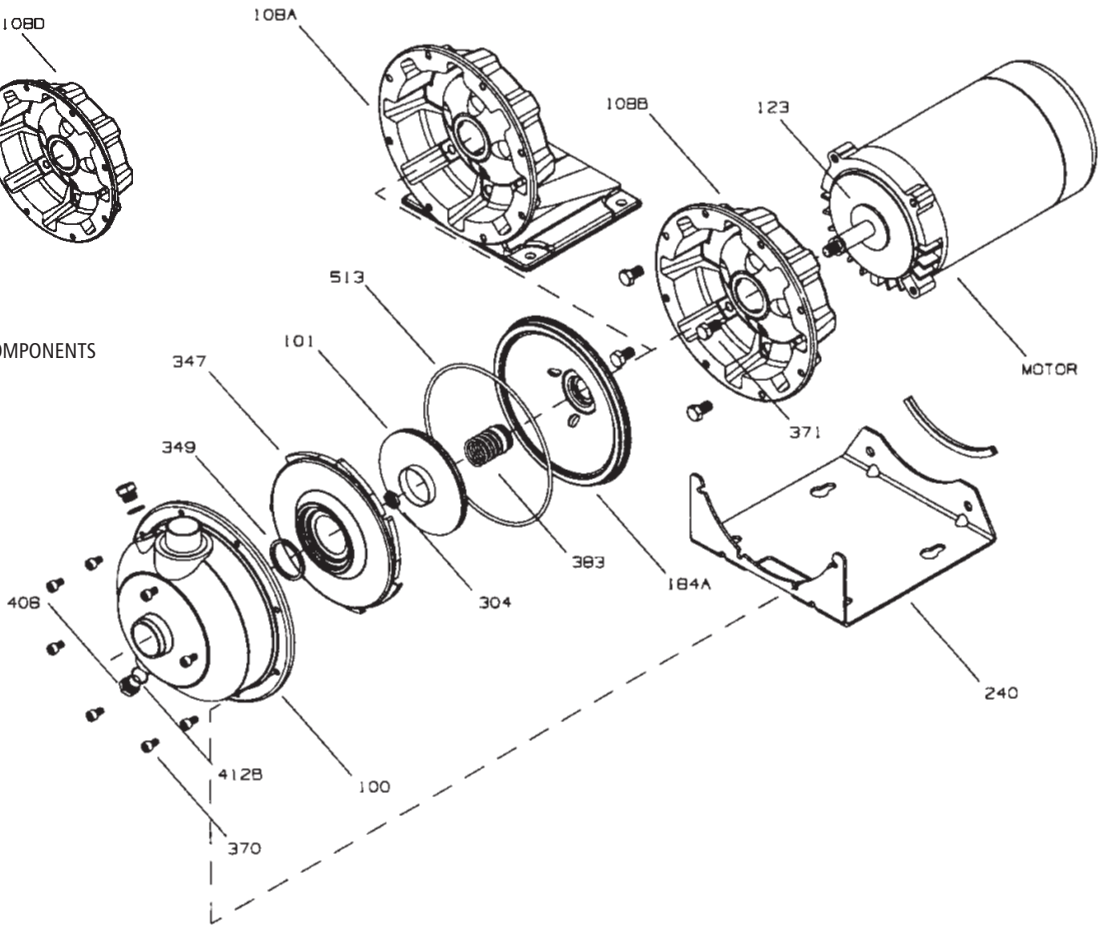
| Item 383 Mechanical Seal (⅝" seal) | | | | |
|---|---|---|---|---|
| Rotary | Stationary | Elastomers | Metal Parts | Part No. |
| Carbon | Sil-Carbide | EPR | 316SS | 10K18 |
| | | Viton | | 10K55 |
| Sil-Carbide | | EPR | | 10K81 |
| | | Viton | | 10K62 |

**NOTE:** Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

**NOTE:** Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.




**NOTE:** OPTIONAL SEAL FLUSH COMPONENTS



## GOULDS WATER TECHNOLOGY LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Water Technology.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Water Technology distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Water Technology Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Water Technology and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

xylem
Let's Solve Water

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Fax: (888) 322-5877
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## Declaration of Conformity

We at,
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declare that the following products: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS comply with Machine Directive 06/42/EC. This equipment is intended to be incorporated with machinery covered by this directive, but must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the actual provisions of the directive.

## Declaración de Conformidad

Nosotros en
Goulds Water Technology / Xylem Inc.
1 Goulds Drive
Auburn, NY 13021
Declaramos que los siguientes productos: NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS cumplen con las Directivas para Maquinarias 06/42/EC. Este equipo ha sido diseñado para ser incorporado a la maquinaria cubierta por esta directiva pero no debe ponerse en funcionamiento hasta que se declare que la maquinaria en la que será incorporado cumple con las disposiciones reales de la directiva.

## Déclaration de Conformité

Nous, à
Goulds Water Technology, Xylem Inc.
1 Goulds Drive
Auburn, NY, U.S.A. 13021,
déclarons que les produits NPE, MCS, MCC, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB et LBS sont conformes à la directive 06/42/EC (législation relative aux machines). Ils sont destinés à être intégrés dans la machinerie faisant l'objet de ladite directive, mais ne doivent pas être mis en service tant que la machinerie en question ne sera pas déclarée conforme aux stipulations de la directive.

xylem
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# NPE/NPE-F REPAIR PARTS

GOULDS
WATER TECHNOLOGY
a xylem brand

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Pictorial Breakdown of Pump .....3
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Impeller Chart by Motor Size at 3500 RPM .....4
Motor Chart .....5

**NOTE:**
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS.

(3) Mechanical Seal upgrades as noted on page 1.

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

## NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F

**SEAL VENT/FLUSH OPTION**

**MECHANICAL SEAL and O-RING**

4 = Pre-Engineered Standard. For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

| 21 Mechanical Seal (⅝" seal) | | | | | | |
|---|---|---|---|---|---|---|
| **Seal Code** | **Rotary** | **Stationary** | **Elastomers** | **Metal Parts** | **Part No.** | **Casing O-Ring** |
| 2 | Carbon | Sil-Carbide | EPR | 316 SS | 10K18 | EPR |
| 4 | | | Viton | | 10K55 | Viton |
| 5 | Sil-Carbide | | EPR | | 10K81 | EPR |
| 6 | | | Viton | | 10K62 | Viton |

**Impeller Option Code . . . No Adder Required**

For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.

Select Optional Impeller Diameter from Pump Performance Curve.

| Impeller Code | Pump Size | | |
|---|---|---|---|
| | **1 x 1¼-6** | **1¼ x 1½-6** | **1½ x 2-6** |
| | **Diameter** | **Diameter** | **Diameter** |
| K | | 6⅛ | |
| G | | 5 15/16 | 5⅜ |
| H | | 5½ | 5 |
| A | 6⅛ | 5¼ | 4¾ |
| B | 5¾ | 5 1/16 | 4⅝ |
| C | 5 3/16 | 4⅞ | 4⅜ |
| D | 4¾ | 4⅝ | 4 1/16 |
| E | 4 7/16 | 4¼ | 3⅝ |
| F | 4 1/16 | 3⅞ | |

**Note:** Not recommended for operation beyond printed H-Q curve.

For critical application conditions, consult factory.

**Note:** Not all combinations of motor, impeller and seal options are available for every pump model. Please check with factory on non-cataloged numbers.

**Note:** Impeller diameter is measured at the vane. The overall diameter of the shroud may be greater.

**DRIVER**

1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

**HP RATING**

C = ½ HP F = 1½ HP J = 5 HP
D = ¾ HP G = 2 HP
E = 1 HP H = 3 HP

**DRIVER: HERTZ/POLE/RPM**

1 = 60 HZ, 2 pole, 3500 RPM
2 = 60 HZ, 4 pole, 1750 RPM
3 = 60 HZ, 6 pole, 1150 RPM
4 = 50 HZ, 2 pole, 2900 RPM
5 = 50 HZ, 4 pole, 1450 RPM

**MATERIAL**

ST = Stainless Steel

**PUMP SIZE**

1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

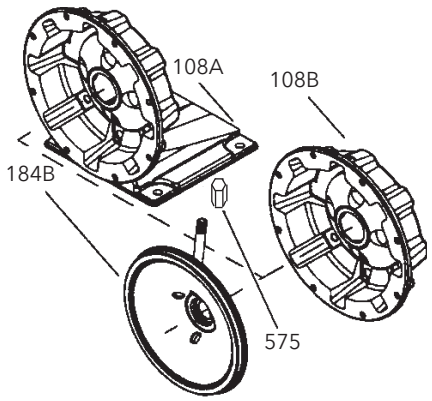
**For Frame Mounted version, substitute the letters "FRM" in these positions.**

## NPE STANDARD REPAIR PARTS LIST

| Item No. | Description | Materials of Construction | 1ST 1 x 1¼ | 2ST 1¼ x 1½ | 3ST 1½ x 2 | QUANTITY |
|---|---|---|---|---|---|---|
| 100 | Casing | AISI 316L SS | 1L81 | 1L82 | 1L83 | 1 |
| 101 | Impeller | AISI 316L SS | See Impeller chart on page 4 | | | 1 |
| 108A | Motor adapter with foot* | AISI 316L SS | 1L80 | | | 1 |
| 108B | Motor adapter less foot* | AISI 316L SS | 1L87 | | | 1 |
| 123 | Deflector | BUNA-N | 5K7 | | | 1 |
| 184A | Seal housing standard | AISI 316L SS | 1L79 | | | 1 |
| 184B | Seal housing with seal flush | AISI 316L SS | 1L333 | | | 1 |
| 240 | Motor support | 300 SS | 4L320 | | | 1 |
| | Rubber channel | Rubber | 9K188 | | | 1 |
| 304 | Impeller locknut | AISI 316 SS | 13K286 | | | 1 |
| 347 | Guidevane | AISI 316L SS | 3L23 | 3L24 | 3L25 | 1 |
| 349 | Seal ring, guidevane | Viton standard | 5K269 | 5K270 | | 1 |
| | | EPR | 5K273 | 5K274 | | |
| | | BUNA | 5K271 | 5K272 | | |
| 370 | Socket head screw, casing | AISI 410 SS | 13L65 | | | 8 |
| 371 | Bolts, motor | Steel/plated | 13K252 | | | 4 |
| 383 | Mechanical seal | | See Mechanical Seal Chart on Page 11 | | | |
| 408 | Drain and vent plug, casing | AISI 316 SS | 6L3 | | | 2 |
| 412B | O-ring, drain plugs | Viton, standard | 5L99 | | | 2 |
| | | EPR | 5L80 | | | |
| | | BUNA | 5L62 | | | |
| 513 | O-ring, casing | Viton standard | 5K206 | | | 1 |
| | | EPR | 5K193 | | | |
| | | BUNA | 5K4 | | | |
| 575 | Pipe Cap | 304 SS | 6K150 | | | 1 |

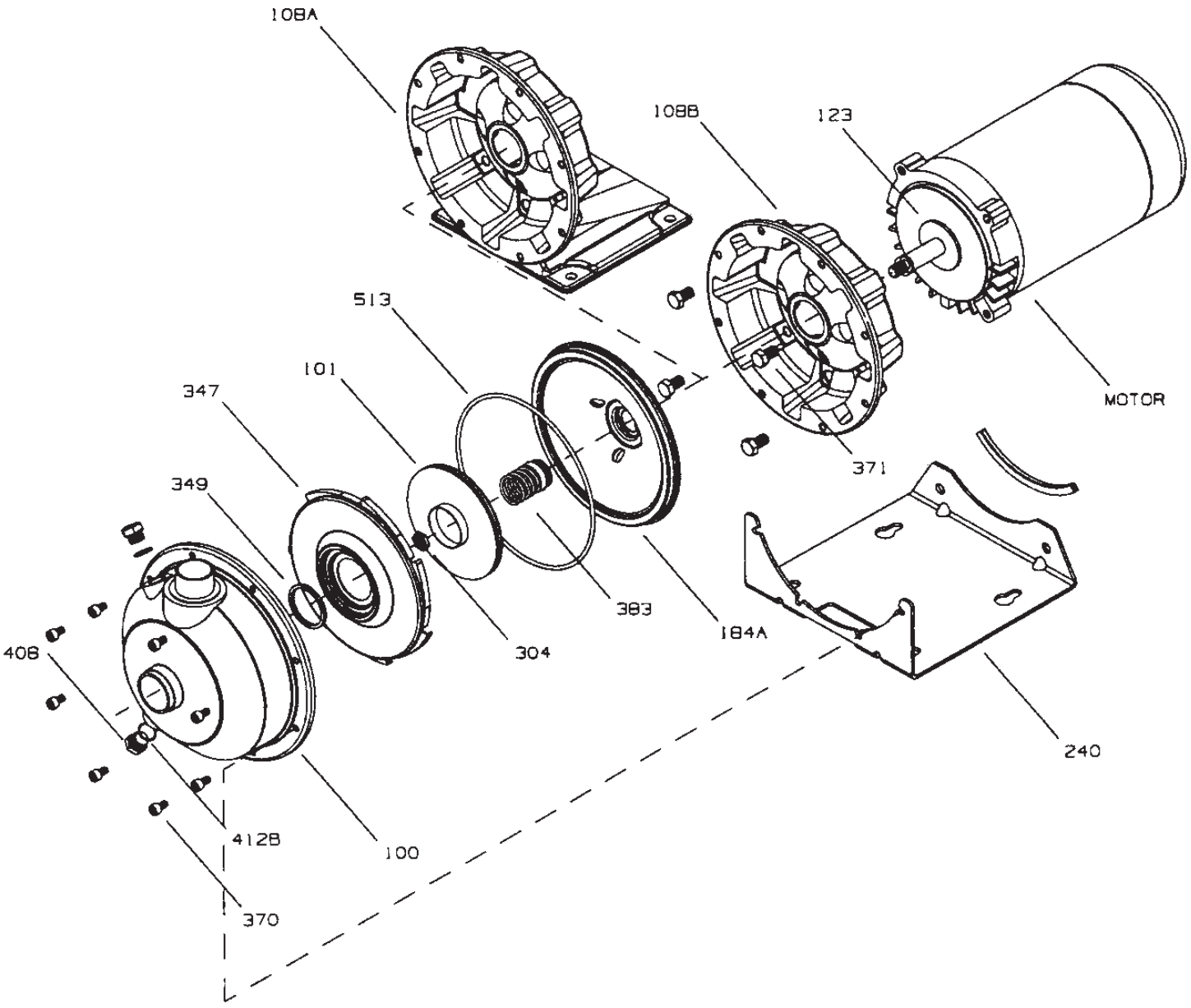
** Flush access hole provided.*

**NOTE:**
OPTIONAL SEAL FLUSH COMPONENTS




**NOTE:**
Close-coupled units using motors ½ – 1 HP (TEFC and ODP) will use footed motor adapter as standard.
Close-coupled units using motors 1½ – 3 HP (TEFC and ODP) will use footless motor adapter as standard.
Close-coupled units using motors 5 HP and all X-Proof will have a foot attached to the motor.

**NOTE:**
Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power Frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



## NPE STANDARD IMPELLERS

| Impeller Code | Pump Size | | | | | |
|---|---|---|---|---|---|---|
| | 1 x 1¼-6 | | 1¼ x 1½-6 | | 1½ x 2-6 | |
| | Diameter | Part No. | Diameter | Part No. | Diameter | Part No. |
| K | | | 6⅛ | 2L885 | | |
| G | | | 5 15/16 | 2L700 | 5⅜ | 2L702 |
| H | | | 5½ | 2L699 | 5 | 2L701 |
| A | 6⅛ | 2L47 | 5¼ | 2L48 | 4¾ | 2L49 |
| B | 5¾ | 2L44 | 5 1/16 | 2L54 | 4⅝ | 2L58 |
| C | 5 3/16 | 2L46 | 4⅞ | 2L53 | 4⅜ | 2L57 |
| D | 4¾ | 2L42 | 4⅝ | 2L52 | 4 1/16 | 2L56 |
| E | 4 7/16 | 2L45 | 4¼ | 2L51 | 3⅝ | 2L55 |
| F | 4 1/16 | 2L59 | 3⅞ | 2L50 | | |

## NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

**For ODP/TEFC Units Built After September 1, 1997**

| HP | HP Code | | 1ST | 2ST | | 3ST |
|---|---|---|---|---|---|---|
| | | | ODP/TEFC | ODP/TEFC | | ODP/TEFC |
| ½ | C | Repair # | 2L45 | | | |
| | | Dia. | 4 7/16 | | | |
| | | Imp. Code | E | | | |
| ¾ | D | Repair # | 2L42 | 2L50 | | |
| | | Dia. | 4¾ | 3⅞ | | |
| | | Imp. Code | D | F | | |
| 1 | E | Repair # | 2L46 | 2L51 | | 2L55 |
| | | Dia. | 5 3/16 | 4¼ | | 3⅝ |
| | | Imp.Code | C | E | | E |
| 1½ | F | Repair # | 2L44 | 2L52 | | 2L56 |
| | | Dia. | 5¾ | 4⅝ | | 4 1/16 |
| | | Imp. Code | B | D | | D |
| 2 | G | Repair # | 2L47 | 2L53 | | 2L57 |
| | | Dia. | 6⅛ | 4⅞ | | 4⅜ |
| | | Imp. Code | A | C | | C |
| 3 | H | Repair # | 2L47 | 2L48 | | 2L49 |
| | | Dia. | 6⅛ | 5¼ | | 4¾ |
| | | Imp. Code | A | A | | A |
| 5 | J | Repair # | | 2L700 | 2L885 | 2L702 |
| | | Dia. | | 5 15/16 | 6⅛ | 5⅜ |
| | | Imp. Code | | G | K | G |

**For Current Explosion Proof and All Units Built Before September 1, 1997**

| HP | HP Code | | 1ST | | 2ST | | 3ST | |
|---|---|---|---|---|---|---|---|---|
| | | | ODP | TEFC/EXP | ODP | TEFC/EXP | ODP | TEFC/EXP |
| ½ | C | Repair # | 2L45 | 2L59 | | | | |
| | | Dia. | 4 7/16 | 4 1/16 | | | | |
| | | Imp. Code | E | F | | | | |
| ¾ | D | Repair # | 2L42 | 2L45 | 2L50 | | | |
| | | Dia. | 4¾ | 4 7/16 | 3⅞ | | | |
| | | Imp. Code | D | E | F | | | |
| 1 | E | Repair # | 2L46 | 2L42 | 2L51 | 2L50 | 2L55 | |
| | | Dia. | 5 3/16 | 4¾ | 4¼ | 3⅞ | 3⅝ | |
| | | Imp. Code | C | D | E | F | E | |
| 1½ | F | Repair # | 2L44 | 2L46 | 2L52 | 2L51 | 2L56 | 2L55 |
| | | Dia. | 5¾ | 5 3/16 | 4⅝ | 4¼ | 4 1/16 | 3⅝ |
| | | Imp. Code | B | C | D | E | D | E |
| 2 | G | Repair # | 2L47 | 2L44 | 2L53 | 2L52 | 2L57 | 2L56 |
| | | Dia. | 6⅛ | 5¾ | 4⅞ | 4⅝ | 4⅜ | 4 1/16 |
| | | Imp. Code | A | B | C | D | C | D |
| 3 | H | Repair # | 2L47 | 2L47 | 2L48 | 2L54 | 2L49 | 2L58 |
| | | Dia. | 6⅛ | 6⅛ | 5¼ | 5 1/16 | 4¾ | 4⅝ |
| | | Imp. Code | A | A | A | B | A | B |
| 5 | J | Repair # | | | 2L700 | 2L885 | 2L702 | |
| | | Dia. | | | 5 15/16 | 6⅛ | 5⅜ | |
| | | Imp. Code | | | G | K | G | |

**Note:**** Max. Explosion Proof rating is 2 HP.

## NPE CLOSE-COUPLED MOTORS

### MODEL NPE 3500 RPM

| HP | Single-Phase, 60 Hz, 115/230 V**, 56J Frame | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Open, Drip-Proof ① | | | Totally Enclosed, Fan Cooled | | | Explosion Proof | | |
| | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) |
| ½ | E04853S | 10.0/5.0 | 16 | E04821S | 6.2/3.1 | 21 | BBC04825 | 6.2/3.1 | 47 |
| ¾ | E05853S | 14.0/7.0 | 19 | E05821S | 8.8/4.4 | 24 | BBC05825 | 8.8/4.4 | 41 |
| 1 | E06853S | 16.0/8.0 | 22 | E06821S | 11.6/5.8 | 26 | BBC06825 | 11.6/5.8 | 49 |
| 1½ | E07858S | 21.4/10.7 | 31 | E07821S | 16.2/8.1 | 35 | BBC07825 | 16.2/8.1 | 56 |
| 2 | E08854S | 26.8/13.4 | 36 | E08821S | 20.8/10.4 | 39 | BBC08825 | 20.8/10.4 | 60 |
| 3 | E09854S | 14.0 | 40 | E09821S | 11.89 | 44 | | | |
| 5 | E10754S | 14.4 | 55 | | | | | | |

**Note:**** 3 and 5 HP Single-Phase motors are 230 V only.

| HP | Three-Phase, 60 Hz, 208-230/460 V, 56J Frame | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Open, Drip-Proof ① | | | Totally Enclosed, Fan Cooled | | | Explosion Proof | | |
| | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) |
| ½ | E04873S | 2.6/1.3 | 19 | E04876S | 1.9/.95 | 18 | BBC04875 | 1.9/.95 | 27 |
| ¾ | E05873S | 3.4/1.7 | 19 | E05876S | 2.3/1.15 | 21 | BBC05875 | 2.3/1.15 | 30 |
| 1 | E06873S | 4.2/2.1 | 22 | E06876S | 3.2/1.6 | 21 | BBC06875 | 3.2/1.6 | 30 |
| 1½ | E07878S | 5.8/2.9 | 25 | E07876S | 4.8/2.4 | 27 | BBC07875 | 4.8/2.4 | 37 |
| 2 | E08874S | 6.9/3.3 | 39 | E08876S | 5.4/2.7 | 33 | BBC08875 | 5.4/2.7 | 44 |
| 3 | E09874S | 7.2/3.6 | 31 | E09876S | 7.6/3.8 | 37 | | | |
| 5 | E10774S | 7.2/14.4 | 50 | E10876S | 6.2/12.4 | 48 | | | |

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

### MODEL NPE 1750 RPM

| HP | Single-Phase, 60 HZ, 115/230 V, 56J Frame | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Open, Drip-Proof ① | | | Totally Enclosed, Fan Cooled | | | Explosion Proof | | |
| | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) |
| ½ | E04811 | 8.6/4.3 | 19 | E04812 | 8.0/4.0 | 20 | BBC04815 | 8.0/4.0 | 45 |

| HP | Three-Phase, 60 HZ, 208-230/460 V, 56J Frame | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Open, Drip-Proof ① | | | Totally Enclosed, Fan Cooled | | | Explosion Proof | | |
| | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) | Order No. | Max. Amps | Wt. (lbs.) |
| ½ | E04831 | 3.76/4.0/2.0 | 20 | E04832 | 1.77/1.6/.8 | 20 | BBC04835 | 1.77/1.6/.8 | 45 |

**Note:** Explosion Proof Motors are class 1 and 2, Group D

# Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

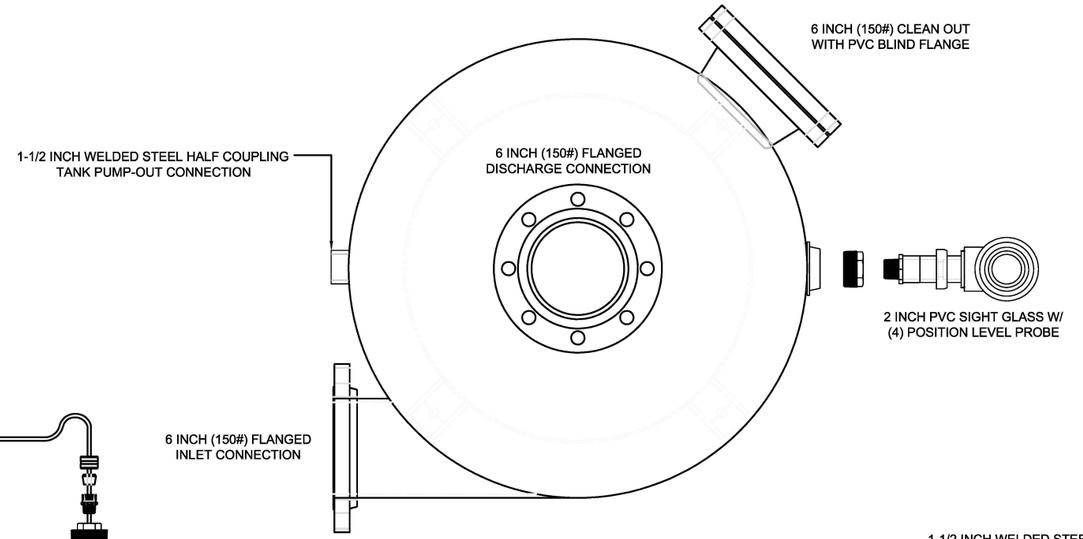
We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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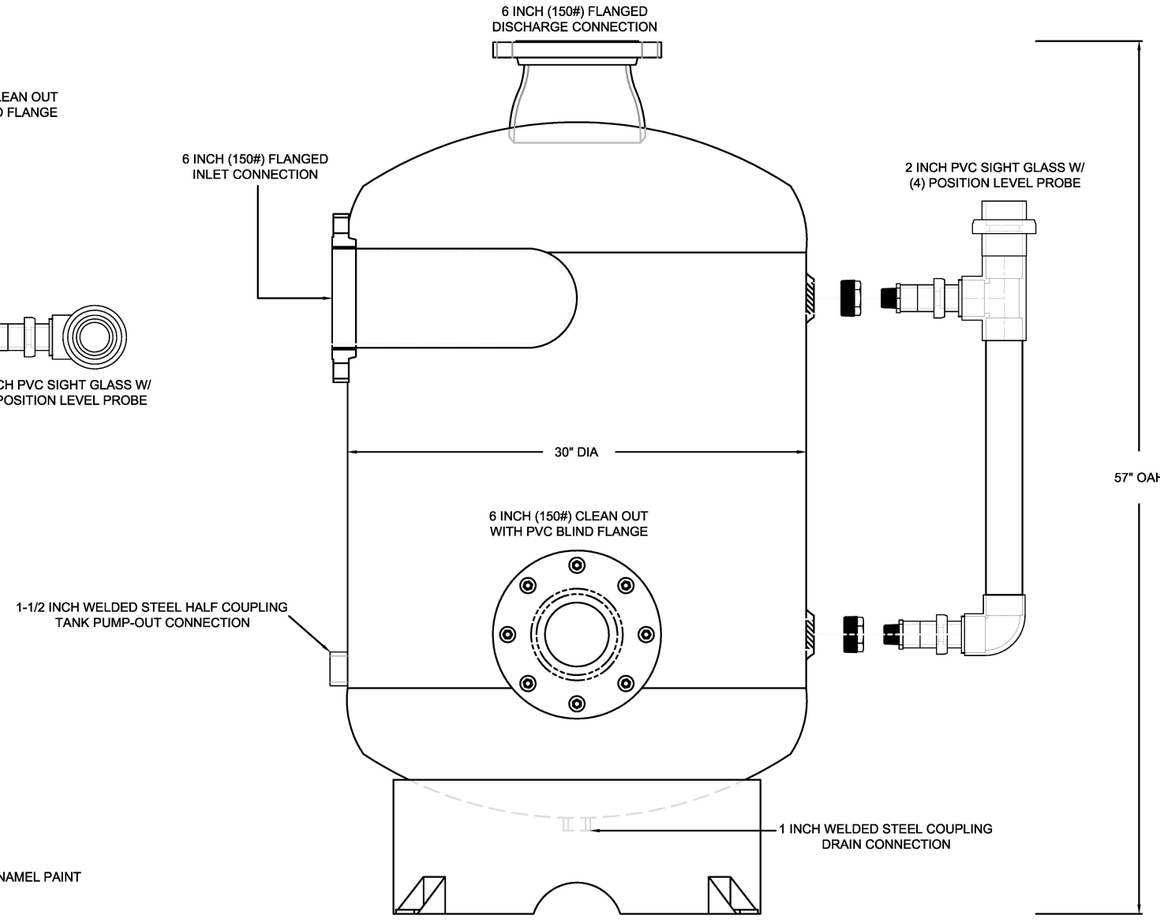
xylem
Let's Solve Water

Xylem, Inc.
2881 East Bayard Street Ext., Suite A
Seneca Falls, NY 13148
Phone: (800) 453-6777
Fax: (888) 322-5877
www.xyleminc.com/brands/goulds watertechnology

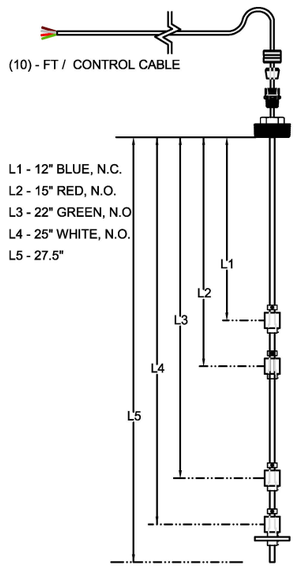
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(VLS-101) SEPARATOR TANK
PLAN VIEW




(VLS-101) SEPERATOR TANK
ELEVATIONAL VIEW




BODY MATERIAL - STAINLESS STEEL CONSTRUCTION
FLOAT MATERIAL - STAINLESS STEEL CONSTRUCTION
PROCESS CONNECTION - 2 INCH MNPT

4 - POSITION LEVEL SENSOR
(LSHH-101, LSH-101, LSL-101 & LSLL-101)
ELEVATION VIEW

NOTES:
1. TANK CONSTRUCTION - CARBON STEEL. 200 PSI RATED VESSEL
2. EXTERIOR MECHANICALLY PRE-PARED, PRIMED AND PAINTED WITH INDUSTRIAL ENAMEL PAINT (RUSTOLEUM SERIES 7400 OR EQUAL)
3. ESTIMATED CONDENSATE LEVELS:
   - LSHH-101 - 77 GALLONS
   - LSH-101 - 68 GALLONS
   - LSL-101 - 46 GALLONS
   - LSLL - 101 - 37 GALLONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| A | AS BUILT | 10-31-13 | CJJ |

REVISIONS

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| | |
|---|---|
| DRWN BY | CJJ |
| DATE | 10-15-13 |
| CHK BY | KWB |
| DATE | 10-17-13 |
| APPR BY | |
| DATE | |

NES™
NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

TITLE: 120 GALLON MOISTURE SEPARATOR (VLS-101)
4 POSITION LEVEL PROBE: LSHH, LSH, LSL & LSLL-101

SANBORN HEAD - IBM: FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

| JOB NO. | SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|---|
| 13-189 | NTS | B | M-3 | 1 OF 1 | A |

# MOISTURE SEPARATOR

## GENERAL THEORY

The moisture separator removes liquids from the process stream in soil venting applications to help protect the blower from corrosion and mineral deposits caused by water.

## DESIGN INFORMATION

NES moisture separators operate on the principles of cyclonic section aided by velocity reduction. The moisture separator inlet pipe is set tangential to the tank wall, a stringer pipe extends down past the separator inlet is placed in the center of the tank. The moisture laden air stream is forced into a cyclonic rotation. The centrifugal force produced throws the water droplets to the outer wall of the separator where they fall and collect at the bottom. Additional efficiency is produced when the velocity is reduced to values between 1500 fpm and 6000 fpm. For a separator of this type, moisture separation efficiency is typically 95% or greater for moisture droplets greater than 10 micron.

## CONSTRUCTION

NES moisture separators are constructed of carbon steel with bronze drain valves, removable lid with EPDM gasket, mechanical ball and float assembly standard for drum style separators. Sight glass, emergency high-level switch and pump out switches are optional. Tank style separators are standard with carbon steel construction, bronze drain valves, flanged clean-out port, sight glass and emergency high level switch. Pump-out switches and mist eliminator are optional. All separators are primed and coated with a rust inhibitor to prevent corrosion.

National Environmental Systems
Phone 508-226-1100 Fax 508-226)-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz





**DRUM STYLE SEPARATOR** **TANK STYLE SEPARATOR**

## NORMAL SERIES OF OPERATION FOR MOISTURE SEPARATOR LEVEL SWITCHES

1. Water level rises and actuates low level switch (wired normally open).
2. Switch closes and sends signal to controller.
3. Water level continues to rise and actuates high level switch (wired normally open).
4. Switch closes and sends signal to controller to activate moisture sepaator transfer pump.
5. Water level drops when pump activates.
6. De-energizes high switch.
7. Continues to drop.
8. De-energizes low switch.
9. Controller calls off pump.
10. Series repeats.

## ACTIVATION OF EMERGENCY HIGH LEVEL SWITCH

1. Water level rises and actuates low level switch (wired normally open).
2. Switch closes and sends signal to controller.
3. Water level continues to rise and actuates high level switch (wired normally open).
4. Switch closes and sends signal to controller to activate moisture separator transfer pump.
5. Problem with pump, level switch or down stream process, water level does not drop.
6. Water level rises until emergency high switch (wired normally closed) is actuated.
7. Appropriate process equipment is de-energized (i.e. pump, SVE blower)

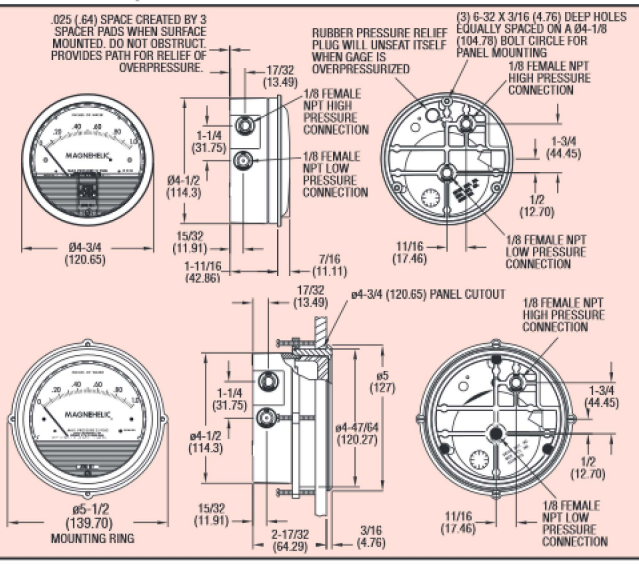
National Environmental Systems
Phone 508-226-1100 Fax 508-226)-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz

Series 2000

# Magnehelic® Differential Pressure Gages

## Indicate Positive, Negative or Differential, Accurate within 2%




**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® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

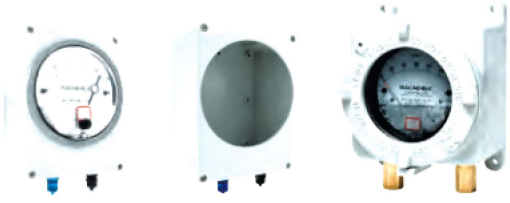
The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

### Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. 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 4-9/16″ hole is required for flush panel mounting. Complete mounting and connection fittings, plus instructions, are furnished with each instrument. See pages 6 and 7 for more information on mounting accessories.



**Flush, Surface or Pipe Mounted**



**Enclosure Mounted**

### SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases (natural gas option available).
**Note:** May be used with hydrogen. Order a Buna-N diaphragm. Pressures must be less than 35 psi.
**Wetted Materials:** Consult factory.
**Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
**Accuracy:** ±2% of FS (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
**Pressure Limits:** -20 in Hg to 15 psig† (-0.677 to 1.034 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar).
**Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. See Overpressure Protection Note on next page.
**Temperature Limits:** 20 to 140°F*
(-6.67 to 60°C). -20°F (-28°C) with low temperature option.
**Size:** 4″ (101.6 mm) diameter dial face.
**Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations.
**Process Connections:** 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
**Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
**Standard Accessories:** Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter, and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for three adapters in MP & HP gage accessories.)
**Agency Approval:** RoHS. **Note:** -SP models not RoHS approved.
†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.

### ACCESSORIES



**Model A-432 Portable Kit**
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ ID rubber tubing, standhang bracket and terminal tube with holder.



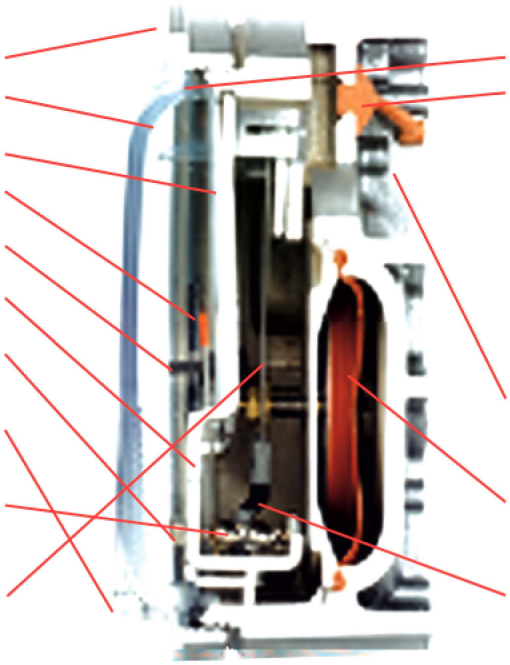
**Model A-605 Air Filter Gage Accessory Kit**
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

**A-605B Air Filter Gage Accessory Kit,** Air filter kit with two plastic open/close valves, two 4″ steel static tips, plastic tubing and mounting flange

**A-605C Air Filter Gage Accessory Kit,** Air filter kit with two plastic open/close valves, two plastic static tips, plastic tubing and mounting flange

Series 2000

# Magnehelic® Gage Models & Ranges



**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.

**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.

**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.

**O-ring seal** for cover assures pressure integrity of case.

**OVERPRESSURE PROTECTION**
**Blowout plug** is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023" clearance when gage is surface mounted. Do not obstruct the gap created by these pads. The blowout plug is not used on models above 180" of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm. The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings or any component.

**Die cast aluminum case** is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

**Silicone rubber diaphragm** with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

**Samarium Cobalt magnet** mounted at one end of range spring rotates helix without mechanical linkages.

| Model | Range Inches of Water |
|---|---|
| 2000-00N†•• | .05-0-.2 |
| 2000-00†•• | 0-.25 |
| 2000-0†• | 0-.50 |
| 2001 | 0-1.0 |
| 2002 | 0-2.0 |
| 2003 | 0-3.0 |
| 2004 | 0-4.0 |
| 2005 | 0-5.0 |
| 2006 | 0-6.0 |
| 2008 | 0-8.0 |
| 2010 | 0-10 |
| 2012 | 0-12 |
| 2015 | 0-15 |
| 2020 | 0-20 |
| 2025 | 0-25 |
| 2030 | 0-30 |
| 2040 | 0-40 |
| 2050 | 0-50 |
| 2060 | 0-60 |
| 2080 | 0-80 |
| 2100 | 0-100 |
| 2120 | 0-120 |
| 2150 | 0-150 |
| 2160 | 0-160 |
| 2180* | 0-180 |
| 2250* | 0-250 |
| **Zero Center Ranges** | |
| 2300-00†•• | 0.125-0-0.125 |
| 2300-0†• | .25-0-.25 |
| 2301 | .5-0-.5 |
| 2302 | 1-0-1 |
| 2304 | 2-0-2 |
| 2310 | 5-0-5 |
| 2320 | 10-0-10 |
| 2330 | 15-0-15 |

| Model | Range PSI |
|---|---|
| 2201 | 0-1 |
| 2202 | 0-2 |
| 2203 | 0-3 |
| 2204 | 0-4 |
| 2205 | 0-5 |
| 2210* | 0-10 |
| 2215* | 0-15 |
| 2220* | 0-20 |
| 2230** | 0-30 |

| Model | Range, CM of Water |
|---|---|
| 2000-15CM | 0-15 |
| 2000-20CM | 0-20 |
| 2000-25CM | 0-25 |
| 2000-50CM | 0-50 |
| 2000-80CM | 0-80 |
| 2000-100CM | 0-100 |
| 2000-150CM | 0-150 |
| 2000-200CM | 0-200 |
| 2000-250CM | 0-250 |
| 2000-300CM | 0-300 |
| **Zero Center Ranges** | |
| 2300-4CM | 2-0-2 |
| 2300-10CM | 5-0-5 |
| 2300-30CM | 15-0-15 |

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
•• Accuracy +/-4%
*MP option standard
**HP option standard

| Model | Range MM of Water |
|---|---|
| 2000-6MM†•• | 0-6 |
| 2000-10MM†• | 0-10 |
| 2000-15MM | 0-15 |
| 2000-25MM | 0-25 |
| 2000-30MM | 0-30 |
| 2000-50MM | 0-50 |
| 2000-80MM | 0-80 |
| 2000-100MM | 0-100 |
| 2000-125MM | 0-125 |
| 2000-150MM | 0-150 |
| 2000-200MM | 0-200 |
| 2000-250MM | 0-250 |
| 2000-300MM | 0-300 |
| **Zero Center Ranges** | |
| 2300-6MM†•• | 3-0-3 |
| 2300-10MM†• | 5-0-5 |
| 2300-20MM†• | 10-0-10 |
| **Model** | **Range, Pa** |
| 2000-60NPA†•• | 10-0-50 |
| 2000-60PA†•• | 0-60 |
| 2000-100PA†• | 0-100 |
| 2000-125PA†• | 0-125 |
| 2000-250PA | 0-250 |
| 2000-300PA | 0-300 |
| 2000-500PA | 0-500 |
| 2000-750PA | 0-750 |
| 2000-1000PA | 0-1000 |
| **Zero Center Ranges** | |
| **Model** | **Range, Pa** |
| 2300-60PA†•• | 30-0-30 |
| 2300-100PA†• | 50-0-50 |
| 2300-120PA | 60-0-60 |
| 2300-200PA | 100-0-100 |
| 2300-250PA | 125-0-125 |
| 2300-300PA | 150-0-150 |
| 2300-500PA | 250-0-250 |
| 2300-1000PA | 500-0-500 |

| Model | Range, kPa |
|---|---|
| 2000-0.5KPA | 0-0.5 |
| 2000-1KPA | 0-1 |
| 2000-1.5KPA | 0-1.5 |
| 2000-2KPA | 0-2 |
| 2000-2.5KPA | 0-2.5 |
| 2000-3KPA | 0-3 |
| 2000-4KPA | 0-4 |
| 2000-5KPA | 0-5 |
| 2000-8KPA | 0-8 |
| 2000-10KPA | 0-10 |
| 2000-15KPA | 0-15 |
| 2000-20KPA | 0-20 |
| 2000-25KPA | 0-25 |
| 2000-30KPA | 0-30 |
| **Zero Center Ranges** | |
| 2300-1KPA | .5-0-.5 |
| 2300-2KPA | 1-0-1 |
| 2300-2.5KPA | 1.25-0-1.25 |
| 2300-3KPA | 1.5-0-1.5 |

**Dual Scale Air Velocity Units**
For use with pitot tube

| Model | Range in W.C./ Velocity F.P.M. |
|---|---|
| 2000-00AV†•• | 0-.25/300-2000 |
| 2000-0AV†• | 0-.50/500-2800 |
| 2001AV | 0-1.0/500-4000 |
| 2002AV | 0-2.0/1000-5600 |
| 2005AV | 0-5.0/2000-8800 |
| 2010AV | 0-10/2000-12500 |

**Dual Scale English/Metric Models**

| Model | Range, in w.c. | Range, Pa or kPa |
|---|---|---|
| 2000-00D†•• | 0-.25 | 0-62 Pa |
| 2000-0D†• | 0-0.5 | 0-125 Pa |
| 2001D | 0-1.0 | 0-250 Pa |
| 2002D | 0-2.0 | 0-500 Pa |
| 2003D | 0-3.0 | 0-750 Pa |
| 2004D | 0-4.0 | 0-1.0 kPa |
| 2005D | 0-5.0 | 0-1.25 kPa |
| 2006D | 0-6.0 | 0-1.5 kPa |
| 2008D | 0-8.0 | 0-2.0 kPa |
| 2010D | 0-10 | 0-2.5 kPa |
| 2015D | 0-15 | 0-3.7 kPa |
| 2020D | 0-20 | 0-5 kPa |
| 2025D | 0-25 | 0-6.2 kPa |
| 2050D | 0-50 | 0-12.4 kPa |
| 2060D | 0-60 | 0-15 kPa |

**VELOCITY AND VOLUMETRIC FLOW UNITS**
Scales are available on the Magnehelic® that read in velocity units (FPM, m/s) or volumetric flow units (SCFM, $m^3/s$, $m^3/h$). Stocked velocity units with dual range scales in inches w.c. and feet per minute are shown above. For other ranges contact the factory.
When ordering volumetric flow scales please specify the maximum flow rate and its corresponding pressure. Example: 0.5 in w.c. = 16,000 CFM.

**ACCESSORIES**
**A-321,** Safety Relief Valve
**A-448,** 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
**A-135,** Rubber gasket for panel mounting



**A-310A 3-Way Vent Valves**
In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

# Magnehelic® Gage Options

**OPTIONS** — To order, add suffix: I.E. 2001-ASF
**LT,** Low Temperatures to -20°F (-28°C)
**NIST,** NIST traceable calibration certificate
**FC,** factory calibration certificate



**LED Setpoint Indicator**
Bright red LED on right scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Setpoint indicator option comes with medium pressure (MP) bezel.
**Note:** 4-13/16″ hole for flush mounting.
**-SP**



**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.
**-ASF**



**Transparent Overlays**
Furnished in red, yellow, or green to highlight and emphasize critical pressures.
**-R (Red)**
**-Y (Yellow)**
**-G (Green)**



**Mirrored Scale Overlay**
A Mirrored Scale Overlay is also available to assist in reducing parallax error.
**-M**

**MODELS FOR HIGH STATE PRESSURE APPLICATIONS**



**Medium Pressure Option:** for pressures to 35 psig.
**-MP**

**High Pressure Option:** for pressures to 80 psig.
**-HP**

**Note:** 4-13/16″ hole is required for flush mounting.

**OPTIONAL BEZELS**



**Stainless Steel Bezel Option:**
304 Stainless Steel Electro polished Ra 16 finished bezel for the Magnehelic® is now available.

**-SB**



**Chrome Bezel Option:**
A Chrome Plated Aluminum Bezel is now available on the Magnehelic® gage for an aesthetically pleasing finish when mounting on metal surfaces such as control panels.

**-CB**

# Magnehelic® Gage Mounting Accessories

**Model A-464, Flush Mount Kit for Magnehelic® Gages**




**The A-464 Mounting Kit** provides a flush mounting solution for Magnehelic® gage installations for applications such as clean rooms and mechanical equipment rooms. The A-464 can also be used as an alternative means to flush mount Magnehelic® gages on control panel enclosures. The space pressure reference port eliminates the need to drill separate holes and run tubing long distances. Utilizing the A-464 for Magnehelic® gage installations reduces installation time while also producing an aesthetically pleasing result.

**SPECIFICATIONS**
**Material:** White ABS plastic.
**Weight:** 4 oz (113 g).

**Model A-464**

**Model A-286, Magnehelic® Gage Panel Mounting Flange**



The new mounting flange can be used on any Dwyer Instruments, Inc. gage that possesses a 4-1/2˝ (115 mm) diameter housing. The flange is secured to the gage behind its bezel with three set screws. The set screws hold the gage tight in place. The gage/flange can then be quickly attached to a surface or panel with a drill and the supplied mounting screws. The flange's three mounting holes follow the industry standard mounting pattern. The flange is made of a robust plastic composite and comes with three pre-installed set screws, an allen wrench for tightening and three flange mounting screws.

**SPECIFICATIONS**
**Flange Materials:** Plastic.
**Weight:** 2.3 oz (65 g).

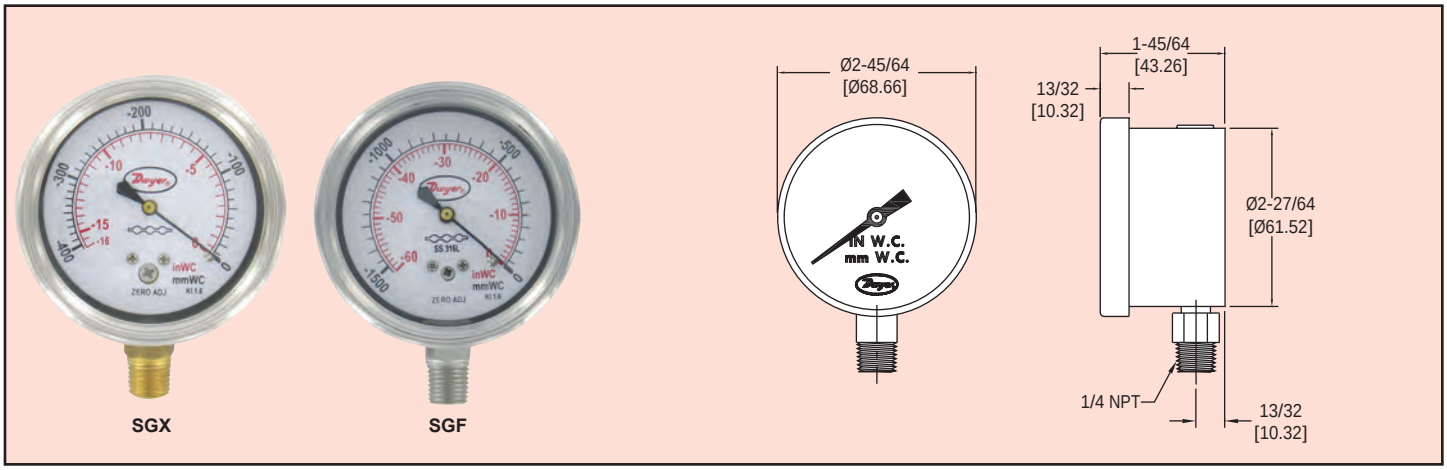
**INCLUDED ACCESSORIES**
3 Pre-installed metal set screws
3 Mounting screws
1 Allen wrench
1 Instruction manual with mounting template

**Model A-286**

Series SGX & SGF

# 2.5″ Stainless Steel Low Pressure Gages

## Brass or 316 SS Wetted Parts




**The Series SGX/SGF Gages** have dual English/metric scales with ±1.6% full-scale accuracy. The Series SGX/SGF gages are designed with 304 SS housing and brass or 316 SS wetted parts. Units can withstand ambient temperatures up to 149°F (65°C) and process temperatures up to 212°F (100°C). Ranges of vacuum, compound and pressures to 235 in w.c. are available. Included on the dial is a convenient zero adjustment screw which allows the user to easily re-zero the needle.

**APPLICATIONS**

Pneumatic, draft measurement, filter monitoring, liquid level

**SPECIFICATIONS**

**Service:** Compatible gases & liquids.
**Wetted Materials:** SGX: Brass; SGF: 316/316L SS.
**Housing:** 304 SS.
**Lens:** Glass.
**Accuracy:** ±1.6% full-scale on positive pressure ranges 15 in w.c. and greater; ±2.5% full scale on all other ranges.
**Pressure Limit:** Full-scale value.
**Temperature Limits:**
Ambient: -13 to 149°F (-25 to 65°C);
Process: 212°F max. (100°C max.).
**Size:** 2.5″ (63 mm).
**Process Connections:** 1/4″ male NPT.
**Enclosure Rating:** NEMA 3 (IP54).
**Weight:** 4.6 oz (0.13 kg).

| Brass Gages | | 316SS Gages | |
|---|---|---|---|
| **Model** | **Range** | **Model** | **Range** |
| **SGX-D7122N** | -10-0 in w.c. (-250-0 mm) | **SGF-D7122N** | -10-0 in w.c. (-250-0 mm) |
| **SGX-D7322N** | -25-0 in w.c. (-600-0 mm) | **SGF-D7322N** | -25-0 in w.c. (-600-0 mm) |
| **SGX-D7522N** | -60-0 in w.c. (-1600-0 mm) | **SGF-D7522N** | -60-0 in w.c. (-1600-0 mm) |
| **SGX-D7722N** | -100-0 in w.c. (-2500-0 mm) | **SGF-D7722N** | -100-0 in w.c. (-2500-0 mm) |
| **SGX-D8022N** | 0-10 in w.c. (0-250 mm) | **SGF-D8022N** | 0-10 in w.c. (0-250 mm) |
| **SGX-D8122N** | 0-15 in w.c. (0-400 mm) | **SGF-D8122N** | 0-15 in w.c. (0-400 mm) |
| **SGX-D8222N** | 0-25 in w.c. (0-600 mm) | **SGF-D8222N** | 0-25 in w.c. (0-600 mm) |
| **SGX-D8322N** | 0-40 in w.c. (0-1000 mm) | **SGF-D8322N** | 0-40 in w.c. (0-1000 mm) |
| **SGX-D8422N** | 0-60 in w.c. (0-1600 mm) | **SGF-D8422N** | 0-60 in w.c. (0-1600 mm) |
| **SGX-D8722N** | 0-160 in w.c. (0-4000 mm) | **SGF-D8622N** | 0-100 in w.c. (0-2500 mm) |
| **SGX-D8922N** | -4-0-6 in w.c. (-100-0-150 mm) | **SGF-D8722N** | 0-160 in w.c. (0-4000 mm) |
| **SGX-D9122N** | -8-0-16 in w.c. (-200-0-400 mm) | | |
| **SGX-D9722N** | -80-0-160 in w.c. (-2000-0-4000 mm) | | |

**OPTION**

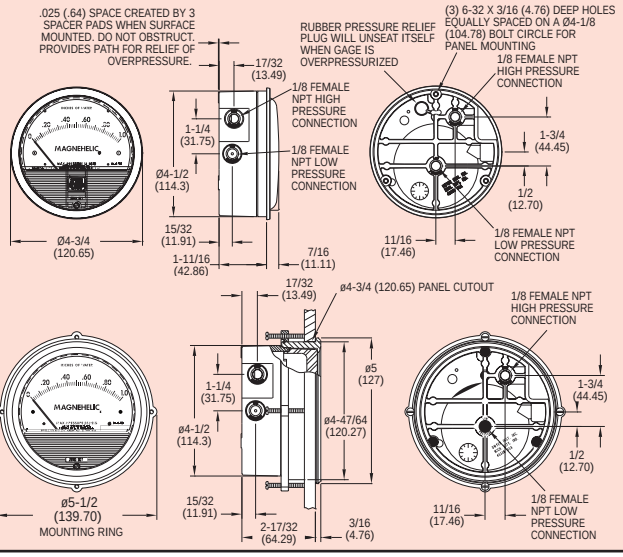
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

Series 2000

# Magnehelic® Differential Pressure Gages

## Indicate Positive, Negative or Differential, Accurate within 2%




**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® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® gage 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.

### Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. 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 4-9/16″ hole is required for flush panel mounting. Complete mounting and connection fittings, plus instructions, are furnished with each instrument. See pages 6 and 7 for more information on mounting accessories.



**Flush, Surface or Pipe Mounted**



**Enclosure Mounted**

### SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases (natural gas option available).
**Note:** May be used with hydrogen. Order a Buna-N diaphragm. Pressures must be less than 35 psi.
**Wetted Materials:** Consult factory.
**Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
**Accuracy:** ±2% of FS (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
**Pressure Limits:** -20 in Hg to 15 psig† (-0.677 to 1.034 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar).
**Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. See Overpressure Protection Note on next page.
**Temperature Limits:** 20 to 140°F*
(-6.67 to 60°C). -20°F (-28°C) with low temperature option.
**Size:** 4″ (101.6 mm) diameter dial face.
**Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations.
**Process Connections:** 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
**Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
**Standard Accessories:** Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter, and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for three adapters in MP & HP gage accessories.)
**Agency Approval:** RoHS. **Note:** -SP models not RoHS approved.
†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.

### ACCESSORIES



**Model A-432 Portable Kit**
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ ID rubber tubing, standhang bracket and terminal tube with holder.



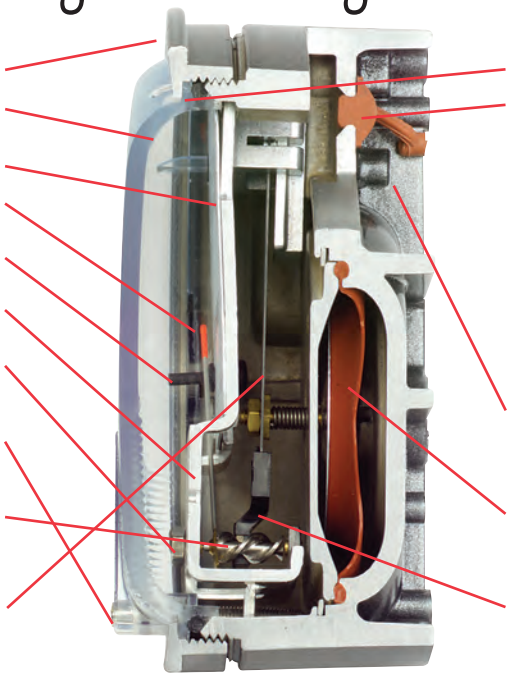
**Model A-605 Air Filter Gage Accessory Kit**
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

**A-605B Air Filter Gage Accessory Kit,** Air filter kit with two plastic open/close valves, two 4″ steel static tips, plastic tubing and mounting flange

**A-605C Air Filter Gage Accessory Kit,** Air filter kit with two plastic open/close valves, two plastic static tips, plastic tubing and mounting flange

Series 2000

# Magnehelic® Gage Models & Ranges



**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.

**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.

**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.

**O-ring seal** for cover assures pressure integrity of case.

**OVERPRESSURE PROTECTION**
**Blowout plug** is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads. The blowout plug is not used on models above 180″ of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm. The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings or any component.

**Die cast aluminum case** is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

**Silicone rubber diaphragm** with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

**Samarium Cobalt magnet** mounted at one end of range spring rotates helix without mechanical linkages.

| Model | Range Inches of Water |
|---|---|
| 2000-00N†•• | .05-0-.2 |
| 2000-00†•• | 0-.25 |
| 2000-0†• | 0-.50 |
| 2001 | 0-1.0 |
| 2002 | 0-2.0 |
| 2003 | 0-3.0 |
| 2004 | 0-4.0 |
| 2005 | 0-5.0 |
| 2006 | 0-6.0 |
| 2008 | 0-8.0 |
| 2010 | 0-10 |
| 2012 | 0-12 |
| 2015 | 0-15 |
| 2020 | 0-20 |
| 2025 | 0-25 |
| 2030 | 0-30 |
| 2040 | 0-40 |
| 2050 | 0-50 |
| 2060 | 0-60 |
| 2080 | 0-80 |
| 2100 | 0-100 |
| 2120 | 0-120 |
| 2150 | 0-150 |
| 2160 | 0-160 |
| 2180* | 0-180 |
| 2250* | 0-250 |
| **Zero Center Ranges** | |
| 2300-00†•• | 0.125-0-0.125 |
| 2300-0†• | .25-0-.25 |
| 2301 | .5-0-.5 |
| 2302 | 1-0-1 |
| 2304 | 2-0-2 |
| 2310 | 5-0-5 |
| 2320 | 10-0-10 |
| 2330 | 15-0-15 |

| Model | Range PSI |
|---|---|
| 2201 | 0-1 |
| 2202 | 0-2 |
| 2203 | 0-3 |
| 2204 | 0-4 |
| 2205 | 0-5 |
| 2210* | 0-10 |
| 2215* | 0-15 |
| 2220* | 0-20 |
| 2230** | 0-30 |
| **Model** | **Range, CM of Water** |
| 2000-15CM | 0-15 |
| 2000-20CM | 0-20 |
| 2000-25CM | 0-25 |
| 2000-50CM | 0-50 |
| 2000-80CM | 0-80 |
| 2000-100CM | 0-100 |
| 2000-150CM | 0-150 |
| 2000-200CM | 0-200 |
| 2000-250CM | 0-250 |
| 2000-300CM | 0-300 |
| **Zero Center Ranges** | |
| 2300-4CM | 2-0-2 |
| 2300-10CM | 5-0-5 |
| 2300-30CM | 15-0-15 |

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

| Model | Range MM of Water |
|---|---|
| 2000-6MM†•• | 0-6 |
| 2000-10MM†• | 0-10 |
| 2000-15MM | 0-15 |
| 2000-25MM | 0-25 |
| 2000-30MM | 0-30 |
| 2000-50MM | 0-50 |
| 2000-80MM | 0-80 |
| 2000-100MM | 0-100 |
| 2000-125MM | 0-125 |
| 2000-150MM | 0-150 |
| 2000-200MM | 0-200 |
| 2000-250MM | 0-250 |
| 2000-300MM | 0-300 |
| **Zero Center Ranges** | |
| 2300-6MM†•• | 3-0-3 |
| 2300-10MM†• | 5-0-5 |
| 2300-20MM†• | 10-0-10 |
| **Model** | **Range, Pa** |
| 2000-60NPA†•• | 10-0-50 |
| 2000-60PA†•• | 0-60 |
| 2000-100PA†• | 0-100 |
| 2000-125PA†• | 0-125 |
| 2000-250PA | 0-250 |
| 2000-300PA | 0-300 |
| 2000-500PA | 0-500 |
| 2000-750PA | 0-750 |
| 2000-1000PA | 0-1000 |
| **Zero Center Ranges** | |
| **Model** | **Range, Pa** |
| 2300-60PA†•• | 30-0-30 |
| 2300-100PA†• | 50-0-50 |
| 2300-120PA | 60-0-60 |
| 2300-200PA | 100-0-100 |
| 2300-250PA | 125-0-125 |
| 2300-300PA | 150-0-150 |
| 2300-500PA | 250-0-250 |
| 2300-1000PA | 500-0-500 |

| Model | Range, kPa |
|---|---|
| 2000-0.5KPA | 0-0.5 |
| 2000-1KPA | 0-1 |
| 2000-1.5KPA | 0-1.5 |
| 2000-2KPA | 0-2 |
| 2000-2.5KPA | 0-2.5 |
| 2000-3KPA | 0-3 |
| 2000-4KPA | 0-4 |
| 2000-5KPA | 0-5 |
| 2000-8KPA | 0-8 |
| 2000-10KPA | 0-10 |
| 2000-15KPA | 0-15 |
| 2000-20KPA | 0-20 |
| 2000-25KPA | 0-25 |
| 2000-30KPA | 0-30 |
| **Zero Center Ranges** | |
| 2300-1KPA | .5-0-.5 |
| 2300-2KPA | 1-0-1 |
| 2300-2.5KPA | 1.25-0-1.25 |
| 2300-3KPA | 1.5-0-1.5 |

**Dual Scale Air Velocity Units**
For use with pitot tube

| Model | Range in W.C./ Velocity F.P.M. |
|---|---|
| 2000-00AV†•• | 0-.25/300-2000 |
| 2000-0AV†• | 0-.50/500-2800 |
| 2001AV | 0-1.0/500-4000 |
| 2002AV | 0-2.0/1000-5600 |
| 2005AV | 0-5.0/2000-8800 |
| 2010AV | 0-10/2000-12500 |

**Dual Scale English/Metric Models**

| Model | Range, in w.c. | Range, Pa or kPa |
|---|---|---|
| 2000-00D†•• | 0-.25 | 0-62 Pa |
| 2000-0D†• | 0-0.5 | 0-125 Pa |
| 2001D | 0-1.0 | 0-250 Pa |
| 2002D | 0-2.0 | 0-500 Pa |
| 2003D | 0-3.0 | 0-750 Pa |
| 2004D | 0-4.0 | 0-1.0 kPa |
| 2005D | 0-5.0 | 0-1.25 kPa |
| 2006D | 0-6.0 | 0-1.5 kPa |
| 2008D | 0-8.0 | 0-2.0 kPa |
| 2010D | 0-10 | 0-2.5 kPa |
| 2015D | 0-15 | 0-3.7 kPa |
| 2020D | 0-20 | 0-5 kPa |
| 2025D | 0-25 | 0-6.2 kPa |
| 2050D | 0-50 | 0-12.4 kPa |
| 2060D | 0-60 | 0-15 kPa |

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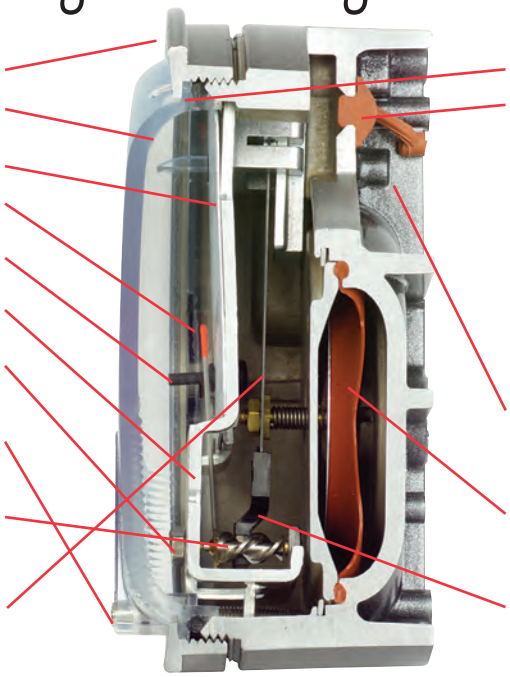
**ACCESSORIES**
**A-321,** Safety Relief Valve
**A-448,** 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
**A-135,** Rubber gasket for panel mounting



**A-310A 3-Way Vent Valves**
In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

Series 2000

# Magnehelic® Gage Models & Ranges



**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.

**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.

**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.

**O-ring seal** for cover assures pressure integrity of case.

**OVERPRESSURE PROTECTION**
**Blowout plug** is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads. The blowout plug is not used on models above 180″ of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm. The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings or any component.

**Die cast aluminum case** is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

**Silicone rubber diaphragm** with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

**Samarium Cobalt magnet** mounted at one end of range spring rotates helix without mechanical linkages.

| Model | Range Inches of Water |
|---|---|
| 2000-00N†•• | .05-0-.2 |
| 2000-00†•• | 0-.25 |
| 2000-0†• | 0-.50 |
| 2001 | 0-1.0 |
| 2002 | 0-2.0 |
| 2003 | 0-3.0 |
| [illegible] | [illegible] |
| 2005 | 0-5.0 |
| [illegible] | [illegible] |
| 2008 | 0-8.0 |
| 2010 | 0-10 |
| 2012 | 0-12 |
| 2015 | 0-15 |
| 2020 | 0-20 |
| 2025 | 0-25 |
| 2030 | 0-30 |
| 2040 | 0-40 |
| 2050 | 0-50 |
| 2060 | 0-60 |
| 2080 | 0-80 |
| 2100 | 0-100 |
| 2120 | 0-120 |
| 2150 | 0-150 |
| 2160 | 0-160 |
| 2180* | 0-180 |
| 2250* | 0-250 |
| **Zero Center Ranges** | |
| 2300-00†•• | 0.125-0-0.125 |
| 2300-0†• | .25-0-.25 |
| 2301 | .5-0-.5 |
| 2302 | 1-0-1 |
| 2304 | 2-0-2 |
| 2310 | 5-0-5 |
| 2320 | 10-0-10 |
| 2330 | 15-0-15 |

| Model | Range PSI |
|---|---|
| 2201 | 0-1 |
| 2202 | 0-2 |
| 2203 | 0-3 |
| 2204 | 0-4 |
| 2205 | 0-5 |
| 2210* | 0-10 |
| 2215* | 0-15 |
| 2220* | 0-20 |
| 2230** | 0-30 |
| **Model** | **Range, CM of Water** |
| 2000-15CM | 0-15 |
| 2000-20CM | 0-20 |
| 2000-25CM | 0-25 |
| 2000-50CM | 0-50 |
| 2000-80CM | 0-80 |
| 2000-100CM | 0-100 |
| 2000-150CM | 0-150 |
| 2000-200CM | 0-200 |
| 2000-250CM | 0-250 |
| 2000-300CM | 0-300 |
| **Zero Center Ranges** | |
| 2300-4CM | 2-0-2 |
| 2300-10CM | 5-0-5 |
| 2300-30CM | 15-0-15 |

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

| Model | Range MM of Water |
|---|---|
| 2000-6MM†•• | 0-6 |
| 2000-10MM†• | 0-10 |
| 2000-15MM | 0-15 |
| 2000-25MM | 0-25 |
| 2000-30MM | 0-30 |
| 2000-50MM | 0-50 |
| 2000-80MM | 0-80 |
| 2000-100MM | 0-100 |
| 2000-125MM | 0-125 |
| 2000-150MM | 0-150 |
| 2000-200MM | 0-200 |
| 2000-250MM | 0-250 |
| 2000-300MM | 0-300 |
| **Zero Center Ranges** | |
| 2300-6MM†•• | 3-0-3 |
| 2300-10MM†• | 5-0-5 |
| 2300-20MM†• | 10-0-10 |
| **Model** | **Range, Pa** |
| 2000-60NPA†•• | 10-0-50 |
| 2000-60PA†•• | 0-60 |
| 2000-100PA†• | 0-100 |
| 2000-125PA†• | 0-125 |
| 2000-250PA | 0-250 |
| 2000-300PA | 0-300 |
| 2000-500PA | 0-500 |
| 2000-750PA | 0-750 |
| 2000-1000PA | 0-1000 |
| **Zero Center Ranges** | |
| **Model** | **Range, Pa** |
| 2300-60PA†•• | 30-0-30 |
| 2300-100PA†• | 50-0-50 |
| 2300-120PA | 60-0-60 |
| 2300-200PA | 100-0-100 |
| 2300-250PA | 125-0-125 |
| 2300-300PA | 150-0-150 |
| 2300-500PA | 250-0-250 |
| 2300-1000PA | 500-0-500 |

| Model | Range, kPa |
|---|---|
| 2000-0.5KPA | 0-0.5 |
| 2000-1KPA | 0-1 |
| 2000-1.5KPA | 0-1.5 |
| 2000-2KPA | 0-2 |
| 2000-2.5KPA | 0-2.5 |
| 2000-3KPA | 0-3 |
| 2000-4KPA | 0-4 |
| 2000-5KPA | 0-5 |
| 2000-8KPA | 0-8 |
| 2000-10KPA | 0-10 |
| 2000-15KPA | 0-15 |
| 2000-20KPA | 0-20 |
| 2000-25KPA | 0-25 |
| 2000-30KPA | 0-30 |
| **Zero Center Ranges** | |
| 2300-1KPA | .5-0-.5 |
| 2300-2KPA | 1-0-1 |
| 2300-2.5KPA | 1.25-0-1.25 |
| 2300-3KPA | 1.5-0-1.5 |

**Dual Scale Air Velocity Units**
For use with pitot tube

| Model | Range in W.C./ Velocity F.P.M. |
|---|---|
| 2000-00AV†•• | 0-.25/300-2000 |
| 2000-0AV†• | 0-.50/500-2800 |
| 2001AV | 0-1.0/500-4000 |
| 2002AV | 0-2.0/1000-5600 |
| 2005AV | 0-5.0/2000-8800 |
| 2010AV | 0-10/2000-12500 |

**Dual Scale English/Metric Models**

| Model | Range, in w.c. | Range, Pa or kPa |
|---|---|---|
| 2000-00D†•• | 0-.25 | 0-62 Pa |
| 2000-0D†• | 0-0.5 | 0-125 Pa |
| 2001D | 0-1.0 | 0-250 Pa |
| 2002D | 0-2.0 | 0-500 Pa |
| 2003D | 0-3.0 | 0-750 Pa |
| 2004D | 0-4.0 | 0-1.0 kPa |
| 2005D | 0-5.0 | 0-1.25 kPa |
| 2006D | 0-6.0 | 0-1.5 kPa |
| 2008D | 0-8.0 | 0-2.0 kPa |
| 2010D | 0-10 | 0-2.5 kPa |
| 2015D | 0-15 | 0-3.7 kPa |
| 2020D | 0-20 | 0-5 kPa |
| 2025D | 0-25 | 0-6.2 kPa |
| 2050D | 0-50 | 0-12.4 kPa |
| 2060D | 0-60 | 0-15 kPa |

**VELOCITY AND VOLUMETRIC FLOW UNITS**
Scales are available on the Magnehelic® that read in velocity units (FPM, m/s) or volumetric flow units (SCFM, $m^3/s$, $m^3/h$). Stocked velocity units with dual range scales in inches w.c. and feet per minute are shown above. For other ranges contact the factory.
When ordering volumetric flow scales please specify the maximum flow rate and its corresponding pressure. Example: 0.5 in w.c. = 16,000 CFM.

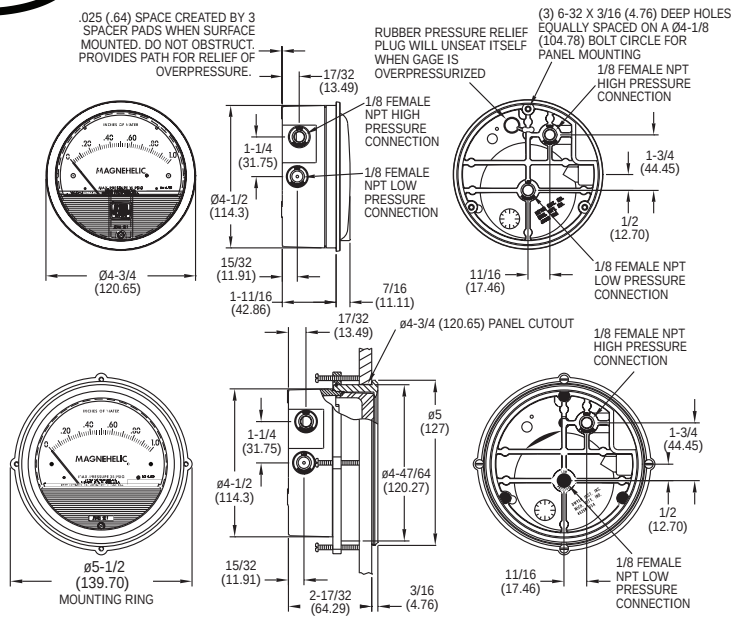
**ACCESSORIES**
**A-321,** Safety Relief Valve
**A-448,** 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
**A-135,** Rubber gasket for panel mounting



**A-310A 3-Way Vent Valves**
In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

Bulletin A-27

# Magnehelic® Differential Pressure Gage




**The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.*

**STANDARD GAGE ACCESSORIES:** Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapters and three flush mounting adapters with screws.

**MP AND HP GAGE ACCESSORIES:** Mounting ring and snap ring retainer substituted for 3 adaptors, 1/4" compression fittings replace 1/8" pipe thread to rubber tubing adaptors.

**OVERPRESSURE PROTECTION:** Standard Magnehelic® Differential Pressure Gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (excludes MP and HP models). To provide a free path for pressure relief, there are four spacer pads which maintain .023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

## SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases. (Natural Gas option available.)
**Wetted Materials:** Consult factory.
**Housing:** Die cast aluminum case and bezel, with acrylic cover. (MP model has polycarbonate cover).
**Accuracy:** ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on -00, - 00N, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
**Pressure Limits:** -20″ Hg to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
**Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
**Temperature Limits:** 20 to 140°F (-6.67 to 60°C). *Low temperature models available as special option.
**Size:** 4″ (101.6 mm) diameter dial face.
**Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations.
**Process Connections:** 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
**Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
**Agency Approvals:** RoHS.

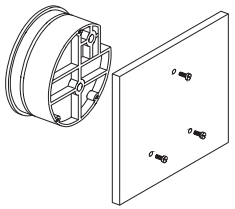
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.

**Note:** May be used with hydrogen when ordering Buna-N diaphragm. Pressure must be less than 35 psi.

## INSTALLATION

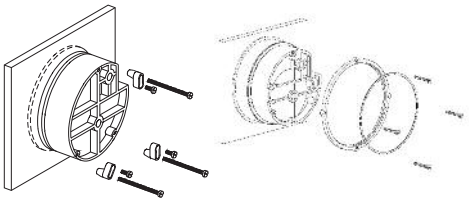
Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.
All standard Magnehelic® Differential Pressure Gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range models of 0.5" w.c. plus 0.25" w.c. and metric equivalents must be used in the vertical position only.

## SURFACE MOUNTING



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

## FLUSH MOUNTING



Provide a 4-9/16" dia. (116 mm) opening in panel. Provide a 4-3/4" dia. (120 mm) opening for MP and HP models. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place.

## PIPE MOUNTING

To mount gage on 1-1/4" - 2" pipe, order optional A-610 pipe mounting kit.

## TO ZERO GAGE AFTER INSTALLATION

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

## OPERATION

**Positive Pressure:** Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.
**Negative Pressure:** Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.
**Differential Pressure:** Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.
When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

**A.** For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with flexible rubber or vinyl tubing.
**B.** For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended.

## MAINTENANCE

No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves should be used in permanent installations. The Series 2000 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

## WARNING

Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended.

## TROUBLE SHOOTING TIPS

**Gage won't indicate or is sluggish.**

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.

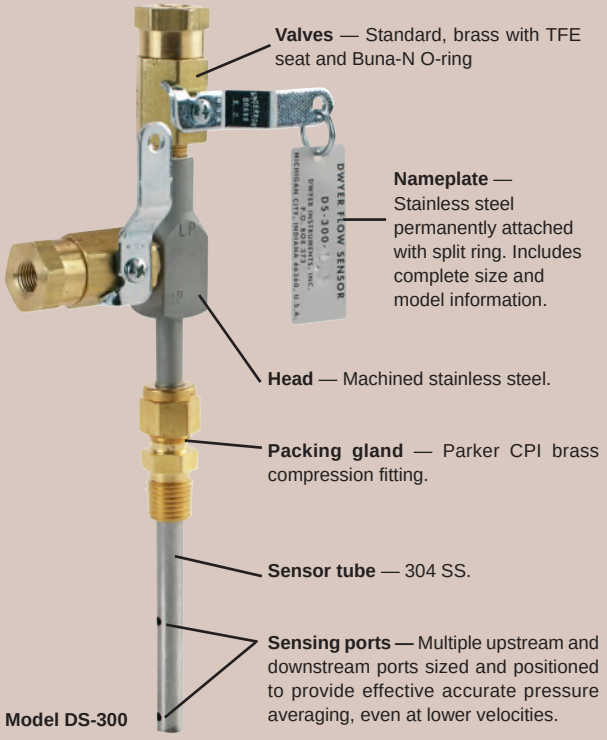

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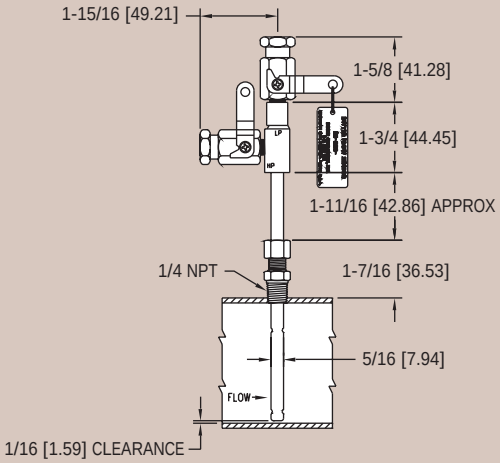

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Series DS

# In-Line Flow Sensors

## Use with the Dwyer® Differential Pressure Gages or Transmitters




**In-Line 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.

**The 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 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® gage 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″.

**DS-400 Averaging Flow Sensors** are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. 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 1/8″ female NPT. A pair of 1/8″ NPT X 1/4″ 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 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a Threaded Branch Connection.

Select model with suffix which matches pipe size
**Model DS-300-1″**
**Model DS-300-1-1/4″**
**Model DS-300-1-1/2″**
**Model DS-300-2″**
**Model DS-300-2-1/2″**
**Model DS-300-3″**
**Model DS-300-4″**
**Model DS-300-6″**
**Model DS-300-8″**
**Model DS-300-10″**

**Model DS-400-6″**
**Model DS-400-8″**
**Model DS-400-10″**
**Model DS-400-12″**
**Model DS-400-14″**
**Model DS-400-16″**
**Model DS-400-18″**
**Model DS-400-20″**
**Model DS-400-24″**

**OPTIONS & ACCESSORIES**
DS-300 or DS-400 Less Valves. To order, add suffix **-LV**
**A-160,** Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi
**A-161,** Brass Bushing, 1/4″ x 3/8″

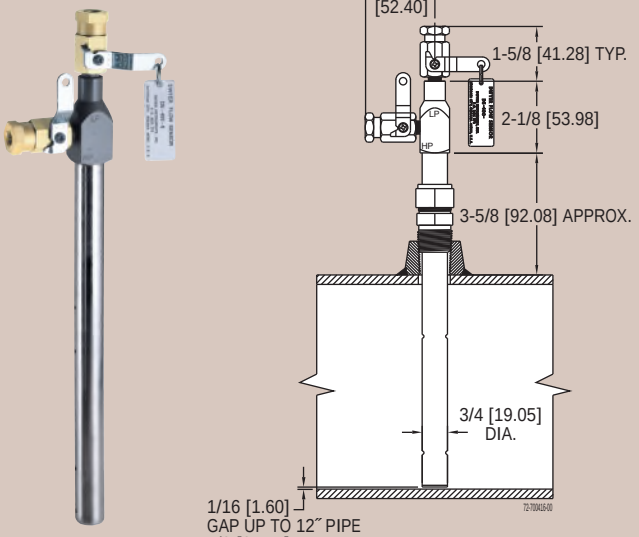
# How To Order

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″ | 1-1/4″ | 1-1/2″ | 2″ | 2-1/2″ | 3″ | 4″ | 6″ | 8″ | 10″ |
| 2 | Water (GPM) | 4.8 | 8.3 | 11.5 | 20.5 | 30 | 49 | 86 | 205 | 350 | 560 |
| | 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 to 200°F (0 to 93.3°C). 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 1-1/4″- 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 10 and 11 for complete information on the Capsuhelic® gage

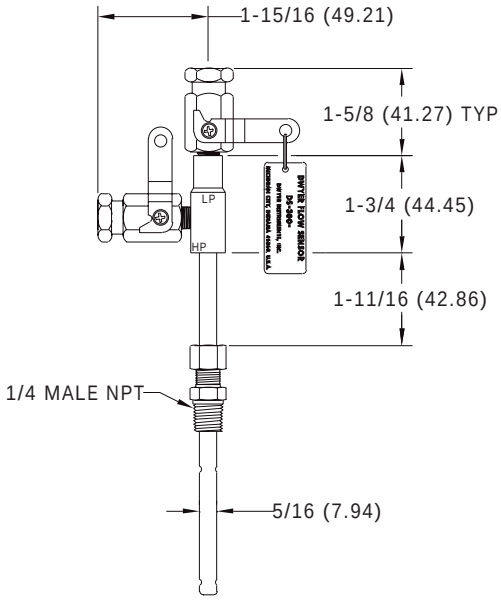


**Capsuhelic® Gage Shown Instaled In A-471 Portable Kit**

# 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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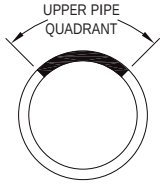
## POSITION

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**

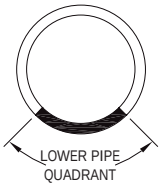
Install in upper quadrant of pipe




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

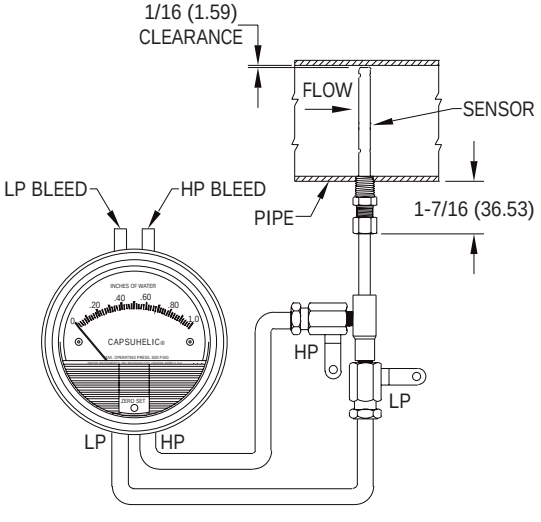
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

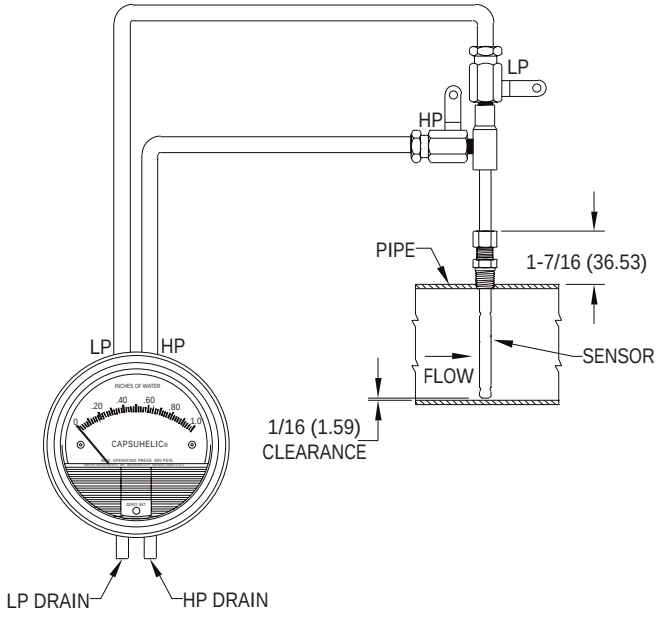
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

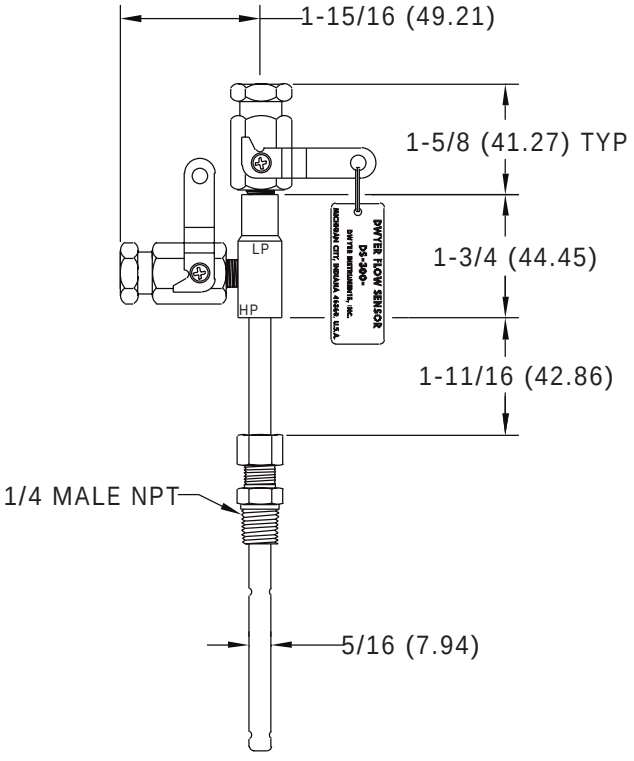
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

**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 Water @ 70°F (D/P in. W.C.) | Velocity Ranges Not Recommended (Feet per Second) |
|---|---|---|---|---|
| 1 | 0.52 | 1.10 to 186 | 4.00 to 675 | 146 to 220 |
| 1-1/4 | 0.58 | 1.15 to 157 | 4.18 to 568 | 113 to 170 |
| 1-1/2 | 0.58 | 0.38 to 115 | 1.36 to 417 | 96 to 144 |
| 2 | 0.64 | 0.75 to 75 | 2.72 to 271 | 71 to 108 |
| 2-1/2 | 0.62 | 1.72 to 53 | 6.22 to 193 | 56 to 85 |
| 3 | 0.67 | 0.39 to 35 | 1.43 to 127 | 42 to 64 |
| 4 | 0.67 | 0.28 to 34 | 1.02 to 123 | 28 to 43 |
| 6 | 0.71 | 0.64 to 11 | 2.31 to 40 | 15 to 23 |
| 8 | 0.67 | 0.10 to 10 | 0.37 to 37 | 9.5 to 15 |
| 10 | 0.70 | 0.17 to 22 | 0.60 to 79 | 6.4 to 10 |

## FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

## DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

## Technical Notations

The following notations apply:

$\Delta P$ = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
$S_f$ = Sp Gr at flowing conditions
$S_s$ = Sp Gr at 60°F (15.6°C)

## SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

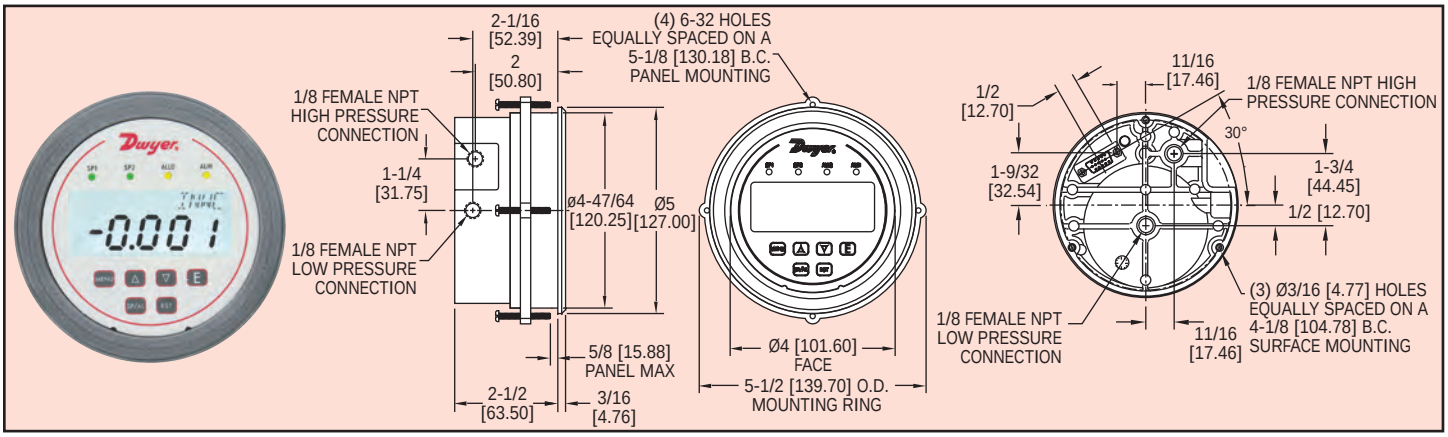
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Series DH3

# Digihelic® Differential Pressure Controller

## Digihelic® Controller in Photohelic® Gage, Square Root Output for Flow




**The Series DH3 Digihelic® Differential Pressure Controller** is a 3 in 1 instrument possessing a digital display gage, control relay switches, and a transmitter with current output all packed in the popular Photohelic® gage style housing. Combining these 3 features allows the reduction of several instruments with one product, saving inventory, installation time and money. The Digihelic® controller is the ideal instrument for pressure, velocity and flow applications, achieving a 1% full scale accuracy on ranges down to the extremely low 0.25 in w.c. to 2.5 in w.c. full scale. Ranges of 5 in w.c. and greater maintain 0.5% F.S. accuracy. Bi-directional ranges are also available.

The Series DH3 Digihelic® controller allows the selection of pressure, velocity or volumetric flow operation in several commonly used engineering units. 2 SPDT control relays with adjustable deadbands are provided along with a scalable 4-20 mA process output.

Programming is easy using the menu key to access 5 simplified menus which provide access to: security level; selection of pressure, velocity or flow operation; selection of engineering units; K-factor for use with flow sensors; rectangular or circular duct for inputting area in flow applications; set point control or set point and alarm operation; alarm operation as a high, low, or high/low alarm; automatic or manual alarm reset; alarm delay; view peak and valley process reading; digital damping for smoothing erratic process applications; scaling the 4-20 mA process output to fit your applications range and field calibration. See applications below for some popular uses.

### APPLICATIONS

- SCFM flow in ducts
- Filter status
- Static pressures in ducts or buildings
- Damper control
- Fan control

| Model | Ranges |
|---|---|
| **DH3-002** | 0-0.25 in w.c. |
| **DH3-003** | 0-0.5 in w.c. |
| **DH3-004** | 0-1 in w.c. |
| **DH3-005** | 0-2.5 in w.c. |
| **DH3-006** | 0-5 in w.c. |
| **DH3-007** | 0-10 in w.c. |
| ***DH3-009** | 0-25 in w.c. |
| ***DH3-010** | 0-50 in w.c. |
| ***DH3-011** | 0-100 in w.c. |
| ***DH3-013** | 0.25-0-0.25 in w.c. |
| ***DH3-014** | 0.5-0-0.5 in w.c. |
| ***DH3-015** | 1-0-1 in w.c. |
| ***DH3-016** | 2.5-0-2.5 in w.c. |
| ***DH3-017** | 5-0-5 in w.c. |
| ***DH3-018** | 10-0-10 in w.c. |

*Velocity and volumetric flow not available on bi-directional range units and models DH3-009 and DH3-010.

### SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases.
**Wetted Materials:** Consult factory.
**Housing Material:** Die cast aluminum case and bezel.
**Accuracy:** ±1.5% for 0.25″ and ±0.25″ w.c. ranges. Ranges 0.5″ to 5″ w.c. and corresponding bi-directional (except ±2.5″ w.c.) ±1%; All other ranges: ±0.5% @ 77°F (25°C) including hysteresis and repeatability (after 1 hour warm-up).
**Stability:** < ±1% per year.
**Pressure Limits:** Ranges ≤ 2.5 in w.c.: 25 psi; ±2.5″, 5 in w.c.: 5 psi; 10 in w.c.: 5 psi; 25 in w.c.: 5 psi; 50 in w.c.: 5 psi; 100 in w.c.: 9 psi.
**Temperature Limits:** 32 to 140°F (0 to 60°C).
**Compensated Temperature Limits:** 32 to 140°F (0 to 60°C).
**Thermal Effects:** 0.020%/°F (0.036/°C) from 77°F (25°C). For 0.25″ and ±0.25″ w.c. ranges: ±0.03%/°F (±0.054%/°C).
**Power Requirements:** 12-28 VDC, 12-28 VAC 50 to 400 Hz.
**Power Consumption:** 3 VA max.
**Output Signal:** 4-20 mA DC into 900 ohms max.
**Zero & Span Adjustments:** Accessible via menus.
**Response Time:** 250 ms (damping set to 1).
**Display:** Backlit 4 digit LCD 0.4″ height LED indicators for set point and alarm status.
**Electrical Connections:** 15 pin male high density D-sub connection. 18″ (46 cm) cable with 10 conductors included. 4′ and 10′ cables available.
**Process Connections:** 1/8″ female NPT. Side or back connections.
**Mounting Orientation:** Mount unit in vertical plane.
**Size:** 5″ (127 mm) OD x 3-1/8″ (79.38 mm).
**Weight:** 1.75 lbs. (794 g).
**Agency Approvals:** CE.

### SWITCH SPECIFICATIONS

**Switch Type:** 2 SPDT relays.
**Electrical Rating:** 1 amp @ 30 VAC/VDC.
**Set Point Adjustment:** Adjustable via keypad on face.

### ACCESSORIES

**A-298,** Flat Aluminum Bracket for flush mounting
**A-301,** Static Pressure Tip for 1/4″ metal tubing connection
**A-302,** Static Pressure Tip for 3/16″ and 1/8″ I.D. plastic or rubber tubing
**A-302F-A,** 303 SS Static Pressure Tip with mounting flange. For 3/16″ ID rubber or plastic tubing. 4″ insertion depth. Includes mounting screws
**A-320-B,** Instrument Enclosure
**A-370,** Mounting Bracket flush mount bracket. Bracket is then surface mounted. Steel with gray hammertone epoxy finish
**A-489,** 4″ Straight Static Pressure Tip with Flange

### OPTIONS

For NIST traceable calibration certificate, add suffix -NIST to model numbers. Example DH3-004-NIST.
For factory calibration certificate, add suffix -FC to model numbers. Example DH3-004-FC.

See page 587 for process tubing options.

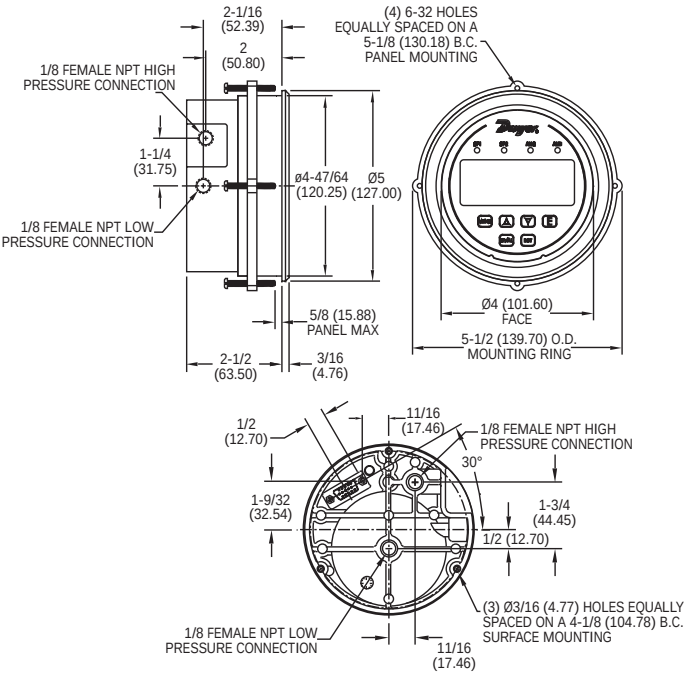
# Series DH3 Digihelic® Differential Pressure Controller

## Specifications - Installation and Operating Instructions




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## DIMENSIONS




## SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases.

**Wetted Materials:** Consult factory.

**Housing Material:** Die cast aluminum case and bezel.

**Accuracy:** ±1.5% for 0.25″ and ±0.25″ w.c. ranges. Ranges 0.5″ to 5″ w.c. and corresponding bi-directional (except ±2.5″ w.c.): ±1%; All other ranges: ±0.5% @ 77°F (25°C) including hysteresis and repeatability (after 1 hour warm-up).

**Stability:** < ±1% per year.

**Pressure Limits:** Ranges ≤ 2.5″ w.c.: 25 psi; ±2.5″, 5″ w.c.: 5 psi; 10″: w.c. 5 psi; 25″ w.c.: 5 psi; 50″ w.c.: 5 psi; 100″ w.c.: 9 psi.

**Temperature Limits:** 32 to 140°F (0 to 60°C).

**Compensated Temperature Limits:** 32 to 140°F (0 to 60°C).

**Thermal Effects:** 0.020%/°F (0.036/°C) from 77°F (25°C). For 0.25″ and ±0.25″ w.c. ranges: ±0.03%/°F (±0.054%/°C).

**Power Requirements:** 12-24 VAC/VDC.

**Power Consumption:** 3 VA max.

**Output Signal:** 4-20 mA DC into 900 ohms max.

**Zero & Span Adjustments:** Accessible via menus.

**Response Time:** 250 ms (dampening set to 1).

**Display:** Backlit 4 digit LCD 0.4″ height LED indicators for set point and alarm status.

**Electrical Connections:** 15 pin male high density D-Sub connection. 18″ (46 cm) cable with 10 conductors included.

**Process Connections:** 1/8″ female NPT. Side or back connections.

**Mounting Orientation:** Mount unit in vertical plane.

**Size:** 5″ (127 mm) O.D. x 3-1/8″ (79.38 mm).

**Weight:** 1.75 lbs. (794 g).

**Agency Approvals:** CE.

## SWITCH SPECIFICATIONS

**Switch Type:** 2 SPDT relays.

**Electrical Rating:** 1 amp @ 30 VAC/VDC.

**Set Point Adjustment:** Adjustable via keypad on face.

**INSTALLATION**

**LOCATION:** Select a clean, dry location free from shock and vibration where temperature limits will not be exceeded. Distance from the transmitter to the receiver is limited only by total loop resistance. See ELECTRICAL CONNECTIONS. Tubing feeding pressure to the instrument can be practically any length required, but long lengths will increase response time slightly.

**POSITION:** All standard models are calibrated for use in a vertical mounting position. Higher range models will perform properly at other angles but should be spanned and zeroed in the position in which they will be used. Because of their sensitivity to gravitational forces, models with ranges under 1″ w.c. (25.4 mm w.c.) must always be mounted vertically.

**PRESSURE CONNECTIONS:** For installation convenience two sets of 1/8″ female NPT pressure ports are supplied. Be sure to seal the unused ports with pipe plugs included.

**Positive Pressure** - Connect tubing to HIGH PRESSURE port and vent LOW PRESSURE port to atmosphere.

**Negative (Vacuum) Pressure** - Connect tubing to LOW PRESSURE port and vent HIGH PRESSURE port to atmosphere. (When operating this device in a dusty environment, install an optional A-331 Filter Vent Plug in the vented port to keep interior clean.)

**Differential Pressure** - Connect tubing from the higher source to HIGH PRESSURE port and from the lower source to LOW PRESSURE port.

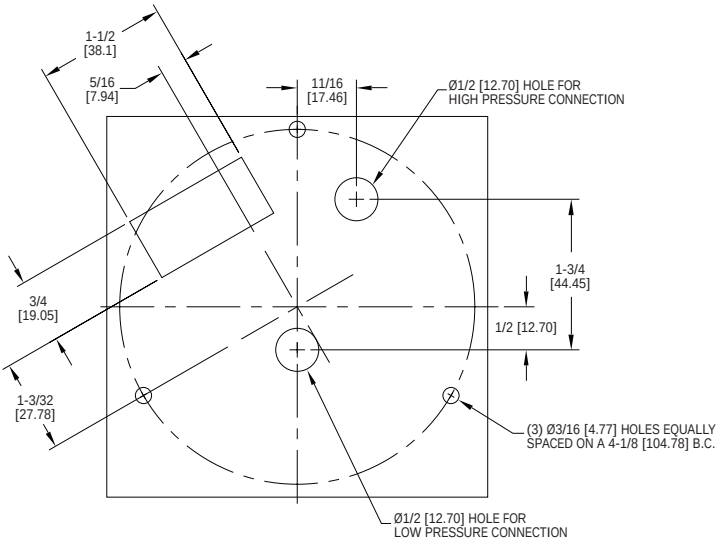



**Fig. A**

**MOUNTING:** The DH 3 may be either panel (flush) mounted or surface mounted.

**Panel Mounting** - Cut a 4-13/16″ or 122 mm diameter hole in the panel and insert the unit from the front. Slip on the mounting ring with the stepped side facing rear. Next, fit the snap ring into the narrow groove at back edge of bezel. Thread four (6) 32 x 1-1/4″ mounting screws into tapped holes in mounting ring and set it against snap ring. Tighten screws against rear of panel. See Fig. B.

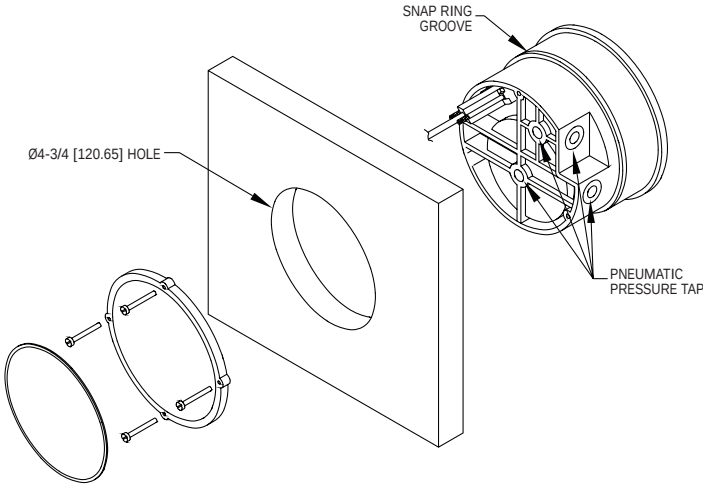



**Fig. B**

**Surface Mounting -** Drill (3) 3/16″ (4.76 mm) diameter holes for mounting and cut a 9/16″ x 1-1/2″ (14.3 x 38.1 mm) opening for access to terminal block as indicated in Fig. B. If rear pressure connections are to be used, also provide 1/2″ diameter holes as shown in Figs. A and C. Insert 6-32 machine screws from rear of mounting surface, thread into tapped holes on back of transmitter and tighten.

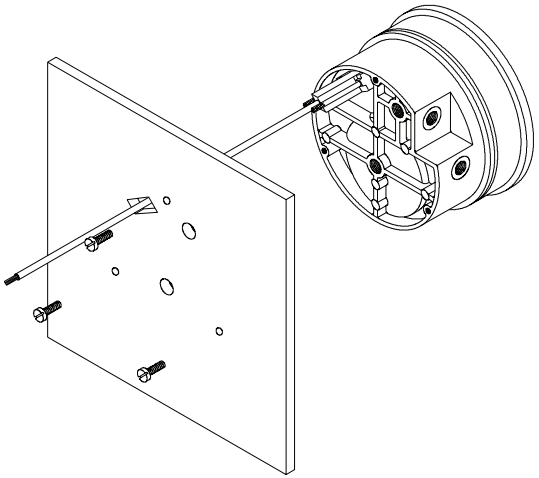


**Fig. C**

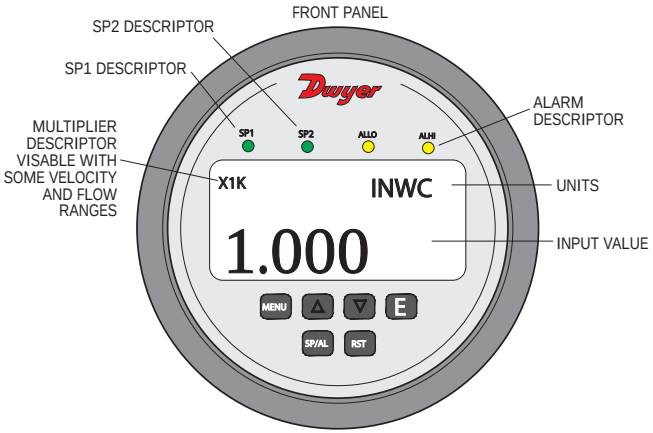
**WIRING**

The DH 3 uses a standard 15 pin male high density D-Sub connector available from most electronic distributors. A pre-wired 18″ cable is included with each unit.
See below table for cable color wiring information.

| Function | 15 PIN Connector Terminal | Cable Color |
|---|---|---|
| 12-24 VAC/VDC Power | 1 | Brown |
| 12-24 VAC/VDC Power | 6 | Yellow |
| 4-20mA XMTR Output - | 2 | Black |
| 4-20mA XMTR Output + | 11 | Red |
| SP1 Relay N/O | 12 | Vilolet |
| SP1 Relay Com | 13 | Grey |
| SP1 RELAY N/C | 14 | White |
| SP2 or ALarm Relay N/O | 15 | Blue |
| SP2 or ALarm Relay Com | 10 | Green |
| SP2 or ALarm Relay N/C | 5 | Orange |

**NOTES:**

1. If 12-24 VDC power is used, the polairty is unimportant.
2. Wire in accordance with an equivalent national standard or code. Use copper conductors only rated for 60°C.
3. All terminals are rated CLASS 2.
4. ISOLATION: All inputs and outputs to each other: 500 VAC.
5. 4-20 mA Transmitter – Check the specifications for the device receiving this signal for input resistance. Typical 250 to 600 OHMS, 600 OHMS maximum.

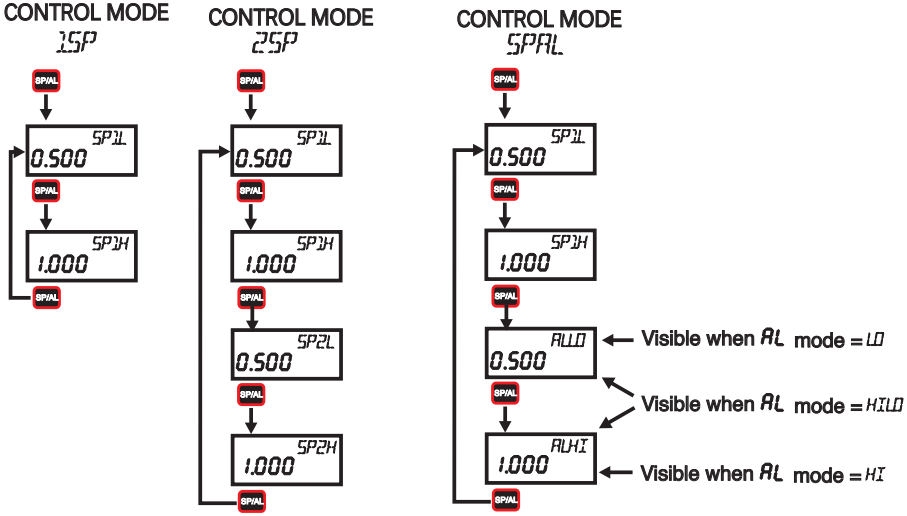



## KEY FUNCTIONS

| | **Home Position Function** | **Main Menu Function** | **Sub Menu Function** |
|---|---|---|---|
| SP/AL<br>SP/AL | Sequences the display through SET POINT and ALARM settings | Return to home position | Return to home position |
| MENU<br>MENU | Allows access to the menus | Return to home position | Return to previous menu |
| △<br>UP ARROW | | Sequences through menus | Increments a value |
| ▽<br>DOWN ARROW | | Sequences through menus | Decrements a value |
| E<br>ENTER | Displays full scale range of unit | Enter into SUB MENU | Changes a value or setting. Press ENTER and display will blink. Adjust with UP or DOWN arrows. Press ENTER to store. Display will stop blinking. |
| RST<br>RESET | Clears or resets an Alarm (alarm set for manual reset) | | Peak/Valley SUB MENU resets display to present value. |

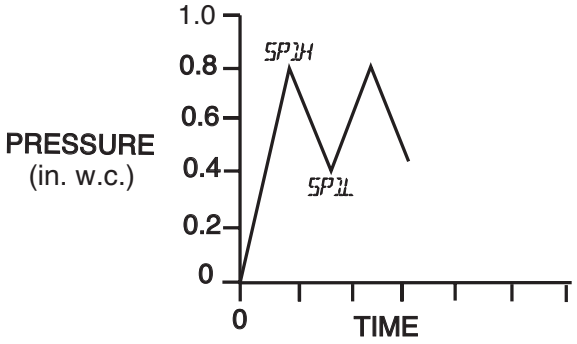
## SETTING SET POINTS AND ALARMS

The SP/AL hot key provides direct access to the Set Point and Alarm MENU. The Set Point and Alarm MENUS that are displayed are based upon the Control (CtrL) SUB MENU.



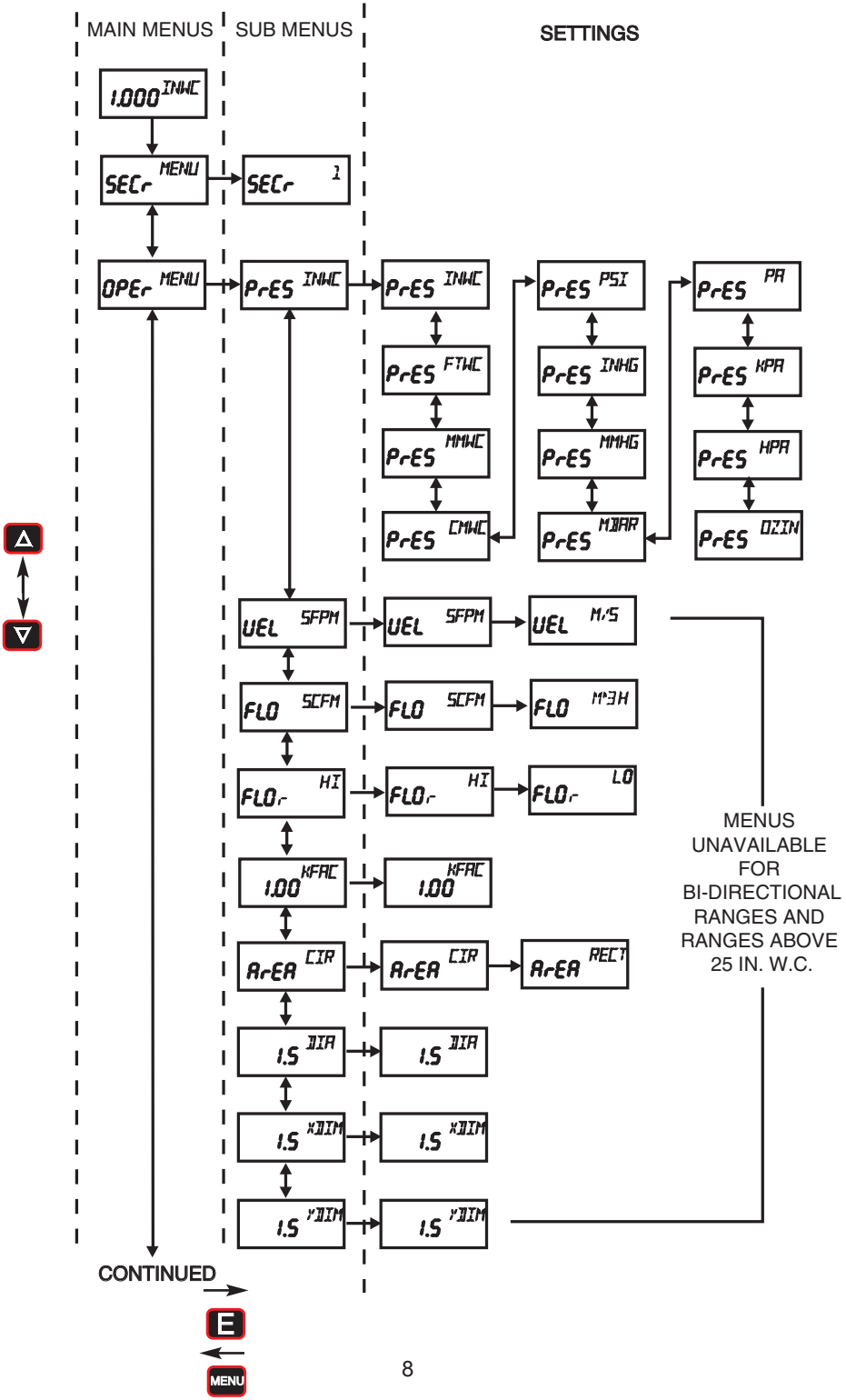

### SET POINT ADJUSTMENT

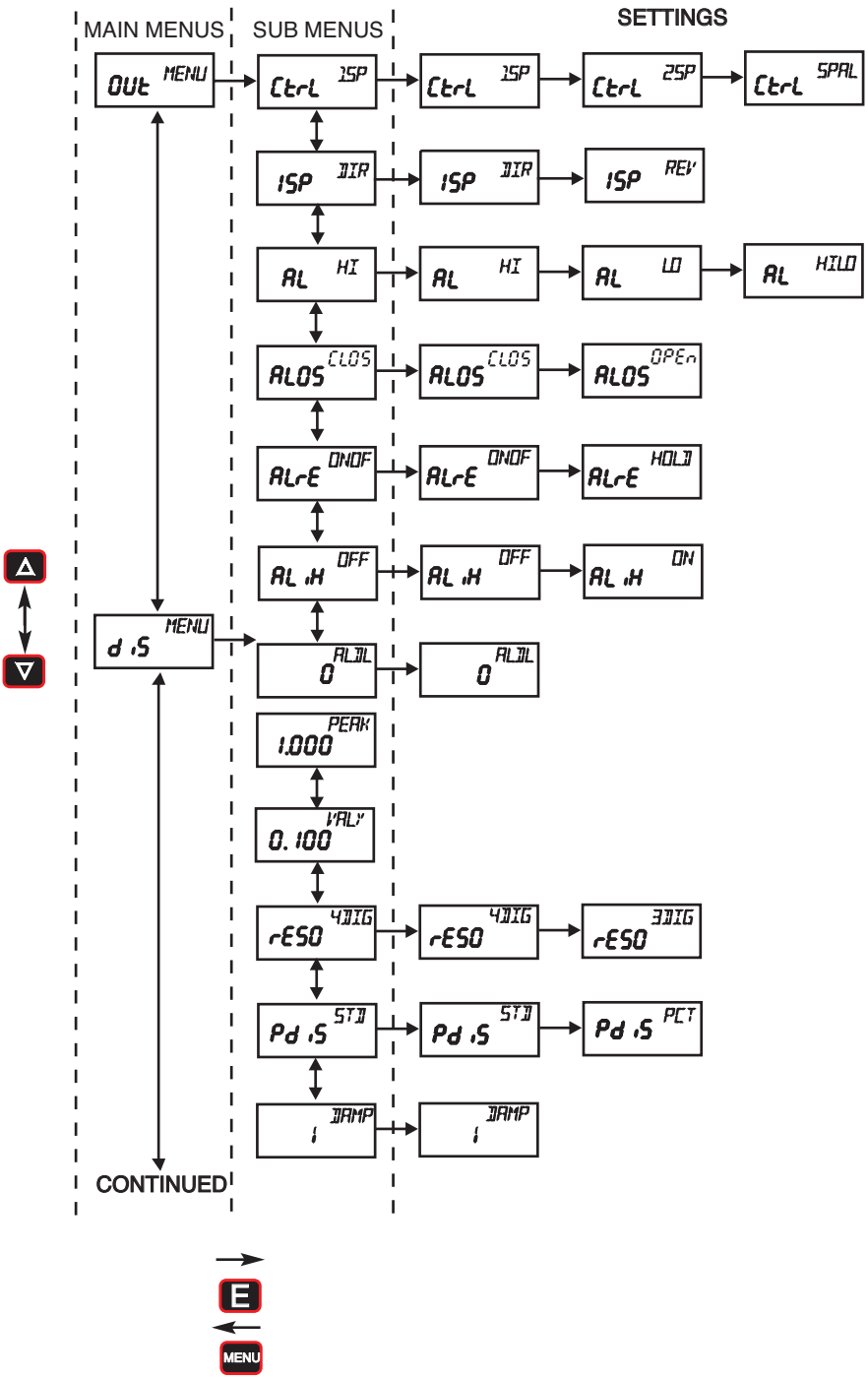
Adjusting the DH® 3 Set Points is quick and simple. Instead of setting a set point and dead-band, simply adjust *SP1H* or *SP2H* for the desired relay turn on point, and then adjust *SP1L* or *SP2L* for the desired relay turn off point.

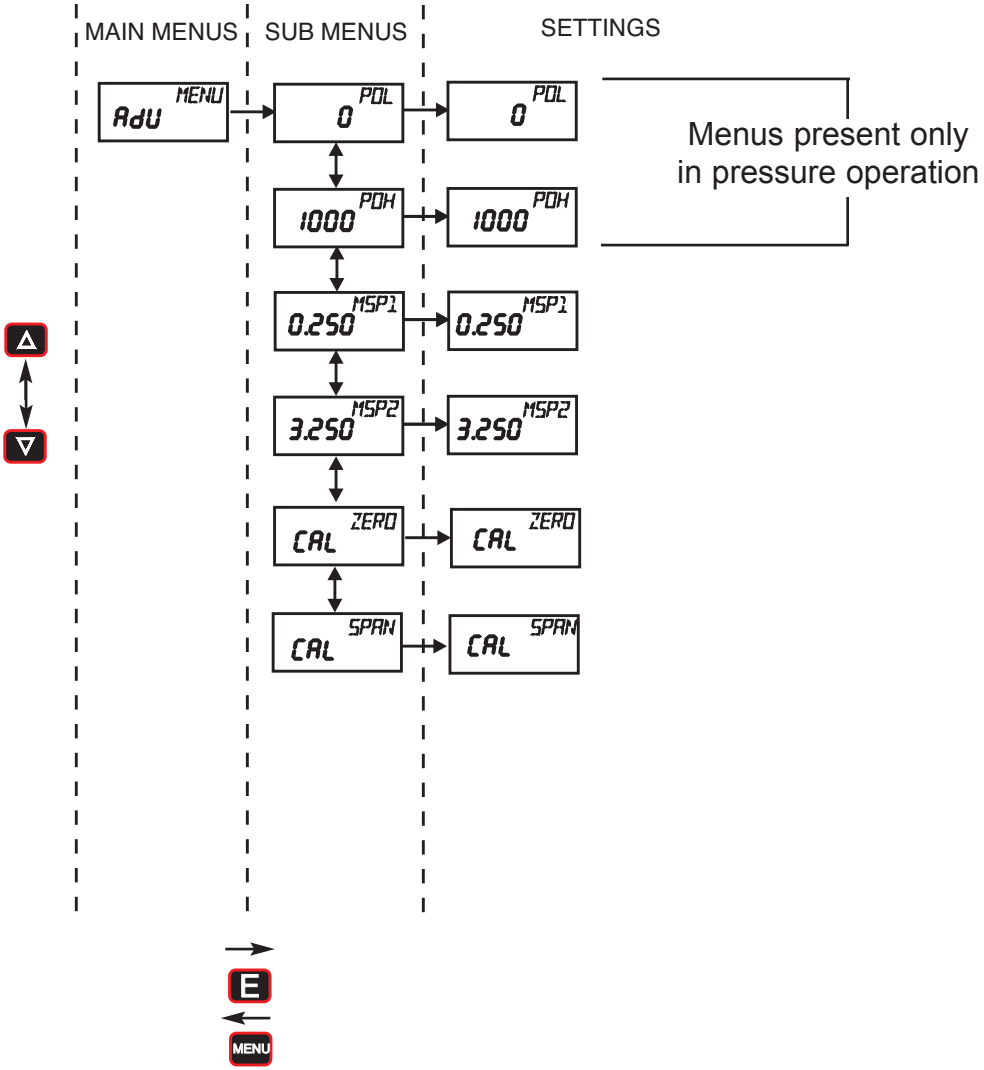



In the above graph, an instrument with a 1.0″ range would have the SP1 relay turn on at 0.8″ and off at 0.4″. *SP1H* sets the relay turn on point, and *SP1L* sets the relay turn off point. The relays outputs normally function in the direct acting mode, which means the relays turn on with an increase in pressure. SP1 may be configured to act as a reverse acting relay (refer to the 1SP SUB MENU setting, page 15). When set for reverse acting, *SP1H* sets the relay turn OFF point, and *SP1L* sets the relay turn ON point. SP2 is always direct acting.

# MENU MAP


MAIN MENUS
SUB MENUS
SETTINGS
1.000 INWC
SECr MENU
SECr 1
OPEr MENU
PrES INWC
PrES INWC
PrES FTWC
PrES MMWC
PrES CMWC
PrES PSI
PrES INHG
PrES MMHG
PrES MBAR
PrES PA
PrES KPA
PrES HPA
PrES OZIN
UEL SFPM
UEL SFPM
UEL M/S
FLO SCFM
FLO SCFM
FLO M^3H
FLOr HI
FLOr HI
FLOr LO
1.00 KFAC
1.00 KFAC
ArEA CIR
ArEA CIR
ArEA RECT
1.5 DIA
1.5 DIA
1.5 XDIM
1.5 XDIM
1.5 YDIM
1.5 YDIM
MENUS UNAVAILABLE FOR BI-DIRECTIONAL RANGES AND RANGES ABOVE 25 IN. W.C.
CONTINUED
E
MENU


MAIN MENUS
SUB MENUS
SETTINGS
OUt MENU
Ctrl 1SP
Ctrl 1SP
Ctrl 2SP
Ctrl SPAL
1SP DIR
1SP DIR
1SP REV
AL HI
AL HI
AL LO
AL HILO
ALOS CLOS
ALOS CLOS
ALOS OPEn
ALrE ONOF
ALrE ONOF
ALrE HOLD
AL iH OFF
AL iH OFF
AL iH ON
d iS MENU
0 AL3L
0 AL3L
1.000 PEAK
0.100 VALV
rESO 4DIG
rESO 4DIG
rESO 3DIG
Pd iS STD
Pd iS STD
Pd iS PCT
1 DAMP
1 DAMP
CONTINUED
E
MENU


MAIN MENUS
SUB MENUS
SETTINGS
MENU
AdU
POL
0
POL
0
POH
1000
POH
1000
MSP1
0.250
MSP1
0.250
MSP2
3.250
MSP2
3.250
ZERO
CAL
ZERO
CAL
SPAN
CAL
SPAN
CAL
Menus present only
in pressure operation
E
MENU

**Main Menu Selections (Upper Right Display Reads *MENU*)**

*SECr* Security - Lock out access to Set Point and Alarm settings, or lock out access to all settings.

*OPEr* Operation - Selection of Pressure, Velocity or Flow and corresponding engineering units.

*OUt* Output - Select a Single Set Point, 2 Set Points, or a Set Point and an Alarm mode of operation.

*diS* Display - Monitor and adjust display related settings: Peak, Valley, display resolution, % output and dampening.

*AdJ* Advanced functions - Modify advanced function parameters, transmitter output scaling, Maintenance Set Point settings and calibration.

**MAIN MENUS and SUB MENUS**

**SECr (Security) MAIN MENU**

SECr is the only SUB MENU in the security MENU. When the security SUB MENU is selected, the present security level is displayed in the upper right hand display. To change the security level, adjust the number displayed to the number shown in the following table for the desired security level.

| Security Level Displayed | Access | Password Value to Enter |
|---|---|---|
| 1 | All menus access | 10 |
| 2 | Menu Access SP/AL Locked | 70 |
| 3 | SP/AL Access Menus Locked | 90 |
| 4 | All settings locked | 111 |

The password values shown in the table cannot be altered, so retain a copy of these pages for future reference.

**OPEr (Operation) MAIN MENU**

The OPEr MENU selects the measurement type of the instrument.
The SUB MENUS are:

PrES - Pressure  KFAC - K Factor  XDIM - X Dimension

UEL - Velocity  ArEA - Area  YDIM - Y Dimension

FLO - Flow  DIA - Diameter

If the instrument is set for Velocity, the OPEr MENU will have an additional KFAC SUB MENU. If the instrument is set for Flow, the OPEr MENU will have additional KFAC and ArEA SUB MENUS. These will be discussed under Velocity and Flow. When scrolling through the OPEr SUB MENUS, the measurement type the unit is currently set for will show the units in the upper right display. The other measurement types will have a blank upper right display.




Units visible, so unit is presently set to measure pressure

Units not visible

Units not visible

P-ES **(Pressure) SUB MENU**

For pressure measurement, the following units are available:

INWC - Inches of water column
FTWC - Feet of water column
MMWC - Millimeters of water column
CMWC - Centimeters of water column
PSI - Pounds per square inch
INHG - Inches of mercury
MMHG - Millimeters of mercury
MBAR - Millibar
PA - Pascal
KPA - Kilopascals
HPA - Hectopascals
OZIN - Ounce inches

**Table 1 Pressure Range vs. Available Units**

| INWC | FTWC | MMWC | CMWC | PSI | INHG | MMHG | MBAR | PA | KPA | HPA | OZIN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| .1000 | | 2.540 | .2540 | | | .1868 | .2491 | 24.91 | | .2491 | |
| .2500 | | 6.350 | .6350 | | | .4671 | .6227 | 62.27 | | .6227 | .1445 |
| .5000 | | 12.70 | 1.270 | | | .9342 | 1.245 | 124.5 | .1245 | 1.245 | .2890 |
| 1.000 | | 25.40 | 2.540 | | | 1.868 | 2.491 | 249.1 | .2491 | 2.491 | .5780 |
| 2.500 | .2083 | 63.50 | 6.350 | | .1839 | 4.671 | 6.227 | 622.7 | .6227 | 6.227 | 1.445 |
| 5.000 | .4167 | 127.0 | 12.70 | .1806 | .3678 | 9.342 | 12.45 | 1245 | 1.245 | 12.45 | 2.890 |
| 10.00 | .8333 | 254.0 | 25.40 | .3613 | .7356 | 18.68 | 24.91 | 2491 | 2.491 | 24.91 | 5.780 |
| 25.00 | 2.083 | 635.0 | 63.50 | .9032 | 1.839 | 46.71 | 62.27 | 6227 | 6.227 | 62.27 | 14.45 |
| 50.00 | 4.167 | 1270 | 127.0 | 1.806 | 3.678 | 93.42 | 124.5 | | 12.45 | 124.5 | 28.90 |
| 100.0 | 8.333 | 2540 | 254.0 | 3.613 | 7.356 | 186.8 | 249.1 | | 24.91 | 249.1 | 57.80 |

**NOTE:** OVFL (over flow) or UNFL (under flow) will appear when the ranges have been exceeded above or below full scale by 2%.

UEL **(Velocity) SUB MENU**

For velocity measurement, the following units are available:

SFPM - Standard feet per minute
M/S - Meters per second

**Table 2 Available Velocity Ranges**

| INPUT RANGE INWC | SFPM RANGE | M/S RANGE |
|---|---|---|
| 0 - 0.1 | 0 - 1266 | 0 - 6.431 |
| 0 - 0.25 | 0 - 2002 | 0 - 10.17 |
| 0 - 0.5 | 0 - 2832 | 0 - 14.39 |
| 0 - 1 | 0 - 4004 | 0 - 20.35 |
| 0 - 2.5 | 0 - 6332 | 0 - 32.17 |
| 0 - 5 | 0 - 8954 | 0 - 45.48 |
| 0 - 10 | 0 - 12.66 x IK | 0 - 64.33 |
| 0 - 25 | 0 - 20.02 x IK | 0 - 101.7 |

**NOTE:** Air velocity and flow readings are based upon standard dry air conditions with an ambient temperature of 70°F and a barometric pressure of 29.92 INHG.

FLO **(Flow) SUB MENU**

For flow measurements the following units are available:

SCFM - Standard cubic feet per minute

M^3H - Cubic meters per hour

FLOr **(Flow Range) SUB MENU**

LO - 99.99 x 1K flow range

HI - 999.9 x 1K flow range

Tables 3-6 show the flow ranges available, and the maximum duct size that can be set for each input range.

**Table 3**

FLOr **= LO Maximum Duct Size (English)**

| RANGE IN WC | SCFM RANGE | MAX. DUCT SIZE, SQ. FT. |
|---|---|---|
| 0.1 | 99.99 x 1K | 78.9 |
| 0.25 | 99.99 x 1K | 49.9 |
| 0.5 | 99.99 x 1K | 35.3 |
| 1 | 99.99 x 1K | 24.9 |
| 2.5 | 99.99 x 1K | 15.7 |
| 5 | 99.99 x 1K | 11.1 |
| 10 | 99.99 x 1K | 7.8 |
| 25 | 99.99 x 1K | 4.9 |

**Table 4**

FLOr **= HI Maximum Duct Size (English)**

| RANGE IN WC | SCFM RANGE | MAX. DUCT SIZE, SQ. FT. |
|---|---|---|
| 0.1 | 999.9 x 1K | 789.8 |
| 0.25 | 999.9 x 1K | 499.5 |
| 0.5 | 999.9 x 1K | 353.1 |
| 1 | 999.9 x 1K | 249.7 |
| 2.5 | 999.9 x 1K | 157.9 |
| 5 | 999.9 x 1K | 111.7 |
| 10 | 999.9 x 1K | 78.9 |
| 25 | 999.9 x 1K | 49.9 |

**Table 5**

FLOr **= LO Maximum Duct Size (Metric)**

| RANGE IN WC | M^3/Hr RANGE | MAX. DUCT SIZE M^2 |
|---|---|---|
| 0.1 | 99.99 x 1K | 4.32 |
| 0.25 | 99.99 x 1K | 2.73 |
| 0.5 | 99.99 x 1K | 1.93 |
| 1 | 99.99 x 1K | 1.37 |
| 2.5 | 99.99 x 1K | 0.86 |
| 5 | 99.99 x 1K | 0.61 |
| 10 | 99.99 x 1K | 0.43 |
| 25 | 99.99 x 1K | 0.27 |

**Table 6**

FLOr **= HI Maximum Duct Size (Metric)**

| RANGE IN WC | $M^3$/Hr Range | MAX. DUCT SIZE, $M^2$ |
|---|---|---|
| 0.1 | 999.9 x 1K | 43.19 |
| 0.25 | 999.9 x 1K | 27.31 |
| 0.5 | 999.9 x 1K | 19.3 |
| 1 | 999.9 x 1K | 13.64 |
| 2.5 | 999.9 x 1K | 8.63 |
| 5 | 999.9 x 1K | 6.10 |
| 10 | 999.9 x 1K | 4.31 |
| 25 | 999.9 x 1K | 2.73 |

KFAC **SUB MENU**

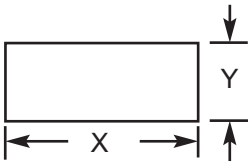
KFAC K Factor - becomes accessible if the instrument is set for Velocity or Flow. When the DH3® is used with a Pitot tube, the manufacturer may specify a K Factor. The adjustment range is 0.01 to 2.00. The factory setting is 1.

## ArEA, DIA, XDIM and YDIM SUB MENUS

These SUB MENUS become accessible if the instrument is set for flow. When measuring flow, the area of the duct must be specified. Tables 3 and 4 show the input range vs maximum flow and duct size. For a rectangular duct the maximum size is specified in square feet or meters. For a circular duct the maximum size is specified as the diameter. X, Y and circular dimensions are entered in feet with 0.01 foot resolution for FLOr = LO and 0.1 foot resolution for FLOr = HI, or entered in millimeters with 1 millimeter resolution.

ArEA - Area, select CIR for a circular duct or RECT for a rectangular duct. If a circular duct is selected, the DIA SUB MENU will be activated. If a rectangular duct is selected, the XDIM and YDIM SUB MENUS will be activated.

DIA - Diameter, enter the diameter of a duct
XDIM - Enter the "X" dimension of a duct
YDIM - Enter the "Y" dimension of a duct




### OUt (Output) MAIN MENU

The OUt MENU selects the output type of the instrument. The SUB MENUS are:

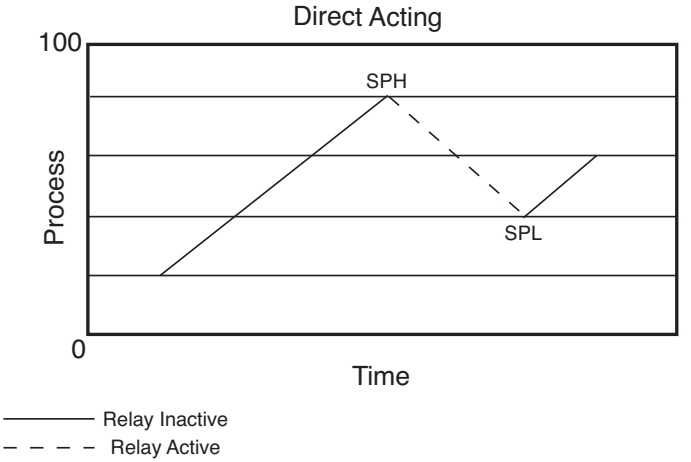
CtrL - Control type
ISP - SP1 reverse or direct acting
AL - Alarm type
ALrE - Alarm reset, manual or auto
AL.H - Alarm inhibit
ALDL - Alarm delay

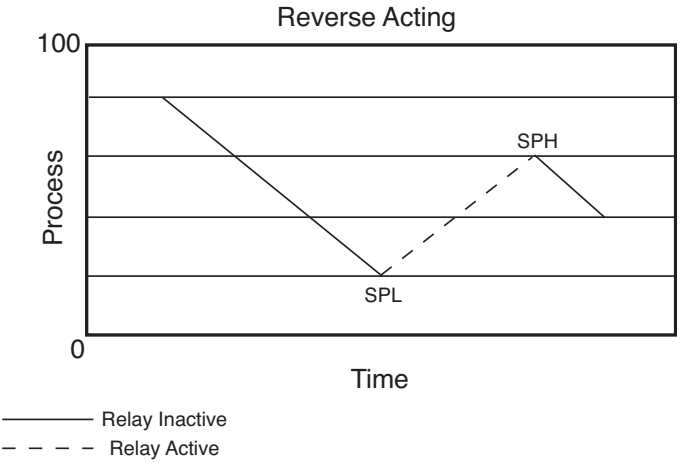
C+rL **(Control) SUB MENU**

1SP - Single set point
2SP - Two fully independent set points
SPAL - Single set point and alarm

1SP **(SP1 Reverse or Direct Acting) SUB MENU**

DIR - Direct. Relay turns on with increasing pressure
REV - Reverse. Relay turns on with decreasing pressure



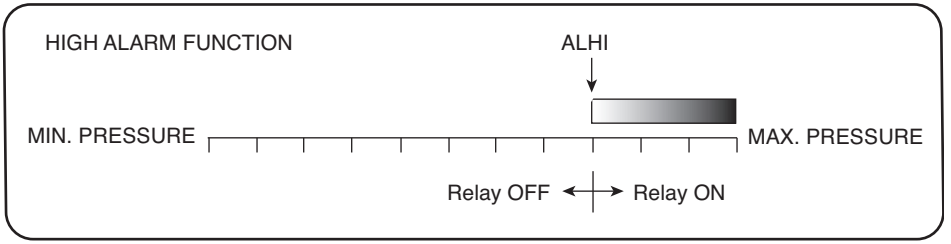
The following alarm function SUB MENUS are activated when *CtrL* is set to *SPAL*:

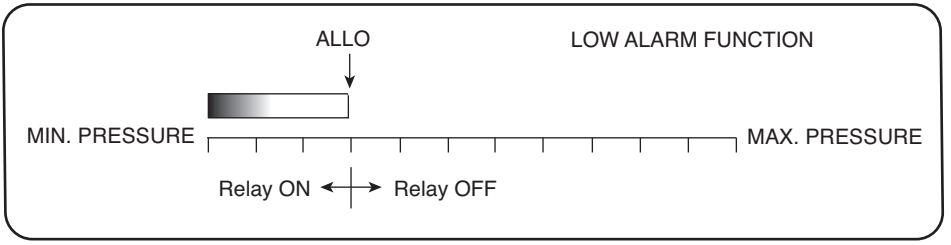
***AL* (Alarm Type) SUB MENU**

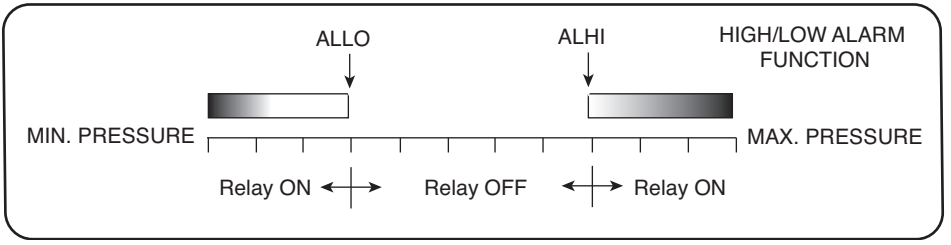
*HI* - High alarm
*LO* - Low alarm
*HILO* - For a high/low guardband type alarm

**ALARM ADJUSTMENT**

Alarm settings are dependent upon the selected alarm mode. The DH3® differential pressure controller alarm may be configured as a High Alarm, Low Alarm, or High/Low Alarm. Alarm settings are all absolute and may be set to anywhere within the range of the instrument. The dead bands of the alarms are fixed at 1% of full scale.



*ALOS* **(Alarm Output State) SUB MENU**

*CLOS* - Alarm relay contacts close upon alarm condition
*OPEN* - Alarm relay contacts open upon alarm condition

*ALrE* **(Alarm Reset) SUB MENU**

*ONOF* - Automatic reset
*HOLD* - Manual reset. An alarm is reset by the RESET key on the front panel, or an external reset switch.

*AL.H* **(Low Alarm Inhibit) SUB MENU**

*ON* - Alarm inhibit is on
*OFF* - Alarm inhibit is off

If *AL.H* is selected ON, a low alarm condition is suspended upon power up until the process value passes through the alarm set point once.

*ALDL* **(Alarm Delay) SUB MENU**

Sets the amount of time an alarm condition must be continuously met before the alarm condition is recognized. The alarm delay is adjustable from 0-3600 seconds.

*d.S* **(Display) MAIN MENU**

*PEAK* - Peak value
*VAL4* - Valley value
*ZERO* - Zero
*rESO* - Resolution
*Pd.S* - Process display
*DAMP* - Dampening level

*PEAK* **(Peak) SUB MENU**

The Peak feature stores the highest pressure reading the instrument has measured since the last reset or power up. At power up *PEAK* is reset to the present pressure reading. To manually reset the *PEAK* value, press the RESET key while in the *PEAK* SUB MENU.

*VAL4* **(Valley) SUB MENU**

The valley feature stores the lowest pressure reading the instrument has measured since the last reset or power up. At power up *VAL4* is reset to the present pressure reading. To manually reset the *VAL4* value, press the RESET key while in the *VAL4* SUB MENU.

*rESO* **(Resolution) SUB MENU**

The DH 3 is capable of displaying four digits of resolution. However, at very low pressures the instability of the pressure may cause fluctuations in the least significant digit causing the least significant digit to be of little value.
Three digit resolution (*3DIG*) can only be active when there is at least one digit to the right of a decimal.

*3DIG* - Set display for 3 digit resolution
*4DIG* - Set display for 4 digit resolution

*Pd.S* **(Process Display) SUB MENU**

*STD* - Display reads pressure, velocity, or flow values
*PCT* - Display reads % of full scale value

When the display is reading percent, *PCT* is displayed in the upper right of the display. The percent display is only available in pressure operation.

*DAMP* **(Dampening) SUB MENU**

Adjust from 1-16

Dampening stabilizes the display from instabilities due to things such as vibration and excessive pressure fluctuations. The dampening setting adjusts the amount of readings that are averaged for each display update. Adjust the dampening value until the display reads a stable value for the application.

*AdJ* **(Advanced) MAIN MENU**

*POL* - Process output low
*POH* - Process output high
*MSP1* - Maintenance set point 1
*MSP2* - Maintenance set point 2
*ZERO* - Zero calibration
*SPAN* - Span calibration

*POL* **and** *POH* **(Process Output Low and High) SUB MENUS**

This feature is used in pressure operation only.

Process output low and high are used to scale the 4-20 mA output. Set *POL* to the desired display reading for 4mA output, and set *POH* to the desired display reading for 20 mA output. *POH* must be higher than *POL*. *POL* may be adjusted 2% BELOW minimum scale up to *POH*. *POH* may be adjusted from *POL* to 2% ABOVE maximum scale.

### *MSP1* and *MSP2* (Maintenance Set Point 1 & 2) SUB MENUS

Adjust for the desired maintenance set points when the unit is placed in the maintenance mode. The deadband is fixed at 2% of full scale. To enter or leave the maintenance mode, press and hold the SP/AL for 8 seconds.

### *ZERO* and *SPAN* (Calibration of Zero and Span) SUB MENUS

The lower display reads *CAL* in this mode.

**_ZERO_ Calibration**
**NOTE:** For accurate calibration, DO NOT apply any pressure when performing this function.

With the display reading *ZERO*, press the ENTER key. The upper display will blink. Press ENTER again to complete the zeroing of the instrument or press the *MENU* key to cancel.

**_SPAN_ Calibration**
With the display set to *SPAN*, apply full scale pressure to the unit. Press the ENTER key. The upper display will blink. Press ENTER again to complete the calibration or press the *MENU* key to cancel.

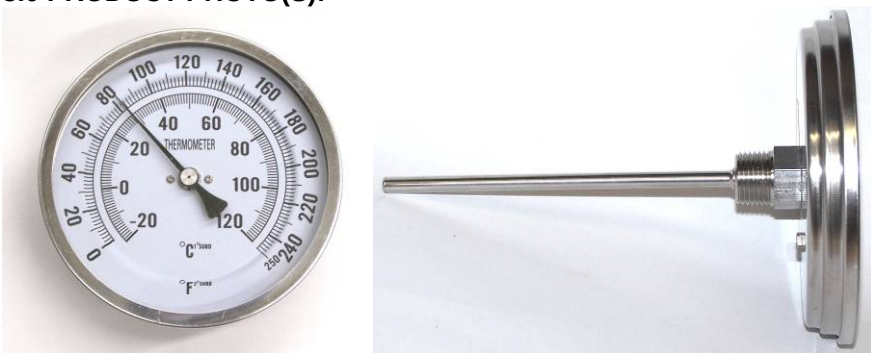
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| GRAINGER® FOR THE ONES WHO GET IT DONE<br>GRAINGER INTERNATIONAL, INC.<br>GLOBAL SOURCING DIVISION | -- GGS TECHNICAL SPECIFICATION -- | | | |
|---|---|---|---|---|
| | SPECIFICATION NUMBER:<br>1NFY4_TSRev1.doc | AUTHOR:<br>Hoskinson | TITLE:<br>ENG | REL. DATE:<br>5/25/07 |
| | GGS MODEL NUMBER(s):<br>1NFY4 | DESCRIPTION:<br>Industrial thermometer | REVISION #:<br>1 | REV. DATE:<br>8/10/07 |

| | |
|---|---|
| **1.0 BRAND:** | No brand |
| **2.0 PRODUCT DESCRIPTION:** | Bimetal Industrial Thermometer |

**3.0 PRODUCT PHOTO(S):**




**4.0 PRODUCT REQUIREMENTS:**

| 4.1 Features & Performance | Requirement |
|---|---|
| Temperature scale(s) | °F: 0 to 250<br>°C: -20 to 120 |
| Connection location/type | Back; 1/2 inch NPT |
| Dial size (inches) | 3 |
| Stem length (inches) | 2 1/2 |
| Stem diameter (inches) | 1/4 In |
| Rotated degrees | N/A |
| Angled degrees | N/A |
| Full scale accuracy | ≤40°F: ±1.5%<br>41 to 200°F: ±1%<br>≥201°F: ±1.5% |
| Calibration | External Adjustment |

| 4.2 Materials & Construction | Requirement |
|---|---|
| Case | Stainless Steel<br>Hermetically Sealed to Prevent Icing/Fogging Inside |
| Stem | Stainless Steel |
| Coil dampening | Silicone for Superior Time Response and Vibration Dampening |
| Dial face | Glass |

| 4.3 Finish / Color | Requirement |
|---|---|
| All Surface Finishes | a) Surface finishes must be uniform and continuous. The surface finish must not exhibit any visual defects such as blisters, rust, corrosion, scratches, peeling, bubbles, and/or cracking.<br>b) All exposed surfaces must be free of burrs and sharp edges.<br>c) All applied finishes must adhere to the surface and show no signs of delamination or peeling. |
| Finish | Stainless Steel |


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This specification is based on the manufacturers design and is to be used as a Quality Control document.

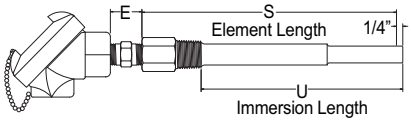
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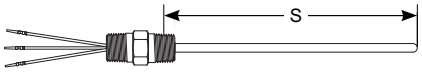
# Sensors with Connection Heads

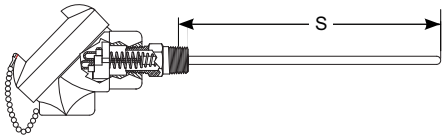
Configuration Code GP03

## Spring-Loaded RTD/Thermowell Assemblies with General Purpose Connection Heads

Spring-Loaded RTD Thermowell Assemblies with General Purpose Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the RTD assembly below, the thermowell from the thermowell section of this catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. They are supplied with a 316 stainless steel sheath and are available in various initial accuracies and temperature ranges as noted in the tables below. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed postition. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.




## ORDER CODES

***Example Order Number:***

| 1-0 | 1-1 | 1-2 | | 2-0 | | 3-0 | | 4-0 | 4-1 | 4-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R1T185L | 48 | 3 | - | Select Thermowell Part # or Insert 3 Digit Length Code | - | SL | - | 8HN | 31, | T- | Select Type and Range from back of section |

### 1-0 100 Ω Platinum RTD Elements

$\alpha$ = 0.003 85 ºC$^{-1}$

| CODE | | INITIAL ELEMENT ACCURACY 0 ºC |
|---|---|---|
| *LOW RANGE WIRE WOUND (-200 to 204) ºC* | | |
| ***SINGLE*** | ***DUPLEX*** | |
| R1T185L | R1T285L | ± 0.1% |
| R5T185L | R5T285L | ± 0.01% |
| *LOW RANGE THIN FILM (-40 to 204) ºC* | | |
| RBF185L | RBF285L | ± 0.12% |
| RAF185L | RAF285L | ± 0.06% |
| *HIGH RANGE WIRE WOUND (-200 to 600) ºC* | | |
| R1T185H | R1T285H | ± 0.1% |

### 1-1 Sheath Diameters

| CODE | DIAMETERS (inches) 316 SS |
|---|---|
| 38 | 3/16 |
| 48 | 1/4 |

### 1-2 Element Connection

| CODE | DESCRIPTION |
|---|---|
| 2 | 2 wire |
| 3 | 3 wire |
| 4[1] | 4 wire |

[1] Not available in duplex or with 440 Series Transmitter

### 2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

### 3-0 Element Options

| CODE | DESCRIPTION |
|---|---|
| SL[1] | Spring-loaded element |
| SC | Self-contained spring-loaded element |
| SN | Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max. |

[1] Not available with option 35T-642A

### 4-0 Head Mounting Fittings

| CODE | DESCRIPTION | CODE | DESCRIPTION |
|---|---|---|---|
| *STEEL FITTINGS* | | *316SS FITTINGS* | |
| 6HN | 1/2" x 1/2" NPT hex nipple 1" length | 8HN | 1/2" x 1/2" NPT hex nipple 1" length |
| 6PN_ | 1/2" NPT pipe nipple (specify "E" length in inches) | 8PN_ | 1/2" NPT pipe nipple (specify "E" length in inches) |
| 6PU_ [1] | 1/2" NPT union/nipple (specify "E" length in inches) | 8PU_ [1] | 1/2" NPT union/nipple (specify "E" length in inches) |

[1] 4" Minimum length required

### 4-1 Head and Sheath Terminations

| CODE | DESCRIPTION |
|---|---|
| 22 | 3" Individual Teflon® leads with terminal pins |
| 31 | Aluminum screw cover head |
| 34 | Cast iron screw cover head |
| 35T-642A | (4 to 20) mA HART® Field Transmitter with aluminum general purpose housing |
| 49 | Flip-top aluminum head |
| 53 | Grey Delrin® screw cover head |
| 62 | White DIN form B polypropylene head |
| 63 | White polypropylene head |
| 91 | 316 L stainless steel screw cover head |
| 92 | DIN form B 316 stainless steel screw cover head |
| **4-2** | **Options** |
| W[1] | Epoxy Coating |
| GS | Ground screw |
| I | Stainless tag |
| NB | 1/2" NPT nylon conduit reducer bushing |
| SB | 1/2" NPT conduit reducer bushing |
| T-440[2] | (4 to 20) mA head mounted RTD transmitter |
| T-441[3] | (4 to 20) mA Isolated head mounted transmitter |
| T-442[3] | (4 to 20) mA Isolated Hart® head mounted transmitter |

**See transmitter ordering information in back of section.**

[1] Available with option 31 only.
[2] Available with option 31, 34, 49, 53, 63, 91 only.
[3] Available with option 31, 49, 62, 92 only.


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## ORDER CODES

***Unconfigured Order Number:*** 440-00[1]

***Configured Order Number:*** **4 4 0 - 3 85 U - S (50-300) F**

1 2 3 4 5

**1**

| CODE | DESCRIPTION |
|---|---|
| 2 | RTD (2-wire) |
| 3 | RTD (3-wire) |

**2**

| CODE | DESCRIPTION |
|---|---|
| 85 | 100 ohm platinum ($\alpha$ = 0.003 85 $^{\circ}C^{-1}$) |

[1] Default setting for unconfigured transmitter is Pt100 (0 -100)°C

**3**

| CODE | DESCRIPTION |
|---|---|
| U | Upscale Burnout ≥ 21.0 mA |
| D | Downscale Burnout ≤ 3.6 mA |

**4**

0-400F

| RANGE |
|---|
| S ( lower limit – upper limit) |

**5**

| CODE | DESCRIPTION |
|---|---|
| C | Celsius |
| F | Fahrenheit |

**Accessories**

| CODE | DESCRIPTION |
|---|---|
| 440-CABLE | Communication Cable and Software (RS232) |
| 440-CABLE-USB | Communication Cable and Software (USB) |
| 440-DIN35 | 35 mm DIN rail mounting clip |

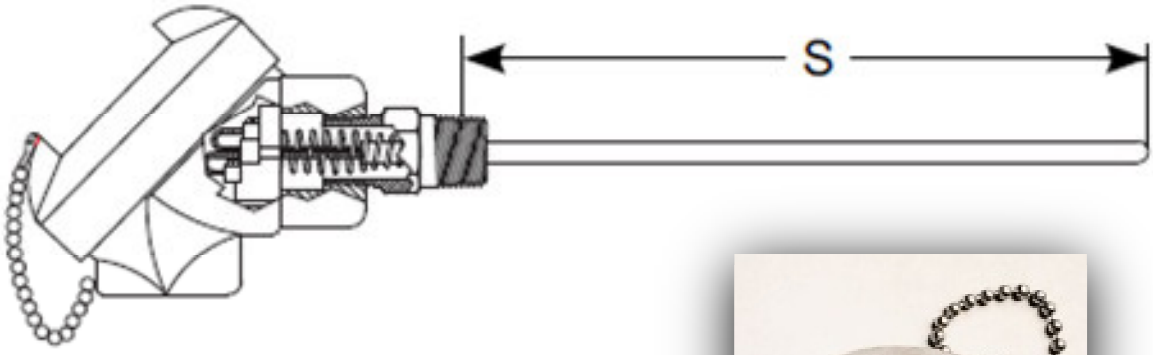

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# Assembly Instructions for the Sensor for McMaster-Carr Item Number 40705K35

***RTD Assembly Installation and Operating Instructions***

**Sensors with Connection Heads**

Configuration Code GP03
**Spring-Loaded RTD/Thermowell Assemblies with General Purpose Connection Heads**






## Measuring System

Resistance Temperature Detector (RTD) assembly GP03 with spring loaded element with or without a thermowell.

The RTD sensor complies with IEC 60751 and ASTM E1137. The sensor is designed to ensure highest accuracy and long term stability.

# Important Notice

## Warning!

Electrical shock could cause death or serious injury. If the sensor is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on the connection terminals or the probe itself.

Safe and secure operation of the temperature sensor can only be guaranteed if the operating instructions and all included safety notes are read, understood and followed.

# Correct Use

Installation processes and conditions vary with each application. The instructions provided here are intended as a best prescribed method for RTD installation.

The manufacturer cannot be held responsible for damage caused by misuse of the unit. The installation conditions and connection values indicated in the operating instructions must be followed!

## Warning!

The RTD assembly (GP03) is designed to be used in conjunction with a thermowell. It is not meant to be used directly in pressurized applications;
Maximum working pressure = Patm. (Atmospheric pressure)

# Installation Guidelines and Safety Instructions

1. Install the unit according to the relevant NEC Code and local regulations.
2. Avoid any spark due to impact, friction and installation. Anti-sparking wrenches should be utilized.
3. The temperature sensor should be connected to the power supply or other external circuit using the appropriate cable glands and wire entries.
4. For ambient temperature higher than 70 °C [158 °F], suitable cables, conduit and conductors must be used. Only use approved wire entries.
5. When utilized in dust atmospheres, the connection between the housing and fittings should provide a minimum degree of Ingress Protection. Liquid/gas sealants should be used. Local regulations need to be respected.

## Warning!

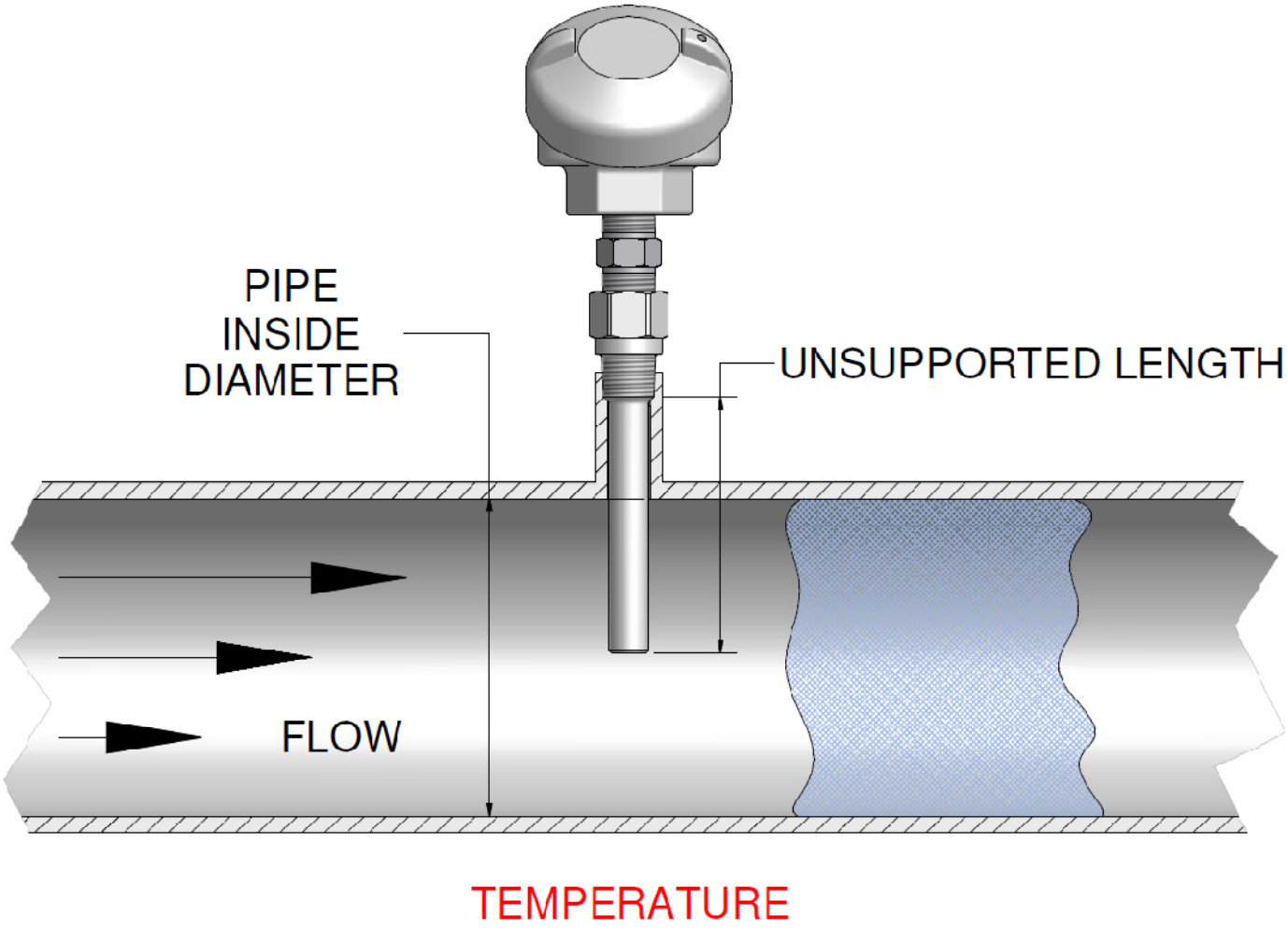
Do not disconnect equipment unless power has been switched off or the area is not hazardous.

The accessories for pipe connections and the appropriate gaskets and sealing rings are not supplied with the sensors. The acquisition of these items are the customer's responsibility. For further information regarding connections, please refer to the corresponding Standards.

## Installation and Operation

The unit is constructed using the most up-to-date production equipment and complies with the safety requirements of local guidelines, however, if it is installed incorrectly or misused, certain application dangers can occur. Installation, wiring and maintenance of the unit must be completed only by trained, skilled personnel who are authorized to do so by the plant operator. The plant operator must make sure that the measurement system has been correctly wired according to the connection schematics. Procedures indicated in these instructions must be followed.

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Example of a spring-loaded insert installation using a threaded thermowell

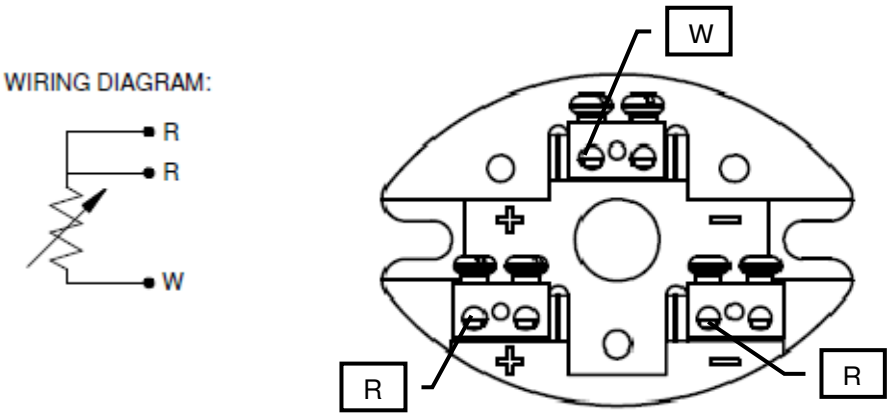
## To install sensor assembly, proceed as follows:

1. Attach thermowell to pipe or process container wall. Install and/or tighten thermowell before applying process pressure.
2. Make sure that the process fitting matches the maximum specified process pressure.
3. Seal the extension nipples with TFE tape or paste before screwing in the device.
4. Thermowells are used in measuring the temperature of a moving fluid in a conduit, where the stream exerts an appreciable force. The limiting value for the thermowell is governed by the temperature, the pressure and the speed of the medium, the immersion length, the material construction of the thermowell and the medium, etc. For operating conditions, a stress calculation should be carried out.

## Warning!

Do not install the RTD assembly GP03 directly to the process pipe or process container wall. It could cause death, serious injury or damage to equipment!

## Terminal block mounted




### Note!

The block is shown as it will sit inside the head in reference to the conduit opening.

## Storage Requirements

Ambient temperature limits for the housing and termination are (-40 to 150) °C, [-40 to 300] °F.

## Performance Characteristics

Based on product GP03 part string:

| TEMPERATURE | | CLASS B (0.12%) [1] TOLERANCE ±[ 0.30 + 0.0050 \|t\| ] °C | | BAND 1 (0.1%) [1] TOLERANCE ±[ 0.26 + 0.0042 \|t\| ] °C | | CLASS A (0.06%) [1] TOLERANCE ±[ 0.15 + 0.0020 \|t\| ] °C | | BAND 3 (0.03%) [1] TOLERANCE ±[ 0.08 + 0.0017 \|t\| ] °C | | BAND 5 (0.01%) [2] TOLERANCE ±[ 0.03 + 0.0017 \|t\| ] °C | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| °C | [°F] | °C | [°F] | °C | [°F] | °C | [°F] | °C | [°F] | °C | [°F] |
| -200 | [-328] | 1.30 | [2.34] | 1.10 | [1.98] | 0.55 | [0.99] | 0.42 | [0.76] | 0.37 | [0.67] |
| -100 | [-148] | 0.80 | [1.44] | 0.68 | [1.22] | 0.35 | [0.63] | 0.25 | [0.45] | 0.20 | [0.36] |
| 0 | [32] | 0.30 | [0.54] | 0.26 | [0.47] | 0.15 | [0.27] | 0.08 | [0.14] | 0.03 | [0.05] |
| 100 | [212] | 0.80 | [1.44] | 0.68 | [1.22] | 0.35 | [0.63] | 0.25 | [0.45] | 0.20 | [0.36] |
| 200 | [392] | 1.30 | [2.34] | 1.10 | [1.98] | 0.55 | [0.99] | 0.42 | [0.76] | 0.37 | [0.67] |

# McMaster-Carr Item Number 40705K35
# Series 440 Installation and Operating Instructions

## 1 SAFETY NOTES

Safe and secure operation of the head transmitter can only be guaranteed if the operating instructions and all safety notes contained are understood and followed.

### 1.1 Correct Use

The unit is a universal, presettable temperature transmitter for resistance thermometer (RTD). The unit is constructed for mounting in a connection head and a field housing. The manufacturer cannot be held responsible for damage caused by misuse of the unit.

### 1.2 Installation, commissioning and operation

The unit is constructed using the most up-to-date production equipment and complies with the safety requirements of the EU guidelines. If it is installed incorrectly or is misused, certain application dangers can occur. Trained personnel must do installation, wiring, and maintenance of the unit. These personnel must have read and understood these instructions and must follow them to the letter.

## 2 FUNCTION AND SYSTEM CONSTRUCTION

### 2.1 Function

Provides electronic monitoring of input signals into an analog output signal in industrial temperature measurement. The head transmitter is mounted in a connection head or separated from the sensor in a field housing. Setting up of the head transmitter is done using PC and configuration software. The configuration kit is required for setting up the head transmitter.

### 2.2 Measurement system

Transforming the following input signals:
• Resistance thermometers (RTD) (in 2 or 3 wire connection systems)

Fault monitoring of:
• Measurement range override or undercut
• Sensor breakage and short circuit

## 3 INSTALLATION

### 3.1 Installation conditions

Ambient temperature: (-40 to 85) °C [-40 to 185] °F
Installation area: Field housing; connection head
Installation angle: No limit

Safety notes: The unit must only be powered by a power supply that operates using an IEC 61010-1 compliant energy limited circuit.

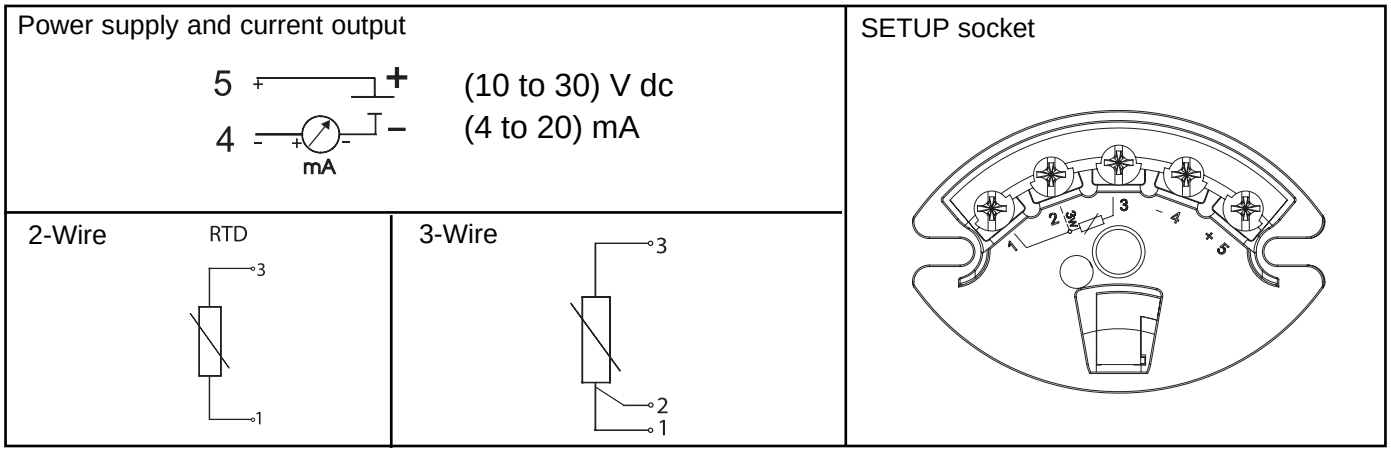
### 3.2 Installation

• Feed the sensor leadwires through the central hole in the head transmitter
• Position the head transmitter in the connection head
• Feed the installation screws through the slots in the head transmitter.
• Screw the head transmitter into the field housing using a screwdriver while not over tightening.

## 4 WIRING

### 4.1 Overview

Terminal layout



### 4.2 Measurement unit connection

**Attention:** Switch off power supply before opening the housing cover. Do not install or connect the unit to mains power. If this is not followed parts of the electronic circuit will be damaged.

• Sensors:
Connect the sensor leads to the respective head transmitter terminals (Terminals 1 to 3) by following the wiring diagram (see figure 4.1).

• Output signal and power supply:
Open the PG cable gland on the head transmitter or field housing. Feed the cable through the opening in the PG cable gland and then connect the cable cores to terminals 4 and 5 according to the wiring diagram (see figure 4.1).

• PC configuration (SETUP socket):
Open the flap on the SETUP socket (Figure 4.1) and connect the SETUP connection cable.

**Hint:** The screws on the terminals must be screwed tightly. Head transmitter configuration during measurement operation is possible. There is no need to disconnect leads.

**Potential leveling**
Please take note when installing the head transmitter remotely in a field housing. The screen on the (4 to 20) mA signal output must have the same potential as the screen at the sensor connections. When using earthed thermocouples, screening of the output (4 to 20) mA cable is recommended. In plants with strong electromagnetic fields, screening of all cables with a low ohm connection to the transmitter housing is recommended.

## 5 OPERATION

### 5.1 Short form instructions (SETUP)

| **PRESETTABLE PARAMETERS** | |
|---|---|
| Standard settings | • Sensor type<br>• Connection mode (2 or 3 wire connection)<br>• Units (°C or °F)<br>• Measurement range start (depends on sensor)<br>• Measurement range end (depends on sensor) |
| Expanded settings | • Compensation resistance (0 to 20) on 2 wire connection<br>• Fault condition reaction (≤ 3.6 mA or ≥ 21.0 mA)<br>• Output (analog standard/inverse)<br>• Damping (0 to 8) s<br>• Offset (-9.9 to +9.9) ˚C [-17.8 to +17.8] ˚F<br>• Measurement point identification/TAG Service functions |
| Service functions | • Simulation (on/off) |

For detailed TransComm operating instructions, please read the online documentation contained in the software.

### 5.2 Communication

The head transmitter must be set up using a PC and configuration kit. The following points must be taken into account if trouble free setting up is to be achieved:
• Configuration software installation.
• Connect the head transmitter to the PC using the connection cable from the configuration kit.

| **CONFIGURATION SOFTWARE INSTALLATION** | |
|---|---|
| System conditions | • IBM PC or compatible computer (minimum Pentium 166 MHz)<br>• Windows 95/98/ME/NT4.0/2000<br>• 64 MB RAM<br>• Minimum 30 MB free memory on hard drive<br>• CD-ROM drive<br>• Screen resolution 800 x 600 Pixel<br>• Free serial interface |
| Recommended minimum configuration | • Pentium 400 MHz<br>• 128 MB main RAM<br>• 120 MB free hard drive memory<br>• Screen resolution 1024 x 768 Pixel |
| Installation start | Start Windows<br>1. Place installations-CD in the respective drive<br>2. Start “Setup.exe” and follow the installation instructions<br>3. If required, the help/operating manual can be printed once the software has been successfully installed. |

**Connecting the head transmitter to the PC using the configuration kit connection cable**

1. Connect the SETUP connector of the interface cable to the SETUP socket in the head transmitter (see figure 4.1).

2. Connect the RS232C connector to a free serial interface socket on the PC. In order to achieve optimum connection, tighten the RS232C connector screws to the PC.

**Note:** Configuration of the head transmitter can be done with or without power applied.

## 6 COMMISSIONING

### 6.1 Installation check

Monitor all connections making sure they are tight. In order to guarantee fault free operation, the terminal screws must be tight onto the connection cables. The unit is now ready for operation.

### 6.2 Commissioning

Once the power supply has been connected the head transmitter is operational.

**Set up using the PC configuration software**

The head transmitter left the factory with a default parameter configuration. If no customer specific configuration was mentioned on the order the default parameter configuration is constructed as follows:

| | |
|---|---|
| Sensor | Pt100 (RTD) |
| Connection mode | 3-wire |
| Measurement range and units | (0 to 100) °C |

**Hint:** If a change has been made to the measurement point the head transmitter can be re-configured. In order to re-configure the parameters follow these instructions:

- Install the configuration software and make connection to the PC (see Chapter 5, Operation).
- For detailed operating instructions for the PC configuration software, please read the online documentation contained in the software.

**Interactive setting up of the temperature transmitter**

Customer specific linearization and sensor matching is done using the TransComm configuration software. The program calculates the linearization coefficients X0 to X4, that need to be entered into the PC configuration software.

### 6.3 Function check

Measuring the analogue (4 to 20) mA output signal or following failure signals:

| | |
|---|---|
| Measurement range undercut | Linear fall to 3.8 mA |
| Measurement range excess | Linear rise to 20.5 mA |
| Sensor break; sensor short circuit | ≤ 3.6 mA or ≥ 21.0 mA selectable |

## 7 MAINTENANCE

The head transmitter is maintenance free.

## 8 FAULT FINDING

### 8.1 Repair concept and disposal

Due to its construction, the head transmitter cannot be repaired. When disposing of the head transmitter please take note of local disposal regulations.

### 8.2 Faultfinding and repairs

Trouble shooting in general

| FAULT | CAUSE | ACTION/CURE |
|---|---|---|
| No communication | 2 wire connection incorrect | Re-connect correctly (see connection diagram) |
| | No power supply to the 2 wire connection | Check the current loop |
| | Power supply too low (< 10 V dc) | Check power supply |
| | Interface cable defective | Check the interface cable |
| | PC-interface defective | Check the interface of your PC |
| | Head transmitter defective | Replace head transmitter |

**Trouble shooting on RTDs (Pt100)**

| FAULT | CAUSE | ACTION/CURE |
|---|---|---|
| Current (≤ 3.6 or ≥ 21.0) mA | Sensor defective | Check sensor |
| | Incorrect RTD connection | Connect the cables correctly (see connection diagram) |
| | Incorrect 2 wire connection | Connect the cables correctly (see connection diagram)(Polarity) |
| | No power supply on the 2 wire connection | Check the current loop; the supply should be > 10 V dc |
| | Incorrect transmitter programming (number of wires) | Change parameter ‘connection mode’ (see chap. Operation) |
| | Programming | Thermocouple set up (see chap. Operation). Change to RTD |
| | Head transmitter defective | Replace head transmitter |
| Incorrect or inaccurate measured value | Sensor is incorrectly installed | Reinstall sensor correctly |
| | Heat dissipation via sensor | Monitor sensor installation positioning |
| | Incorrect transmitter programming (number of wires) | Change parameter ‘connection mode’ |
| | Transmitter programming faulty (scale) | Change scale |
| | Wrong RTD set up | Change parameter ‘sensor type’ |
| | Sensor connection (2 wire) | Monitor sensor connection |
| | Sensor cable resistance not compensated (2 wire) | Compensate cable resistance |
| | Offset incorrectly set up | Monitor offset |

# Rugged, Weatherproof, Wall Mounted Temperature Sensor

## Pt100 Class A Sensor in NEMA 4X (IP65) Enclosure

**EWSE Series**

1 YEAR WARRANTY — ACCURACY IEC CLASS A (±0.15°C @ 0°C)




EWSE-PT100 with customer supplied connection installed shown actual size.

- **Designed for Indoor and Outdoor Use**
- **Screw Terminal Block for 4-Wire Pt100 Connection**
- **Optional Built in 4 to 20 mA Transmitter**
- **Rugged Sensor and Protection Tube Design**
- **Supplied with NEMA 4X (IP68) Cable Gland or Electrical Connection**

OMEGA's new air temperature sensors offer the perfect solution for temperature monitoring outdoors or in demanding environments.

A rugged 6 mm–diameter sheathed RTD probe is housed in the center of a 14 mm (0.551") outer protection tube which is drilled to improve airflow around the sensor. A 4-terminal connector block or 4 to 20 mA transmitter are housed in a tough aluminum alloy enclosure rated to NEMA 4X (IP65).

A cable gland is fitted on the left hand side of the enclosure, suitable for cables from 2.5 to 6.5 mm (0.098 to 0.25") diameter.

## Specifications

**Dimensions:**
**Box:** 80 W x 75 H x 58 mm D (3 x 2.9 x 2.3")
**Sensor:** 75 mm long x 14 mm OD (2.9 x 0.55")

**Cable Entry:** NEMA 4X (IP68) gland for 2.5 to 6.5 mm (0.098 x 0.25") OD cable

**EWSE-PT100:**
**Sensor Type:** Thin film Pt100 class A 4 wire

**Ambient Temperature Range:** -50 to 100°C (-58 to 212°F)

**Electrical Connection:** Screw terminal block

**EWSE-PT100-TX:**
**Ambient Temperature Range:** -40 to 85°C (-40 to 185°F) at 10 to 90% RH non condensing

**Standard Transmitter Scaling:** 4 mA -25°C (-13°F), 20 mA at 75°C

75 mm (2.95")




**Electrical Connection:** Screw terminals, 2-wire

**Power Supply:** 10 to 30 Vdc, loop powered

**Maximum Output Load:** [(V supply-10)/20] kΩ eg 700Ω @ 24V

| To Order *Visit omega.com/ewse for Pricing and Details* | |
|---|---|
| **Model No.** | **Description** |
| **EWSE-PT100** | External air temperature assembly, 4-wire RTD |
| **EWSE-PT100-TX** | External air temperature assembly with 2-wire 4 to 20 mA transmitter |
| **TX-SCALED** | Factory scaling charge for non-standard temperature range on 4 to 20mA output models |
| **TX4-100** | Multi-conductor hook-up wire, 30.5 m (100') spool |

*Other probe lengths available on request. Contact sales to discuss your specific requirements.*
***Ordering Example: EWSE-PT100,** air temperature sensor.*

# EWSE Series

## Rugged, Weatherproof Temperature Sensors and Transmitters

INSTRUCTION SHEET

**MUK001/0311**

*Shop online at: omega.co.uk e-mail: sales@omega.co.uk*
*For latest product manuals: omega.co.uk*




## 1.0 Description

The EWSE air temperature sensors are designed for wall or pipe mounting in harsh indoor or outdoor environments.

A rugged 6mm diameter sheathed RTD probe is housed in the centre of a 14mm dia. outer protection tube. The RTD sensor terminal block or optional transitter are housed in a tough aluminium alloy enclosure, rated to IP65.

An IP68 cable gland is fitted to the left hand side of the enclosure, suitable for cables from 2.5 to 6.5mm diameter.

## 2.0 Receiving and Unpacking

Please inspect the packaging and sensor thoroughly for any signs of transit damage. Please notify Omega customer service if any damage is found.

## 3.0 Specifications

**Dimensions:**
Box: 80 W x75 H x 58 mm D
Sensors: 75 mm long x 14 mm O.D
Cable Entry: IP68 gland for 2.5 to 6.5 O.D cable

**EWSE-Pt100 Sensor Only Model:**
**Sensor Type:**
- Pt100 class A 4-wire standard
- Pt1000 on request

**Ambient Temperature Range:**
-50 to +100°C
**Electrical Conection:**
Screw terminal block

**EWSE-Pt100-TX:**
**Ambient Temperature Range:**
-40 to +85°C at 10 to 90% RH non condensing
**Standard Transmitter Scaling:**
4 mA at -25 C, 20 mA at +75°C
**Electrical Connection:**
Screw terminals, 2-wire
**Power Supply:**
10 to 30Vdc, loop powered
**Power Supply:**
[(V supply-10)/20] KΩ. eg. 700Ω @ 24V

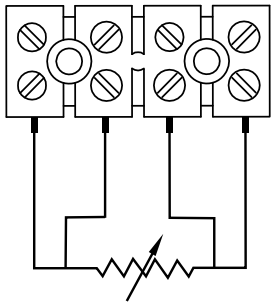
## 4.0 Mechanical Installation

The EWSE has been designed for wall or pipe mounting.
For wall fixing a drilling template is provided in **Annex A** of this manual.

An optional bracket, part number EWSE-MB is avaiable for pipe mounting. See **Annex B** for details.

## 5.0 Electrical Installation

For the EWSE-Pt100-TX temperature sensor with transmitter please refer to the transmitter manual M4561 for wiring and scaling information.The standard EWSE-Pt100 model features a 4 way screw termal block for connection to the 4-wire Pt100 sensor.



Pt100

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|---|---|
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Engineering Service: 1-800-872-9436/1-800-USA-WHEN®


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The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
**WARNING:** These products are not designed for use in, and should not be used for, human applications.


MADE IN UK

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, LTD. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

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## RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
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2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

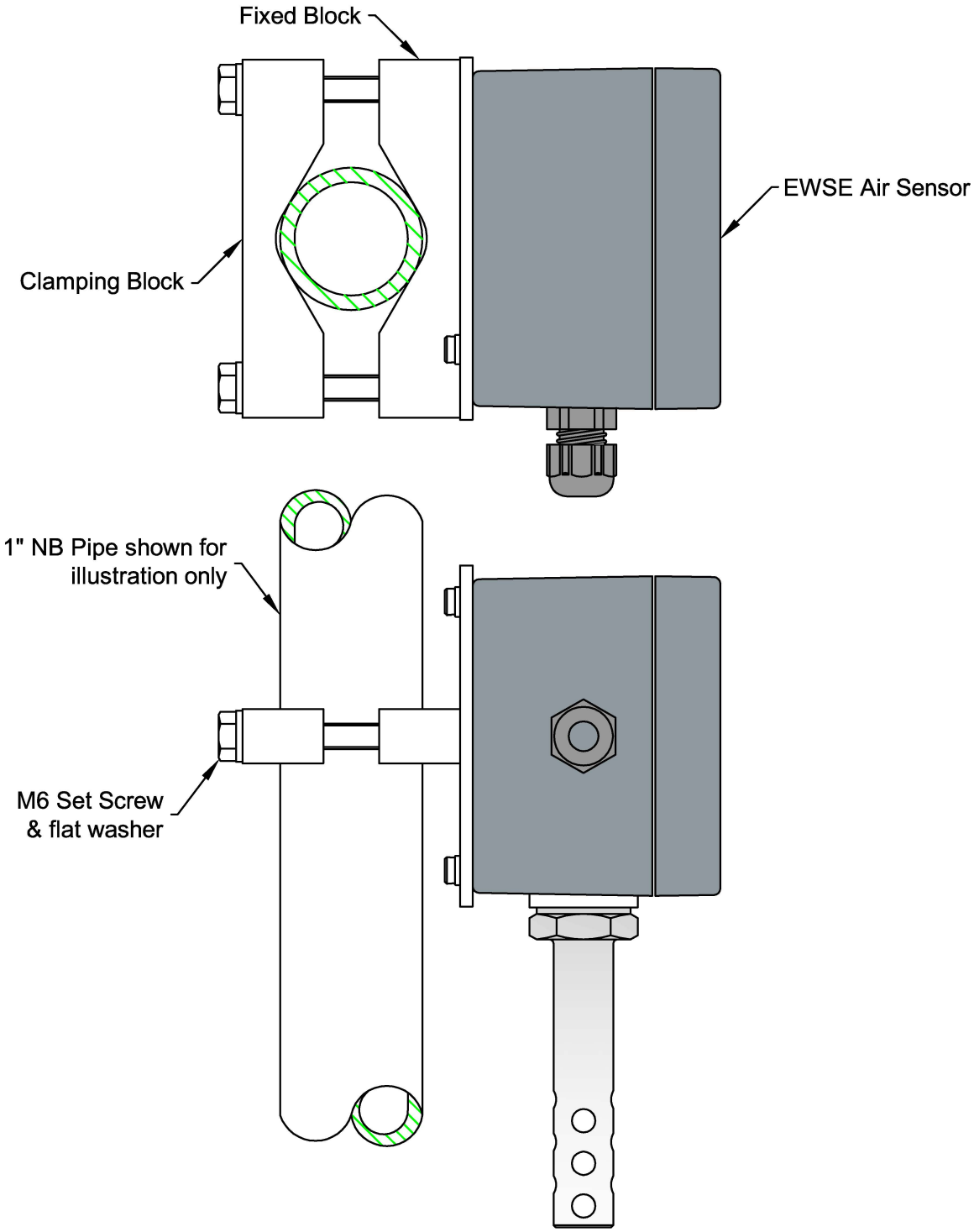
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# EWSE MOUNTING BRACKET

**SUITABLE FOR USE WITH PIPES BETWEEN Ø30mm TO Ø60mm**

**ORDERING PART NUMBER: EWSE - MB**




**FIXING KIT**

**The following fasteners are supplied with each bracket assembly:**

2 x M6 x 75 long BZP Hexagon headed set screws
2 x M6 x 40 long BZP Hexagon headed set screws
2 x M6 flat washers BZP
2 x M4 x 20 long BZP Cap screws



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# TX12

**PUSH BUTTON**
**PT100 TX**

CE

MADE IN UNITED KINGDOM

INSTRUCTION SHEET

**M4561/0807**

***Shop online at: omega.co.uk e-mail: sales@omega.co.uk***
***For latest product manuals: omega.co.uk***

## 1.0 DESCRIPTION

The TX12 head mounted temperature transmitter connects to any standard pt100 resistance sensor and converts the linearised temperature to a (4 to 20) mA signal. The transmitter is a two wire device, and is fully configurable by the user, over a wide temperature range, with the aid of a simple push button. This new TX12 design incorporates additional configuration menus, allowing the user to push button trim the transmitter output at both zero and span, ideal for trimming out sensor errors. The transmitters advanced circuitry guaranties high stability over the wide operating ambient temperature ranges experienced by head mounted devices.

One of the transmitters features is the program LED, which provides visual indication of sensor fault when in normal operation and is also used to guide the operator through the simple menus during configuration.

## 2.0 RECEIVING AND UNPACKING

Please inspect the packaging and instrument thoroughly for any signs of transit damage. If the instrument has been damaged, please notify your supplier immediately.

## 3.0 SPECIFICATION @ 20 °C

| | |
|---|---|
| **INPUT** | |
| **Sensor Type** | PT100 100 R @ 0°C 2 or 3 Wire |
| **Sensor Range** | (-200 to +850) ° C (18 to 390) _ |
| **Sensor Connection** | Screw terminal |
| **Minimum span (see note 1)** | 25 °C |
| **Linearisation** | BS EN 60751(IEC 751) standard / JISC1604 |
| **Accuracy (see note 2)** | ±0.1 ° C±0.05% of Reading |
| **Thermal Drift** | 0.0025 % / °C |
| **Excitation current** | < 200 uA |
| **Lead Resistance effect** | 0.002 ° C/ _ |
| **Maximum lead Resistance** | 20 _ per leg |

| | |
|---|---|
| Note 1 | Any span may be selected, full accuracy is only guaranteed for spans greater than the minimum recommended span. |
| Note 2 | Basic measurement accuracy includes the effects of calibration, linearisation and repeatability |

| | |
|---|---|
| **OUTPUT** | |
| **Type** | Two wire (4 to 20) mA sink |
| **Limits** | Low 3.8 mA ; high 21.5 mA |
| **Accuracy** | ±(mA out / 2000) or ±5 uA which ever greater |
| **Loop Effect** | ± 0.2 uA / V measured @ 50 Hz 1 V (peak to peak) |
| **Thermal Drift** | ± 1 uA / °C typical ; ±1.5 uA Max |
| **Max Load** | [ (Vsupply – 10)/20 ] K_ |
| **GENERAL** | |
| **Update Time** | 0.5 Seconds |
| **Response Time** | 1 Second to reach 90% of final value |
| **Start up time** | From power up typically 5 Seconds |
| **Filter Factor** | Adaptive |
| **Ambient Temperature** | (-40 to 85) °C |
| **Connection** | Screw Terminal |
| **Approvals** | BS EN 61326 ; 1998 – Electrical equipment for measurement and control ANNEX A ; ANNEX F |
| **Factory Default** | (0 to 100) °C upscale burnout (0.0 °C user trim) |

## 4.0 INSTALLATION AND WIRING

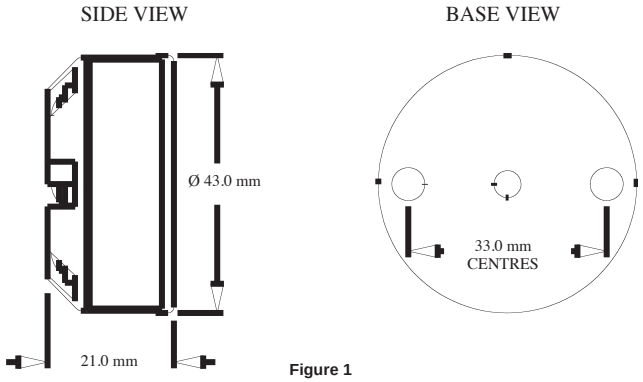



**Figure 1**

**Mounting holes : two holes 5.5 mm diameter, 33 mm centres**
**Centre Hole sensor wire entry : 4 mm**

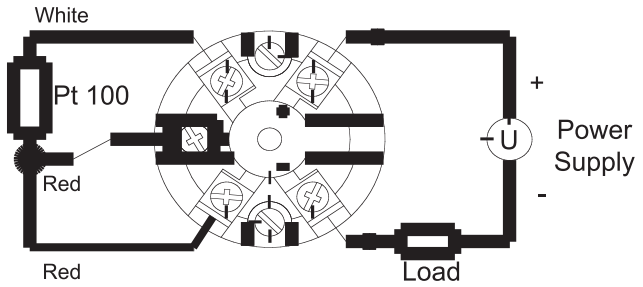
### 4.1 Mechanical

The TX12 transmitter has been specifically designed to fit inside a DIN standard probe head enclosure (such as the Omega NB series), which provides adequate protection from moisture, dust, corrosive atmosphere etc. All cable entries must be sealed using the correct size gland. Likewise any probe assembly fitted must be sealed.
Care must be taken when locating the transmitter to ensure the working ambient temperature range of (-40 to 85) °C is not exceeded. The TX12 enclosure has a centre hole allowing the sensor wired to enter screw terminals from the transmitter centre, this is applicable when the sensor is mounted directly below the transmitter.

### 4.2 Electrical

Electrical connections to the transmitter are made to the screw terminal provided on the top face. The sensor wires must be equal length and type for the lead compensation to work correctly. The screw terminals allow for wires to enter either inner or outer direction.
The transmitter is protected against reverse connection and over voltage. If no sensor (input) connection is made the transmitter will go into either up or down scale output current, depending on configuration.
Figure 2 gives connection details, the output is shown connected to a 24 V supply. The load symbol represent any other device connected in the loop, such as Monitoring equipment , panel indicators and loop isolators. The load value can range from 0 ohms to the max loop load for given supply, refer to section 3 “Max load” for more information.
The transmitter conforms with EC directive BS EN 61326 : 1998 when correctly installed in a termination head providing at least IP20 protection and with sensor wires less than 3 metres. Screened or twisted pair wires are recommended for output wires. Always ensure the (4 to 20 ) mA loop is grounded at one point, this would normally be at the monitoring equipment or loop power supply.
In normal operation the program LED acts as over-range LED.

**Figure 2**




## 5.0 USER CONFIGURATION

**IMPORTANT**
**READ COMPLETE SECTION BEFORE ATTEMPTING CONFIGURATION**
**PARTICULAR CARE SHOULD BE TAKEN REGARDING TIMEOUTS IN MENU 2 & 3**

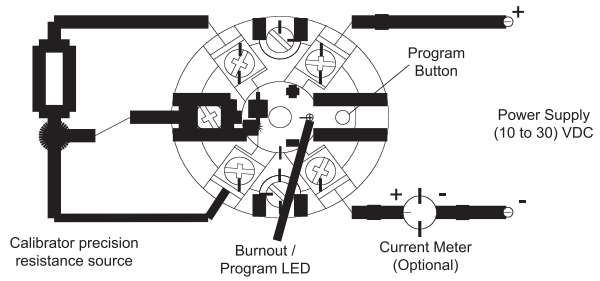



**Figure 3 Configuration circuit**

**User Configuration**

User configuration uses three menus, each menu sets a different parameter:-

| | |
|---|---|
| Menu 1 | Set range |
| Menu 2 | Set direction of output on sensor burnout |
| Menu 3 | User trim at 4 mA and 20 mA. |

The configuration menus are navigated using the push button and program LED, The push button is located under the hole in the keyhole shaped wiring label. To press the button use a 3 mm screw driver (flat blade) inserted into the hole. The button has a slight click action.

Three types of button press are used:-

- Single button press = Advance
- Double press within 0.5 seconds = Escape or change direction
- Press and hold button > two seconds = Enter

When a menu is selected the Program LED will flash in bursts of one to three flashes, the number of flashes represents the menu number.

**Navigating the menus**

- To access menus, press and hold button > 2 second, then program LED will start to flash, one flash every burst. This Indicates “menu 1” is selected.
- Use single button press to advance selection to “menu 2”, the program LED will now show two flashes per burst. The Next single presses will advance the selected menu to menu 3 and the next single press will advance selected menu back to menu 1. Repeated single presses will cycle the selected menu back around menus 1 to 3, in the above sequence.
- Double press button to escape from menus, and return to normal. Normal operation can also be selected by turning transmitter power off and on. Note the transmitter will not time out and automatically escape from menus.

**Menu 1 Range configuration (No Timeout)**

Configuration will require the following tools and equipment :-

- DC Supply (12 to 30) V @ 30 mA
- Precision resistance decade box to simulate PT100 sensor.
- Screw driver flat blade 3mm wide
- PT100 resistance tables
- Current meter (user trim)

## 5.0 USER CONFIGURATION

**IMPORTANT**

**READ COMPLETE SECTION BEFORE ATTEMPTING CONFIGURATION**
**PARTICULAR CARE SHOULD BE TAKEN REGARDING TIMEOUTS IN MENU 2 & 3**

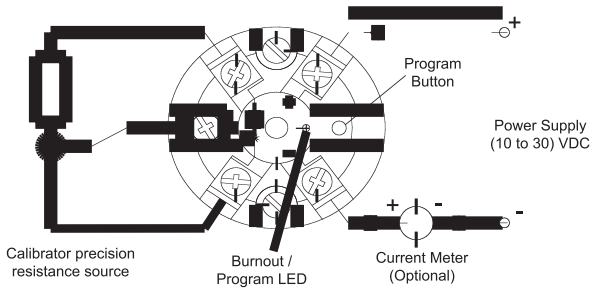



**Figure 3 Configuration circuit**

### User Configuration

User configuration uses three menus, each menu sets a different parameter:-

Menu 1 Set range
Menu 2 Set direction of output on sensor burnout
Menu 3 User trim at 4 mA and 20 mA.

The configuration menus are navigated using the push button and program LED, The push button is located under the hole in the keyhole shaped wiring label. To press the button use a 3 mm screw driver (flat blade) inserted into the hole. The button has a slight click action.

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- Double press button to escape from menus, and return to normal. Normal operation can also be selected by turning transmitter power off and on. Note the transmitter will not time out and automatically escape from menus.

### Menu 1 Range configuration (No Timeout)

Configuration will require the following tools and equipment :-

- DC Supply (12 to 30) V @ 30 mA
- Precision resistance decade box to simulate PT100 sensor.
- Screw driver flat blade 3mm wide
- PT100 resistance tables
- Current meter (user trim)

### Using Menus

To re-range the temperature scale follow the following instructions:-

- Refer to figure 3, connect resistance box to TX12 input terminals using three wire connection. Connect output to a DC supply, observe polarity. Turn power on and allow 1 minute warm up period.
- Set calibrator to the equivalent resistance of the PT100 sensor, at required low range temperature. If the program LED is on at this stage the input is out of range, check resistance and connection.
- Press and hold button > 2 seconds to enter menus, menu 1 will then be selected, indicated by one flash every burst.
- Whilst menu 1 is selected, press and hold button > 2 seconds to enter menu 1, at which stage the program LED toggle on and off at a slow rate.
- Allow ten seconds then single press button to store low range setting, the program LED will now flash at a fast rate.
- Set calibrator to the equivalent resistance of the pt100 sensor, at required high range temperature and allow ten seconds.
- Press button to store high range setting, the program LED will flicker for one second before the transmitter returns to normal operation. The transmitter is now re-ranged.

### Menu 2 Burnout Selection (Timeout is 3 Seconds)

- Refer to figure 3, Connect output to a DC supply, observe polarity. For this menu the input can be connected or open circuit. Turn power on.
- Press and hold button > 2 seconds to enter menus, menu 1 will then be selected, indicated by one flash every burst.
- Single press button to advance selection to menu 2, indicated by two flashes of the program LED every burst.
- Whilst menu 2 is selected, press and hold button > 2 seconds to enter menu 2, at which stage the program LED will either toggle on and off at a slow indicating low scale burnout or fast rate indicating upscale burnout.
- To change burnout direction single press button. The Program LED toggle rate will change to the other setting. Repeated single presses will toggle between up and down scale.
- To store setting allow 3 seconds with no button action, the program will then timeout, store new setting then return to normal operation.

### Menu 3 User trim (Timeout is 20 Seconds)

**This menu allows the user to trim the output current at 4 mA and 20 mA points, (similar function to trim potentiometers) and is very useful for trimming out sensor errors.**
**The input of the transmitter must be connected to either a calibrator or temperature sensor held at a known temperature. The (4 to 20) mA loop current also need to be monitored with a current meter.**

- Refer to figure 3, connect sensor or resistance box to TX12 input terminals using three wire connection. Connect output to a DC supply, observe polarity, connect current meter in series with loop. Turn power on and allow 1 minute warm period.
- Set calibrator to the equivalent resistance of the PT100 sensor, at required point. Alternatively ensure sensor temperature is at the required calibration point.
- The transmitter will automatically trim the 4 mA end if the output is within the active band of (3.8 to 6) mA, and trim the 20 mA end if the output is within the active band of (18 to 21.5) mA. No setting adjustment is performed if the output current not within these two bands. Ensure your calibration points are within these bands.
- Press and hold button > 2 seconds to enter menus, menu 1 will then be selected, indicated by one flash every burst.
- Single press button to advance selection to menu 2, and single press again select menu 3 indicated by three flashes of the program LED every burst.
- Whilst menu 3 is selected, press and hold button > 2 seconds to enter menu 3, which stage the program LED toggle on and off at either a slow rate indicating downward trim direction or fast rate indicating upwards trim direction.
- To change trim direction double press button. The Program LED toggle rate toggle to the opposite direction. Repeated double presses will toggle between and down trim direction
- To trim output current, single press button to advance current 2 uA in set direction, or press and hold button to auto advance in set direction release button to stop advance. Note after approximately 20 seconds of continuous button press, auto trim rate will speed up. Monitor the current change on the current meter.
- To store new setting allow 20 seconds with no button action, the program will then timeout, store new setting then return to normal operation.

### Reset to factory default settings

If required theTX12 can be reset to factory default setting, this procedure also removes any user trim adjustment. Factory default settings are :

| | |
|---|---|
| Range | (0 to 100) °C |
| Burnout | up-scale |
| User trim | All user adjustment cleared |

To reset to factory setting, hold the button down whilst the TX12 is powered up.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
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OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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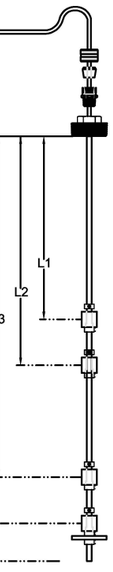
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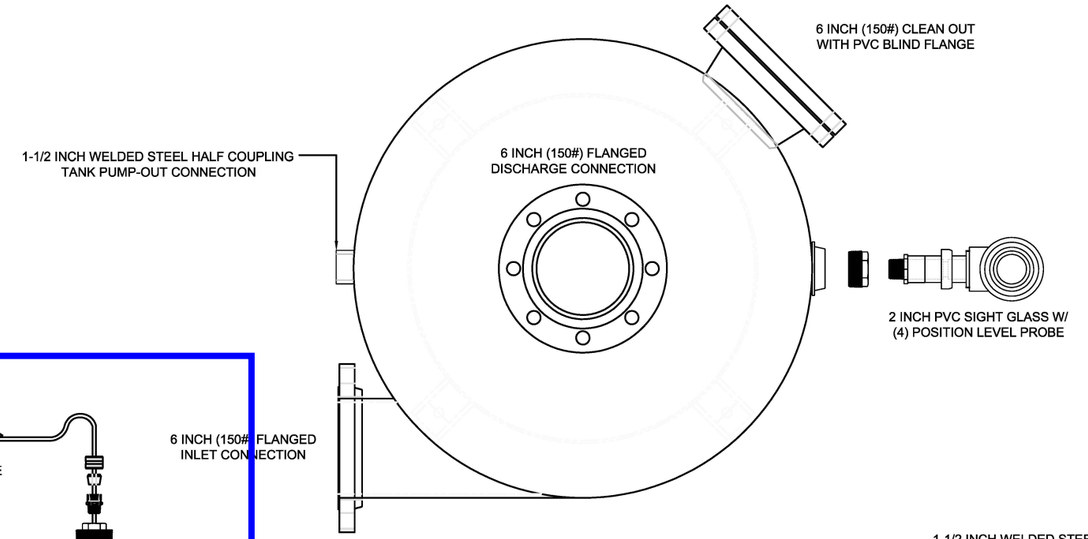
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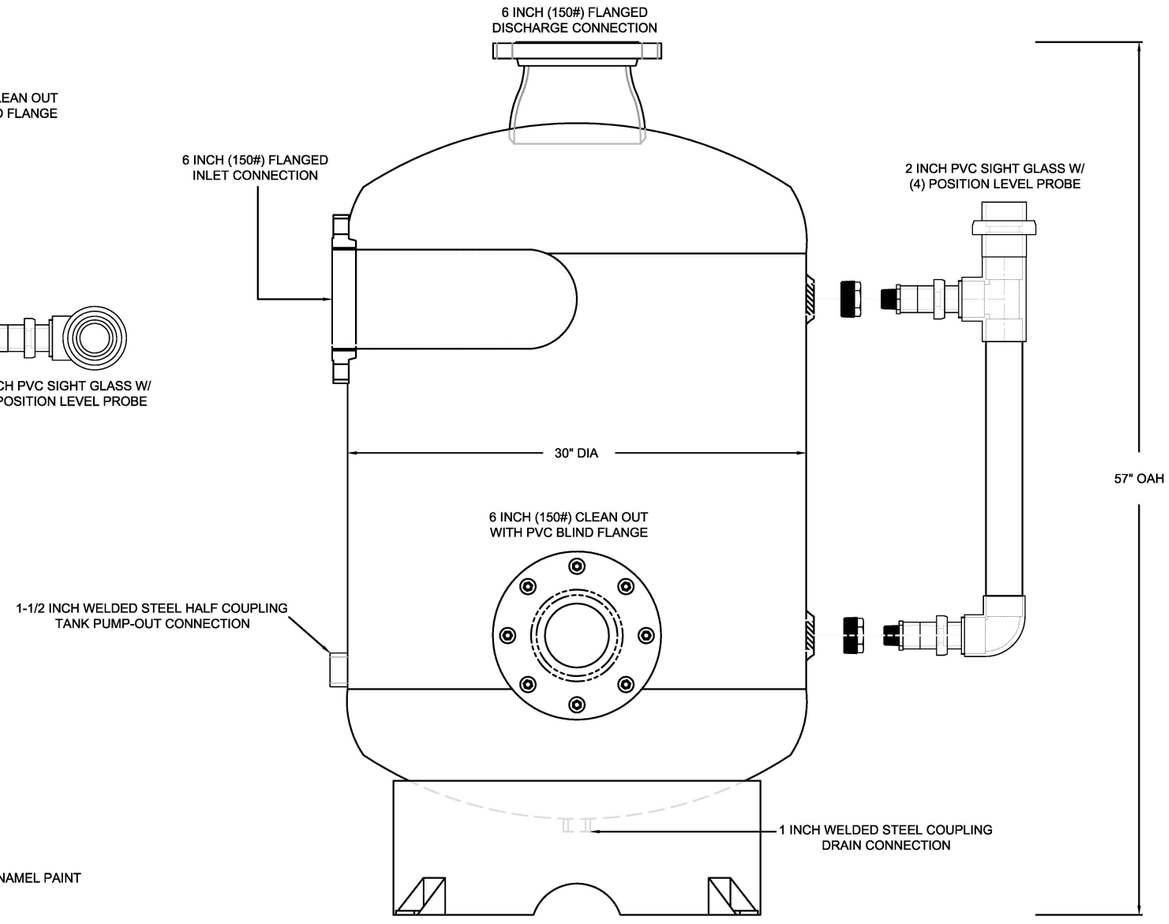



BODY MATERIAL - STAINLESS STEEL CONSTRUCTION
FLOAT MATERIAL - STAINLESS STEEL CONSTRUCTION
PROCESS CONNECTION - 2 INCH MNPT

4 - POSITION LEVEL SENSOR
(LSHH-101, LSH-101, LSL-101 & LSLL-101)
ELEVATION VIEW




(VLS-101) SEPARATOR TANK
PLAN VIEW




(VLS-101) SEPERATOR TANK
ELEVATIONAL VIEW

NOTES:
1. TANK CONSTRUCTION - CARBON STEEL. 200 PSI RATED VESSEL
2. EXTERIOR MECHANICALLY PRE-PARED, PRIMED AND PAINTED WITH INDUSTRIAL ENAMEL PAINT (RUSTOLEUM SERIES 7400 OR EQUAL)
3. ESTIMATED CONDENSATE LEVELS:
   - LSHH-101 - 77 GALLONS
   - LSH-101 - 68 GALLONS
   - LSL-101 - 46 GALLONS
   - LSLL - 101 - 37 GALLONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| A | AS BUILT | 10-31-13 | CJJ |

REVISIONS

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| | |
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| DATE | 10-15-13 |
| CHK BY | KWB |
| DATE | 10-17-13 |
| APPR BY | |
| DATE | |

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NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

TITLE: 120 GALLON MOISTURE SEPARATOR (VLS-101)
4 POSITION LEVEL PROBE: LSHH, LSH, LSL & LSLL-101

SANBORN HEAD - IBM: FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

| JOB NO. | SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|---|
| 13-189 | NTS | B | M-3 | 1 OF 1 | A |

# Specialty Switches – Continued

## Portable Level Switch — Integral Mounting Magnet



Precisely monitors liquid level and is ideal for controlling filling operations and preventing overflows. Permanent magnet attaches unit securely to steel tank wall at exact level required.

## LS-750 Series — Weighted for Suspension Cable



With a compact-sized float, slosh shield and weighted collar, the LS-750 provides liquid level detection for a wide variety of applications. Suspend in stand pipes or sumps for leak detection duty, or drop into wells for ground-water monitoring. Supplied with 25 feet of waterproof cable.

U.L. Recognized— File No. E-45168. CSA Listed-File No. LR-30200.

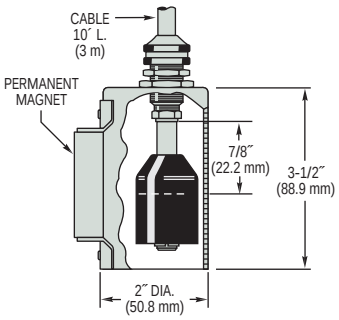
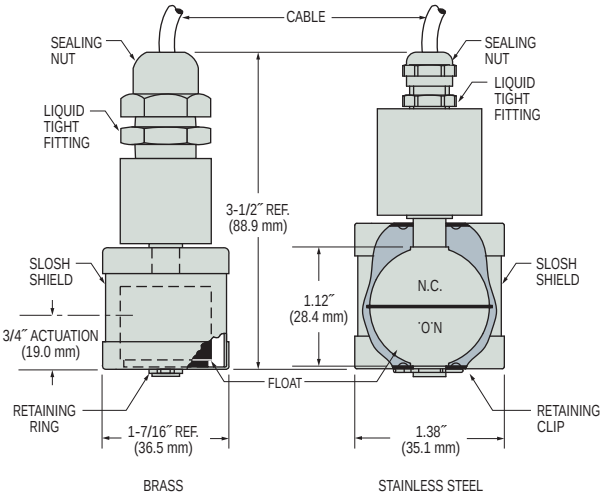
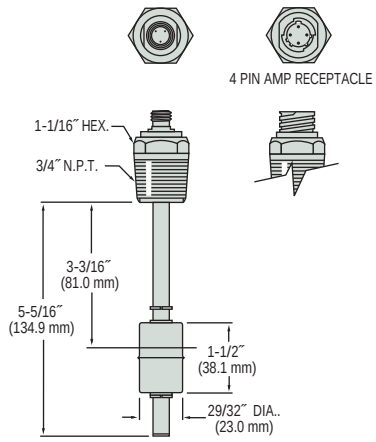
## LS-700F Series



Overfill Protection for Refrigerant Tanks.The LS-700F enables safe compliance with EPA directives to recover refrigerants. These units are designed to fit standard 30# and 50# D.O.T. approved refrigerant tanks. They provide 80% full shutoff capability when used as an integral part of a recovery system.

U.L. Recognized— File No. SA8857. CSA Listed-File No. LR-30200-31.

## Dimensions

| Portable Level Switch | LS-750 | LS-700F |
|---|---|---|
|   |   |   |
| SJO, 18/2 10´L., Neoprene | 22 AWG, 2-Wire Cable | 3- or 4-Pin, Quick-Connect Receptacle |

†$L_1$ = Switch actuation level. In liquid with specific gravity of 1.0, switch actuation is approximately half the distance from end of stem to mounting, or at the halfway point of float travel.

## How To Order — Select Part Number based on specifications required.

| Series | Material: Stem and Mounting | Material: Float | Material: Other Wetted | Min. Liquid Sp. Gr. | Operating Temperature | Pressure PSI, Max. | Switch* | Electrical Termination Option | Part Number |
|---|---|---|---|---|---|---|---|---|---|
| Portable | Brass | Buna N | Aluminum, 316 S.S. | .85 | Oil: -40°F to +230°F (-40°C to +110°C) Water: to 180°F (82°C) | 10 | SPST, 20 VA N.O., Dry | — | **15208** ⚡ |
| LS-750 | Brass | Buna N | Nylon, PVC, Beryllium Copper | .45 | | 150 | SPST, 20 VA N.C., Dry | PVC Cable Jacket | **149350** ⚡ |
| | 316 S.S.** | 316 S.S. | PVDF, Viton® | .65 | -40°F to 212°F (-40°C to +100°C) | 375 | SPST, 10 VA N.C., Dry | Teflon® Cable Jacket | **197433** |
| LS-700F | Brass | 304 S.S. | — | .98 | -40°F to +221°F (-40°C to +105°C) | 400 | SPST, 20 VA N.C., Dry | 3-Pin | **128500** ⚡ |
| | | | | | | | | 4-Pin | **144900** ⚡ |

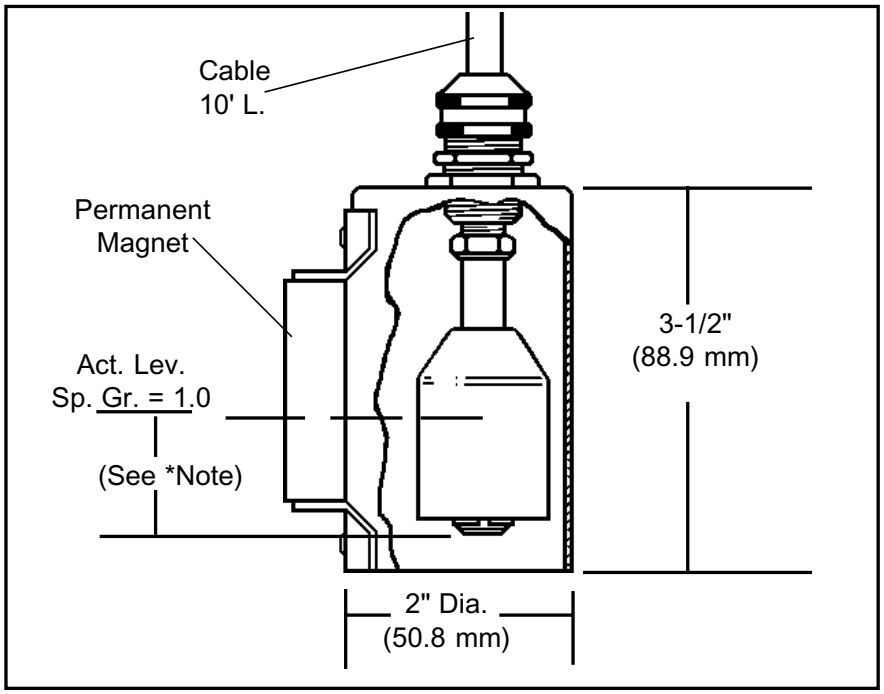
*See "Electrical Data" on Page X-5 for more information.

⚡ – Stock Items.

** Stainless steel is generally recognized as safe (GRAS) with FDA for food contact regulations.

# LS-15208
# Portable Level Switch

**Instruction Bulletin**
**No. 72938**




*Note: Switch actuation point is approximately half the distance from end of stem to mounting, or at the halfway point of float travel (in liquid with sp. gr. of 1).

## Switch Ratings - Max. Resistive Load

| VA | Volts | Amps AC | Amps DC |
|---|---|---|---|
| 20 | 0-30 | .4 | .3 |
| | 120 | .17 | .13 |
| | 240 | .08 | .06 |

## Specifications . . .

| | |
|---|---|
| Stem/Mtg. Material | Brass |
| Float Material | Buna N |
| Slosh Shield Mat. | Aluminum |
| Other Wetted Materials | 316 Stainless Steel (Cad. Plated) |
| Operating Temperature | Oil: -40°F to +230°F (-40°C to +110°C)<br>Water: to +180°F (+82.2°C) |
| Pressure Rating | 10 psi, Max. |
| Min. Liquid Spec. Gravity | .85 |
| Switch Rating | SPST, 20 VA, N.O., Dry |
| Electrical Connection | SJO, 18/2 10' L., Neoprene |

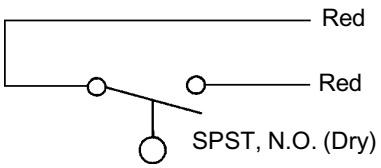
## Installation . . .

Attach LS-15208 unit to tank or vessel wall by means of permanent magnet on unit - in vertical position with cable upward. Locate unit so that actuation level is at level to be monitored. See "Dimensional Data".

## Electrical Connection . . .

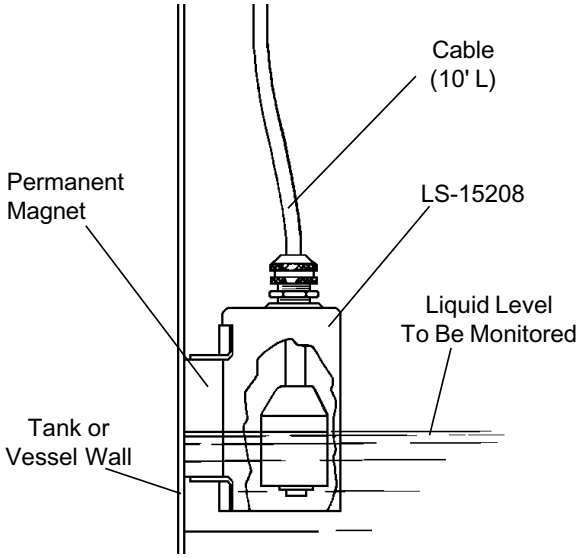
See "Wiring Diagram". connect cable to load circuit outside of tank. CAUTION: See "Specifications" and "Switch Ratings" before connecting power.

## Typical Wiring Diagram . . .

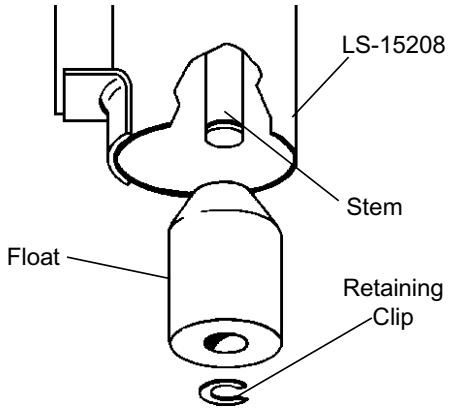



## Maintenance . . .

An occasional cleaning when excessive contamination is present in the liquid is normally all that is required. Remove retaining clip and float from unit, wipe down components and reassemble unit as shown (right). CAUTION: Be sure that tapered end of float is upward when reassembling unit.




**LS-15208 Unit Installed**




**LS-15208 Unit Disassembled for Wipe-Down Cleaning**

### Important Points!

Product must be maintained and installed in strict accordance with the National Electrical Code and GEMS product catalog and instruction bulletin. Failure to observe this warning could result in serious injuries or damages.

An appropriate explosion-proof enclosure or intrinsically safe interface device must be used for hazardous area applications involving such things as *(but not limited to)* ignitable mixtures, combustible dust and flammable materials.

Pressure and temperature limitations shown on individual catalog pages and drawings for the specified level switches must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.

Selection of materials for compatibility with the media is critical to the life and operation of GEMS level switches. Take care in the proper selection of materials of construction; particularly wetted materials.

Life expectancy of switch contacts varies with applications. Contact GEMS if life cycle testing is required.

Ambient temperature changes do affect switch set points, since the specific gravity of a liquid can vary with temperature.

Level switches have been designed to resist shock and vibration; however, shock and vibration should be minimized.

Liquid media containing particulate and/or debris should be filtered to ensure proper operation of GEMS products.

Electrical entries and mounting points may require liquid/vapor sealing if located in an enclosed tank.

Level switches must not be field repaired.

Physical damaged sustained by the product may render it unserviceable.


***Gems Sensors Inc.***
One Cowles Road
Plainville, CT
06062.1198

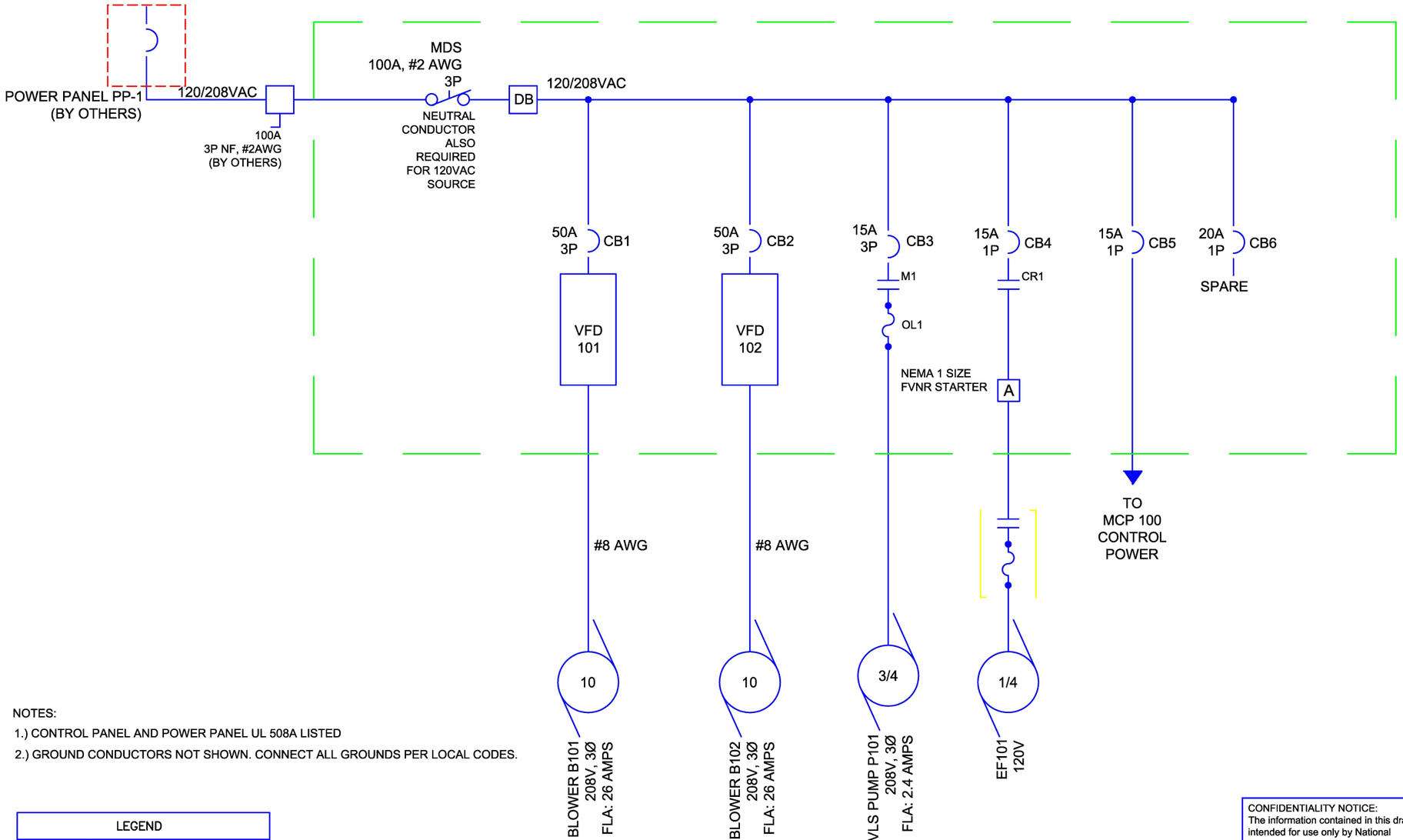
*tel* 860.747.3000
*fax* 860.747.4244



P/N 72938
Rev. D

# Attachment 5

# Power and Control Panel Manuals and Drawings




NOTES:

1.) CONTROL PANEL AND POWER PANEL UL 508A LISTED

2.) GROUND CONDUCTORS NOT SHOWN. CONNECT ALL GROUNDS PER LOCAL CODES.

| LEGEND | |
|---|---|
| ABBREV. | DESCRIPTION |
| M | MOTOR STARTER |
| MDS | MAIN DISCONNECT SWITCH |
| CB | CIRCUIT BREAKER |
| OL | OVER LOAD |
| AWG | AMERICAN WIRE GAGE |
| DB | DISTRIBUTION BLOCK |
| ---- | PP–100 LIMIT |
| ---- | EF–101 PANEL LIMITS |

| REVISIONS | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | APPROVED |
| A | AS BUILT | 11-11-13 | EMB |

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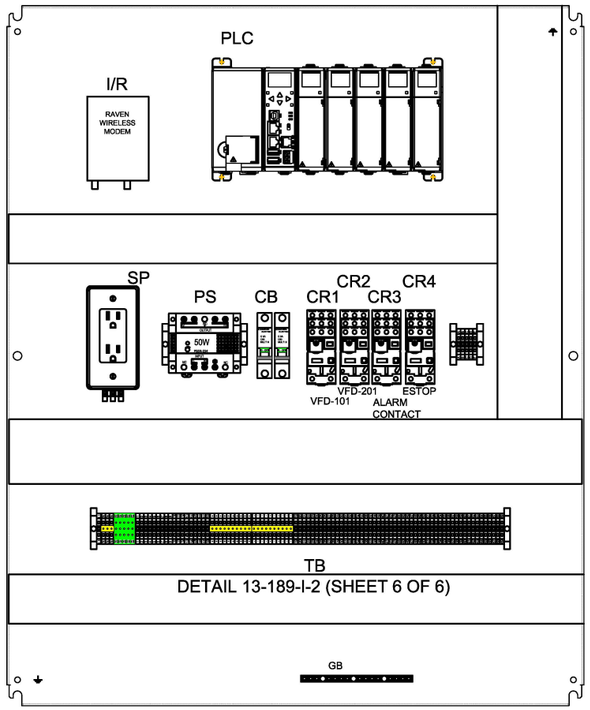
| | |
|---|---|
| DRWN BY | EMB |
| DATE | 10-13-13 |
| CHK BY | RJD |
| DATE | 10-15-13 |
| APPR BY | |
| DATE | |

TITLE: ONE LINE DIAGRAM

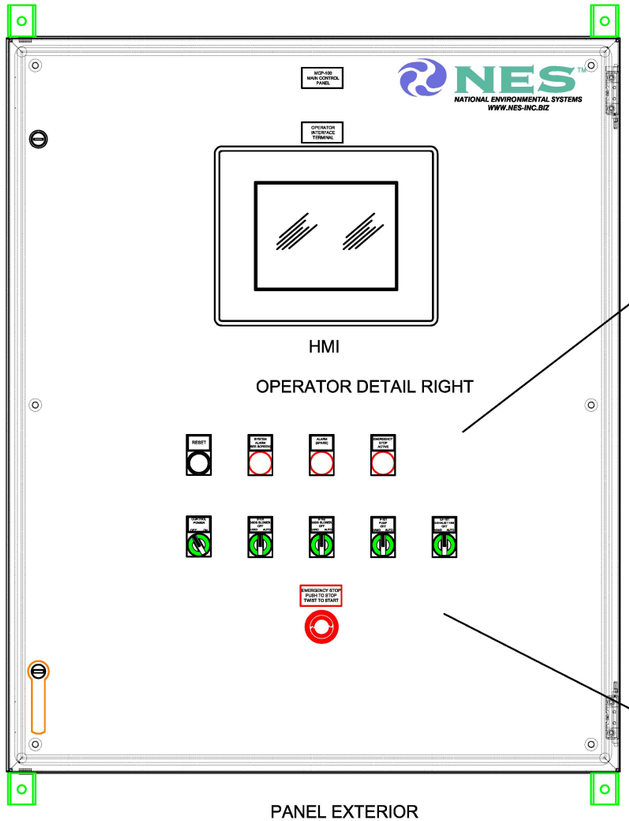
SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

JOB NO. 13-189

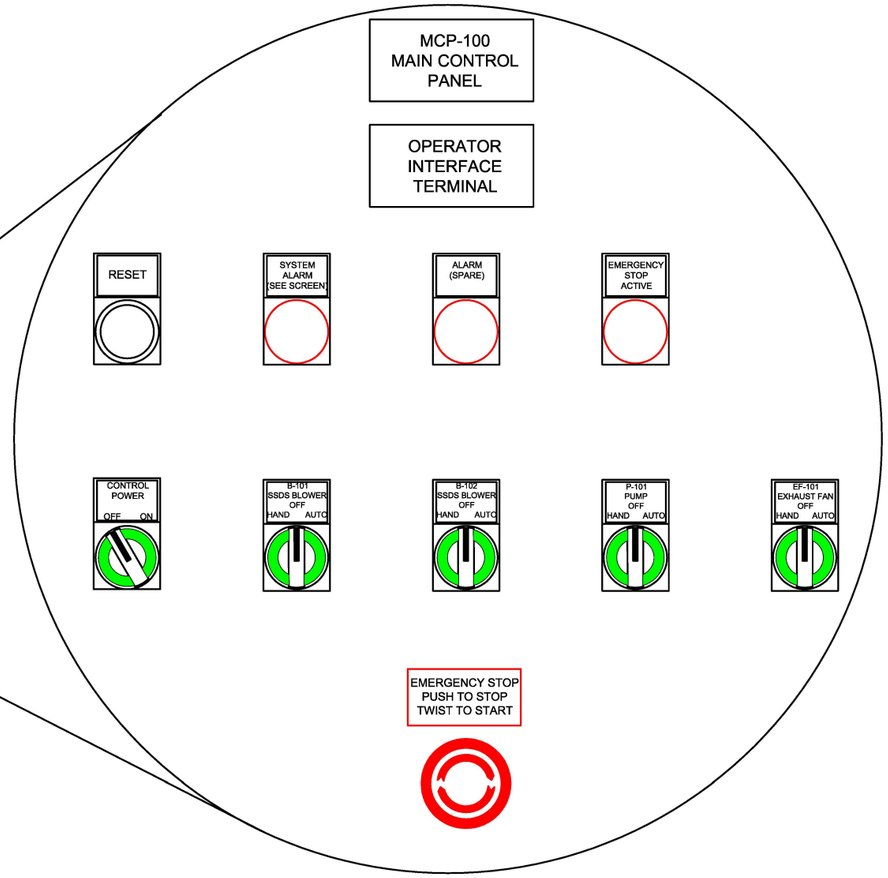
| SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|
| NTS | B | E-1 | 1 OF 1 | A |




PANEL INTERIOR




PANEL EXTERIOR
ENCLOSURE EXTERNAL DIMENSIONS: 36"L X 30"W X 12"D




| REV | DESCRIPTION | DATE | APPROVED |
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| DATE | |

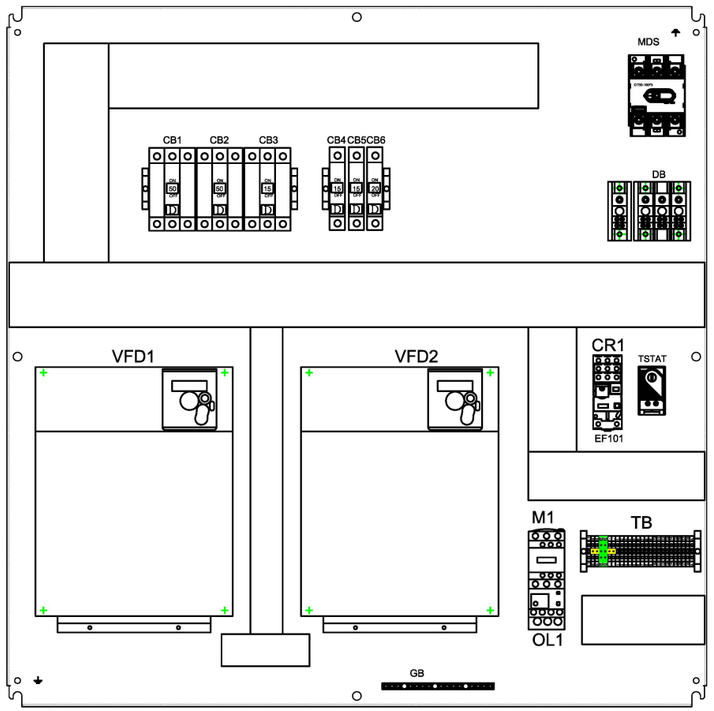
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TITLE
MCP-100 INTERIOR / EXTERIOR LAYOUT

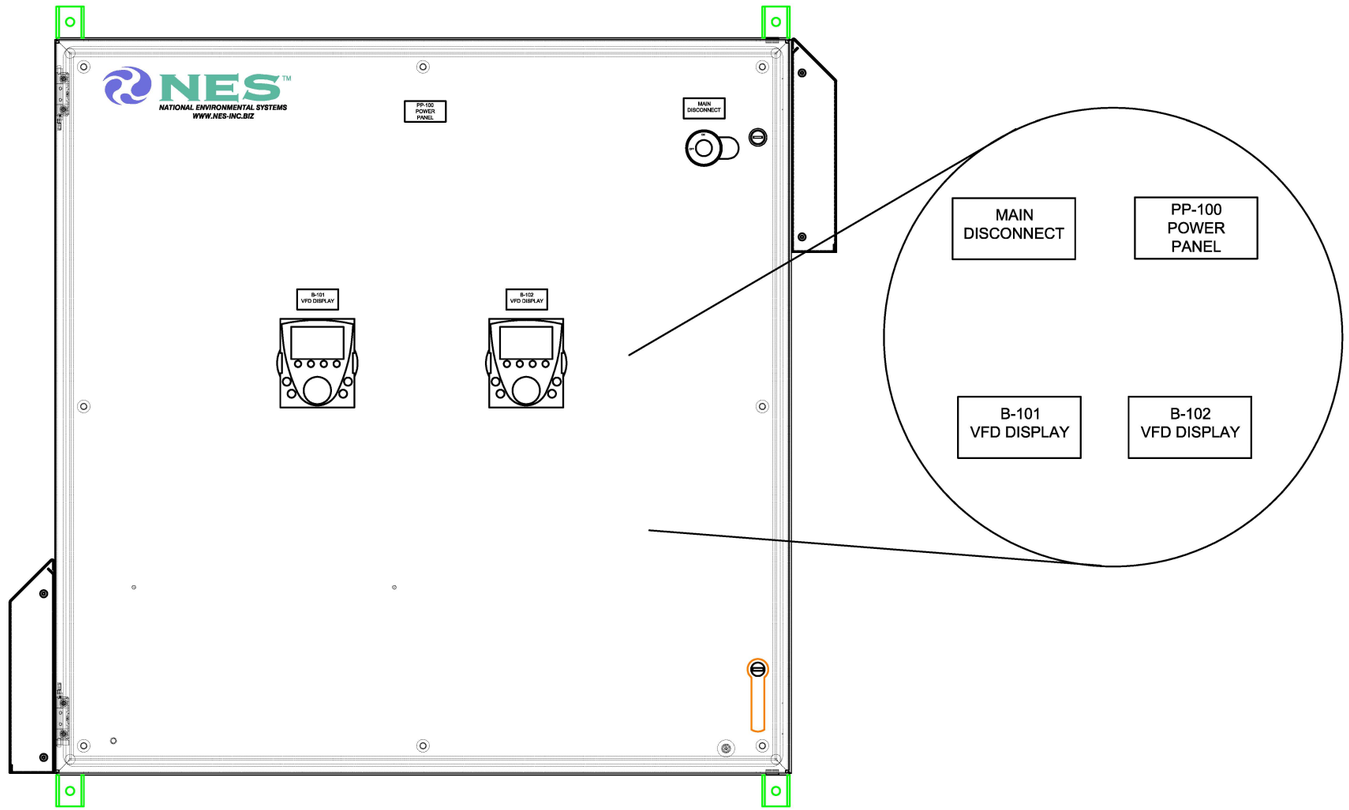
SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

JOB NO. 13-189

| SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|
| NTS | B | I-1 | 1 OF 4 | A |




PANEL INTERIOR




PANEL EXTERIOR
ENCLOSURE EXTERNAL DIMENSIONS: 36"L X 36"W X 12"D

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TITLE
# PP-100 INTERIOR / EXTERIOR LAYOUT

SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

| JOB NO. | SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|---|
| 13-189 | NTS | B | I-1 | 2 OF 4 | A |

| ITEM | | QTY | MODEL | MANUFACTURER |
|---|---|---|---|---|
| MASTER CONTROL PANEL (MCP-100) | MCP-100 | 1 | C-SD363012 | HOFFMAN |
| BACK PANEL | MCP-100 | 1 | C-P3630 | HOFFMAN |
| MOUNTING FEET | MCP-100 | 1 | CMFK | HOFFMAN |
| LOCKING HANDLE | MCP-100 | 1 | CWHPTO | HOFFMAN |
| PLC CABLE | PLC | 1 | EA-2CBL | AUTOMATION DIRECT |
| RACK 5 SLOT | PLC | 1 | P3-05B | AUTOMATION DIRECT |
| RACK POWER SUPPLY | PLC | 1 | P3-01AC | AUTOMATION DIRECT |
| P3000 CPU | PLC | 1 | P3-550 | AUTOMATION DIRECT |
| 16 POINT DC INPUT CARD | PLC | 2 | P3-16ND3 | AUTOMATION DIRECT |
| ANALOG COMBO CARD (8 IN 4 OUT) | PLC | 2 | P3-8AD4DA-1 | AUTOMATION DIRECT |
| 16 POINT RELAY OUTPUT CARD | PLC | 1 | P3-16TR | AUTOMATION DIRECT |
| IO CARD CONNECTOR | PLC | 5 | P3-RTB | AUTOMATION DIRECT |
| TOUCH SCREEN 8 INCH COLOR | HMI | 1 | EA7-T8C | AUTOMATION DIRECT |
| POWER SUPPLY FOR TOUCH SCREEN | HMI | 1 | EA-AC | AUTOMATION DIRECT |
| CELLULAR MODEM | I/R | 1 | V2226E-VA | GET WIRELESS |
| MODEM BRACKET | I/R | 1 | 100-170-1015 | GET WIRELESS |
| MODEM ANTENNA | I/R | 1 | 301125 | GET WIRELESS |
| 24VDC POWER SUPPLY | PS | 1 | PS5R-D24 | IDEC |
| DIM-MOUNTED RECEPTACLE | SP | 1 | 16252-DIN | LEVITON |
| 6 AMP BREAKER | CB | 1 | MG24430 | SQUARE D |
| 3 AMP BREAKER | CB | 1 | MG24427 | SQUARE D |
| 2 POLE RELAY | CR1-2 | 2 | RUMF2AB2F7 | SQUARE D |
| 2 / 3 POLE RELAY BASE | CR1-4 | 4 | RUZSF3M | SQUARE D |
| 3 POLE RELAY | CR3-4 | 2 | RUMF3AB2F7 | SQUARE D |
| GROUND BAR | GB | 1 | PKA15GTA | SQUARE D |
| TERMINAL BLOCKS | TB | 98 | AB1VV235U | SQUARE D |
| GROUNDING TERMINAL BLOCKS | TB | 5 | AB1TP235U | SQUARE D |
| END ANCHORS | TB | 6 | AB1AB8M35 | SQUARE D |
| END BARRIERS | TB | 6 | AB1AC24 | SQUARE D |
| SELECTOR SWITCH 2 WAY | | 1 | ZB5AK1233 | SQUARE D |
| SELECTOR SWITCH 3 WAY MAINTAINED | | 1 | ZB5AK1333 | SQUARE D |
| SELECTOR SWITCH 3 WAY SPRING RETURN | | 3 | ZB5AK1733 | SQUARE D |
| PUSH BUTTON | | 1 | ZB5AA2 | SQUARE D |
| RED PILOT LIGHT | | 3 | ZB5AV043 | SQUARE D |
| E-STOP BUTTON | | 1 | ZB5AS54 | SQUARE D |
| MOUNTING LATCH | | 2 | ZB5AZ009 | SQUARE D |
| GREEN LED LIGHT 120VAC | | 5 | ZB5AVG3 | SQUARE D |
| RED LED LIGHT 120VAC | | 3 | ZB5AVG4 | SQUARE D |
| NORMALLY OPEN CONTACTS | | 16 | ZBE101 | SQUARE D |
| NORMALLY CLOSED CONTACT | | 1 | ZBE102 | SQUARE D |

| REV | DESCRIPTION | DATE | APPROVED |
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TITLE: MCP-100 BILL OF MATERIALS

SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

JOB NO. 13-189

| SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|
| NTS | B | I-1 | 3 OF 4 | A |

| ITEM | TAG | QTY | MODEL | MANUFACTURER |
|---|---|---|---|---|
| POWER PANEL (PP-100) | PP-101 | 1 | C-SD363612 | HOFFMAN |
| BACK PANEL | PP-101 | 1 | C-P3636 | HOFFMAN |
| MOUNTING FEET | PP-101 | 1 | CMFK | HOFFMAN |
| LOCKING HANDLE | PP-101 | 1 | CWHPTO | HOFFMAN |
| COOLING FAN | | 1 | A-4AXFN | HOFFMAN |
| FILTER | | 1 | A-FLT44 | HOFFMAN |
| TEMP SWITCH | TSTAT | 1 | A-TEMNO | HOFFMAN |
| RAIN HOODS | | 2 | 181020000012 | PFANNENBURG |
| NON-FUSIBLE DISCONNECT | MDS | 1 | OT100F3 | ABB |
| DISCONNECT SHAFT | MDS | 1 | OXS6X330 | ABB |
| DISCONNECT HANDLE | MDS | 1 | OHB65J6 | ABB |
| VFD 15HP 240VAC 3PH | VFD1, VFD2 | 2 | ATV312HD11M3 | SQUARE D |
| VFD KEYPAD | VFD1, VFD2 | 2 | VW3A1101 | SQUARE D |
| VFD MOUNTING BRACKET FOR KEYPAD | VFD1, VFD2 | 2 | VW3A1102 | SQUARE D |
| INTERFACE CABLE | VFD1, VFD2 | 2 | VW3A1104R30 | SQUARE D |
| 50 AMP CIRCUIT BREAKER (240VAC) | CB1, CB2 | 2 | QOU350 | SQUARE D |
| 15 AMP CIRCUIT BREAKER (240VAC) | CB3 | 1 | QOU315 | SQUARE D |
| 15 AMP CIRCUIT BREAKER (120VAC) | CB4, CB5 | 2 | QOU115 | SQUARE D |
| 20 AMP CIRCUIT BREAKER (120VAC) | CB6 | 1 | QOU120 | SQUARE D |
| 2 POLE RELAY | CR1 | 1 | RUMF2AB2F7 | SQUARE D |
| 2 POLE RELAY BASE | CR1 | 1 | RUZSF3M | SQUARE D |
| DISTRIBUTION BLOCK | DB | 1 | 9080LBA362104 | SQUARE D |
| DISTRIBUTION BLOCK | DB | 1 | 9080LBA162104 | SQUARE D |
| GROUND BAR | GB | 1 | PKA15GTA | SQUARE D |
| TERMINAL BLOCKS | TB | 24 | AB1VV235U | SQUARE D |
| END ANCHORS | TB | 6 | AB1AB8M35 | SQUARE D |
| END BARRIERS | TB | 2 | AB1AC24 | SQUARE D |
| MOTOR STARTER | M1 | 1 | LC1D09G7 | SQUARE D |
| OVERLOAD | OL1 | 1 | LRD07 | SQUARE D |

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| A | AS BUILT | 11-12-13 | EMB |

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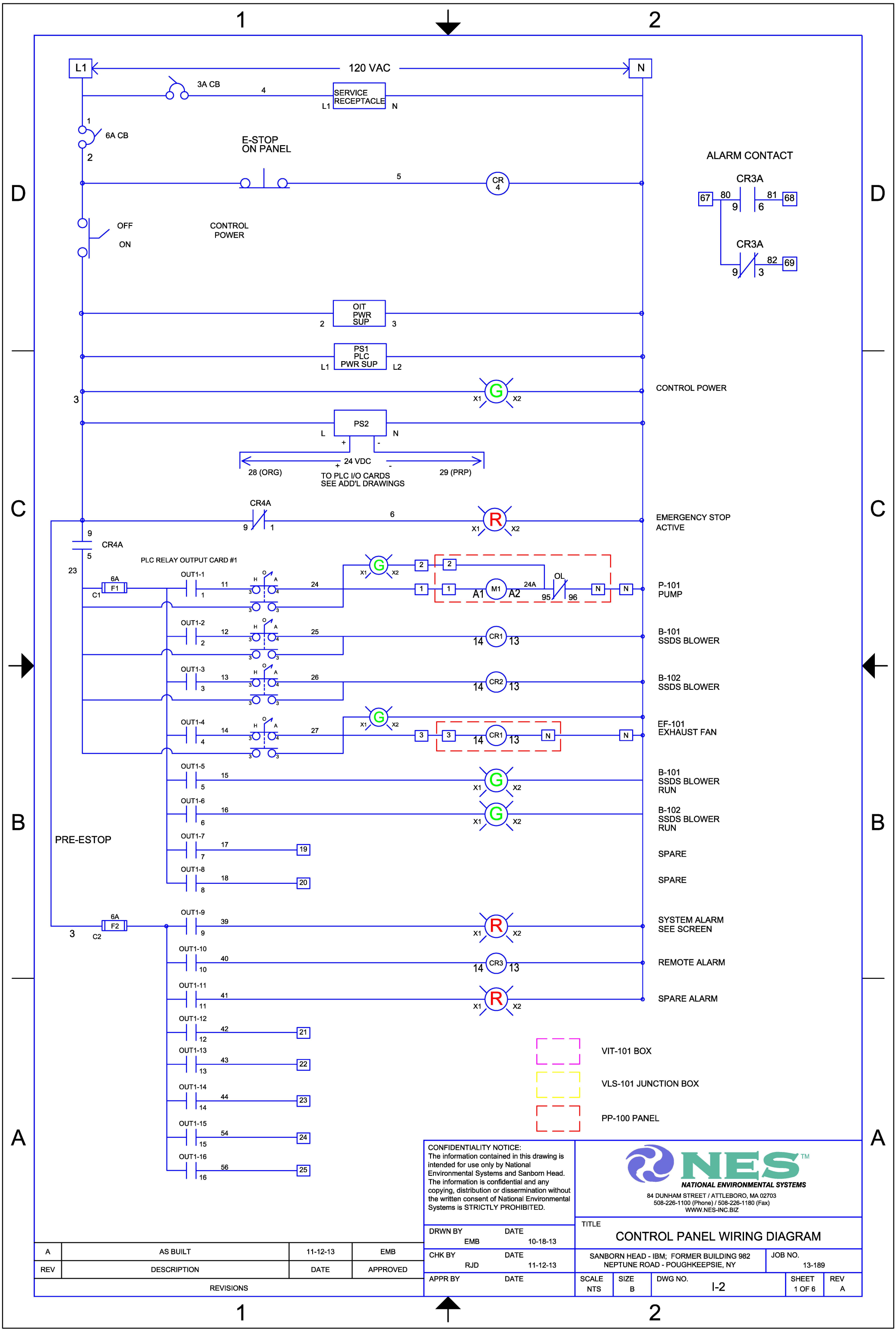
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TITLE
# PP-100 BILL OF MATERIALS

SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

JOB NO. 13-189

| SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|
| NTS | B | I-1 | 4 OF 4 | A |




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| DATE | 10-18-13 |
| CHK BY | RJD |
| DATE | 11-12-13 |
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| DATE | |

TITLE: CONTROL PANEL WIRING DIAGRAM

SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

JOB NO. 13-189

| SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|
| NTS | B | I-2 | 1 OF 6 | A |

# DC INPUT 1

INPUTS:
DI-0.1.1.1 THRU
DI-0.1.1.16

| | | | | | |
|---|---|---|---|---|---|
| | | | | C1 | |
| RESET | 31 | A | DI1A | BLK | 1 |
| VLS LOW LOW LEVEL | LLL-101 26 26 | | DI1A | RED | 2 |
| VLS LOW LEVEL | LSL-101 27 27 | | DI1A | GRN | 3 |
| VLS HIGH LEVEL | LSH-101 28 28 | | DI1A | WHT | 4 |
| | | | | C2 | |
| VLS HIGH HIGH LEVEL | LHH-101 29 29 | | DI1A | BLU | 5 |
| P-101 RUNNING | M1 AUX 18 18 | | DI1A | BRN | 6 |
| P-101 IN AUTO | 32 | B | DI1A | GRY | 7 |
| SECONDARY CONTAINMENT HIGH LEVEL | LSH-102 30 30 | | DI1A | YEL | 8 |
| | | | | C3 | |
| B-101 IN AUTO | 33 | C | DI1B | BLK | 9 |
| B-101 RUNNING | VFD1 7 7 | | DI1B | RED | 10 |
| B-101 FAULT | VFD1 8 8 | | DI1B | GRN | 11 |
| B-102 IN AUTO | 34 | D | DI1B | WHT | 12 |
| | | | | C4 | |
| B-102 RUNNING | VFD2 14 14 | | DI1B | BLU | 13 |
| B-102 FAULT | VFD1 15 15 | | DI1B | BRN | 14 |
| EMERGENCY STOP (ON=OK, OFF=PANIC) | CR4B | | DI1B | GRY | 15 |
| EF-101 IN AUTO | 35 | E | DI1B | YEL | 16 |

24 VDC

(-) PRP 29

(+) ORG 28

# DC INPUT 2

INPUTS:
DI-0.1.1.1 THRU
DI-0.1.1.16

| | | | | | |
|---|---|---|---|---|---|
| | | | | C1 | |
| EF-102 RUNNING | 66 | | DI2A | BLK | 1 |
| SPARE | 31 | | DI2A | RED | 2 |
| SPARE | 32 | | DI2A | GRN | 3 |
| SPARE | 33 | | DI2A | WHT | 4 |
| | | | | C2 | |
| SPARE | 34 | | DI2A | BLU | 5 |
| SPARE | 35 | | DI2A | BRN | 6 |
| SPARE | 36 | | DI2A | GRY | 7 |
| SPARE | 37 | | DI2A | YEL | 8 |
| | | | | C3 | |
| SPARE | 38 | | DI2B | BLK | 9 |
| SPARE | 39 | | | RED | 10 |
| SPARE | 40 | | | GRN | 11 |
| SPARE | 41 | | | WHT | 12 |
| | | | | C4 | |
| SPARE | 42 | | | BLU | 13 |
| SPARE | 43 | | | BRN | 14 |
| SPARE | 44 | | | GRY | 15 |
| SPARE | 45 | | | YEL | 16 |

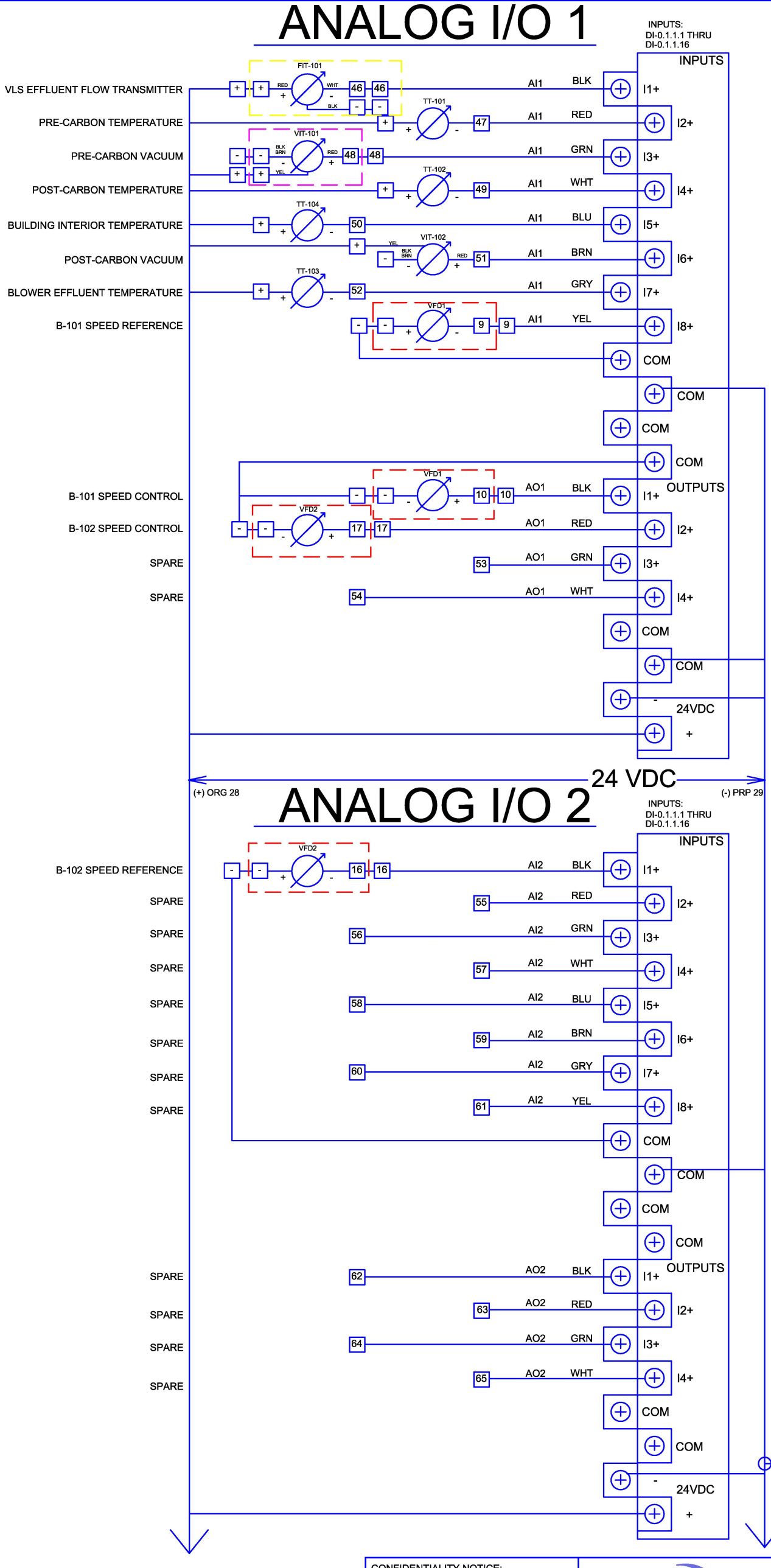
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|---|---|---|---|---|---|---|
| DRWN BY | DATE | TITLE | | | | |
| EMB | 10-18-13 | CONTROL PANEL WIRING DIAGRAM | | | | |
| CHK BY | DATE | SANBORN HEAD - IBM; FORMER BUILDING 982<br>NEPTUNE ROAD - POUGHKEEPSIE, NY | | | JOB NO. | |
| RJD | 11-12-13 | | | | 13-189 | |
| APPR BY | DATE | SCALE | SIZE | DWG NO. | SHEET | REV |
| | | NTS | B | I-2 | 2 OF 6 | A |

# ANALOG I/O 1




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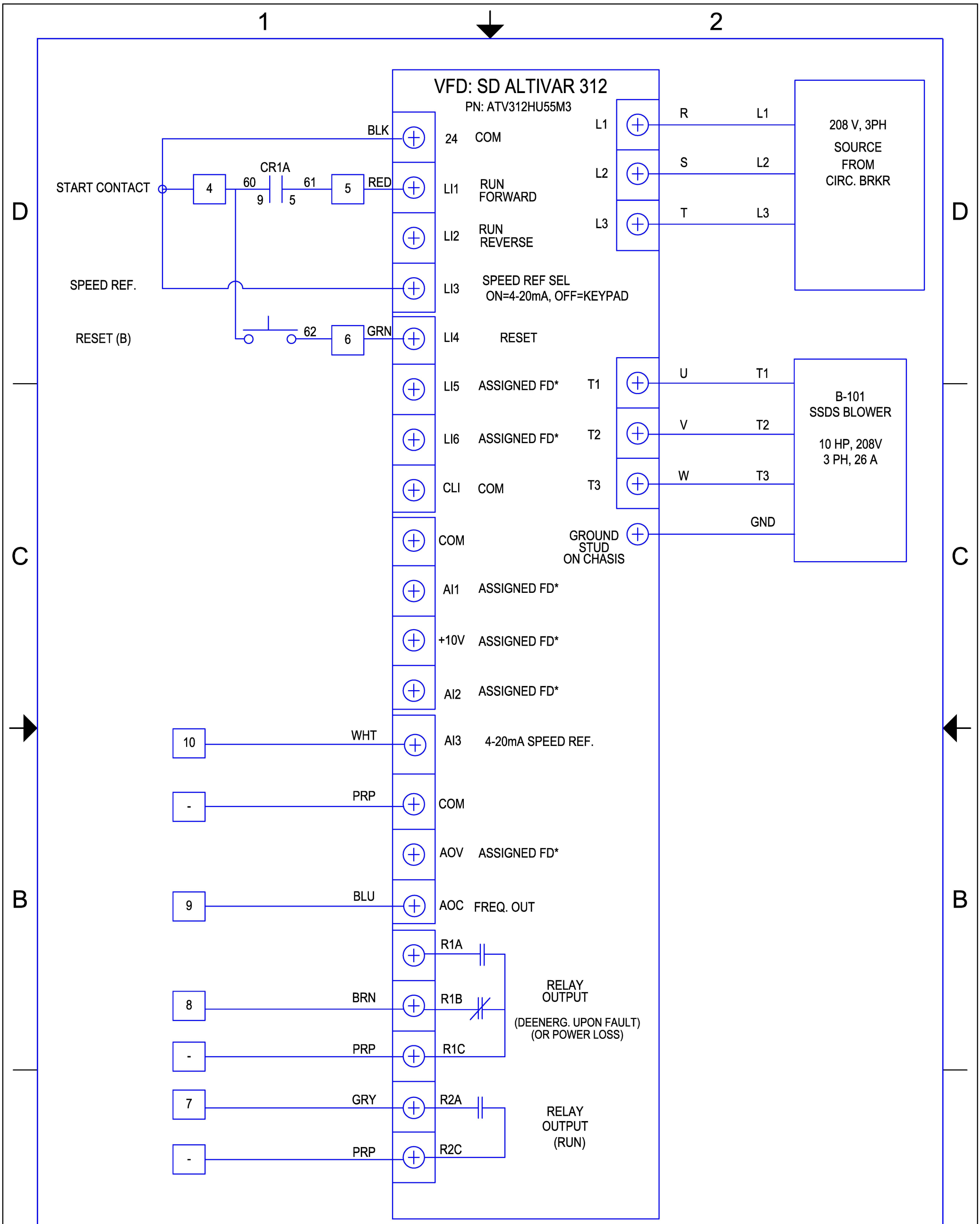
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TITLE
# CONTROL PANEL WIRING DIAGRAM

SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

JOB NO. 13-189

| SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|
| NTS | B | I-2 | 3 OF 6 | A |




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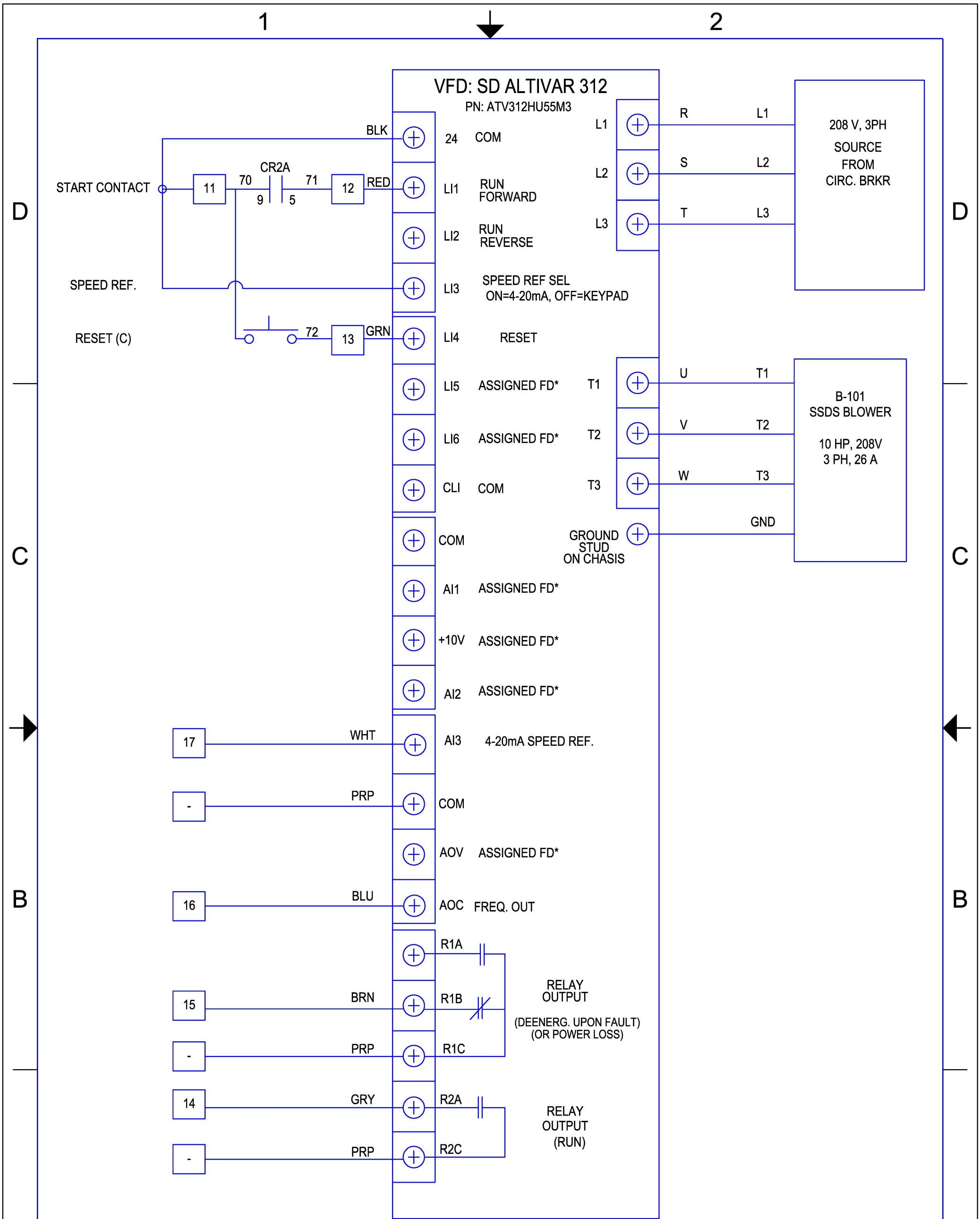
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| DATE | 10-18-13 |
| CHK BY | RJD |
| DATE | 11-12-13 |
| APPR BY | |
| DATE | |

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TITLE
# CONTROL PANEL WIRING DIAGRAM

SANBORN HEAD - IBM; FORMER BUILDING 982
NEPTUNE ROAD - POUGHKEEPSIE, NY

| JOB NO. | SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|---|
| 13-189 | NTS | B | I-2 | 4 OF 6 | A |



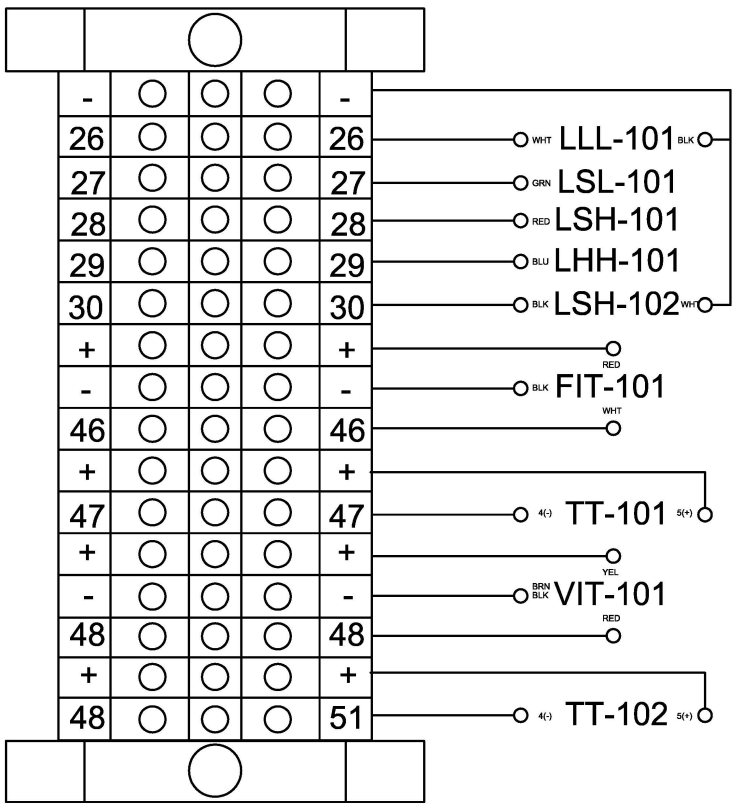

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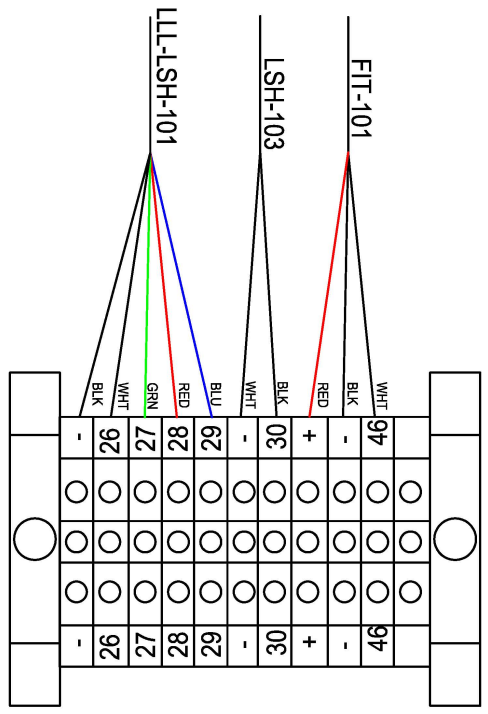
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|---|---|---|---|
| DRWN BY | DATE | TITLE | |
| EMB | 10-18-13 | CONTROL PANEL WIRING DIAGRAM | |
| CHK BY | DATE | SANBORN HEAD - IBM; FORMER BUILDING 982 NEPTUNE ROAD - POUGHKEEPSIE, NY | JOB NO. 13-189 |
| APPR BY | DATE | SCALE NTS / SIZE B / DWG NO. I-2 | SHEET 5 OF 6 / REV A |

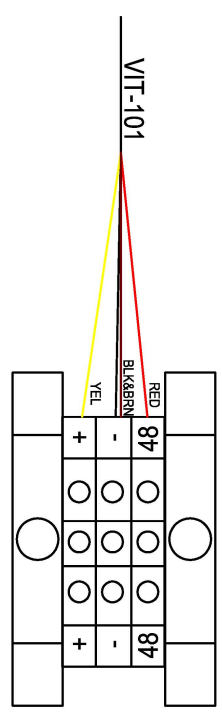
## FIELD INSTALL TERMINAL CONNECTIONS




## FIELD INSTALL TERMINAL CONNECTIONS
## VLS-101 SKID




## FIELD INSTALL TERMINAL CONNECTIONS
## VIT-101




NOTES:

1. SKID VLS-101 HAS A JUNCTION BOX FOR REMOTE SIGNAL/INSTRUMENT WIRING.
   - REFER TO JUNCTION BOX INSIDE COVER FOR TERMINAL CONNECTIONS DIAGRAM.
2. VIT-101 HAS TERMINALS INSIDE FOR CONNECTION WITH CORRESPONDING NUMBERS.
3. TT-101 AND TT-102 CONNECTIONS ARE 4(-) 5(+)

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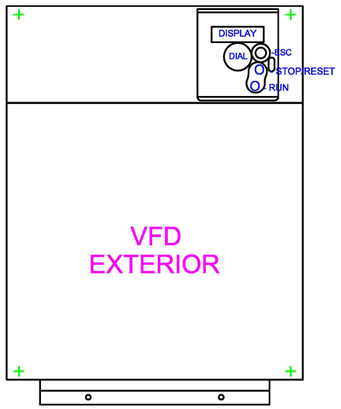
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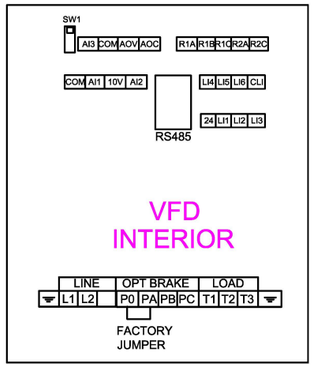
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NEPTUNE ROAD - POUGHKEEPSIE, NY

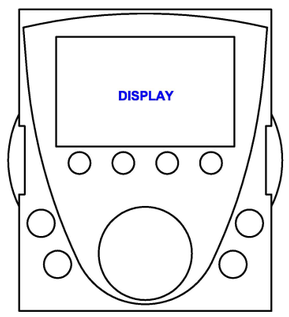
| JOB NO. | SCALE | SIZE | DWG NO. | SHEET | REV |
|---|---|---|---|---|---|
| 13-189 | NTS | B | I-2 | 6 OF 6 | A |

# SQUARE D / SCHNEIDER ELECTRIC ATV 312 SERIES VFD
# PROGRAMMING & OPERATION DRAWING

INTEGRAL KEYPAD




**PROGRAMMING VIA INTEGRAL VFD KEYPAD**

**DANGER**

- HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH READ AND UNDERSTAND THE ATV START GUIDE BEFORE PERFORMING ANY PROCEDURE WITH THIS DRIVE.
- THE USER IS RESPONSIBLE FOR COMPLIANCE WITH ALL INTERNATIONAL AND NATIONAL ELECTRICAL CODE REQUIREMENTS WITH RESPECT TO GROUNDING OF ALL EQUIPMENT.
- MANY PARTS OF THIS DRIVE, INCLUDING THE PRINTED CIRCUIT BOARDS, OPERATE AT THE LINE VOLTAGE. DO NOT TOUCH.
- USE ONLY ELECTRICALLY INSULATED TOOLS.
- DO NOT TOUCH UNSHIELDED COMPONENTS OR TERMINAL STRIP SCREW CONNECTIONS WITH VOLTAGE PRESENT.

1. TURN DIAL TO SET
2. PRESS DIAL TO SELECT MENU
3. PRESS DIAL TO SELECT SUB-MENU
4. TURN DIAL TO PARAMETER SELECTIONS (BLINKS)
5. PRESS DIAL TO SAVE PARAMETER (BLINKS)

**VFD INTERIOR**

1. SEE WARNINGS ABOVE
2. RS485 - REMOTE KEYPAD CONNECTION
3. LI3 - DISCONNECT TO DISABLE HMI / OIT VFD CONTROL

**REMOTE KEYPAD MONITORING**

1. TURN DIAL TO SET
2. PRESS DIAL TO SELECT MENU
3. PRESS DIAL TO SELECT SUB-MENU
4. TURN DIAL TO PARAMETER SELECTIONS (BLINKS)
5. PRESS DIAL TO SAVE PARAMETER (BLINKS)

**TABLE 3 - VFD CONFIGURATION (NES 13-189)**

1. NES CONFIGURATION - OPERATOR INTERFACE TERMINAL (OIT/HMI) CONTROLS VFD OPERATION
2. SELECT "ANALOG SETPOINTS" SCREEN ON OIT/HMI
3. SELECT BLOWER (B-xxx), ENTER VALUE BETWEEN 30-60HZ

**SETPOINTS LOADED BY NES - VIA VFD INTEGRAL KEYPAD**

| MENU | SUBMENU | PARAMETER CODE | DESCRIPTION | VFD SETTINGS (B-101) | VFD SETTINGS (B-102) |
|---|---|---|---|---|---|
| FUn | StC | Stt | STOP CONTROL (nST = COAST) | nST | nST |
| IO | | A0lt | SET MINIMUM OUTPUT CURRENT TO 40mA | 4A | 4A |
| IO | | d0 | SET OUTPUT CURRENT TO FREQUENCY OUT | 0Fr | 0Fr |
| IO | | r2 | SETS RELAY 2 TO RUN | rUn | rUn |
| dRc | | bFr | MOTOR NAMEPLATE FREQUENCY | 60 (HZ) | 60 (HZ) |
| dRc | | FrS | MAXIMUM ALLOWED OUTPUT FREQUENCY | 60 (HZ) | 60 (HZ) |
| SEt | | LSP | MINIMUM OUTPUT FREQUENCY | 30 (HZ) | 30 (HZ) |
| SEt | | HSP | MAXIMUM OUTPUT FREQUENCY | bFr(=60 (HZ)) | bFr(=60 (HZ)) |
| CtL | | LAC | SET USER LEVEL ACCESS | L2 | L2 |
| CtL | | Fr1 | SETS FREQ. (SPEED) REF. 1 (KEYPAD) | A1U1 | A1U1 |
| CtL | | Fr2 | SETS FREQ. (SPEED) REF. 2 (OIT, 4-20Ma) | Ai2 | Ai2 |
| CtL | | rFC | SET SPEED REFERENCE SELECTION TO LI3 | LI3 | LI3 |
| FUn | SAI | SA2 | DISABLE SUMMING INPUTS | n0 | n0 |
| FUn | PSS | PS2 | DISABLE FACTORY SPEED REFERENCE ASSIGNMENT | n0 | n0 |
| FUn | PSS | PS4 | DISABLE FACTORY SPEED REFERENCE ASSIGNMENT | n0 | n0 |
| FLt | | 0PL | OUTPUT PHASE LOSS FAULT | yES | yES |
| FLt | | IPL | INPUT PHASE LOSS FAULT | yES | yES |
| IO | | tCt | START AFTER POWER CYCLED (WHEN = LEL) | LEL | LEL |
| IO | | SCS | STORE CONFIGURATION FOR RECALL | YES (STR1) | YES (STR1) |
| dRc | | tFr | ANALOG OUTPUT MAXIMUM FREQUENCY | 60 (HZ) | 60 (HZ) |
| FUn | rPC | ACC | ACCELERATION TIME (RAMP UP) | 5 SEC | 5 SEC |
| SEt | | itH | MOTOR FULL LOAD (OVER-CURRENT PROTECTION) | 26 (AMPS) | 26 (AMPS) |
| CtL | | ChcF | SPEED REFERENCE & START/STOP SIGNALS (=SEP) | SEP | SEP |

PLEASE NOTE: PARAMETERS NOT LISTED REMAIN AT FACTORY DEFAULT

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| A | AS BUILT | 11-12-13 | EMB |

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| | | | |
|---|---|---|---|
| DRWN BY: RJD | DATE: 11-07-13 | TITLE: SQUARE D / SCHNEIDER ELECTRIC ATV 312 | |
| CHK BY: KWB | DATE: 11-12-13 | SANBORN HEAD - IBM; FORMER BUILDING 982 NEPTUNE ROAD - POUGHKEEPSIE, NY | JOB NO.: 13-189 |
| APPR BY: | DATE: | SCALE: NTS / SIZE: B / DWG NO.: I-3 | SHEET: 1 OF 1 / REV: A |

| TABLE 3 - VFD CONFIGURATION (NES 13-189) | | | | | |
|---|---|---|---|---|---|
| | 1. NES CONFIGURATION - OPERATOR INTERFACE TERMINAL (OIT/HMI) CONTROLS VFD OPERATION | | | | |
| | 2. SELECT "ANALOG SETPOINTS" SCREEN ON OIT/HMI | | | | |
| | 3. SELECT BLOWER (B-xxx), ENTER VALUE BETWEEN 30-60HZ | | | | |
| | | | | | |
| **SETPOINTS LOADED BY NES - VIA VFD INTEGRAL KEYPAD** | | | | | |
| **MENU** | **SUBMENU** | **PARAMETER CODE** | **DESCRIPTION** | **VFD SETTINGS (B-101)** | **VFD SETTINGS (B-102)** |
| FUn | StC | Stt | STOP CONTROL (nST = COAST) | nST | nST |
| IO | | A0lt | SET MINIMUM OUTPUT CURRENT TO 40mA | 4A | 4A |
| IO | | d0 | SET OUTPUT CURRENT TO FREQUENCY OUT | 0Fr | 0Fr |
| IO | | r2 | SETS RELAY 2 TO RUN | rUn | rUn |
| dRc | | bFr | MOTOR NAMEPLATE FREQUENCY | 60 (HZ) | 60 (HZ) |
| dRc | | FrS | MAXIMUM ALLOWED OUTPUT FREQUENCY | 60 (HZ) | 60 (HZ) |
| SEt | | LSP | MINIMUM OUTPUT FREQUENCY | 30 (HZ) | 30 (HZ) |
| SEt | | HSP | MAXIMUM OUTPUT FREQUENCY | bFr(=60 (HZ)) | bFr(=60 (HZ)) |
| CtL | | LAC | SET USER LEVEL ACCESS | L2 | L2 |
| CtL | | Fr1 | SETS FREQ. (SPEED) REF. 1 (KEYPAD) | A1U1 | A1U1 |
| CtL | | Fr2 | SETS FREQ. (SPEED) REF. 2 (OIT, 4-20Ma) | Ai2 | Ai2 |
| CtL | | rFC | SET SPEED REFERENCE SELECTION TO LI3 | LI3 | LI3 |
| FUn | SAI | SA2 | DISABLE SUMMING INPUTS | n0 | n0 |
| FUn | PSS | PS2 | DISABLE FACTORY SPEED REFERENCE ASSIGNMENT | n0 | n0 |
| FUn | PSS | PS4 | DISABLE FACTORY SPEED REFERENCE ASSIGNMENT | n0 | n0 |
| FLt | | 0PL | OUTPUT PHASE LOSS FAULT | yES | yES |
| FLt | | IPL | INPUT PHASE LOSS FAULT | yES | yES |
| IO | | tCt | START AFTER POWER CYCLED (WHEN = LEL) | LEL | LEL |
| IO | | SCS | STORE CONFIGURATION FOR RECALL | YES (STR1) | YES (STR1) |
| dRc | | tFr | ANALOG OUTPUT MAXIMUM FREQUENCY | 60 (HZ) | 60 (HZ) |
| FUn | rPC | ACC | ACCELERATION TIME (RAMP UP) | 5 SEC | 5 SEC |
| SEt | | itH | MOTOR FULL LOAD (OVER-CURRENT PROTECTION) | 26 (AMPS) | 26 (AMPS) |
| CtL | | ChcF | SPEED REFERENCE & START/STOP SIGNALS (=SEP) | SEP | SEP |
| PLEASE NOTE: PARAMETERS NOT LISTED REMAIN AT FACTORY DEFAULT | | | | | |

**TABLE 2**
**NES 13-189, REVISION A - INTERLOCK SCHEDULE**
Sub-Slab Depressurization System Skid
Former Bldg. 982 - Neptune Road Poughkeepsie, NY

| Interlock | Interlock ID | Interlock Description | SSDS Blower B-101 | SSDS Blower B-102 | VLS Transfer Pump, P-101 | Effluent Fan, EF-101 | OPERATOR INTERFACE (HMI) | HMI Adjustable Set Point | WARNING (HMI Screen Display) | ALARM (HMI Screen Display) | Manual Reset (Alarm / Warning) | Remote Warning Notification | Remote Alarm Notification | IBM Remote Notification (Dry Contact Output) | Event Log | DATA LOG ( 60 Minutes) | INSTRUMENT TYPE | Digital Input tp PLC | Analog Input to PLC 4-20mA | Analog Output from PLC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Emergency Stop | O | O | O | O | | | | Y | Y | | Y | Y | Y | | | Y | | |
| 1 | FIT-101 | Flow Transmitter (VLS Pump Out) | | | | | | | | | | | | | | Y * | | | Y | |
| 2 | LHH-101 | VLS High High Level Switch | O | O | | | | | | Y | Y | | Y | Y | Y | | | Y | | |
| 3 | LSH-101 | VLS High Level Switch | | | I | | | | Y | | Y | Y | | Y | Y | | | Y | | |
| 4 | LSL-101 | VLS Low Level Switch | | | O | | | | | | | | | | Y | | | Y | | |
| 5 | LLL-101 | VLS Low Low Level Switch | | | O | | | | | | | | | | Y | | | Y | | |
| 6 | LSH-102 | VLS Secondary Containment High Switch | O | O | O | | | | | Y | Y | | Y | Y | Y | | | Y | | |
| 7 | TT-101 | Pre Carbon Temperature Transmitter | | | | | | | | | | | | | | Y | | | Y | |
| 8 | TT-102 | Post Carbon Temperature Transmitter | | | | | | | | | | | | | | Y | | | Y | |
| 9 | TT-103 | B-101/102 Combined Vapor Effluent Temperature Transmitter | O | O | | | | Y | | Y | Y | | Y | Y | Y | Y | | | Y | |
| 10 | TT-104 | Ambient Temperature Transmitter (High room temp) | O | O | | | | Y | | Y | Y | | Y | Y | Y | | | | Y | |
| 11 | TT-104 | Ambient Temperature Transmitter (Low room temp) | | | | | | Y | Y | | Y | Y | | Y | Y | | | | Y | |
| 12 | TT-104 | Ambient Temperature Transmitter (EF On) | | | | I | | Y | | | | | | | | | | | Y | |
| 13 | TT-104 | Ambient Temperature Transmitter (EF Off) | | | | O | | Y | | | | | | | | | | | Y | |
| 14 | VIT-101 | Pre Carbon Vacuum Transmitter (LOW ~10iwc VAC) | | | | | | Y | Y | | Y | Y | | Y | Y | Y | | | Y | |
| 15 | VIT-102 | Post Carbon Vacuum Transmitter (HIGH ~80iwc VAC) | O | O | | | | Y | | Y | Y | | Y | Y | Y | Y | | | Y | |
| 16 | | B-101 VFD FAULT | O | | | | | | | Y | Y | | Y | Y | Y | | | Y | | |
| 17 | | B-102 VFD FAULT | | O | | | | | | Y | Y | | Y | Y | Y | | | Y | | |
| 18 | | B-101 VFD SPEED SETTING | | | | | | Y | | | | | | | | | | | | Y |
| 19 | | B-101 VFD SPEED SETTING | | | | | | Y | | | | | | | | | | | | Y |
| 20 | TT-102 - TT-101 | High Carbon Differential Temperature | O | O | | | | Y | | Y | Y | | Y | Y | Y | | | | Y | |
| 21 | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | |
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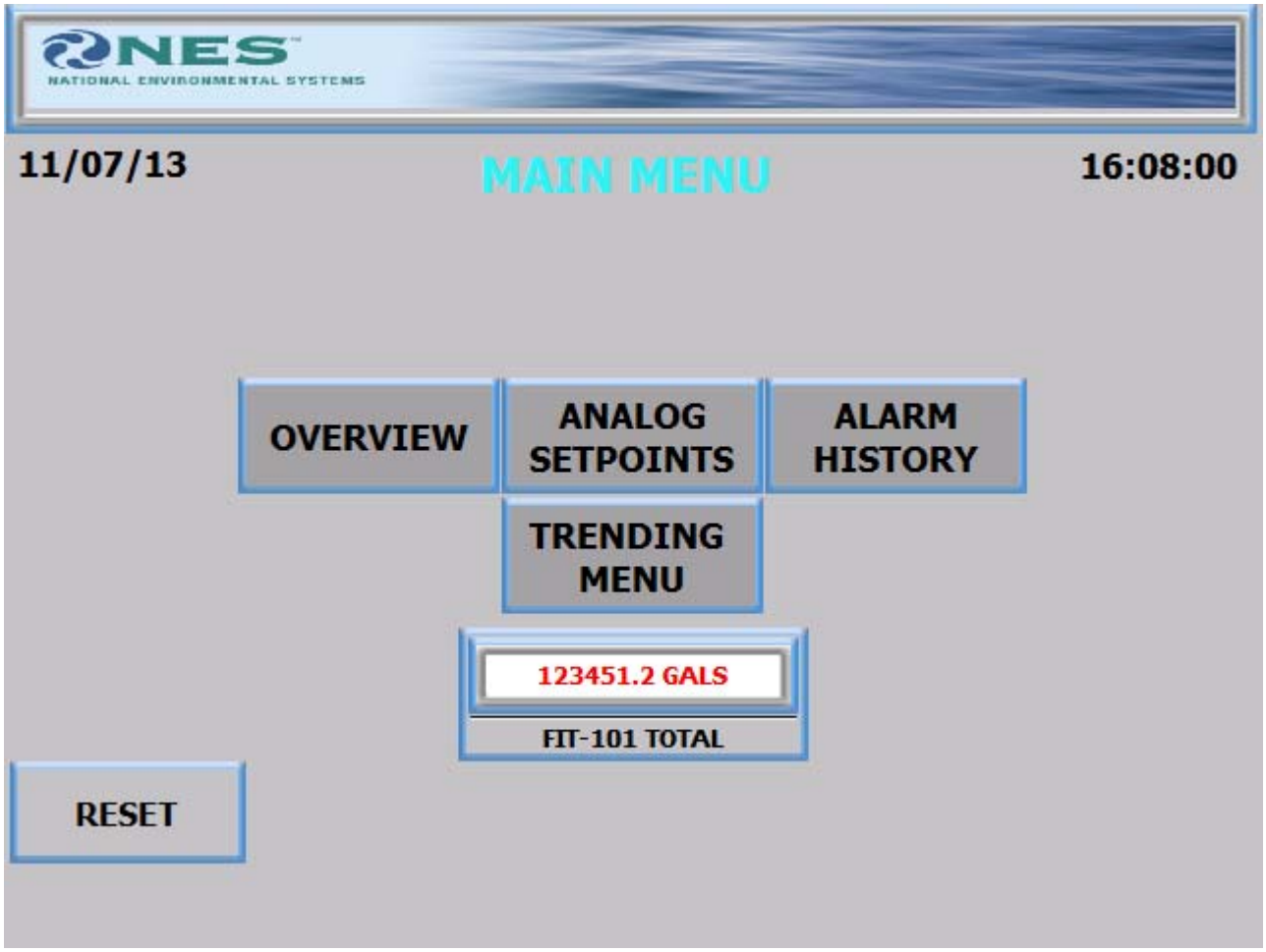
Note:

O - Off
I - On
Y - Yes
N - No
* Instantaneous & Total

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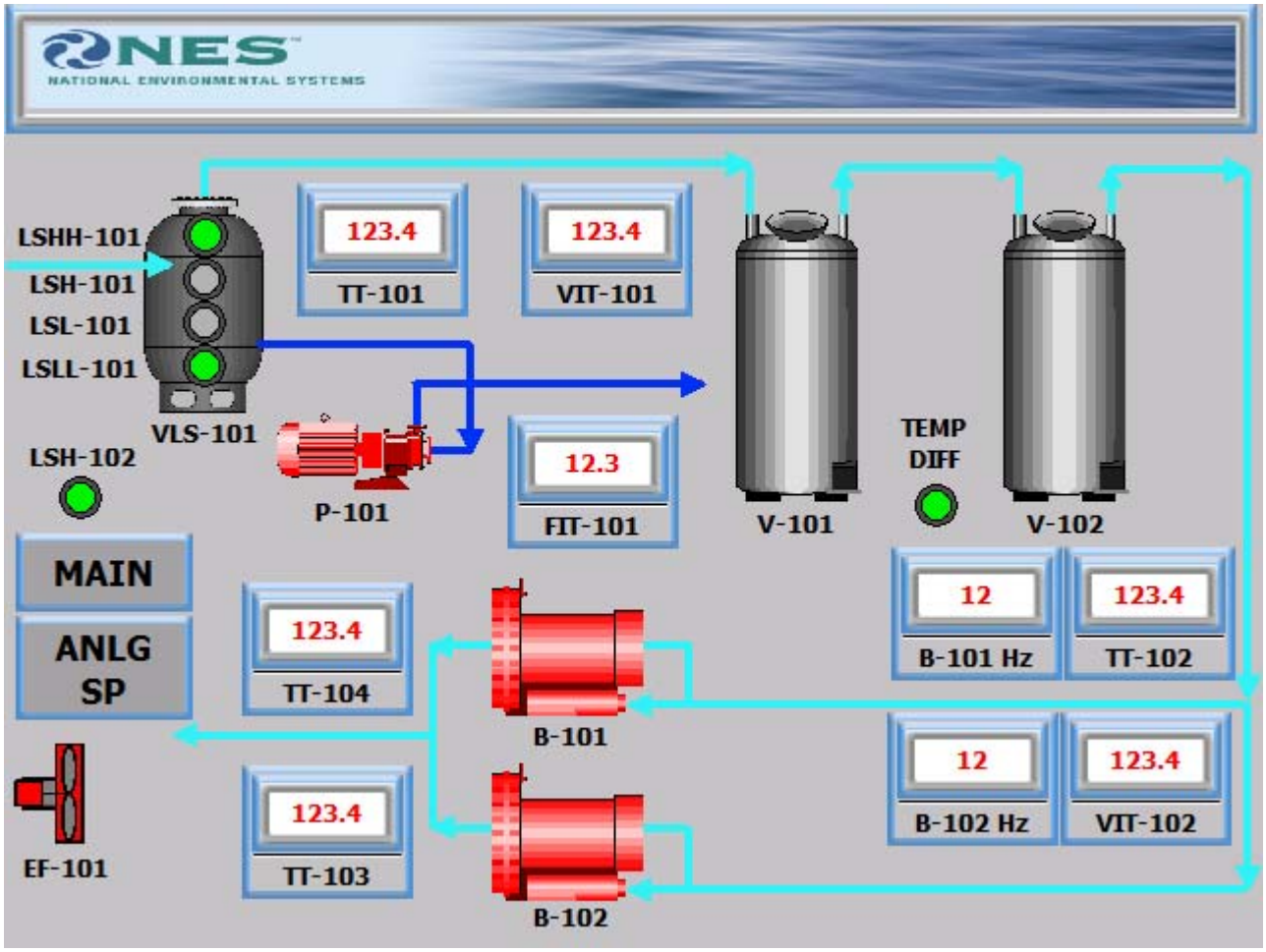
# OIT SCREEN SUMMARY




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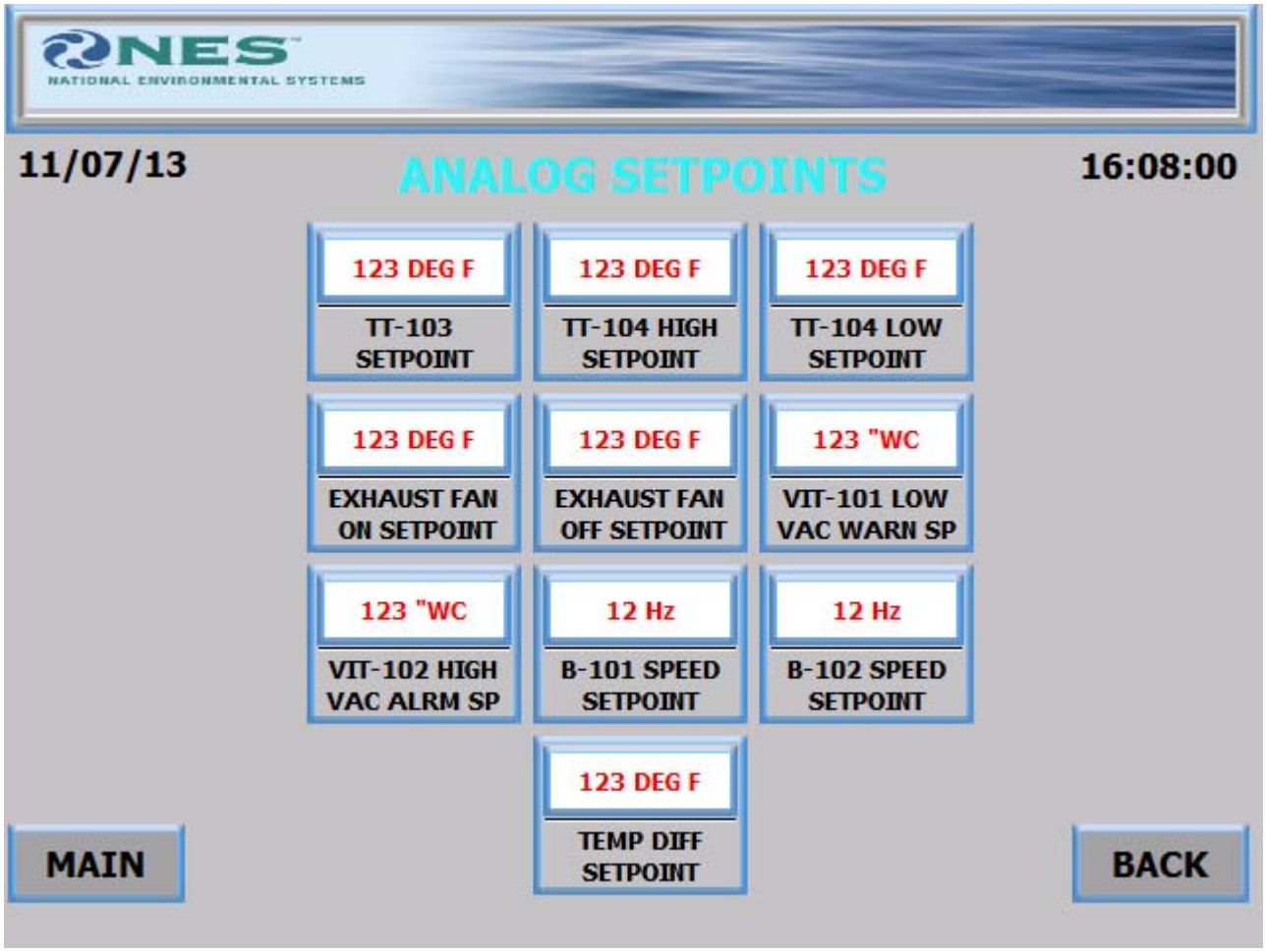
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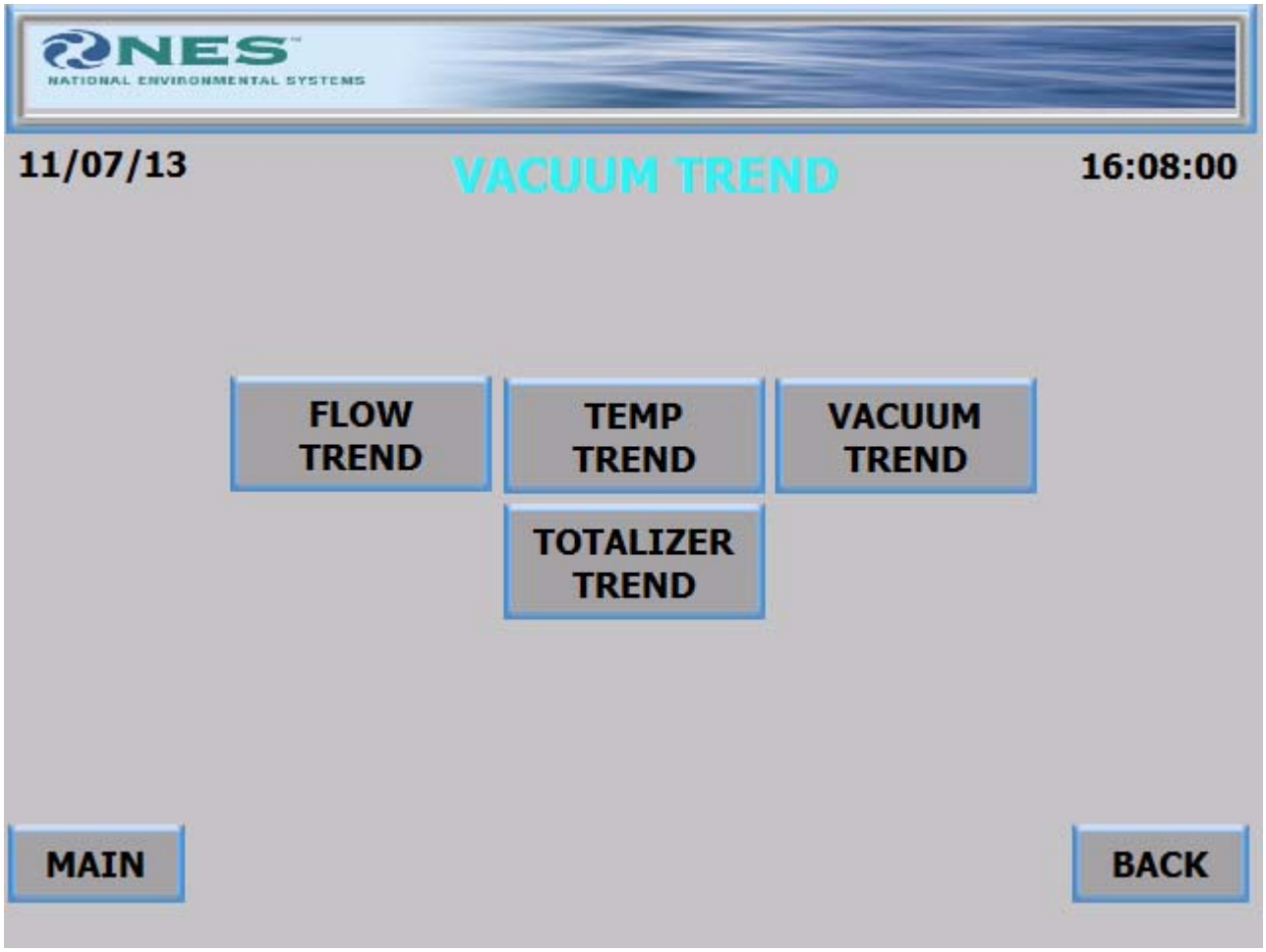
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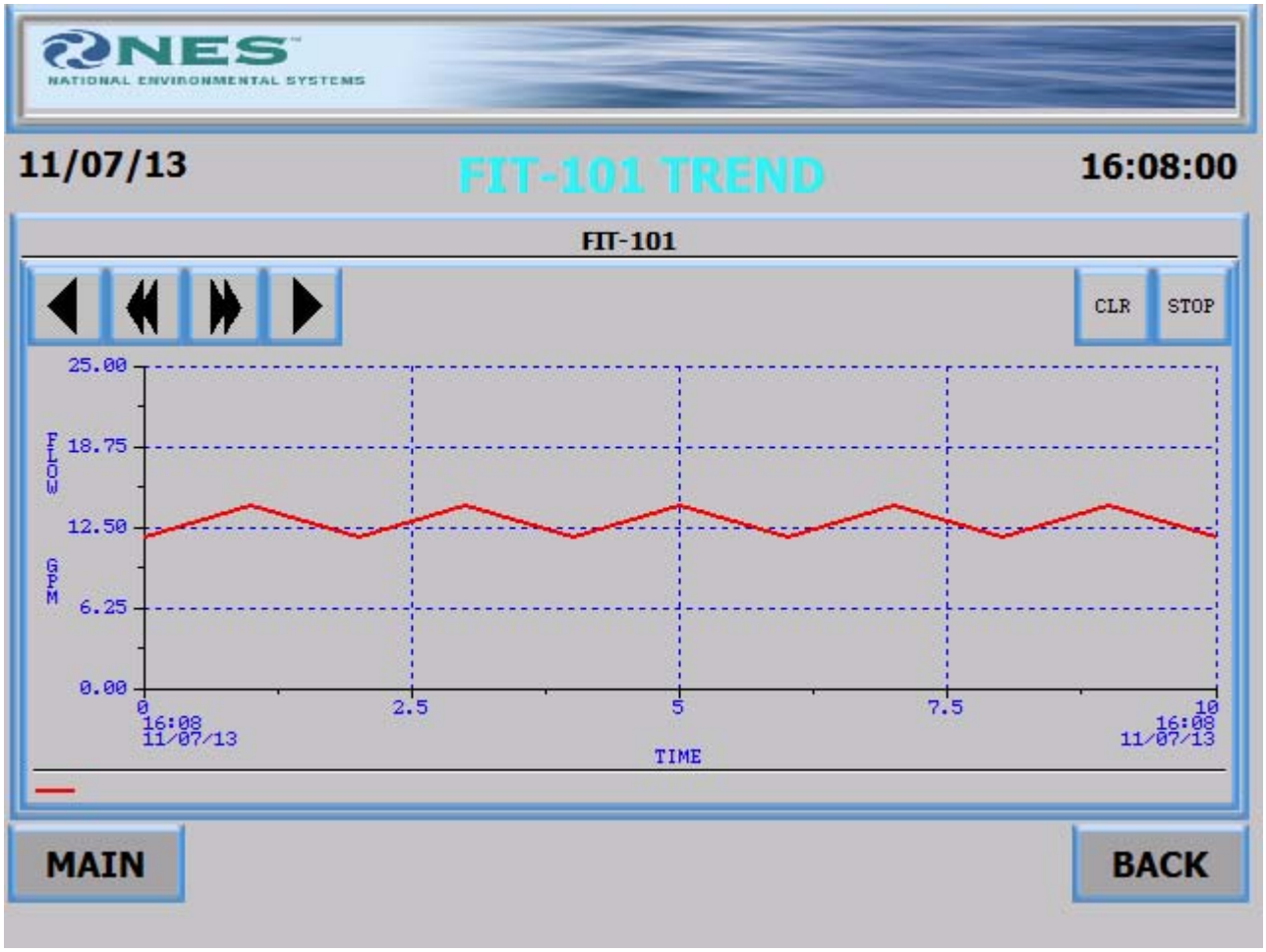
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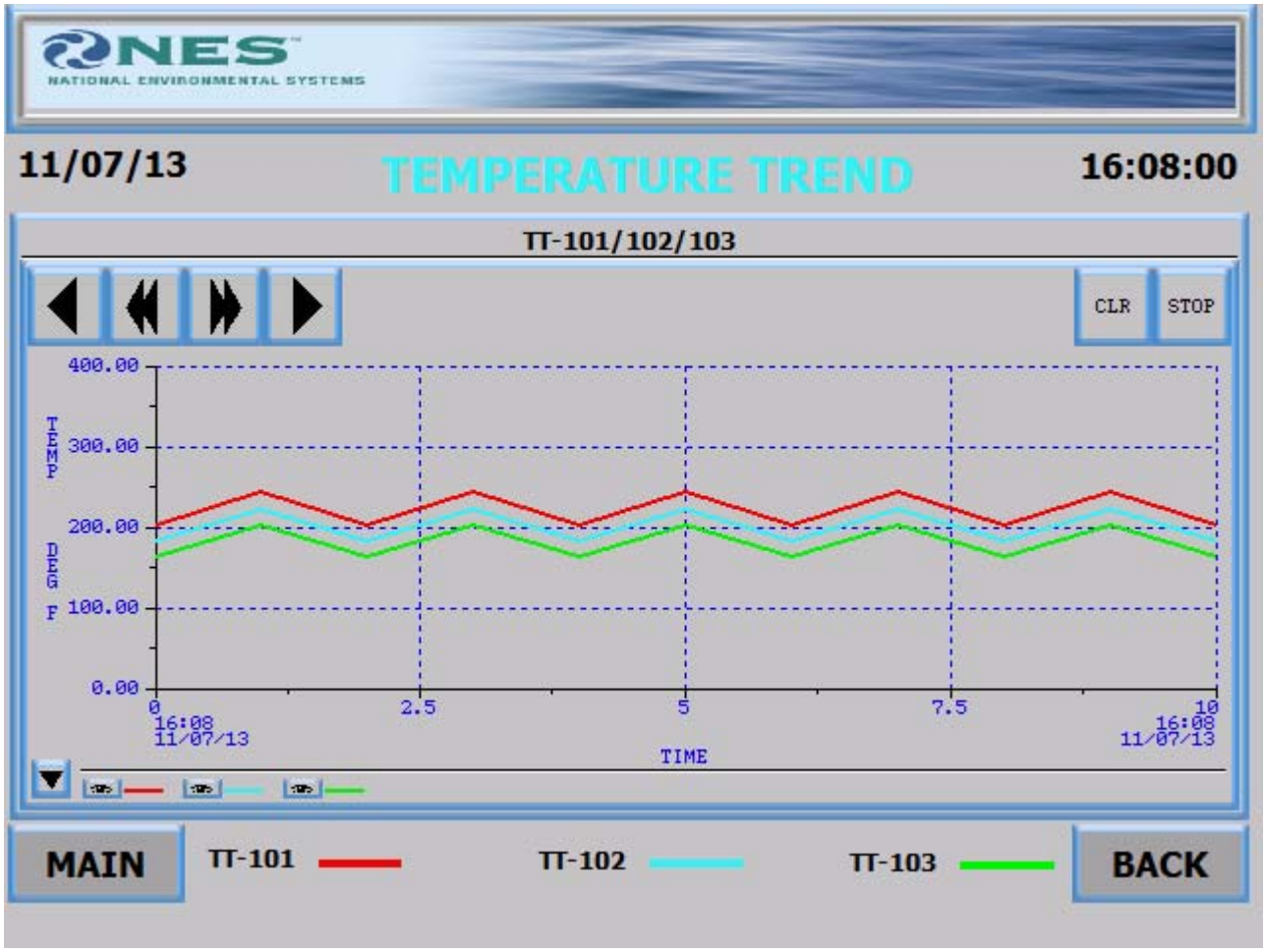
# OIT SCREEN SUMMARY




Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz

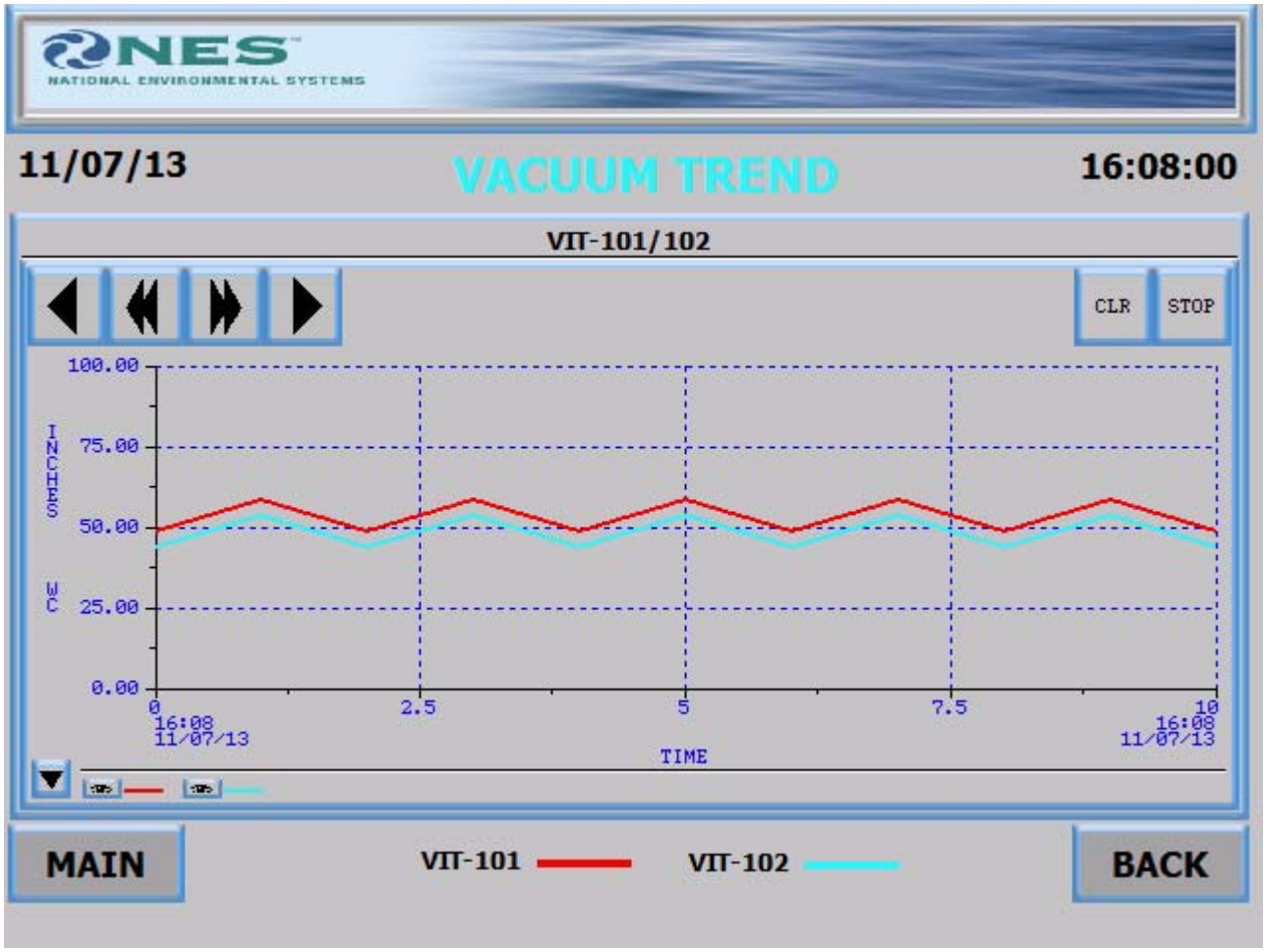
**NES Project: 13-189**
**Sanborn Head – IBM Neptune Rd; Poughkeepsie, NY**

# OIT SCREEN SUMMARY



**NES Project: 13-189**
**Sanborn Head – IBM Neptune Rd; Poughkeepsie, NY**

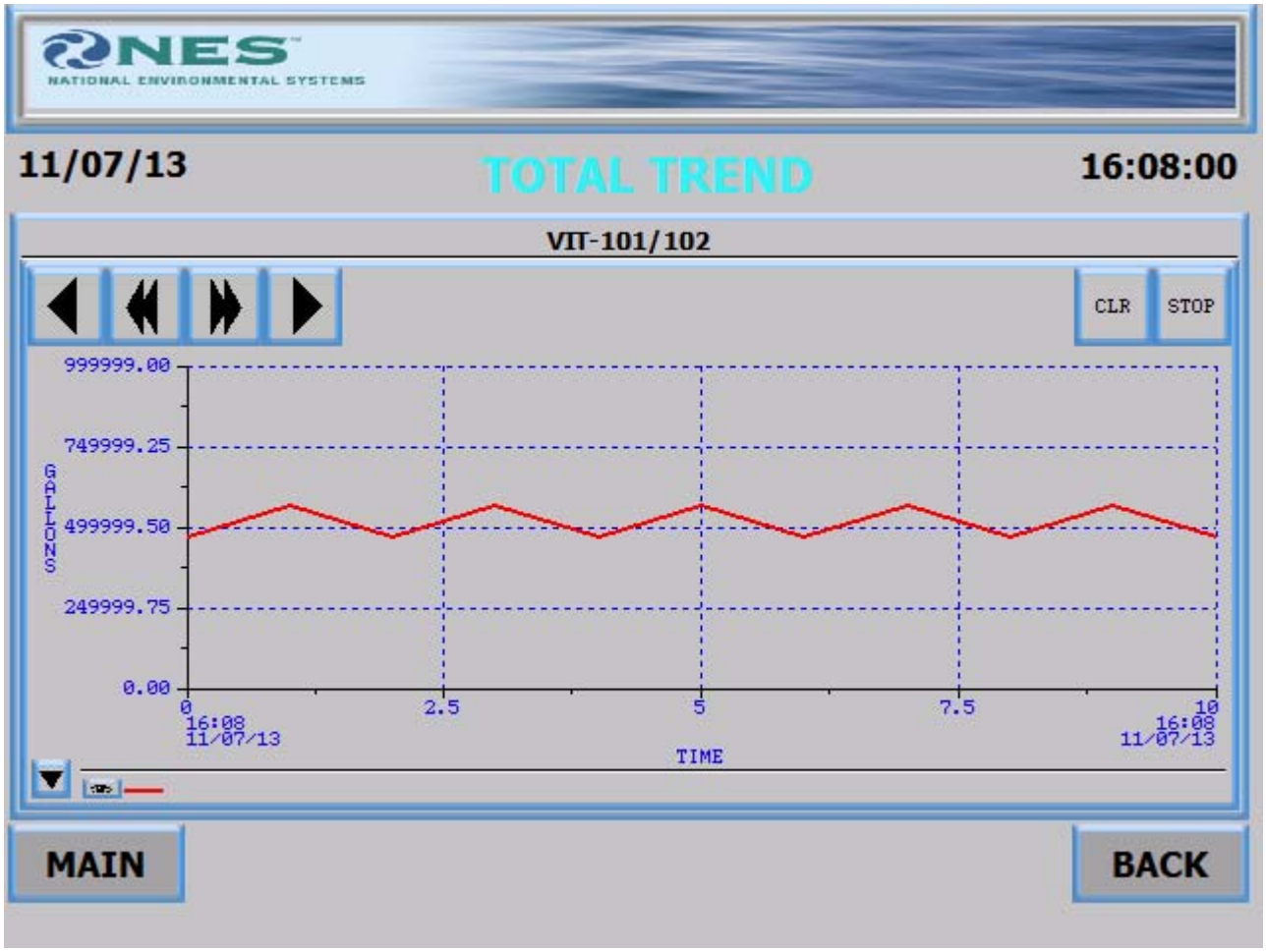
# OIT SCREEN SUMMARY




Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
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**NES Project: 13-189**
**Sanborn Head – IBM Neptune Rd; Poughkeepsie, NY**

# OIT SCREEN SUMMARY




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## CONCEPT™, TYPE 4 AND 12



### INDUSTRY STANDARDS

*Wall-mounting brackets required to maintain UL/CSA external mounting requirement.*

**CONCEPT solid single-door, door with window and flush-mount models**

| |
|---|
| UL 508A Listed; Type 4, 12; File No. E61997<br>cUL Listed per CSA C22.2 No. 94; Type 4, 12; File No. E61997 |

NEMA/EEMAC Type 4, 12, 13
CSA, File No. 42186: Type 4, 12
VDE IP66
IEC 60529, IP66

**CONCEPT two-door models**

| |
|---|
| UL 508A Listed; Type 12; File No. E61997<br>cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997 |

NEMA/EEMAC Type 12
CSA, File No. 42186, Type 12
VDE IP 55
IEC 60529, IP55

### APPLICATION

CONCEPT™ Enclosures are ideal for machine control applications. With streamlined styling, flush quarter-turn latches and an attractive, durable finish. Available in solid or window single-door and two-door landscape, flush-mount and sloped-top versions for application and mounting flexibility. Two-door landscape models provide full-width access and easy panel installation.

### SPECIFICATIONS

- 14, 16 or 18 gauge steel (see table)
- Seams continuously welded and ground smooth
- Corner-formed doors
- Simple easy-to-remove and install hinge pins with built-in captivation clip
- High-torque threadless studs and fasteners on door
- Minimum-width body flange provides maximum door opening (210 degrees)
- External formed body flange
- Panel mounting studs fit optional CONCEPT panels and other accessories
- Mounting holes in back of body for optional external wall-mount brackets
- Hidden hinges
- Doors are interchangeable and easily removed by pulling clip-style hinge pins
- Seamless foam-in-place gasket
- Quarter-turn slotted latch(es)
- Door alignment device on doors wider than 30 in.
- Four hinges on 60-in.-high enclosures
- Grounding stud on body; bonding provision on door (except window-door models)
- Provisions for thermoplastic data pocket (right-hand hinged door on two-door models)
- Hardware kit with panel mounting nuts, panel grounding hardware and sealing washers
- Single-door enclosures have a three-point latch system on enclosures where A is equal to or greater than 42-in. with quarter-turn, slotted latch
- Window-door enclosures have a clear polycarbonate window flush with door surface
- Mounting frame on flush-mount enclosures extends completely around enclosure
- Two-door enclosures have a overlapping door design which provides full-width access
- Two door enclosures have a three-point latch system on right-hand hinged door furnished with flush slotted insert
- Illustrated instruction sheet

### FINISH

Two standard finishes are available: ANSI 61 gray or RAL 7035 textured light-gray polyester powder paint inside and out.

### ACCESSORIES

Door Stop Kit
Handles
Lock Inserts
CONCEPT™ Panels
Mounting-Bracket Kits

### MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

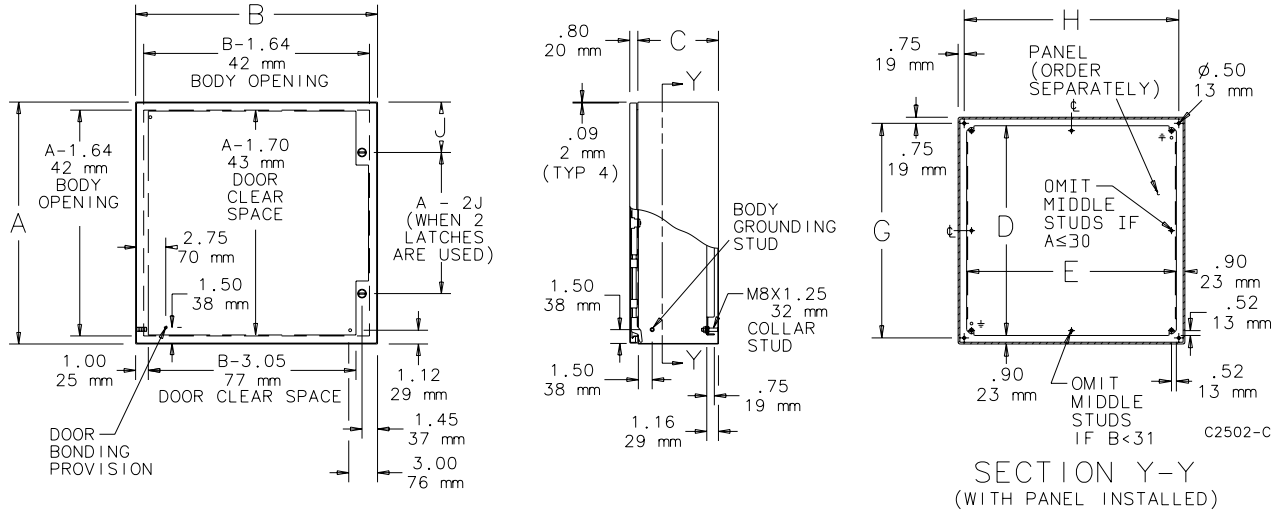
BULLETIN: CW1

| Catalog Number | AxBxC in./mm | Finish | Door Ga. | Body Ga. | CONCEPT Panel | Conductive CONCEPT Panel | Panel Size D x E in./mm | Mounting G x H in./mm | Latches qty. | Latches style | J in./mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD362410LG | 36.00 x 24.00 x 10.00<br>914 x 610 x 254 | RAL 7035 Lt. Gray | 14 | 16 | CP3624 | CP3624G | 34.20 x 22.20<br>869 x 564 | 34.50 x 22.50<br>876 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363010 | 36.00 x 30.00 x 10.00<br>914 x 762 x 254 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363010LG | 36.00 x 30.00 x 10.00<br>762 x 762 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363610 | 36.00 x 36.00 x 10.00<br>914 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363610LG | 36.00 x 36.00 x 10.00<br>914 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD423610 | 42.00 x 36.00 x 10.00<br>1067 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD423610LG | 42.00 x 36.00 x 10.00<br>1067 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD482410 | 48.00 x 24.00 x 10.00<br>1219 x 610 x 254 | ANSI 61 Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD482410LG | 48.00 x 24.00 x 10.00<br>1219 x 610 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD483610 | 48.00 x 36.00 x 10.00<br>1219 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD483610LG | 48.00 x 36.00 x 10.00<br>1219 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD603610 | 60.00 x 36.00 x 10.00<br>1524 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD603610LG | 60.00 x 36.00 x 10.00<br>1524 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD202012 | 20.00 x 20.00 x 12.00<br>508 x 508 x 305 | ANSI 61 Gray | 16 | 16 | CP2020 | CP2020G | 18.20 x 18.20<br>462 x 462 | 18.50 x 18.50<br>470 x 470 | 1 | Quarter-turn | 10.00<br>254 |
| CSD202012LG | 20.00 x 20.00 x 12.00<br>508 x 508 x 305 | RAL 7035 Lt. Gray | 16 | 16 | CP2020 | CP2020G | 18.20 x 18.20<br>462 x 462 | 18.50 x 18.50<br>470 x 470 | 1 | Quarter-turn | 10.00<br>254 |
| CSD242012 | 24.00 x 20.00 x 12.00<br>610 x 508 x 305 | ANSI 61 Gray | 16 | 16 | CP2420 | CP2420G | 22.20 x 18.20<br>564 x 462 | 22.50 x 18.50<br>572 x 470 | 1 | Quarter-turn | 12.00<br>305 |
| CSD242012LG | 24.00 x 20.00 x 12.00<br>610 x 508 x 305 | RAL 7035 Lt. Gray | 16 | 16 | CP2420 | CP2420G | 22.20 x 18.20<br>564 x 462 | 22.50 x 18.50<br>572 x 470 | 1 | Quarter-turn | 12.00<br>305 |
| CSD242412 | 24.00 x 24.00 x 12.00<br>610 x 610 x 305 | ANSI 61 Gray | 14 | 16 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD242412LG | 24.00 x 24.00 x 12.00<br>610 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 16 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD302412 | 30.00 x 24.00 x 12.00<br>762 x 610 x 305 | ANSI 61 Gray | 14 | 16 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD302412LG | 30.00 x 24.00 x 12.00<br>762 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 16 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD303012 | 30.00 x 30.00 x 12.00<br>762 x 762 x 305 | ANSI 61 Gray | 14 | 14 | CP3030 | CP3030G | 28.20 x 28.20<br>716 x 716 | 28.50 x 28.50<br>724 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD303012LG | 30.00 x 30.00 x 12.00<br>762 x 762 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP3030 | CP3030G | 28.20 x 28.20<br>716 x 716 | 28.50 x 28.50<br>724 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD362412 | 36.00 x 24.00 x 12.00<br>914 x 610 x 305 | ANSI 61 Gray | 14 | 16 | CP3624 | CP3624G | 34.20 x 22.20<br>869 x 564 | 34.50 x 22.50<br>876 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD362412LG | 36.00 x 24.00 x 12.00<br>914 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 16 | CP3624 | CP3624G | 34.20 x 22.20<br>869 x 564 | 34.50 x 22.50<br>876 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363012 | 36.00 x 30.00 x 12.00<br>914 x 762 x 305 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363012LG | 36.00 x 30.00 x 12.00<br>914 x 762 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363612 | 36.00 x 36.00 x 12.00<br>914 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363612LG | 36.00 x 36.00 x 12.00<br>914 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD423612 | 42.00 x 36.00 x 12.00<br>1067 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD423612LG | 42.00 x 36.00 x 12.00<br>1067 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD482412 | 48.00 x 24.00 x 12.00<br>1219 x 610 x 305 | ANSI 61 Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD482412LG | 48.00 x 24.00 x 12.00<br>1219 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD483612 | 48.00 x 36.00 x 12.00<br>1219 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD483612LG | 48.00 x 36.00 x 12.00<br>1219 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD603612 | 60.00 x 36.00 x 12.00<br>1524 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD603612LG | 60.00 x 36.00 x 12.00<br>1524 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD242416 | 24.00 x 24.00 x 16.00<br>610 x 610 x 406 | ANSI 61 Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD242416LG | 24.00 x 24.00 x 16.00<br>610 x 610 x 406 | RAL 7035 Lt. Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |

| Catalog Number | AxBxC in./mm | Finish | Door Ga. | Body Ga. | CONCEPT Panel | Conductive CONCEPT Panel | Panel Size D x E in./mm | Mounting G x H in./mm | Latches qty. | Latches style | J in./mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CSD363016** | 36.00 x 30.00 x 16.00<br>914 x 762 x 406 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD363016LG** | 36.00 x 30.00 x 16.00<br>914 x 762 x 406 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD483616** | 48.00 x 36.00 x 16.00<br>1219 x 914 x 406 | ANSI 61 Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| **CSD483616LG** | 48.00 x 36.00 x 16.00<br>1219 x 914 x 406 | RAL 7035 Lt. Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| **CSD242420** | 24.00 x 24.00 x 20.00<br>610 x 610 x 508 | ANSI 61 Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD242420LG** | 24.00 x 24.00 x 20.00<br>610 x 610 x 508 | RAL 7035 Lt. Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD302420** | 30.00 x 24.00 x 20.00<br>762 x 610 x 508 | ANSI 61 Gray | 14 | 14 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD302420LG** | 30.00 x 24.00 x 20.00<br>762 x 610 x 508 | RAL 7035 Lt. Gray | 14 | 14 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD363020** | 36.00 x 30.00 x 20.00<br>914 x 762 x 508 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD363020LG** | 36.00 x 30.00 x 20.00<br>914 x 762 x 508 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |

Purchase panels separately.

Optional NEMA-size panels require conversion kit Catalog Number CCPM4.



| Catalog Number | Panel Type | Panel Size D x E (in.) | Panel Size D x E (mm) | Gauge |
|---|---|---|---|---|
| CP3020G | Conductive | 28.20 x 18.20 | 716 x 462 | 12 |
| CP3220 | Painted steel | 30.20 x 18.20 | 762 x 462 | 12 |
| CP4420 | Painted steel | 42.20 x 18.20 | 1072 x 462 | 12 |
| CP5620 | Painted steel | 53.20 x 18.20 | 1351 x 462 | 12 |
| CP2424 | Painted steel | 22.20 x 22.20 | 564 x 564 | 12 |
| CP2424G | Conductive | 22.20 x 22.20 | 564 x 564 | 12 |
| CP3024 | Painted steel | 28.20 x 22.20 | 716 x 564 | 12 |
| CP3024G | Conductive | 28.20 x 22.20 | 716 x 564 | 12 |
| CP3624 | Painted steel | 34.20 x 22.20 | 869 x 564 | 12 |
| CP3624G | Conductive | 34.20 x 22.20 | 869 x 564 | 12 |
| CP4824 | Painted steel | 46.20 x 22.20 | 1173 x 564 | 12 |
| CP4824G | Conductive | 46.20 x 22.20 | 1173 x 564 | 12 |
| CP3030 | Painted steel | 28.20 x 28.20 | 716 x 716 | 12 |
| CP3030G | Conductive | 28.20 x 28.20 | 716 x 716 | 12 |
| CP3630 | Painted steel | 34.20 x 28.20 | 869 x 716 | 12 |
| CP3630G | Conductive | 34.20 x 28.20 | 869 x 716 | 12 |
| CP4230 | Painted steel | 40.20 x 28.20 | 1021 x 716 | 12 |
| CP4230G | Conductive | 40.20 x 28.20 | 1021 x 716 | 12 |
| CP3636 | Painted steel | 34.20 x 34.20 | 869 x 869 | 12 |
| CP3636G | Conductive | 34.20 x 34.20 | 869 x 869 | 12 |
| CP4236 | Painted steel | 40.20 x 34.20 | 1021 x 869 | 12 |
| CP4236G | Conductive | 40.20 x 34.20 | 1021 x 869 | 12 |
| CP4836 | Painted steel | 46.20 x 34.20 | 1173 x 869 | 12 |
| CP4836G | Conductive | 46.20 x 34.20 | 1173 x 869 | 12 |
| CP6036 | Painted steel | 58.20 x 34.20 | 1478 x 869 | 12 |
| CP6036G | Conductive | 58.20 x 34.20 | 1478 x 869 | 12 |
| CP2442 | Painted steel | 22.20 x 40.20 | 564 x 1021 | 12 |
| CP2442G | Conductive | 22.20 x 40.20 | 564 x 1021 | 12 |
| CP3048 | Painted steel | 28.20 x 46.20 | 716 x 1173 | 12 |
| CP3048G | Conductive | 28.20 x 46.20 | 716 x 1173 | 12 |
| CP3060 | Painted steel | 28.20 x 58.20 | 716 x 1478 | 12 |
| CP3060G | Conductive | 28.20 x 58.20 | 716 x 1478 | 12 |
| CP7236 | Painted steel | 70.20 x 34.20 | 1783 x 869 | 12 |

Catalog number CP4230 is used on CONCEPT disconnect enclosures.

## MOUNTING FOOT KITS



Available in stainless steel or composite material. Kit includes four feet and mounting hardware for all ACCESSPLUS™, D-BOX™, L-BOX™ and COMLINE™ cabinets.

BULLETIN: A80

| Catalog Number | Material |
|---|---|
| CMFK | Steel |
| ~~CMFKSS~~ | ~~Stainless Steel~~ |
| CMTGFT | Composite |

## SCREW PACKAGES



Screw Packages are for mounting rack panels and equipment to rack angles.

BULLETIN: A80, DACCY, X20

| Catalog Number | Color | Description | Pkg. Qty. |
|---|---|---|---|
| ES1224 | Silver | 12-24 x 5/8 in. combo head | 20 |
| ES1224250 | Silver | 12-24 x 5/8 in. combo head | 250 |
| ES1224B | Black | 12-24 x 5/8in. combo head | 20 |
| ES1224B250 | Black | 12-24 x 5/8 in. combo head | 250 |
| ASM5 | Silver | M5 x 20 mm Combo Head | 20 |
| ASM6 | Silver | M6 x 16 mm combo head | 20 |
| ASM5T | Silver | M5 x 12 mm thread-forming Phillips hex head screws | 20 |
| ASM6250 | Silver | M6 x 16 mm combo head | 250 |
| AS1032 | Silver | 10-32 x 5/8 in. combo head | 20 |
| AS1032250 | Silver | 10-32 x 5/8 in. combo head | 250 |
| AS1032B | Black | 10-32 x 5/8 in. combo head | 20 |

Use ASM5T on PROLINE™ frame or Net Series extruded holes.

## CAGE NUT PACKAGE

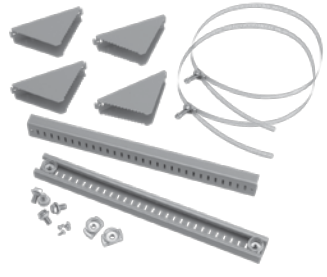


Cage Nut Packages are for use with square-hole rack angles. Cage nuts are plated steel.

BULLETIN: DACCY, P20

| Catalog Number | Color | Description | Pkg. Qty. |
|---|---|---|---|
| PM5CN | Silver | M5 cage nut | 20 |
| PM6CN | Silver | M6 cage nut | 20 |
| PM6CN250 | Silver | M6 cage nut | 250 |
| P1032CN | Silver | 10-32 cage nut | 20 |
| P1032CN250 | Silver | 10-32 cage nut | 250 |
| P1224CN | Silver | 12-24 cage nut | 20 |
| P1224CN250 | Silver | 12-24 cage nut | 250 |

## POLE MOUNTING KITS



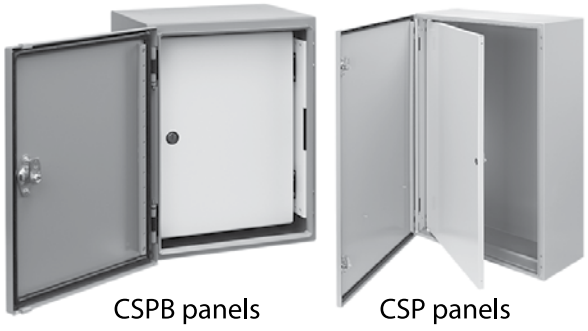


Enable COMLINE™, CONCEPT™, ACCESSPLUS™, D-BOX™ and L-BOX™ enclosures to be mounted to poles of various sizes and shapes. Simply attach the galvanized steel channel bar to the mounting holes at the back of the enclosure, then wrap the stainless steel strap around the pole and through the bar. Kit includes two mounting channels, two straps suitable for up to 12-in. diameter pole, and mounting hardware.

BULLETIN: CWY

| Catalog Number | Fits Enclosure |
|---|---|
| CPMK12 | when B = 12.00 (305) |
| CPMK16 | when B = 16.00 (406) |
| CPMK20 | when B = 20.00 (508) |
| CPMK24 | when B = 24.00 (610) |
| CPMK30 | when B = 30.00 (762) |

## CONCEPT™ SWING-OUT PANELS



CSPB panels CSP panels

Panels swing clear from the front of the enclosure to provide access to mounted internal equipment. For CSPB panels, maximum swing is 94 degrees. For CSP panels, maximum panel swing is 106 degrees. Distance from panel surface to door when in the latched position is 1.71 in. (43 mm) for solid doors and 1.45 in. (37 mm) for window doors. Kits include panel, brackets and hardware to mount to the front flange. Panel is painted white.

*Swing-out panels also can be mounted on front-to-back adjustable rails. CSPB panels require adapter CSPBADB and front-to-back adjustable rails for front-to-back adjustment.*

BULLETIN: CWY

### CSPB Panels

| Catalog Number | Fits Enclosure Size (in.) | Fits Enclosure Size (mm) | Panel Size (in.) | Panel Size (mm) |
|---|---|---|---|---|
| CSPB1212 | 12.00 x 12.00 | 305 x 305 | 9.72 x 9.75 | 247 x 248 |
| CSPB1612 | 16.00 x 12.00 | 406 x 305 | 13.72 x 9.75 | 349 x 248 |
| CSPB1616 | 16.00 x 16.00 | 406 x 406 | 13.72 x 13.75 | 349 x 349 |
| CSPB1620 | 16.00 x 20.00 | 406 x 508 | 13.72 x 17.75 | 349 x 451 |
| CSPB2016 | 20.00 x 16.00 | 508 x 406 | 17.72 x 13.75 | 450 x 349 |
| CSPB2020 | 20.00 x 20.00 | 508 x 508 | 17.72 x 17.75 | 450 x 451 |
| CSPB2024 | 20.00 x 24.00 | 508 x 610 | 17.72 x 21.75 | 450 x 553 |
| CSPB2416 | 24.00 x 16.00 | 610 x 406 | 21.72 x 13.73 | 552 x 349 |
| CSPB2420 | 24.00 x 20.00 | 610 x 508 | 21.72 x 17.75 | 552.452 |
| CSPB2424 | 24.00 x 24.00 | 610 x 610 | 21.72 x 21.75 | 552 x 553 |
| CSPB2430 | 24.00 x 30.00 | 610 x 762 | 21.72 x 27.75 | 552 x 705 |
| CSPB3020 | 30.00 x 20.00 | 762 x 508 | 27.72 x 17.75 | 704 x 451 |
| CSPB3024 | 30.00 x 24.00 | 762 x 610 | 27.72 x 21.75 | 704 x 553 |
| CSPB3030 | 30.00 x 30.00 | 762 x 762 | 27.72 x 27.75 | 704 x 705 |
| CSPB3624 | 36.00 x 24.00 | 914 x 610 | 33.72 x 21.75 | 857 x 553 |
| CSPB3630 | 36.00 x 30.00 | 914 x 762 | 33.72 x 27.75 | 857 x 705 |
| CSPB3636 | 36.00 x 36.00 | 914 x 914 | 33.72 x 33.75 | 857 x 857 |
| CSPB4236 | 42.00 x 36.00 | 1067 x 914 | 39.72 x 33.75 | 1009 x 857 |
| CSPB4824 | 48.00 x 24.00 | 1219 x 610 | 45.72 x 21.75 | 1161 x 553 |
| CSPB4836 | 48.00 x 36.00 | 1219 x 914 | 45.72 x 33.75 | 1161 x 857 |
| CSPB6036 | 60.00 x 36.00 | 1542 x 914 | 57.72 x 33.75 | 1466 x 857 |

### CSP Panels

| Catalog Number | Fits Enclosure (in.) | Fits Enclosure (mm) | Panel Size (in.) | Panel Size (mm) |
|---|---|---|---|---|
| CSP1212 | 12.00 x 12.00 | 305 x 305 | 9.78 x 9.84 | 248 x 250 |
| CSP1612 | 16.00 x 12.00 | 406 x 305 | 13.78 x 9.84 | 350 x 250 |
| CSP1616 | 16.00 x 16.00 | 406 x 406 | 13.78 x 13.84 | 350 x 352 |
| CSP1620 | 16.00 x 20.00 | 406 x 508 | 13.78 x 17.84 | 350 x 453 |
| CSP2016 | 20.00 x 16.00 | 508 x 406 | 17.78 x 13.84 | 452 x 352 |
| CSP2020 | 20.00 x 20.00 | 508 x 508 | 17.78 x 17.84 | 452 x 453 |
| CSP2024 | 20.00 x 24.00 | 508 x 610 | 17.78 x 21.84 | 452 x 555 |
| CSP2416 | 24.00 x 16.00 | 610 x 406 | 21.78 x 13.84 | 553 x 352 |
| CSP2420 | 24.00 x 20.00 | 610 x 508 | 21.78 x 17.84 | 553 x 453 |
| CSP2424 | 24.00 x 24.00 | 610 x 610 | 21.78 x 21.84 | 553 x 555 |
| CSP3020 | 30.00 x 20.00 | 762 x 508 | 27.78 x 17.84 | 706 x 453 |
| CSP3024 | 30.00 x 24.00 | 762 x 610 | 27.78 x 21.84 | 706 x 555 |
| CSP3030 | 30.00 x 30.00 | 762 x 762 | 27.78 x 27.84 | 706 x 707 |
| CSP3624 | 36.00 x 24.00 | 914 x 610 | 33.78 x 21.84 | 858 x 555 |
| CSP3630 | 36.00 x 30.00 | 914 x 762 | 33.78 x 27.84 | 858 x 707 |
| CSP3636 | 36.00 x 36.00 | 914 x 914 | 33.78 x 33.84 | 858 x 860 |

## CONCEPT™ ADAPTER BRACKET

Adapter bracket for use with CONCEPT™ B-style Swing-Out Panels and Adjustable-Depth Mounting Kits. Bracket enables the B-style swing-out panels to be mounted in infinite front-to-back positions within a CONCEPT enclosure.

BULLETIN: CWY

| Catalog Number | Material |
|---|---|
| CSPBADB | Steel |

## HANDLES



Handles can replace the standard slotted insert on all CONCEPT™ wall-mount enclosures. The CONCEPT non-locking handle provides quick and easy access to the enclosure contents. Handle is black plastic. A zinc die-cast keylock handle is available for applications requiring quick access and security. A padlocking handle, also zinc die-cast, accommodates a padlock with up to a 5/16-in. locking bar. Each latch system can be converted from clockwise to counter-clockwise opening. Kit includes all hardware.

BULLETIN: CWY

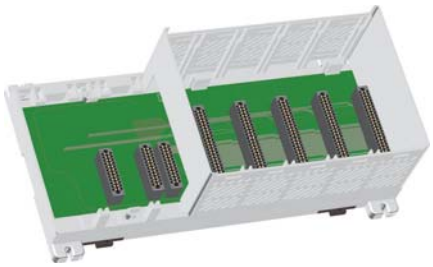
| Catalog Number | UL Rating | Description |
|---|---|---|
| CWHK | Maintains UL/CSA Type 12 when properly installed | Keylock handle |
| CWHNL | Maintains UL Type 3, 4, 4X, 12 when properly installed | Non-locking handle |
| CWHPTO | Maintains UL/CSA Type 3, 4, 12 when properly installed | Padlock handle |

CWHNL is not suitable for 3-point latch operation.

# Productivity3000 Overview

## Bases

Four bases are available, with 3, 5, 8, and 11 slots.



| Productivity3000 Bases | | |
|---|---|---|
| Part Number | Description | Price |
| *P3-03B* | 3-slot base | <---> |
| *P3-05B* | 5-slot base | <---> |
| *P3-08B* | 8-slot base | <---> |
| *P3-11B* | 11-slot base | <---> |

## Power Supplies

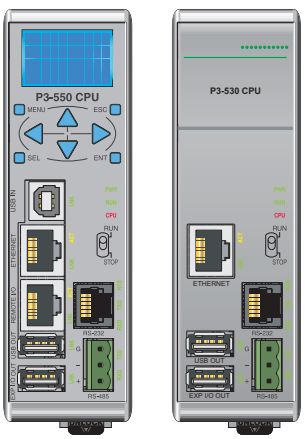
Two power supplies are available; one accepts AC input and one accepts DC input.




| Productivity3000 Power Supplies | | |
|---|---|---|
| Part Number | Description | Price |
| *P3-01AC* | Power supply (powered from AC source) | <---> |
| *P3-01DC* | Power supply (powered from DC source) | <---> |

## CPU Module

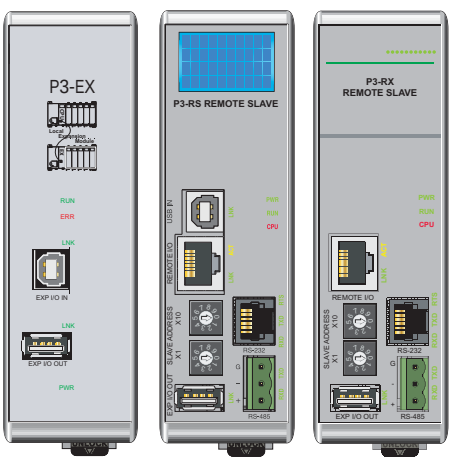
Two CPU modules are currently available.




| Productivity3000 CPU Module | | |
|---|---|---|
| Part Number | Description | Price |
| *P3-550* | CPU module | <---> |
| *P3-530* | CPU module | <---> |

## Expansion and Remote Slave Modules

One local expansion module and two remote slave modules are available.




| Productivity3000 Expansion, Remote Slave Modules | | |
|---|---|---|
| Part Number | Description | Price |
| *P3-EX* | Expansion module | <---> |
| *P3-RS* | Remote slave module | <---> |
| *P3-RX* | Remote slave module | <---> |

# Productivity3000 Overview

## Discrete I/O Modules

Seven discrete input and fourteen discrete output modules are available.



| Discrete Input Modules | | |
|---|---|---|
| **Part Number** | **Description** | **Price** |
| P3-16SIM | Input Simulator | <---> |
| P3-08ND3S | Isolated Sinking /Sourcing Input | <---> |
| P3-16ND3 | Sinking/Sourcing DC Input | <---> |
| P3-32ND3 | Sinking/Sourcing Input | <---> |
| P3-64ND3 | Sinking/SourcingInput | <---> |
| P3-08NAS | Isolated AC Input | <---> |
| P3-16NA | AC input | <---> |

| Discrete Output Modules | | |
|---|---|---|
| **Part Number** | **Description** | **Price** |
| P3-08TD1S | Isolated Sinking Output | <---> |
| P3-08TD2S | Isolated Sourcing Output | <---> |
| P3-16TD1 | Sinking Output | <---> |
| P3-16TD2 | Sourcing Output | <---> |
| P3-32TD1 | Sinking Output | <---> |
| P3-32TD2 | Sourcing Output | <---> |
| P3-64TD1 | Sinking Output | <---> |
| P3-64TD2 | Sourcing Output | <---> |
| P3-08TAS | Isolated AC Out | <---> |
| P3-16TA | AC Output | <---> |
| P3-08TRS | Isolated Relay Output | <---> |
| P3-08TRS-1 | Isolated Relay Output | <---> |
| P3-16TR | Relay Output | <---> |
| P3-16TD3P | Sinking/Sourcing Protected Output | <---> |

## Analog I/O Modules

Six analog input, seven analog output, and two analog input/output modules are available.



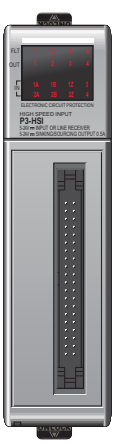
| Analog Input Modules | | |
|---|---|---|
| **Part Number** | **Description** | **Price** |
| P3-04ADS | Isolated Analog Input | <---> |
| P3-08AD | Analog Input | <---> |
| P3-16AD-1 | Analog Current Input | <---> |
| P3-16AD-2 | Analog Voltage Input | <---> |
| P3-08RTD | Analog RTD Input | <---> |
| P3-08THM | Analog Thermocouple | <---> |

| Analog Input/Output Modules | | |
|---|---|---|
| **Part Number** | **Description** | **Price** |
| P3-8AD4DA-1 | Analog Input/Output | <---> |
| P3-8AD4DA-2 | Analog Input/Output | <---> |

| Analog Output Modules | | |
|---|---|---|
| **Part Number** | **Description** | **Price** |
| P3-04DA | Analog Output | <---> |
| P3-08DA-1 | Analog Current Output | <---> |
| P3-08DA-2 | Analog Voltage Output | <---> |
| P3-06DAS-1 | Isolated Analog Current Output | <---> |
| P3-06DAS-2 | Isolated Analog Voltage Output | <---> |
| P3-16DA-1 | Analog Current Output | <---> |
| P3-16DA-2 | Analog Voltage Output | <---> |

## Specialty Modules

The two specialty modules available are the high-speed input and high-speed output modules.



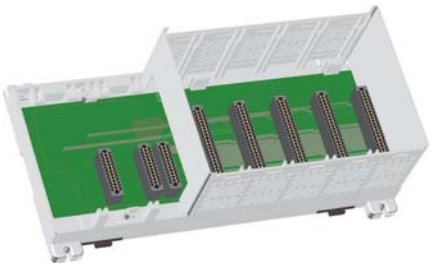
| Specialty Modules | | |
|---|---|---|
| **Part Number** | **Description** | **Price** |
| P3-HSI | High-Speed Input | <---> |
| P3-HSO | High-Speed Output | <---> |

# Productivity3000 Overview

## What you'll need:

Of course, what you'll need for your system depends on your particular application, but this overview shows you what you'll need for a simple system.

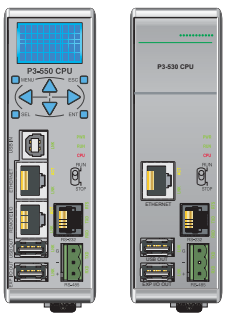
**1. Select your base.**






**2. Select a 24 VDC or 120 VAC power supply.**

**3. Order a CPU module.**






**4. Order and install the Productivity Suite programming software in your PC.**




**5. Select and order your I/O modules.**

At the same time, select and order your *ZIPLink wiring system* or removable terminal blocks.





**6. Select your PC-to-PAC programming cable.**

You will need a standard USB or Ethernet cable for programming, depending on the CPU selected and communications port (USB or Ethernet) chosen.



**7. Select tools, wire, and provide power.**

**Screwdriver DN-SS1**



**Wire Strippers DN-WS**



**Hookup Wire**



# Programming Software

## P3-PGMSW FREE ($495 value)



Productivity Suite is user-friendly programming software designed to allow quick and easy programming of ladder logic programs for the Productivity3000 PAC.

The online help file provides information that will help you get acquainted with the software quickly.

## PC Requirements

Productivity Suite programming software works with Windows® XP (Home or Professional), Vista (Home, Basic, Premium, 32 or 64-bit) or Windows 7 (Home, Professional, Ultimate, 32 or 64-bit). These are the minimum system requirements:

- Windows XP Personal Computer with a 333 MHz or higher processor (CPU) clock speed recommended; Intel Pentium/Celeron family or AMD K6/Athlon/Duron family, or compatible processor recommended
- Vista or Windows 7 Personal Computer with a 800 MHz or higher processor (CPU) clock speed recommended; Intel Pentium/Celeron family or AMD K6/Athlon/Duron family, or compatible processor recommended
- SVGA 800x600 pixels resolution (1024x768 pixels resolution recommended)
- 300MB free hard-disk space
- Windows XP; 128MB free RAM (512MB recommended)
- Vista or Windows 7; 512MB free RAM (1GB recommended).
- CD-ROM or DVD drive for installing software from the CD
- USB or Ethernet port for project transfer to PAC

## Programming Cable

You will need a standard USB or Ethernet cable for programming, depending on the type of CPU and whether you use the USB (P3-550) or Ethernet (P3-530 and P3-550) programming port.

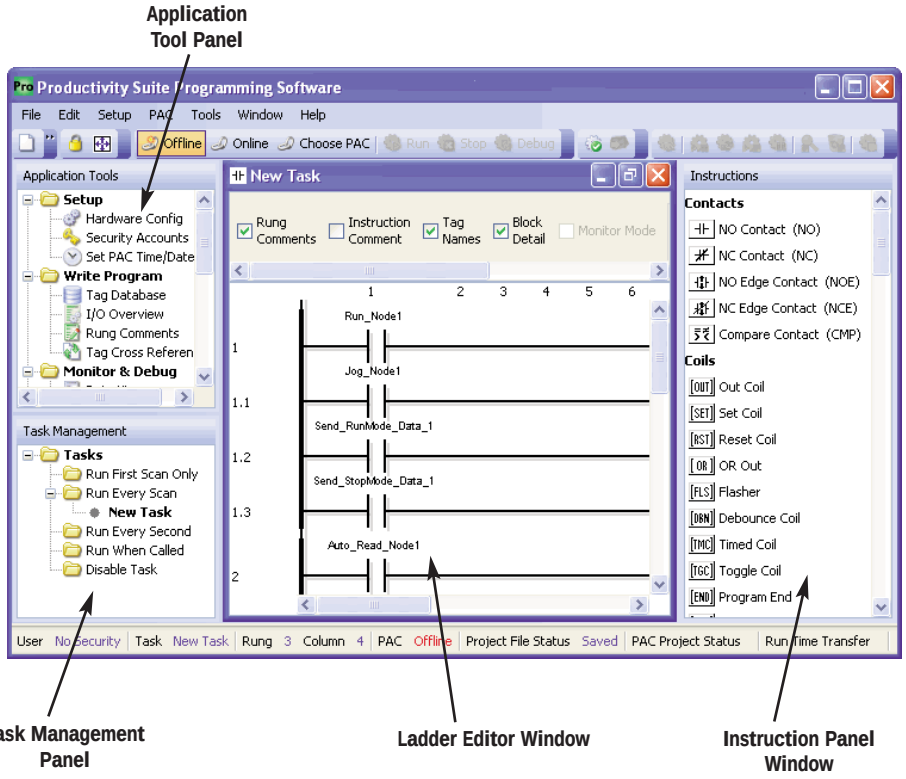
If possible, we recommend using a USB programming cable; just plug it in and it works. We sell these A-to-B USB cables:

- USB-CBL-AB3 (3 ft.)
- USB-CBL-AB6 (6 ft.)
- USB-CBL-AB10 (10 ft.)
- USB-CBL-AB15 (15 ft.)



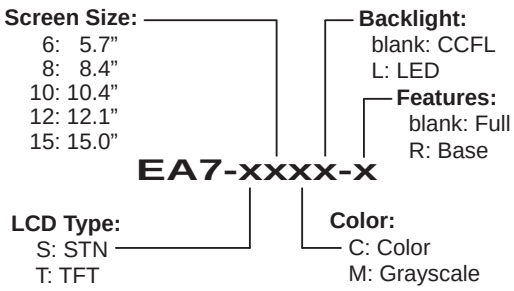

### Main window

The Main Window is displayed when the program opens. It is divided into Menus, Toolbars, and Windows that work together to make project development as simple as possible.



# *C-more* Operator Panels Overview

## Touch Panel Part Number Key:




## Getting started

Installing the software and configuring the ***C-more*** panel is simple. You will need the following to successfully connect and configure a project for the panel:

- ***C-more*** touch panel - 6", 8", 10", 12" or 15" model
- ***C-more*** Programming Software, p/n EA-PGMSW
- ***C-more*** programming cable, USB or Ethernet
- 24 VDC switching power supply (min. 1.5A, switching) or the optional ***C-more*** AC Power Adapter
- Personal Computer - to run ***C-more*** programming software
- PLC communications cable (serial or Ethernet) to connect the ***C-more*** Touch Panel to your controller

| Part Number | Description | Price |
|---|---|---|
| ***EA7-S6M-R*** | 6-inch ***C-more*** grayscale STN touch panel (5.7 inch viewable screen), 15 shades of gray, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. *Base Model: Built-in USB, no Ethernet or Compact Flash support. | <---> |
| ***EA7-T6CL-R*** | 6-inch ***C-more*** color TFT touch panel (5.7 inch viewable screen), 64K colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight, 50,000 hour half-life. Built-in USB, no Ethernet or Compact Flash support. | <---> |
| ***EA7-S6M*** | 6-inch ***C-more*** grayscale STN touch panel (5.7 inch viewable screen), 15 shades of gray, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports Compact Flash. | <---> |
| ***EA7-T6CL*** | 6-inch ***C-more*** color TFT touch panel (5.7 inch viewable screen), 64K colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), non-replaceable LED backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports Compact Flash. | <---> |
| ***EA7-T8C*** | 8-inch ***C-more*** color TFT touch panel (8.4 inch viewable screen), 64K colors, 640 x 480 pixel VGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports Compact Flash. | <---> |
| ***EA7-T10C*** | 10-inch ***C-more*** color TFT touch panel (10.4 inch viewable screen), 64K colors, 640 x 480 pixel VGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash. | <---> |
| ***EA7-T12C*** | 12-inch ***C-more*** color TFT touch panel (12.1 inch viewable screen), 64K colors, 800 x 600 pixel SVGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash. | <---> |
| ***EA7-T15C*** | 15-inch ***C-more*** color TFT touch panel (15.0 inch viewable screen), 64K colors, 1024 x 768 XGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash. | <---> |
| ***EA-PGMSW*** | ***C-more*** touch panel Windows-based configuration software. Requires Windows 2000 (Service Pack 4), XP Home or Professional (Service Pack 2) or Vista. Includes software installation guide and CD-ROM. Requires USB 1.1 or Ethernet connection to touch panel. Cables sold separately. | <---> |
| ***USB-CBL-AB3*** | Standard 3-ft. (0.9m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a 24 VDC power source for configuration and operation.) | <---> |
| ***USB-CBL-AB6*** | Standard 6-ft. (1.8m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a 24 VDC power source for configuration and operation.) | <---> |
| ***USB-CBL-AB10*** | Standard 10-ft (3 meter) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a 24 VDC power source for configuration and operation.) | <---> |
| ***USB-CBL-AB15*** | Standard 15-ft. (4.6m) USB 2.0 cable, A-type connector to B-type connector, used to connect personal computer to any ***C-more*** touch panel for setup and programming. (Note: Touch panels require a 24 VDC power source for configuration and operation.) | <---> |

# *C-more* Selection Guide & Specifications

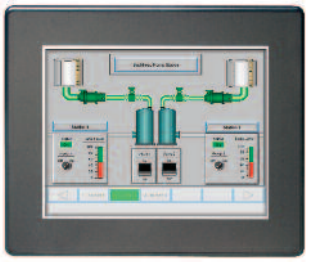
| Specification \ Model | 8" TFT color w/ full features | 10" TFT color w/ full features | 12" TFT color w/ full features | 15" TFT color w/ full features |
|---|---|---|---|---|
| **Part Number** | **EA7-T8C** | **EA7-T10C** | **EA7-T12C** | **EA7-T15C** |
| |  |  |  |  |
| **Price** | <---> | <---> | <---> | <---> |
| **Display Actual Size and Type** | 8.4" TFT color | 10.4" TFT color | 12.1" TFT color | 15.0" TFT color |
| **Color Scale** | 65,536 colors | | | |
| **Display Viewing Area** | 6.73" x 5.05" [170.9 mm x 128.2 mm] | 8.31" x 6.24" [211.2 mm x 158.4 mm] | 9.47" x 7.62" [240.6 mm x 184.5 mm] | 11.97" x 8.98" [304.1 mm x 228.1 mm] |
| **Screen Pixels** | 640 x 480 (VGA) | | 800 x 600 (SVGA) | 1024 x 768 (XGA) |
| **Display Brightness** | 300 cd/m² (NITS) | 270 cd/m² (NITS) | 260 cd/m² (NITS) | 220 cd/m² (NITS) |
| **LCD Panel Dot Pitch** | 0.267 mm x 0.267 mm | 0.33 mm x 0.33 mm | 0.267 mm x 0.267 mm | 0.297 mm x 0.297 mm |
| **Backlight Average Lifetime*** | Approximately 50,000 hours | | | |
| **Backlight User Replaceable** | Yes – Correct replacement bulb is dependent on the panel serial no, see *C-more* Replacement Parts section for complete details | | | |
| **Touch Panel Type** | Analog Resistive (10-bit resolution, 1024 x 1024 touch area) | | Analog Resistive (12-bit resolution, 4096 x 4096 touch area) | |
| **CPU Type** | 32-Bit RISC CPU (400 MHz) | | 32-Bit RISC CPU (400 MHz) Plus Graphic Accelerator Chip | |
| **Battery** | Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354) | | | |
| **System Memory** | SDRAM 32 MBytes | | SDRAM 64 MBytes | |
| **System Flash Memory** | FLASH 32 MBytes | | FLASH 64 MBytes | |
| **Backup Memory (SRAM)** | Control data backup memory (SRAM) 256 KBytes | | | |
| **Logging Data Memory** | CompactFlash Memory Card p/n EA-CF-CARD, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional) | | | |
| **Number of Screens** | Up to 999 – limited by available project memory (10 MBytes) | | Up to 999 – limited by available project memory (40 MBytes) | |
| **Realtime Clock** | Built into panel (PLC clock is still accessible if available) | | | |
| **Calendar – Month/Day/Year** | Yes - battery backup | | | |
| **Screen Saver** | Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled | | | |
| **Serial PLC Interface** | Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female) | | | |
| **USB Port – Type B** | Download/Program – USB Port – type B (ver. 1.2) | | | |
| **USB Port – Type A** | Port for USB device options – type A (ver. 1.2) | | | |
| **Ethernet Port** | Ethernet 10/100 Base-T | | | |
| **Audio Line Out** | Audio Line Out, 1 Volt rms, stereo – requires amplifier and speaker(s) | | | |
| **CF Card – Slot #1** | Optional: CompactFlash Memory Card p/n EA-CF-CARD, industrial grade, high speed, CF slot #1 located on top side of touch panel. | | | |
| **Expansion Assembly (p/n EA-EXP-OPT)** | Optional: Use the CF Card Interface Module p/n EA-CF-IF in the right slot of the Expansion Assembly for installing CF card - Slot #2. The left slot of the Expansion Assembly is for future options. | | | |
| **Supply Power** | 24 VDC, -15%, +20% (20.4–28.8 VDC operating range) (Use an AC Power Adapter, p/n EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.) | | | |
| **Power Consumption** | 15 W @ 24 VDC | 17 W @ 24 VDC | 20 W @ 24 VDC | 33 W @ 24 VDC |
| **Recommended Input Fuse** | 3.0 A DC slow blow | | | |
| **Operating Temperature** | 0 to 50°C (32 to 122°F) Max surrounding air temperature rating: 50°C | | | |
| **Storage Temperature** | –20 to +60°C (–4 to +140°F) | | | |
| **Humidity** | 10–85% RH, non-condensing | | | |
| **Noise Immunity** | Noise voltage: 1000 Vp-p, Pulse width: 1 µs, Rise time: 1 ns | | | |
| **Withstand Voltage** | 1000 VDC for 1 minute, between DC power supply input terminal and safety ground | | | |
| **Insulation Resistance** | Over 20 MΩ between DC power supply input terminal and safety ground | | | |
| **Vibration** | IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes | | | |
| **Shock** | 15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes | | | |
| **Enclosure** | IP65 Meets UL Type 4X when mounted correctly. For indoor use only. | | | |
| **Environment** | For use in Pollution Degree 2 Environment | | | |
| **Agency Approvals** | UL, cUL, CE, CSA; UL file 157382, CSA file 234884 | | | |
| **Dimensions** | 8.748" x 10.894" x 2.053" [222.2 mm x 276.7 mm x 52.1 mm] | 10.669" x 13.661" x 2.079" [271.0 mm x 347.0 mm x 52.8 mm] | 11.024" x 13.366" x 2.075" [280.0 mm x 339.5 mm x 52.7 mm] | 13.000" x 16.748" x 2.048" [330.2 mm x 425.4 mm x 52.0 mm] |
| **Weight** | 2.60 lb. [1,180g] | 3.55 lb. [1,610g] | 4.59 lb. [2,080g] | 7.01 lb. [3,180g] |

**** NOTE: The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.***

# *C-more* 12" TFT Color Touch Panel - Full Model

## Part No. EA7-T12C

12-inch ***C-more*** color TFT touch panel (12.1 inch viewable screen), 64K colors, 800 x 600 pixel SVGA screen resolution, 400 MHz CPU plus Graphic Accelerator chip, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports Compact Flash.



<---->

## Features

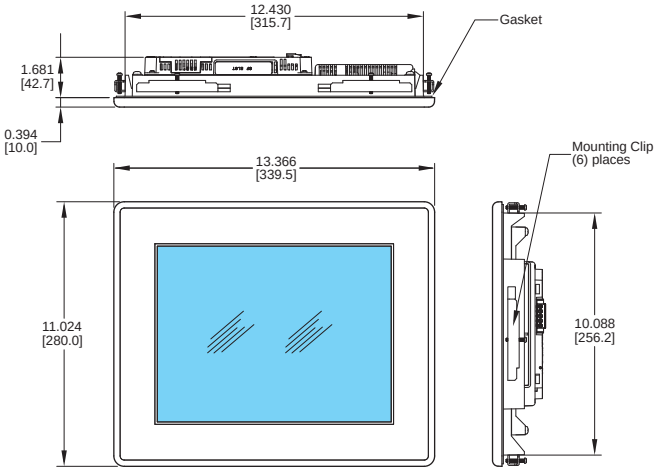
- 12.1" diagonal color TFT (Thin Film Transfer) LCD display with 64K colors
- 800 x 600 pixel resolution
- 260 NITS display brightness
- 50,000 hour average backlight lifetime, user replaceable
- Analog resistive (4096 X 4096) touch screen allowing unlimited touch areas
- USB port B (program/download) and USB port A (USB device options)
- Ethernet 10/100 Base-T port (program/download & PLC comm)
- Remote Internet Access
- Serial PLC interface (RS-232/422/485)
- CompactFlash card slot, built-in
- Expansion assembly (optional) for CompactFlash devices (use with optional CF Card Interface Module)
- 24 VDC powered, 110 VAC power adapter (optional)
- Audio Line Out, stereo - requires amplifier and speaker(s)
- 40 MByte project memory
- Data logging
- 0 to 50°C (32 to 122°F) operating temperature range
- NEMA 4/4X, IP65 compliant when mounted correctly, indoor use only
- Slim design saves panel space
- UL, cUL, CSA & CE agency approvals
- 2-year warranty from date of purchase

| Function | Available | Associated Features |
|---|---|---|
| *Ethernet* | *Yes* | *FTP - Email - Web Server* |
| *USB* | *Yes* | *Data Logging* |
| *Compact Flash* | *Yes* | *Data Logging/Project* |
| *Expansion Assembly* | *Yes* | *CF Module & future modules* |
| *Audio Out* | *Yes* | *Speaker/Amplifier Connection* |
| *Ethernet* | *Yes* | *Remote access over Internet* |

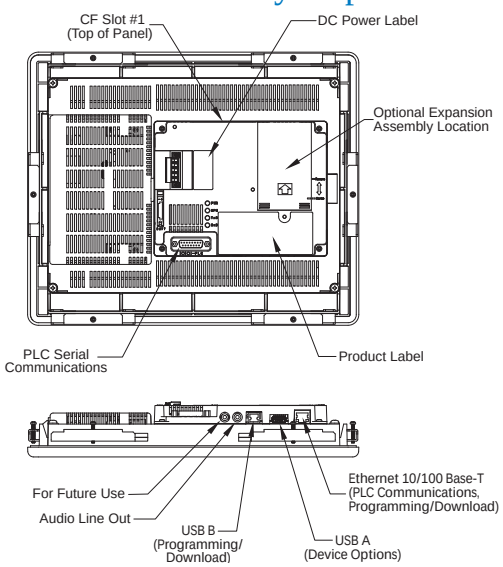
| PLC Drivers | |
|---|---|
| ***Serial*** | ***Avail.*** |
| Productivity3000 | Yes |
| AutomationDirect CLICK | Yes |
| *Direct* LOGIC K-sequence | Yes |
| *Direct* NET | Yes |
| Modbus (Koyo Addressing) | Yes |
| Allen-Bradley DF1 Full & Half Duplex | Yes |
| Allen-Bradley PLC5 DF1 | Yes |
| Allen-Bradley DH-485 | Yes |
| Allen-Bradley DF1 Full & Half Duplex - Tag Based (ControlLogix™ and CompactLogix™) | Yes |
| Modbus RTU | Yes |
| Entivity Modbus RTU | Yes |
| GE SNPX (90/30, 90/70), Micro 90, VersaMax Micro) | Yes |
| Omron Host Link C200 Adapter C500 | Yes |
| Omron FINS (CJ1, CS1) | Yes |
| Mitsubishi FX | Yes |
| Mitsubishi Q02, Q02H, Q06H, Q12H, Q25H | Yes |
| Mitsubishi Q, QnA Serial | Yes |
| Siemens PPI (S7-200 CPU) | Yes |
| ***Ethernet*** | |
| Productivity3000 | Yes |
| *Direct* LOGIC Ethernet | Yes |
| Modbus TCP/IP | Yes |
| Entivity Modbus TCP/IP | Yes |
| Allen-Bradley EtherNet/IP™ Server - Generic I/O Messaging* | Yes |
| Allen-Bradley EtherNet/IP Client - Tag Based (ControlLogix™ and CompactLogix™) | Yes |
| Allen-Bradley EtherNet/IP Client - MicroLogix 1100 & SLC 5/05 via native Ethernet port; MicroLogix 1000, 1100, 1200, 1400, 1500 & SLC 5-03, 04, 05 via AB ENI Adapter | Yes |
| Omron FINS | Yes |
| Mitsubishi Q, QnA Ethernet | Yes |
| Siemens (S7-200 CPU, S7-300 CPU) | Yes |

## Dimensions

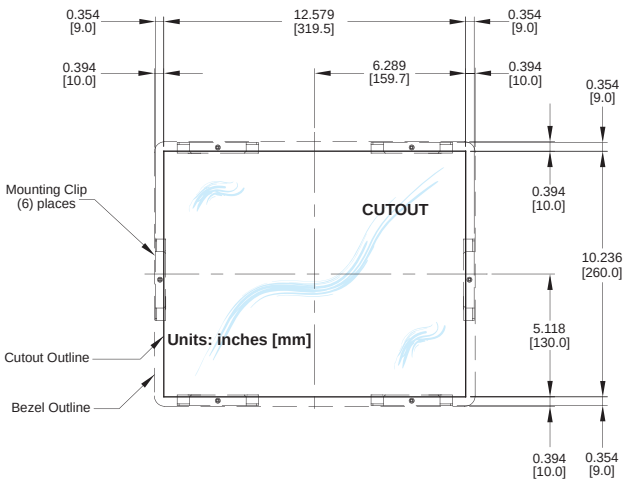
inches / [mm]



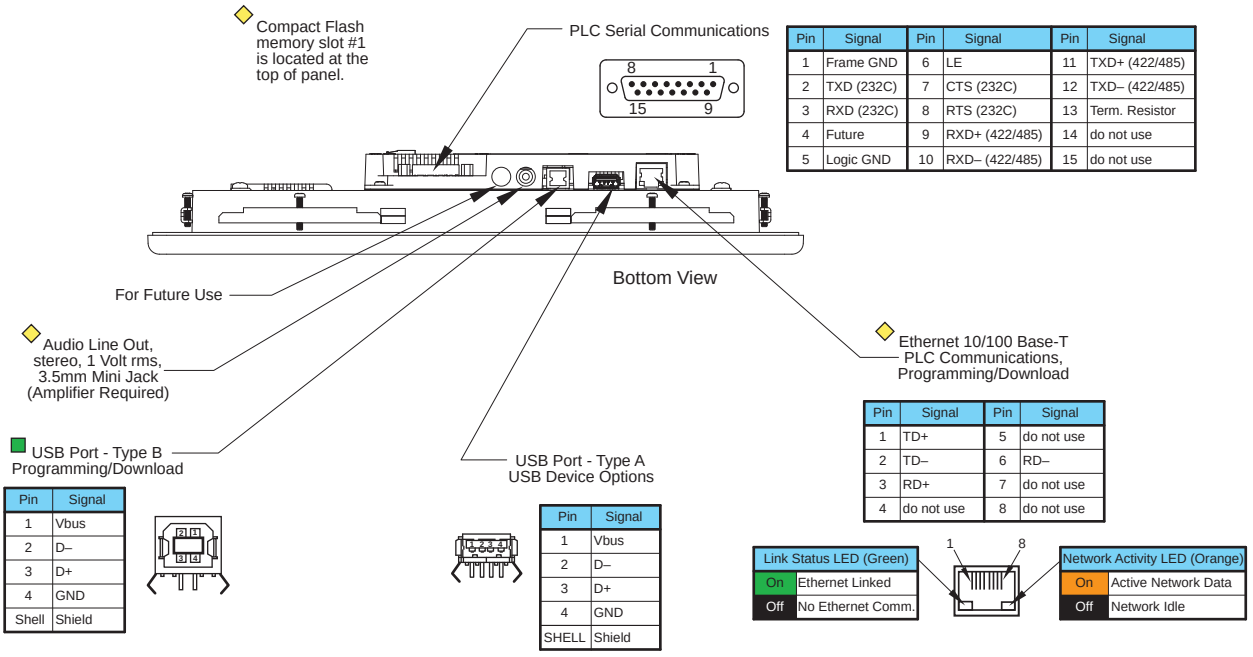

## Ports & Memory Expansion




## Mounting Cutout



# *C-more* Communication Ports




| Pin | Signal | Pin | Signal | Pin | Signal |
|---|---|---|---|---|---|
| 1 | Frame GND | 6 | LE | 11 | TXD+ (422/485) |
| 2 | TXD (232C) | 7 | CTS (232C) | 12 | TXD– (422/485) |
| 3 | RXD (232C) | 8 | RTS (232C) | 13 | Term. Resistor |
| 4 | Future | 9 | RXD+ (422/485) | 14 | do not use |
| 5 | Logic GND | 10 | RXD– (422/485) | 15 | do not use |

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | TD+ | 5 | do not use |
| 2 | TD– | 6 | RD– |
| 3 | RD+ | 7 | do not use |
| 4 | do not use | 8 | do not use |

| Pin | Signal |
|---|---|
| 1 | Vbus |
| 2 | D– |
| 3 | D+ |
| 4 | GND |
| Shell | Shield |

| Pin | Signal |
|---|---|
| 1 | Vbus |
| 2 | D– |
| 3 | D+ |
| 4 | GND |
| SHELL | Shield |

Note: Device is not available on Base Feature touch panels, part numbers EA7-S6M-R and EA7-T6CL-R.

Note: Use USB Programming Cable, such as p/n USB-CBL-AB15.

## Ethernet Port

The Ethernet port has several uses:

- Download program to panel
- Communicate to PLCs/PCs
- Send e-mail
- Access FTP server
- Act as a Web server
- Remote Internet Access

The Ethernet port has an RJ-45 8-wire modular connector with green and orange LEDs.

- The orange LED indicates the Ethernet communication status. It illuminates when there is data activity on the network.
- The green LED indicates link status and illuminates when a link is established.

Ethernet connections:

- Productivity3000
- ***Direct***LOGIC Ethernet
- Modbus TCP/IP
- Allen-Bradley EtherNet/IP™ Server - Generic I/O Messaging (ControlLogix™, CompactLogix™, and FlexLogix™)
- Allen-Bradley EhterNet/IP Client - Tag Based (ControlLogix, CompactLogix, and FlexLogix™)
- Allen-Bradley EtherNet/IP Client - MicroLogix 1100 & SLC 5/05, both via native Ethernet port
- Allen-Bradley MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI Adapter
- Entivity Modbus TCP/IP
- Omron Ethernet FINS
- Siemens Ethernet ISO over TCP

Note: The base panels (-R part numbers) do not include an Ethernet port, and do not have these capabilities.

## USB Port B

Program ***C-more*** via the USB programming port. It's fast and easy, with no baud rate settings, parity, or stop bits to worry about. We stock standard USB cables for your convenience. USB Port B can be used to upload or download projects to and from a PC.

## USB Port A

The Universal Serial Bus (USB) Port A is a standard feature for all models and can be used to connect various USB HID (Human Input Device) devices to the panel, such as:

- USB pen drives, (SDCZ4-2048-A10)
- USB keyboards
- USB barcode scanners
- USB card scanners

***C-more*** can log data to the USB pen drive as well as load projects to the panel from the pen drive. You can also back up project files and panel firmware.

## Sound Interface (Audio Line Out)

When attached to an amplifier and speaker(s), ***C-more*** can play warning sounds or pre-recorded messages such as: "conveyor is jammed". ***C-more*** supports WAV type files. The output is stereo.

## Serial Port

The serial port is an RS-232, RS-422 or RS-485 female 15-pin D-sub connector. Use this port for serial connections to PLCs. The port supports the following PLC protocols:

All AutomationDirect.com PLCs:
- Productivity3000
- ***Direct***LOGIC K-sequence
- ***Direct***NET
- Modbus (Koyo Addressing)
- CLICK

Allen Bradley:
- DF1 Full & Half Duplex
- DF1 Full & Half Duplex - Tag Based
- PLC5 DF1
- DH485

Modbus RTU
Entivity Modbus RTU
GE SNPX (90/30, 90/70, Micro 90, VersaMax Micro)
Omron:
- Host Link (C200 Adapter, C500)
- FINS (CJ1, CS1)

Mitsubishi:
- Melsec FX
- Q/QnA

Siemens PPI (S7-200 CPU)

# *C-more* Communication Protocols & Cables

| Compatibility Table | | | |
|---|---|---|---|
| ***PLC Family*** | ***Model*** | | ***Protocols*** |
| ***Allen-Bradley*** | MicroLogix 1000/1100/1200/1400/1500, SLC 5-/01/02/03, PLC5 | | DH485/AIC/AIC+ |
| | MicroLogix 1000, 1100, 1200 and 1500 | | DF1 Half Duplex; DF1 Full Duplex |
| | SLC 5-/03/04/05 | | |
| | ControlLogix™, CompactLogix™, FlexLogix™ | | |
| | PLC-5 | | DF1 Full Duplex |
| | ControlLogix, CompactLogix, FlexLogix - Tag Based | | DF1 Half Duplex; DF1 Full Duplex |
| | ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging | | EtherNet/IP Server |
| | ControlLogix, CompactLogix, FlexLogix - Tag Based | | EtherNet/IP Client |
| | MicroLogix 1100 & SLC 5/05, both via native Ethernet port | | |
| | MicroLogix 1000, 1100, 1200, 1400,1500 & SLC 5-03/04/05, all via ENI Adapter | | |
| ***Modbus TCP/IP*** | Modbus TCP/IP devices | | Modbus TCP/IP |
| ***GE*** | 90/30, 90/70, Micro 90, VersaMax Micro | | SNPX |
| ***Mitsubishi*** | FX Series | | FX Direct |
| | Q02, Q02H, Q06H, Q12H, Q25H | | Q CPU |
| | Q, QnA Serial | | QnA Serial |
| | Q, Qna Ethernet | | QnA Ethernet |
| ***Omron*** | C200 Adapter, C500 | | Host Link |
| | CJ1/CS1 Serial, CJ1/CS1 Ethernet | | FINS |
| ***Modicon*** | 984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx | | Modbus RTU |
| ***Siemens*** | S7-200 CPU, RS-485 Serial | | PPI |
| | S7-200 CPU, S7-300 CPU; Ethernet | | Ethernet ISO over TCP |
| ***Productivity3000*** | Productivity3000 Serial (P3-550) | | AutomationDirect P3000 Serial |
| | Productivity3000 Ethernet (P3-550) | | AutomationDirect P3000 Ethernet |
| ***CLICK*** | all | | AutomationDirect Modbus (CLICK) |
| ***Direct*LOGIC** | DL05/DL06 | all | K-Sequence |
| | | | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | | H0-ECOM/H0-ECOM100 | *Direct*LOGIC Ethernet |
| | DL105 | all | K-Sequence |
| | DL205 | D2-230 | K-Sequence |
| | | D2-240 | K-Sequence |
| | | | *Direct*NET |
| | | D2-250/D2-250-1/D2-260 | K-Sequence |
| | | | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | | D2-240/D2-250-1/D2-260 Using DCM | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | | H2-ECOM/H2-ECOM100 | *Direct*LOGIC Ethernet |
| | DL305 | D3-330/330P (Requires the use of a Data Communications Unit) | *Direct*NET |
| | | D3-340 | *Direct*NET |
| | | D3-350 | K-Sequence |
| | | | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | | D3-350 DCM | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | DL405 | D4-430 | K-Sequence |
| | | | *Direct*NET |
| | | D4-440 | K-Sequence |
| | | | *Direct*NET |
| | | D4-450 | K-Sequence |
| | | | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | | All with DCM | *Direct*NET |
| | | | Modbus (Koyo addressing) |
| | | H4-ECOM/H4-ECOM100 | *Direct*LOGIC Ethernet |
| | H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version | | Think & Do Modbus RTU (serial port) |
| | H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later | | Think & Do Modbus TCP/IP (Ethernet port) |

| Cable Description | Cable Part Number | Price |
|---|---|---|
| Productivity3000 AutomationDirect CLICK, *Direct*LOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WinPLC (RS-232C) | ***EA-2CBL*** | <---> |
| *Direct*LOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C) | ***EA-2CBL-1*** | <---> |
| *Direct*LOGIC PLC RJ-11 port, D3-340 (RS-232C) | ***EA-3CBL*** | <---> |
| *Direct*LOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C) | ***EA-4CBL-1*** | <---> |
| *Direct*LOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C) | ***EA-4CBL-2*** | <---> |
| Allen-Bradley MicroLogix 1000, 1100, 1200, 1400 & 1500 (RS-232C) | ***EA-MLOGIX-CBL*** | <---> |
| Allen-Bradley SLC 5-03/04/05 ControlLogix, CompactLogix, FlexLogix, DF1 port (RS-232C) | ***EA-SLC-232-CBL*** | <---> |
| Allen-Bradley PLC-5 DF1 port (RS-232C) | ***EA-PLC5-232-CBL*** | <---> |
| Allen-Bradley SLC 500 DH485 port (RS-485A) | ***EA-DH485-CBL*** | <---> |
| GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A) | ***EA-90-30-CBL*** | <---> |
| MITSUBISHI FX Series 25-pin port (RS-422A) | ***EA-MITSU-CBL*** | <---> |
| MITSUBISHI FX Series 8-pin mini-DIN (RS-422A) | ***EA-MITSU-CBL-1*** | <---> |
| OMRON Host Link C200 Adapter, C500 (RS-232C) | ***EA-OMRON-CBL*** | <---> |

***NOTE: EZTouch serial PLC communication cables are compatible with C-more touch panels.***

EA-2CBL



EA-2CBL-1



# *C-more* Computer Programming Connections

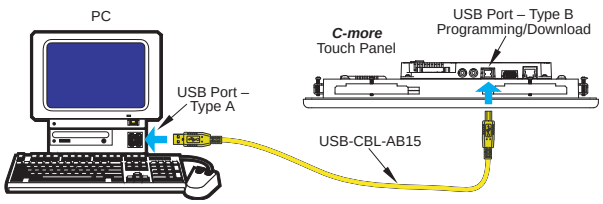
Using the ***C-more*** Programming Software for project development, the touch panel can be connected to a PC (personal computer) in one of several ways:

- Connect a USB Programming Cable such as (USB-CBL-AB15) from a USB port type A on the PC to the USB type B programming port on the C-more touch panel. The USB connection is for direct connection only and does not support USB hubs.
- Connect the ***C-more*** touch panel to a PC via an Ethernet hub or switch, and CAT5 Ethernet cables (full feature panels only). Multiple panels can be programmed in this configuration.
- Use an Ethernet crossover cable directly between the ***C-more*** touch panel's Ethernet port and the PC Ethernet port (full feature panels only).

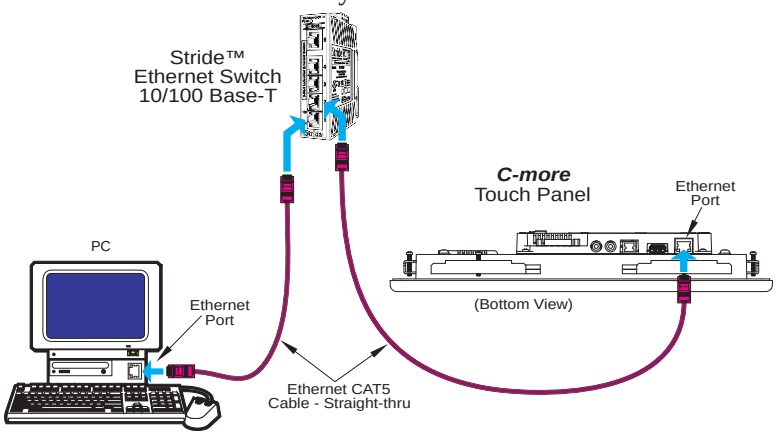
Following are the minimum system requirements for running ***C-more*** Programming Software (p/n EA-PGMSW) on a PC:

- Personal Computer with a 333 MHz or higher processor (CPU) clock speed recommended; Intel® Pentium/Celeron family, or AMD® K6/Athlon/Duron family, or compatible processor recommended
- Keyboard and Mouse or compatible pointing device
- Super VGA color video adapter and monitor with at least 800 x 600 pixels resolution (1024 x 768 pixels recommended) 64K color minimum
- 300 MB free hard-disk space
- 128 MB free RAM (512 MB recommended); 512 MB free RAM (1 GB recommended) for Vista
- CD-ROM or DVD drive for installing software from the CD
- USB port or Ethernet 10/100 Mbps port for project transfer from software to touch panel (Ethernet port not available on -R models)
- Operating System - Windows® Vista, Windows® XP Home / Professional Edition or Windows® 2000 with Service Pack 4.

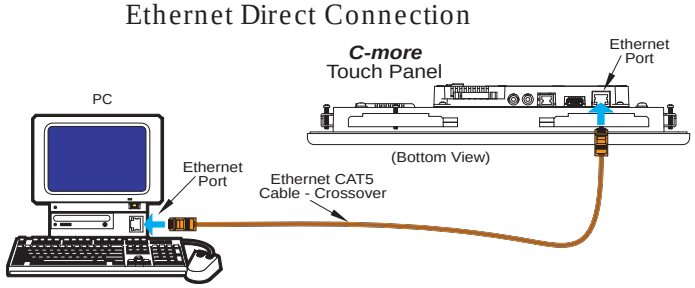
## USB Connectivity




## Ethernet Connectivity via a Hub or Switch




## Ethernet Direct Connection




## USB Programming Cable



Part No. USB-CBL-AB15

< --- >

Other lengths available see USB-CBL-AB3, USB-CBL-AB6, USB-CBL-AB10 on page 9-27

## Stride™ Ethernet Switch




Part No. SE-SW5U

< --- >

## Ethernet Configuration Kit




Part No. RT-CNFGKIT

< --- >

The Ethernet Configuration Kit includes a five-port 10/100 Base-T Ethernet switch, four straight-through cables, and one crossover cable. (The cables are at least five feet in length.) The kit provides a great convenience for configuring systems, demonstration systems or basic control projects using Ethernet.

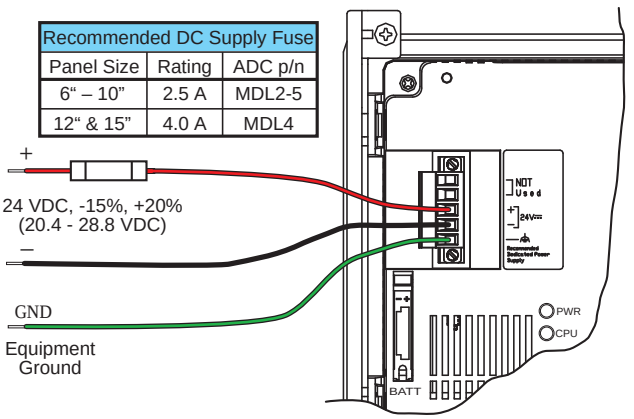
# *C-more* Power Connection Wiring

## Providing Power to the Touch Panel

- Connect a dedicated 24 VDC switching power supply rated for a minimum of 1.5 Amps to the DC connector on the rear of the ***C-more*** touch panel. Connect the ground terminal to a proper equipment ground.
- or, install a ***C-more*** AC Power Adapter (EA-AC) to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60Hertz, to its AC connector.
- then, turn on the power source and check the LED status indicators on the rear of the ***C-more*** touch panel for proper operation.

### DC Wiring

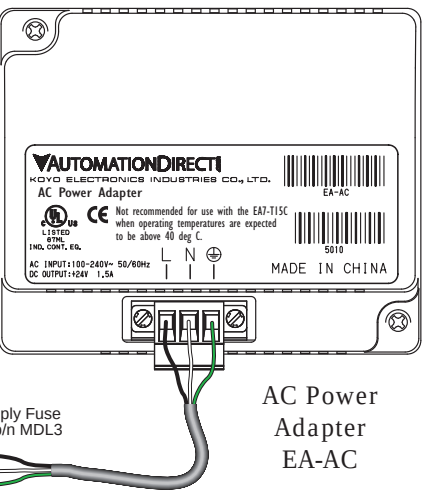
| Recommended DC Supply Fuse | | |
|---|---|---|
| Panel Size | Rating | ADC p/n |
| 6" – 10" | 2.5 A | MDL2-5 |
| 12" & 15" | 4.0 A | MDL4 |




**Recommended Power Supply:**
**AutomationDirect Part No. PS24-050D**

| Tightening Torque | |
|---|---|
| **Power supply cable torque** | 71 - 85 oz-in (0.5 - 0.6 Nm) |
| **Power connector mounting torque** | 71 - 85 oz-in (0.5 - 0.6 Nm) |
| **Mounting flange screw torque** | 57 - 71 oz-in (0.4 - 0.5 Nm) |

### AC Wiring




Recommended AC Supply Fuse
3.0 A time delay, ADC p/n MDL3

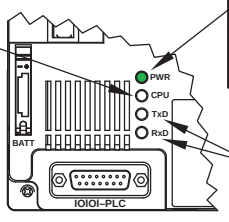
100 - 240 VAC
50/60 Hz

AC Power
Adapter
EA-AC

***NOTE: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].***

### *C-more* LED Status Indicators

| CPU Status LED (Green, Orange & Red) | |
|---|---|
| Off | Power Off |
| Green | Normal – CPU Run State |
| Red | Memory Error |
| Blinking Red | Operating System not found |
| Blinking Orange | LCD Backlight Failure |
| Blinking Green | Power Loss Detection |




| Power LED (Green) | |
|---|---|
| On | Power On |
| Off | Power Off |

| Serial TxD/RxD LED (Green) | |
|---|---|
| On | Comm. is active |
| Off | No communication |

Rear View

**WARNING:** To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

*Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.*

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 1-800-633-0405 or 770-844-4200.

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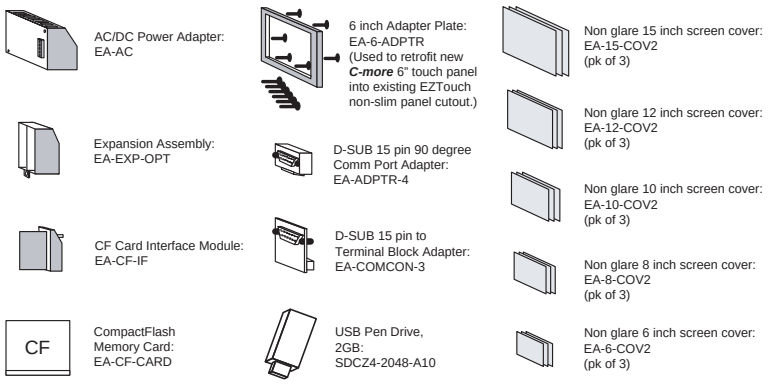
# *C-more* Accessories

## Accessories

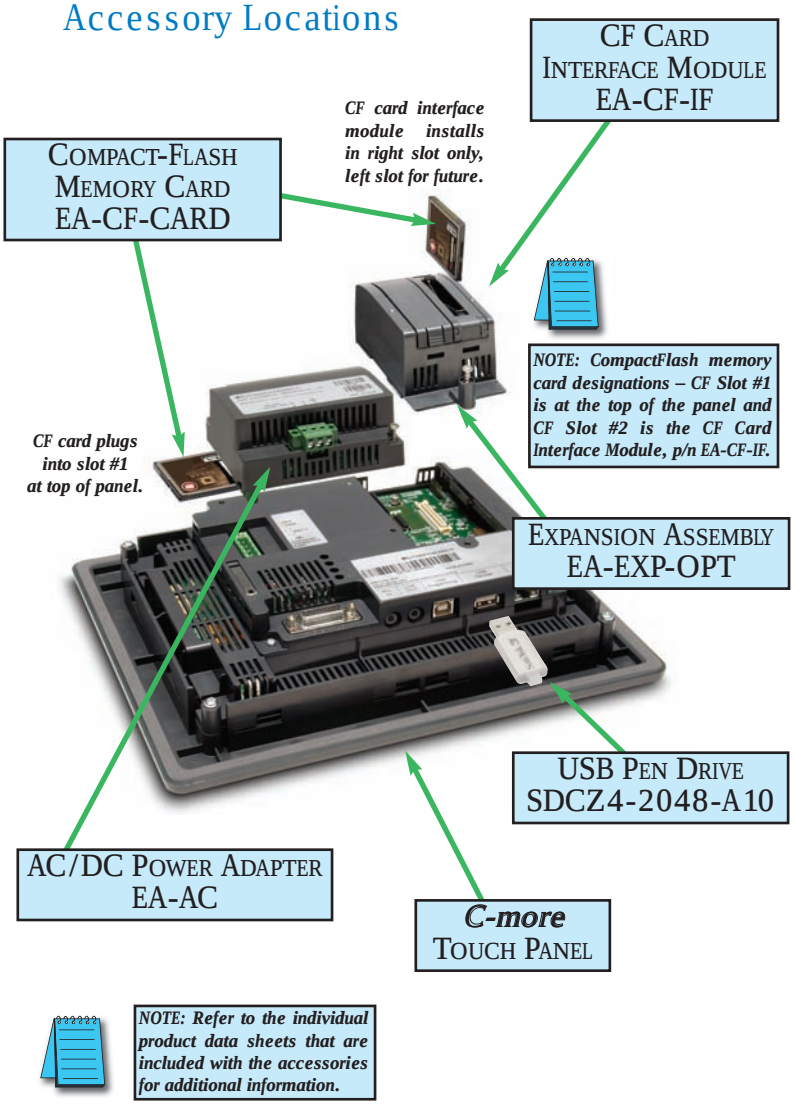
The *C-more* touch panels can be enhanced with the accessories below:

| Part Number | Description | Price |
|---|---|---|
| ***EA-AC*** | The AC/DC Power Adapter, EA-AC, is for *C-more* touch panels only, and is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A. Power Fault features help protect data being logged to CompactFlash during power failures. The *C-more* panel must have firmware version 1.21 Build 6.18E or higher for proper operation. | <---> |
| ***EA-EXP-OPT*** | *C-more* I/O Module Expansion Assembly, used to hold secondary CompactFlash Adapter (EA-CF-IF) and future option modules | <---> |
| ***EA-CF-IF*** | CompactFlash Card Adapter Module, used when adding secondary CompactFlash option to Expansion Assembly. Compatible with EA-CF-CARD Compact-Flash memory card accessory. | <---> |
| ***EA-CF-CARD*** | 512 MB CompactFlash Memory Option, industrial grade, high speed memory for non-volatile storage. | <---> |
| ***EA-6-ADPTR*** | 6-inch mounting adapter plate, REQUIRED to mount a 6 inch *C-more* touch panel into enclosures with legacy wide-bezel EZTouch cutouts. Converts a 8.932 inch x 6.223 inch cutout to 7.522 inch x 5.625 inch cutout. | <---> |
| ***EA-ADPTR-4*** | D-SUB 15-pin 90 degree PLC serial communication port adapter (allows a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements) | <---> |
| ***EA-COMCON-3*** | D-SUB 15-pin to 6-terminal PLC serial communication port adapter to allow wire terminal connections for RS-422/485 PLC communication cable. | <---> |
| ***EA-6-COV2*** | Non Glare 6 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3) | <---> |
| ***EA-8-COV2*** | Non Glare 8 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3) | <---> |
| ***EA-10-COV2*** | Non Glare 10-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3) | <---> |
| ***EA-12-COV2*** | Non Glare 12-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3) | <---> |
| ***EA-15-COV2*** | Non Glare 15-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3) | <---> |
| ***SDCZ4-2048-A10*** | USB Pen Drive, 2GB, SanDisk Cruzer micro Pen Drive. Compatible with Windows 98SE, ME, 2000, XP and Mac OS 9.1.x+, OS X 10.1.2+ Certified Windows XP and Mac OS X. Recommended for use with the *C-more* Operator Touch Panels. | <---> |

## Accessories at a glance:




## Accessory Locations



# *C-more* Accessories

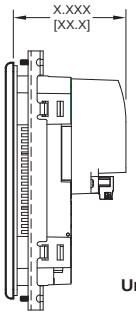
## AC/DC Power Adapter

The AC/DC Power Adapter provides dedicated DC power to the panel if using 110 VAC as a power source. The AC/DC Power Adapter provides some features that a normal DC power supply cannot provide. The adapter provides a power loss signal to the touch panel that can be used to track power outages. This signal also allows the touch panel by way of a timed sequence to stop writing data to CompactFlash memory devices providing a controlled shutdown for increased data logging reliability.

Part No. EA-AC <--->



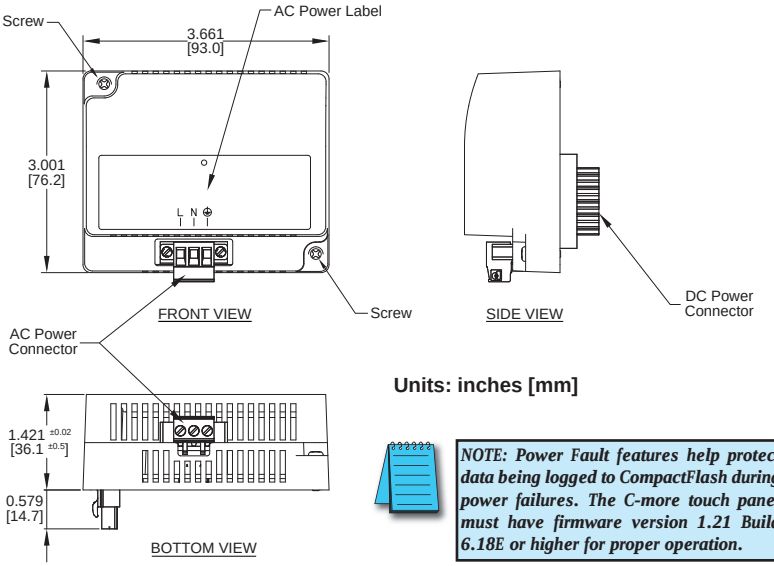
### Overall Panel Depth w/ EA-AC Installed




EA7-S6M-R = 2.921 [74.2]
EA7-T6CL-R = 2.921 [74.2]
EA7-S6M = 2.921 [74.2]
EA7-T6CL = 2.921 [74.2]
EA7-T8C = 3.157 [80.2]
EA7-T10C = 3.106 [78.9]
EA7-T12C = 3.102 [78.8]
EA7-T15C = 3.075 [78.1]

**Units: inches[mm]**

### Dimensions




**Units: inches [mm]**

***NOTE: Power Fault features help protect data being logged to CompactFlash during power failures. The C-more touch panel must have firmware version 1.21 Build 6.18E or higher for proper operation.***

***NOTE: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].***

| AC/DC Power Adapter Specifications | | | |
|---|---|---|---|
| ***Part Number*** | EA-AC | ***Static Electricity Discharge Resistance*** | Compliant with IEC61000-4-2, Contact: 4 kV, Air: 8 kV |
| ***Input Voltage & Frequency*** | 100-240 VAC; 50/60 Hertz | ***Agency Approvals*** | UL508, cUL, CE, EMC EN61132-2 |
| ***Voltage Range*** | 85-264 VAC w/ Under Voltage and Over Voltage Shutdown | ***Environment*** | For use in pollution degree 2 environment |
| ***Permissible Momentary Power Failure*** | Within 40 ms | ***Grounding*** | Ground resistance: less than 100 ohm |
| ***Input Power*** | 68 VA or less | ***Dimensions - inches [mm]*** | 3.00" (H) x 3.66" (W) x 1.42" (D) [76.2 mm x 93.0 mm x 36.1 mm] (Excluding DC Power Connector.) |
| ***Operating Temperature Range*** | 0 °C to 50 °C [32 to 122 °F] Maximum surrounding temperature rating, 50 °C (For the EA7-T15C touch panel, maximum temperature is 40° C, [104 °F] when using the AC/DC Power Adapter.) | ***Weight*** | 6.13 oz. [175 g] |
| ***Storage Temperature Range*** | -20 to 60 °C [-4 to 140 °F] | ***Cooling Method*** | Natural convection when installed on vertically mounted touch panel. |
| ***Operating & Storage Humidity*** | 10-85% RH (non-condensing) | ***Included Parts*** | AC Power Connector, Data Sheet Insert |
| ***Noise Immunity*** | 1000 VAC p-p (Pulse width 1 µs, rise time: 1 ns), with proper ground connection on AC terminal block. | ***Removable AC Power Connector*** | EA-AC-CON or DECA Switchlab MC101-508-03G Secure with (2) captive M2.5 screws, torque to 70 oz-in [0.5 Nm] |
| ***Hi-Pot*** | 1000 VAC, 1 minute, with proper ground connection on AC terminal block. | ***Output Voltage and Ripple*** | 21.6 - 26.4 VDC, Ripple < 100 mV p-p |
| ***Insulation Resistance*** | 500 VDC, 10 M ohm or above, with proper ground connection on AC terminal block. | ***Output Current*** | Maximum 1.5 A |
| ***Vibration*** | Compliant with IEC61131-2 | ***Inrush Current*** | For 100 VAC: 15 A, 3 ms or less<br>For 240 VAC: 20 A, 3 ms or less |
| ***Shock*** | Pulse shape: Sine half wave, Peak acceleration: 147 m/s² (15 G), X, Y, Z: 3 directions, 2 times each | ***Power Fail Detection Voltage*** | 58 VAC ±5% |
| ***Thermal Protection*** | 140 °C [284 °F], with autorecovery | ***Mounting to Touch Panel*** | Secure with (2) spring loaded captive M3-20 screws, torque to 50 oz-in [0.35 Nm] |
| ***Short Circuit Protection*** | 85 VAC: 2.6 A, 100 VAC: 2.8 A, 264 VAC: 3.9 A | | |

# *C-more* Accessories

## Expansion Assembly

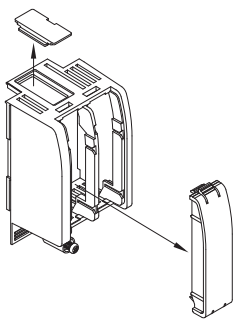
The *C-more* Expansion Assembly allows installation of the optional CF Card Interface Module (shown below) for CF card use. Although the full featured models have a built-in CompactFlash slot, some users may require additional CF memory for data logging.

The optional Expansion Assembly can be installed on the rear of all but the 6-inch base models. This attachable assembly currently allows installation of an additional CompactFlash card with the use of the CF Card Interface Module.

Part No. EA-EXP-OPT

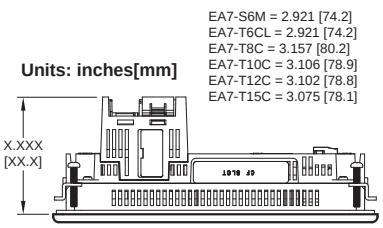


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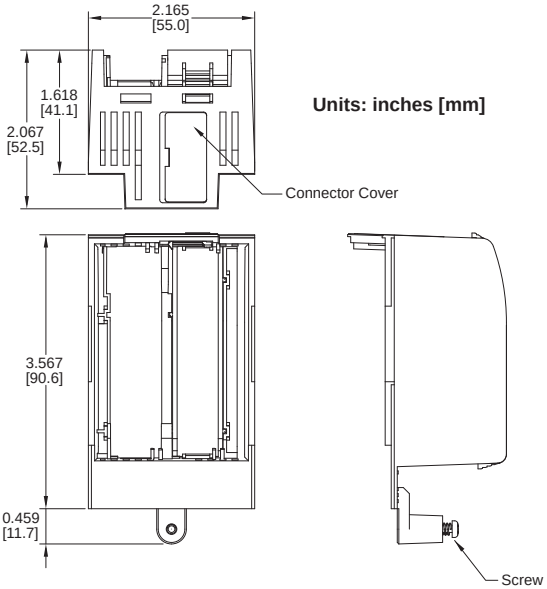


### Overall Panel Depth w/ EA-EXP-OPT Installed

EA7-S6M = 2.921 [74.2]
EA7-T6CL = 2.921 [74.2]
EA7-T8C = 3.157 [80.2]
EA7-T10C = 3.106 [78.9]
EA7-T12C = 3.102 [78.8]
EA7-T15C = 3.075 [78.1]




### Dimensions




## CF Card Interface Module

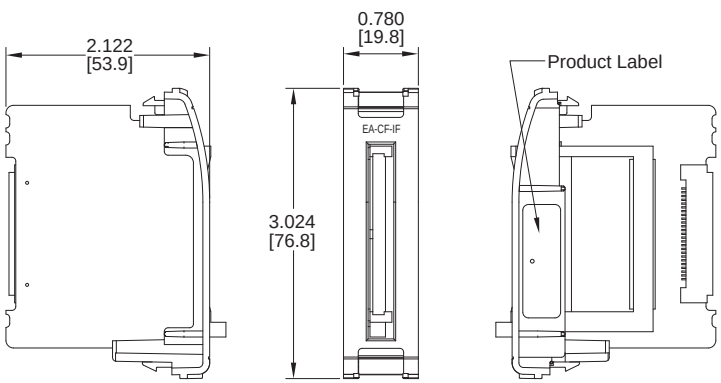
The *C-more* CF Card Interface Module is used with the Expansion Assembly to allow use of standard CompactFlash cards, such as the CompactFlash Memory (EA-CF-CARD). The CF card can be used for data logging or as project backup.

Part No. EA-CF-IF



<---->

### Dimensions




**Units: inches [mm]**

# *C-more* Accessories

## 512 MB CompactFlash Memory Card

EA-CF-CARD is a 512 MB high speed industrial grade CompactFlash memory card for non-volatile storage. Its 85 °C operating temperature makes it perfect for data logging in industrial applications (recommended for *C-more* touch panels). This is a standard “off the shelf” CompactFlash.

Part No.
EA-CF-CARD




<---->

### Specifications/Features:

- CompactFlash® Compatibility
- W/E Endurance 100,000 cycles
- Data transfer rate: 16 MB/second
- Operating Temp: -13 to 185°F ( -25 to 85°C )
- Operating Humidity 85% max, non-condensing
- Storage Temp: -13 to 194 °F ( -25 to 90°C )
- Storage Humidity 95% max, non-condensing

## USB Pen Drive

Part No.
SDCZ4-2048-A10




<---->

The SanDisk Cruzer Micro is an extremely small 2GB USB Flash Drive (UFD) that connects to a USB port. Users can easily store their logging data, project data, key documents and images on a Cruzer Micro and transfer them to another computer with a USB port.

### Specifications/Features:

- Dimensions: 7.9 mm x 18.95 mm x 52.2 mm (H x W x L)
- Stylish, metal casing
- Hi-Speed USB 2.0 certified (backwards compatible with all USB 1.1 ports)
- Compatible with Windows 7, Windows 2000, XP, Vista and Mac OS 9.1.x+, OS X v10.1.2+
- Certified Windows XP, Vista and Mac OS X

## 6” Adapter Plate

The adapter plate simplifies the retrofit of a new ***C-more*** 6” touch panel into an existing cabinet cutout for an EZTouch (units sold by AutomationDirect) 6” wide bezel touch panel, such as our part number EZ-S6C-K, EZ-S6C-F, EZ-S6M-R or EZ-S6M-F.

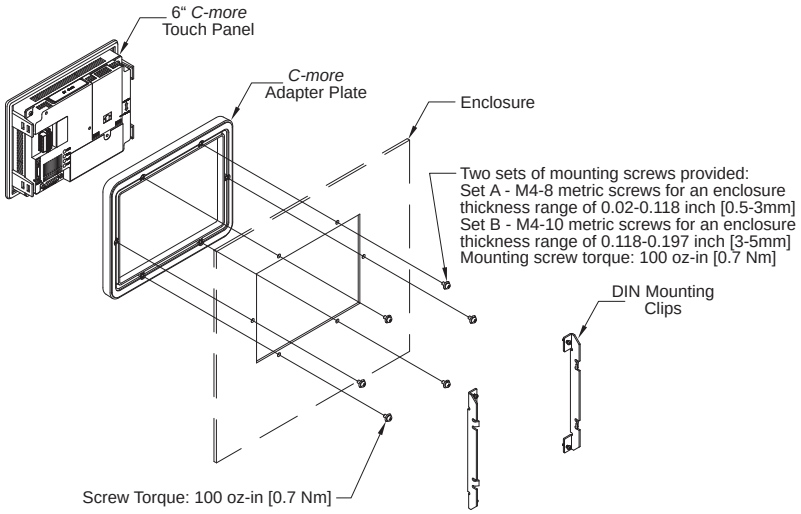
A NEMA 4/4X gasket is included. Please note that all sizes of the ***C-more*** touch panels have the same cutout as similarly sized EZTouch thin bezel (slim) touch panels, allowing quick replacement.

Part No. EA-6-ADPTR

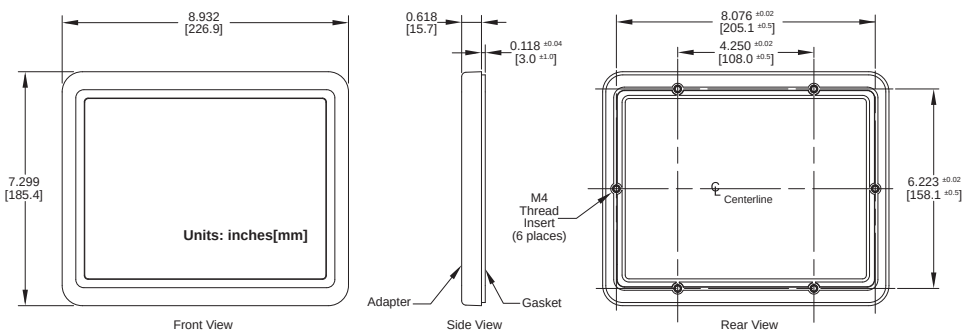


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## Mounting Details

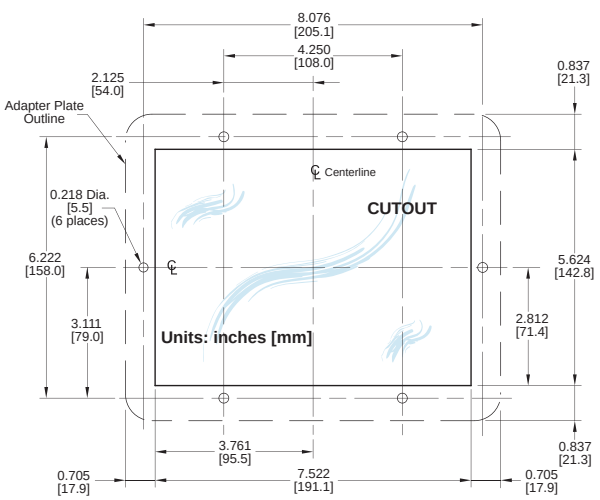



## Dimensions






## Cutout Dimensions



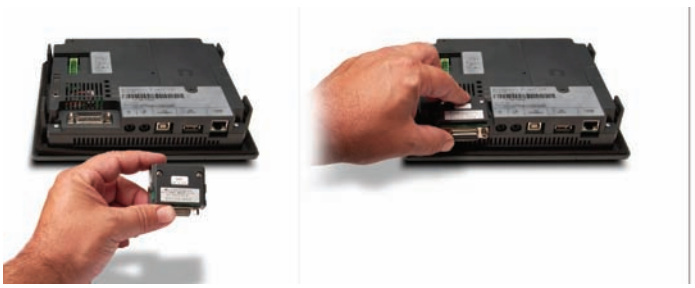
## D-SUB 15-pin 90-degree Communication Port Adapter

The EA-ADPTR-4 adapter plugs into the 15-pin serial port on the rear of the panel to allow a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements. 15-pin straight through pin-out. UL Recognized.

Part No.
EA-ADPTR-4

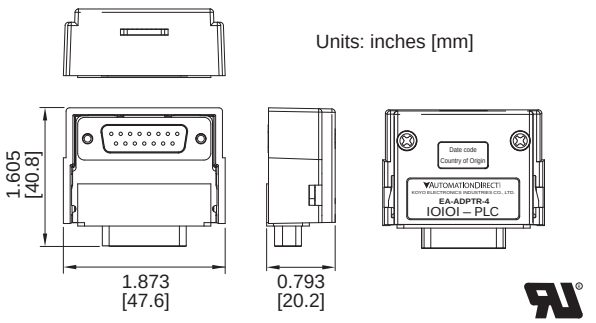


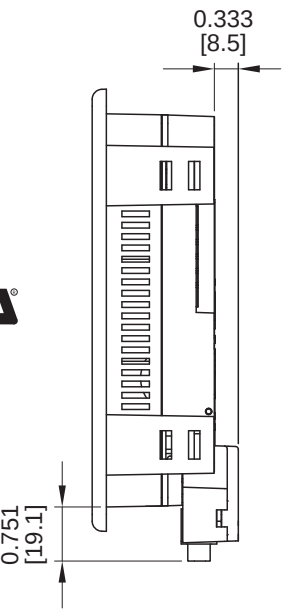
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### Dimensions

Units: inches [mm]




## D-SUB 15-pin to Terminal Block Adapter

The EA-COMCON-3 adapter plugs into the 15-pin serial port on the rear of the panel to allow wire terminal connections for an RS-422/RS-485/DH-485 PLC communication cable. UL Recognized.

Part No.
EA-COMCON-3

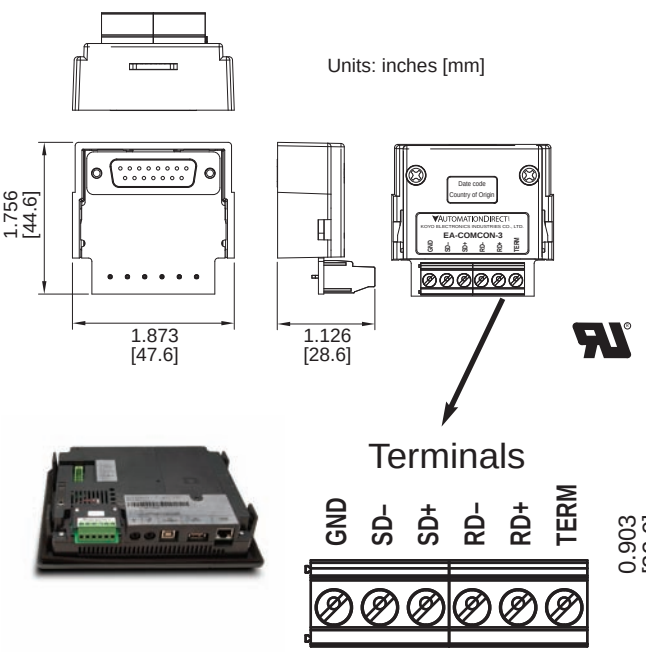


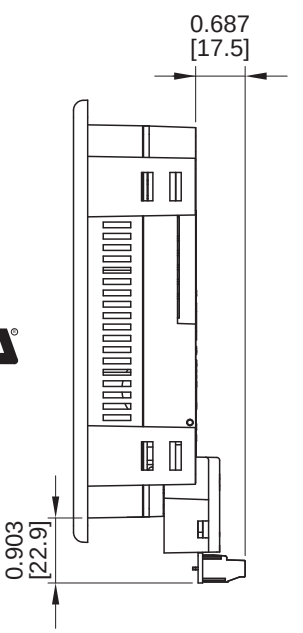
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### Dimensions

Units: inches [mm]



## Non-glare Screen Covers (in packages of 3)

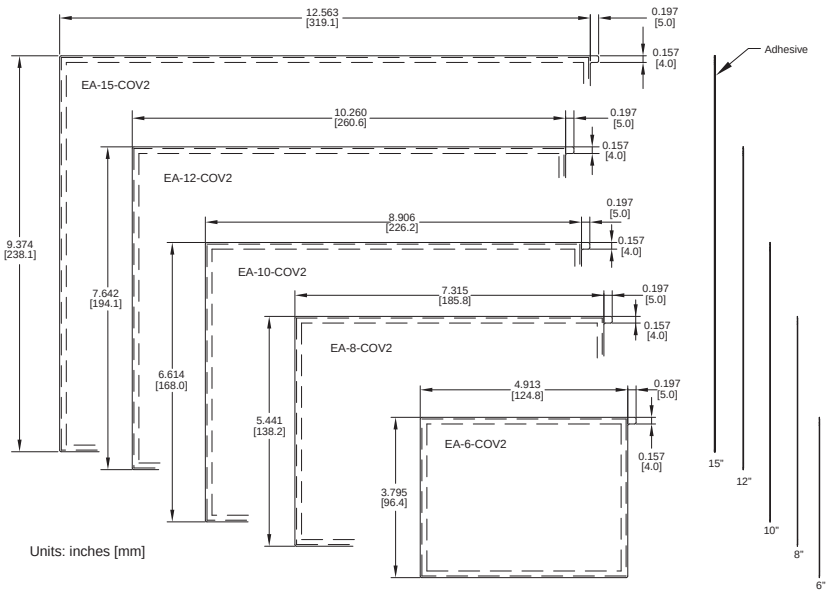
The non-glare screen covers are protective overlays used to protect the touch screen while helping to reduce the glare from external light sources.

Part Nos. EA-6-COV2, EA-8-COV2, EA-10-COV2, EA-12-COV2 and EA-15-COV2

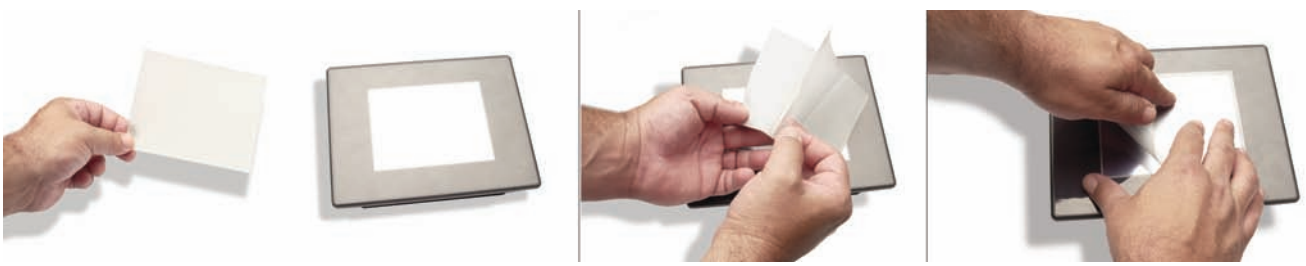


EA-6-COV2 <--->
EA-8-COV2 <--->
EA-10-COV2 <--->
EA-12-COV2 <--->
EA-15-COV2 <--->

### Dimensions




### Installation



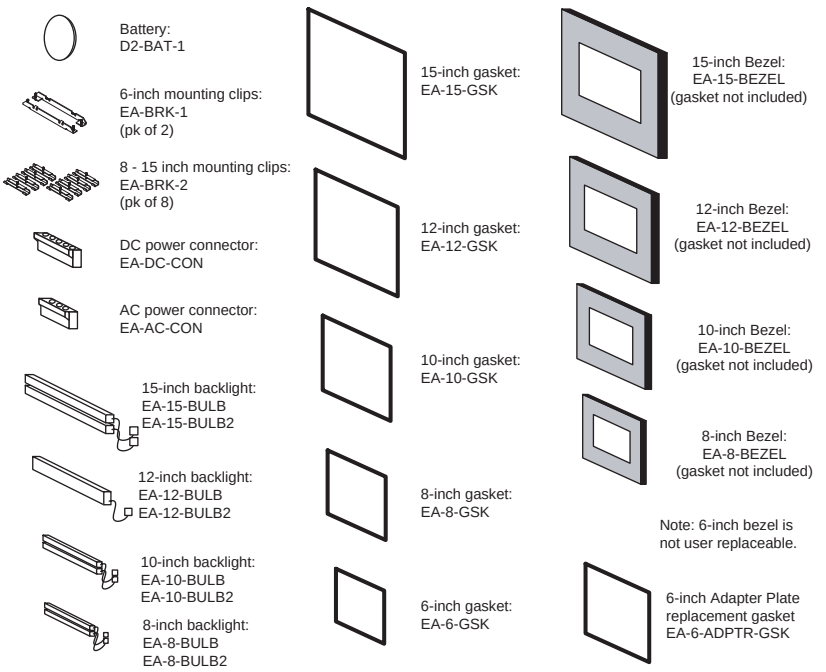
*NOTE: The Protective Cover ships with a thin protective sheet on the face of the cover that needs to be carefully removed. If your panel is not clear, the protective sheet may not have been removed.*

# *C-more* Replacement Parts

The optional replacement parts can be used to replace damaged, worn or lost *C-more* components.

| Part Number | Description | Price |
|---|---|---|
| ***EA-15-BULB**** ***EA-15-BULB2**** | 15" Panel Backlight Bulb Replacement | <---> |
| ***EA-12-BULB**** ***EA-12-BULB2**** | 12" Panel Backlight Bulb Replacement | <---> |
| ***EA-10-BULB**** ***EA-10-BULB2**** | 10" Panel Backlight Bulb Replacement | <---> |
| ***EA-8-BULB**** ***EA-8-BULB2**** | 8" Panel Backlight Bulb Replacement | <---> |
| ***EA-DC-CON*** | DC Panel Power Connector Replacement | <---> |
| ***EA-AC-CON*** | AC Power Adapter Connector Replacement | <---> |
| ***D2-BAT-1*** | Replacement Battery | <---> |
| ***EA-BRK-1*** | 6" Panel Mounting Clip Replacements (2 per pk.) | <---> |
| ***EA-BRK-2*** | 8"-15" Panel Mounting Clip Replacements (8 per pk.) | <---> |
| ***EA-15-BEZEL*** | 15" Panel Bezel Replacement | <---> |
| ***EA-12-BEZEL*** | 12" Panel Bezel Replacement | <---> |
| ***EA-10-BEZEL*** | 10" Panel Bezel Replacement | <---> |
| ***EA-8-BEZEL*** | 8" Panel Bezel Replacement | <---> |
| ***EA-15-GSK*** | 15" Panel Gasket Replacement | <---> |
| ***EA-12-GSK*** | 12" Panel Gasket Replacement | <---> |
| ***EA-10-GSK*** | 10" Panel Gasket Replacement | <---> |
| ***EA-8-GSK*** | 8" Panel Gasket Replacement | <---> |
| ***EA-6-GSK*** | 6" Panel Gasket Replacement | <---> |
| ***EA-6-ADPTR-GSK*** | 6" Adapter Plate Gasket Replacement | <---> |

## Replacement parts at a glance:




***PLEASE REFER TO THE INDIVIDUAL DATA SHEET INSERTS THAT ARE INCLUDED WITH EACH REPLACEMENT PART FOR ADDITIONAL DETAILS.***

| **C-more* Replacement Bulbs | | |
|---|---|---|
| ***C-more* Model** | **Bulb Model** | ***C-more* Serial Number** |
| ***EA7-T8C*** | ***EA-8-BULB*** | EA7-T8C+10Z15B020 and older |
| | ***EA-8-BULB2*** | EA7-T8C+10Z15B021 and newer |
| ***EA7-T10C*** | ***EA-10-BULB*** | EA7-T10C+10Z11B080 and older |
| | ***EA-10-BULB2*** | EA7-T10C+10Z11B081 and newer |
| ***EA7-T12C*** | ***EA-12-BULB*** | EA7-T12C+10Z29B019 and older |
| | ***EA-12-BULB2*** | EA7-T12C+10Z29B020 and newer |
| ***EA7-T15C*** | ***EA-15-BULB*** | EA7-T15C+10Z22B120 and older |
| | ***EA-15-BULB2*** | EA7-T15C+10Z22B121 and newer |

**Serial Number =** [Part Number]+[**YYMDDFNNN**]

**Date Code =** **YYMF**

**YY:** Year (05–99 --- e.g. 05 = 2005)
**M:** Month (1–9, X, Y, Z --- e.g. X = Oct.)
**DD:** Day (1–31)
**F:** Manufacturing Site (0–9, A–Z)
**NNN:** Sequence number for the date listed (000–999)

Part No.
EA-8-BULB, EA-8-BULB2,
EA-10-BULB, EA-10-BULB2,
EA-12-BULB, EA-12-BULB2,
EA-15-BULB, & EA-15-BULB2
*see table*



Backlight assembly, customer replaceable, for *C-more* 8", 10", 12" and 15" touch panels. The 8", 10" and 15" touch panels use two bulbs per panel and the 12" touch panels use one bulb per panel. The bulbs are packaged two per box for the 8", 10" and 15" touch panels and one per box for the 12" touch panels.

# *C-more* Replacement Parts

***MAINTENANCE AND ACCESSORY INSTRUCTION SHEETS CAN BE VIEWED AND DOWNLOADED ONLINE AT: HTTP://WWW.AUTOMATIONDIRECT.COM/STATIC/MANUALS/EAUSERM/EAUSERM.HTML***

## DC Power Connector
## Part No. EA-DC-CON



Replacement 5-terminal DC power connector for *C-more* touch panels.

## AC Power Connector
## Part No. EA-AC-CON



Replacement 3-terminal AC power connector for *C-more* touch panel AC Power Adapters.

## Replacement Battery
## Part No. D2-BAT-1



Backup Battery (supplied with new panels)

*C-more* panels use battery backed RAM to store retentive values for internal tags. This battery will last for up to two years, and is easy to replace. You can even set up an alarm condition, and let *C-more* remind you when the battery needs replacing. The *C-more* panels come with the D2-BAT-1 already installed.

NOTE: The D2-BAT-1 is the same battery used in our DL06, D2-250(-1), D2-260 and D3-350 PLC products.

## 6" Panel Mounting Clips
## Part No. EA-BRK-1



Spare panel mounting clips for 6-inch *C-more* touch panels. Package of 2 clips with 4 screws.

## 8"-15" Panel Mounting Clips
## Part No. EA-BRK-2



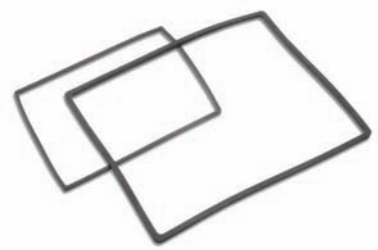
Spare panel mounting clips for the 8-inch through 15-inch *C-more* touch panels. Package of 8 clips with 8 screws.

## Part No. EA-8-BEZEL, EA-10-BEZEL, EA-12-BEZEL and EA-15-BEZEL



NEMA 4/4X bezel, customer replaceable, for *C-more* 8", 10", 12" and 15" touch panels. Gasket not included.

## Part No. EA-6-GSK, EA-8-GSK, EA-10-GSK, EA-12-GSK and EA-15-GSK



Replacement NEMA 4/4X touch panel gaskets for *C-more* 6", 8", 10", 12" and 15" touch panels.

## Part No. EA-6-ADPTR-GSK



6-inch replacement NEMA 4/4X gasket for the *C-more* touch panel adapter plate.

***CAUTION - The battery used in this device may present a risk of fire or chemical burn if mistreated. Do not recharge, disassemble, heat above 100 °C (212 °F) or incinerate. Replace battery with AutomationDirect part number D2-BAT-1 or CR2354 only. Use of another battery may present a risk of fire or explosion. Dispose of used battery properly. Keep away from children.***

***Perchlorate Material, special disposal handling may apply.***

# AirLink™ Raven XE
# Intelligent 3G Gateway

## Rugged Design and Advanced Security for Fixed and Portable Wireless Communication

The AirLink™ Raven XE is a superior and secure Ethernet gateway with a compact and sleek form factor, ideal for enterprise customers requiring 24/7 unmanned operation of remote assets and broadband connectivity. The Raven XE is powered by ALEOS™ embedded intelligence and managed by the AirLink Software Suite, which together drastically reduce total cost of ownership by reducing field visits to remote equipment.

The intelligent gateway, with simple installation and configuration requirements, is designed to handle robust fixed and portable applications requiring broadband communication speeds and bandwidth.

### RUGGED INTELLIGENCE AND MANAGEMENT

Powered by ALEOS technology, the long-standing industry benchmark for reliable and feature-rich intelligence, the Raven XE features embedded machine and routing protocols, ease of integration and advanced security features like IPsec VPN and GRE tunneling.

The AirLink Software Suite is a comprehensive set of device management tools that enable enterprises to perform remote device configuration, administration and control. AirLink Software is tightly integrated with ALEOS embedded intelligence to provide a cohesive experience for the various stakeholders who use, support and manage remote deployments of fixed or mobile industrial and enterprise solutions enabled by AirLink gateways and routers.

### IDEAL FOR BROADBAND DATA APPLICATIONS

The Raven XE is a versatile tool for myriad broadband commercial fixed or portable network connectivity and business continuity data applications. Its small form factor enables integration into close quarters, such as ATMs, kiosks and media servers, while its rugged design makes it an ideal option for surveillance and digital signage. Multiple levels of security ensure data is safe from unauthorized access and enable the Raven XE to be part of a PCI compliant solution for payment applications. Furthermore, its routing features, like NAT and Port Forwarding, enable the Raven XE to be connected to a switch for a routing solution.



### KEY BENEFITS:

- Easy integration with customer equipment
- Consistent user experience across multiple wireless network technologies
- Ethernet connectivity for easy setup
- Remote management and troubleshooting
- IPsec VPN to protect your data from unauthorized access




SIERRA WIRELESS™ | AirLink™

# AirLink™ Raven XE Intelligent 3G Gateway

## Technical Specifications

### PRODUCT FEATURES
- Persistent 3G Network Connectivity
- Low Power Consumption
- Compact Size for Easy Integration
- Rugged Aluminum Case
- Certified for Hazardous Environments
- Remote Management and Configuration

### HIGHLY INTELLIGENT
- Security
  - IPsec VPN
  - GRE Tunneling
- Events Reporting Engine
- Routing Protocols
- Highly Configurable

### TECHNOLOGY
- HSUPA with fallback to: HSDPA, UMTS, EDGE, GPRS, GSM

or
- CDMA EV-DO Rev. A with fallback to: CDMA 1x, CDMA IS-95

### BANDS
- Tri-Band UMTS/HSDPA/HSUPA 850, 1900, 2100 MHz
- Quad-Band GPRS/EDGE 850, 900, 1800, 1900 MHz

or
- Dual-Band EV-DO Rev. A 800, 1900 MHz

### ENVIRONMENTAL
- Operating Temperature: -30° to +70°C / -22° to +158°F
- Storage Temperature: -40° to +85°C / -40° to +185°F

### DIMENSIONS
- 75 mm x 27 mm x 103 mm 3.0 in x 1.0 in x 4.1 in
- 185 grams 6.5 oz

### STANDARDS/APPROVALS
- FCC
- Industry Canada
- Class I Div 2
- RoHS
- Carrier Specific Approvals
- PTCRB
- CE
- A-Tick

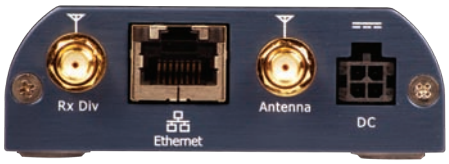
### HOST INTERFACES
- Ethernet: 10BaseT RJ-45
- USB Type B5 Pin Mini
- Antenna Connections:
  - Cellular - 50 Ohm SMA
  - Receive Diversity - 50 Ohm SMA
- I/O Ports: 2

### APPLICATION INTERFACES
- TCP/IP, UDP/IP, DHCP, HTTP, SNMP, SMTP, SMS, MSCI, Modbus

### LED INDICATORS
- Network
- Signal
- Activity
- Power



### APPLICATIONS:
- Surveillance
- Retail/POS
- Vending/Kiosk
- Banking/ATM
- Digital Signage
- Remote Monitoring
- Business Continuity




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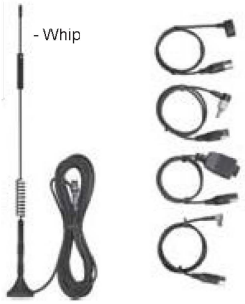
# Dual-Band Magnet Mount Installation Instructions

## 1. Antenna Adapter Required *(Sold Separately)*

In order to attach your antenna to your cell phone you will need an adapter. The adapter connects the phone to the antenna cable and transfers power to and from the antenna. If you need help locating an adapter for your phone, call Wilson toll-free at 1-866-294-6996.

## 2. Installing the Magnet Mount Antenna

Attach the Magnet Mount Antenna to any metal area on top of the roof of the vehicle. The best location is clear of obstacles and as high on the vehicle as possible. Although small, the rare earth magnet is quite strong and won't fall off at high speeds. Make sure the area under the magnet is clean so as not to damage the vehicle's paint and to ensure a strong connection. Bring the cable into the vehicle through a door frame - the cable is protected by the doors rubber molding. **Do not run the cable through a window** because when the window is rolled up and the door is opened the antenna's cable will be pulled - this is likely to destroy your antenna and/or scratch your paint. Connect the magnet mount antenna's cable to the adapter cable.




1



2

# Item List

- Various examples of Adapters are shown - yours may vary.

***(Adapter Sold Separately)***

**Items for Magnet Mount**

1 - Magnet Mount Antenna

2 - Antenna Adapter ***(Sold Separately)***

# Technical Support

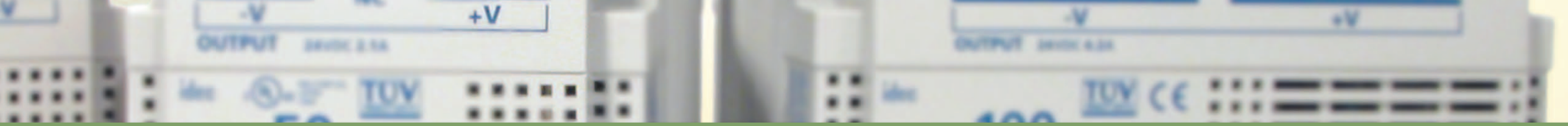
Additional help may be obtained at tech@wilsonelectronics.com or by calling Toll-Free 866-294-1660 Monday through Friday between 7:00 AM and 6:00 PM Mountain Time. Wilson Electronics is closed Saturday, Sunday, and Holidays.

# 90 Day Warranty

The Wilson Electronics Dual-Band Magnet Mount is warranted for 90 days against defects in workmanship and/or materials and will be repaired or replaced, at the discretion of the manufacturer, to the original purchaser with dated sales receipt. The antenna and a copy of the receipt must be sent to the factory at purchaser's expense where it will be repaired or replaced and returned shipping paid. Warranty does not cover damages caused by abuse, misuse, negligence, improper installation, etc. These are considered to be avoidable circumstances and are not covered by warranty. All Wilson warranties are limited to the specific Wilson product only and do not include phone, vehicle or other external product.

**Wilson**
**Electronics, Inc.**
**1-866-294-6996**
**wilsonelectronics.com**
**info@wilsonelectroincs.com**

Part # 103019 DBMM 003 / 09.06.07




## Standard Model Key Features



- Wide Power Range: 7.5W-240W
- Universal Input :
  - 7.5W-75W: 85-264V AC/105-370V DC
  - 100W: 100-120V AC/200-240V AC (Selectable) 240-370V DC
  - 120W-240W: 85-264V AC/105-370V AC
- Overcurrent/Overvoltage Protection
- Power Factor Correction (75W, 120W, 240W models)
  - EN61000-3-3
  - EN61000-3-2
- Voltage adjustment ± 10%
- Spring-up Screw Terminal, IP20 (finger-safe)
- DIN rail or Panel Surface Mount
- Approvals:
  - CE marked
  - UL 508 Listed
  - UL, c-UL
  - TÜV approved
  - EMC Directives:
    - EN50081-2
    - EN50082-2
    - EN61000-6-2
  - LVD EN60950:2000

## Standard Power Supplies





**7.5 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-A05 | 5V DC | 1.5A |
| PS5R-A12 | 12V DC | 0.6A |
| PS5R-A24 | 24V DC | 0.3A |



**15 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-B05 | 5V DC | 2.5A |
| PS5R-B12 | 12V DC | 1.2A |
| PS5R-B24 | 24V DC | 0.6A |



**30 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-C12 | 12V DC | 2.5A |
| PS5R-C24 | 24V DC | 1.3A |



**50 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-D24 | 24V DC | 2.1A |



**75 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-Q24 | 24V DC | 3.1A |



**100 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-E24 | 24V DC | 4.2A |



**120 Watt Power Supply**

| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-F24 | 24V DC | 5A |

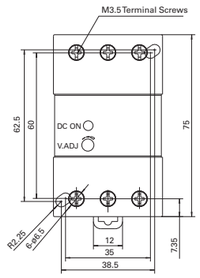


**240 Watt Power Supply**

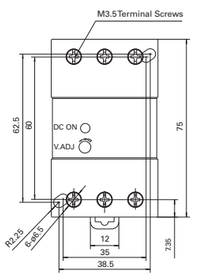
| Part Number | Rated Voltage | Rated Current |
|---|---|---|
| PS5R-G24 | 24V DC | 10A |

## Standard Power Supply Dimensions

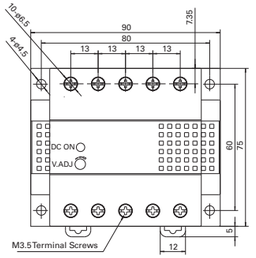
**PS5R-A (7.5W)**
Height 75.0 mm
Width 45.0 mm
Depth 70.0 mm



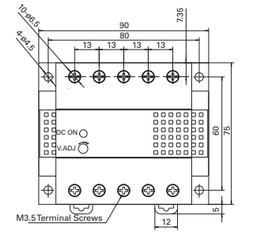

**PS5R-B (15W)**
Height 75.0 mm
Width 45.0 mm
Depth 95.0 mm

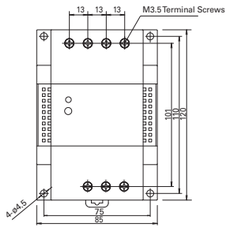



**PS5R-C (30W)**
Height 75.0 mm
Width 90.0 mm
Depth 95.0 mm

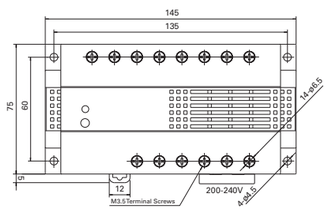



**PS5R-D (50W)**
Height 75.0mm
Width 90.0mm
Depth 95.0mm

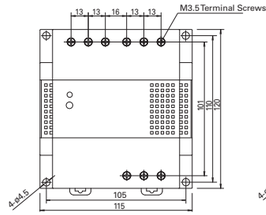


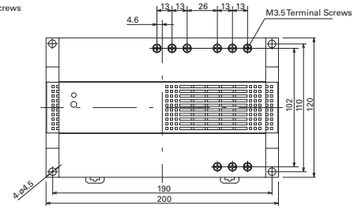

**PS5R-Q (75W)**
Height 120.0 mm
Width 85.0 mm
Depth 140.0 mm




**PS5R-E (100W)**
Height 75.0 mm
Width 145.0 mm
Depth 95.0 mm




**PS5R-F (120W)**
Height 120.0 mm
Width 115.0 mm
Depth 140.0 mm




**PS5R-G (240W)**
Height 120.0mm
Width 200.0mm
Depth 140.0mm

## CONCEPT™, TYPE 4 AND 12



### INDUSTRY STANDARDS

*Wall-mounting brackets required to maintain UL/CSA external mounting requirement.*

**CONCEPT solid single-door, door with window and flush-mount models**

| |
|---|
| UL 508A Listed; Type 4, 12; File No. E61997<br>cUL Listed per CSA C22.2 No. 94; Type 4, 12; File No. E61997 |

NEMA/EEMAC Type 4, 12, 13
CSA, File No. 42186: Type 4, 12
VDE IP66
IEC 60529, IP66

**CONCEPT two-door models**

| |
|---|
| UL 508A Listed; Type 12; File No. E61997<br>cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997 |

NEMA/EEMAC Type 12
CSA, File No. 42186, Type 12
VDE IP 55
IEC 60529, IP55

### APPLICATION

CONCEPT™ Enclosures are ideal for machine control applications. With streamlined styling, flush quarter-turn latches and an attractive, durable finish. Available in solid or window single-door and two-door landscape, flush-mount and sloped-top versions for application and mounting flexibility. Two-door landscape models provide full-width access and easy panel installation.

### SPECIFICATIONS

- 14, 16 or 18 gauge steel (see table)
- Seams continuously welded and ground smooth
- Corner-formed doors
- Simple easy-to-remove and install hinge pins with built-in captivation clip
- High-torque threadless studs and fasteners on door
- Minimum-width body flange provides maximum door opening (210 degrees)
- External formed body flange
- Panel mounting studs fit optional CONCEPT panels and other accessories
- Mounting holes in back of body for optional external wall-mount brackets
- Hidden hinges
- Doors are interchangeable and easily removed by pulling clip-style hinge pins
- Seamless foam-in-place gasket
- Quarter-turn slotted latch(es)
- Door alignment device on doors wider than 30 in.
- Four hinges on 60-in.-high enclosures
- Grounding stud on body; bonding provision on door (except window-door models)
- Provisions for thermoplastic data pocket (right-hand hinged door on two-door models)
- Hardware kit with panel mounting nuts, panel grounding hardware and sealing washers
- Single-door enclosures have a three-point latch system on enclosures where A is equal to or greater than 42-in. with quarter-turn, slotted latch
- Window-door enclosures have a clear polycarbonate window flush with door surface
- Mounting frame on flush-mount enclosures extends completely around enclosure
- Two-door enclosures have a overlapping door design which provides full-width access
- Two door enclosures have a three-point latch system on right-hand hinged door furnished with flush slotted insert
- Illustrated instruction sheet

### FINISH

Two standard finishes are available: ANSI 61 gray or RAL 7035 textured light-gray polyester powder paint inside and out.

### ACCESSORIES

Door Stop Kit
Handles
Lock Inserts
CONCEPT™ Panels
Mounting-Bracket Kits

### MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

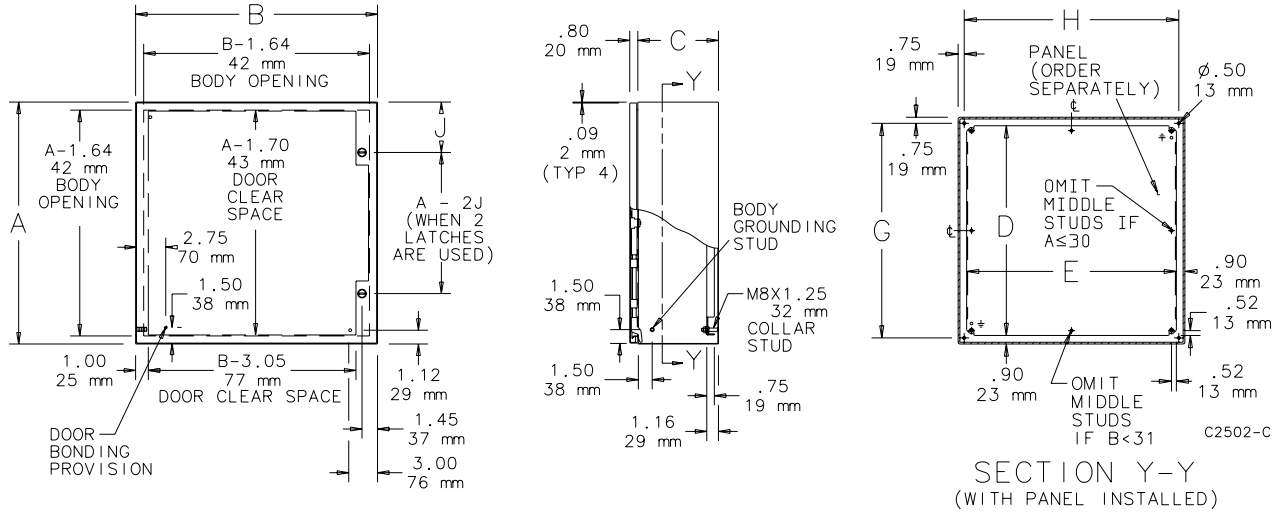
BULLETIN: CW1

| Catalog Number | AxBxC in./mm | Finish | Door Ga. | Body Ga. | CONCEPT Panel | Conductive CONCEPT Panel | Panel Size D x E in./mm | Mounting G x H in./mm | Latches qty. | Latches style | J in./mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD362410LG | 36.00 x 24.00 x 10.00<br>914 x 610 x 254 | RAL 7035 Lt. Gray | 14 | 16 | CP3624 | CP3624G | 34.20 x 22.20<br>869 x 564 | 34.50 x 22.50<br>876 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363010 | 36.00 x 30.00 x 10.00<br>914 x 762 x 254 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363010LG | 36.00 x 30.00 x 10.00<br>762 x 762 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363610 | 36.00 x 36.00 x 10.00<br>914 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363610LG | 36.00 x 36.00 x 10.00<br>914 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD423610 | 42.00 x 36.00 x 10.00<br>1067 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD423610LG | 42.00 x 36.00 x 10.00<br>1067 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD482410 | 48.00 x 24.00 x 10.00<br>1219 x 610 x 254 | ANSI 61 Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD482410LG | 48.00 x 24.00 x 10.00<br>1219 x 610 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD483610 | 48.00 x 36.00 x 10.00<br>1219 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD483610LG | 48.00 x 36.00 x 10.00<br>1219 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD603610 | 60.00 x 36.00 x 10.00<br>1524 x 914 x 254 | ANSI 61 Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD603610LG | 60.00 x 36.00 x 10.00<br>1524 x 914 x 254 | RAL 7035 Lt. Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD202012 | 20.00 x 20.00 x 12.00<br>508 x 508 x 305 | ANSI 61 Gray | 16 | 16 | CP2020 | CP2020G | 18.20 x 18.20<br>462 x 462 | 18.50 x 18.50<br>470 x 470 | 1 | Quarter-turn | 10.00<br>254 |
| CSD202012LG | 20.00 x 20.00 x 12.00<br>508 x 508 x 305 | RAL 7035 Lt. Gray | 16 | 16 | CP2020 | CP2020G | 18.20 x 18.20<br>462 x 462 | 18.50 x 18.50<br>470 x 470 | 1 | Quarter-turn | 10.00<br>254 |
| CSD242012 | 24.00 x 20.00 x 12.00<br>610 x 508 x 305 | ANSI 61 Gray | 16 | 16 | CP2420 | CP2420G | 22.20 x 18.20<br>564 x 462 | 22.50 x 18.50<br>572 x 470 | 1 | Quarter-turn | 12.00<br>305 |
| CSD242012LG | 24.00 x 20.00 x 12.00<br>610 x 508 x 305 | RAL 7035 Lt. Gray | 16 | 16 | CP2420 | CP2420G | 22.20 x 18.20<br>564 x 462 | 22.50 x 18.50<br>572 x 470 | 1 | Quarter-turn | 12.00<br>305 |
| CSD242412 | 24.00 x 24.00 x 12.00<br>610 x 610 x 305 | ANSI 61 Gray | 14 | 16 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD242412LG | 24.00 x 24.00 x 12.00<br>610 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 16 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD302412 | 30.00 x 24.00 x 12.00<br>762 x 610 x 305 | ANSI 61 Gray | 14 | 16 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD302412LG | 30.00 x 24.00 x 12.00<br>762 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 16 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD303012 | 30.00 x 30.00 x 12.00<br>762 x 762 x 305 | ANSI 61 Gray | 14 | 14 | CP3030 | CP3030G | 28.20 x 28.20<br>716 x 716 | 28.50 x 28.50<br>724 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD303012LG | 30.00 x 30.00 x 12.00<br>762 x 762 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP3030 | CP3030G | 28.20 x 28.20<br>716 x 716 | 28.50 x 28.50<br>724 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD362412 | 36.00 x 24.00 x 12.00<br>914 x 610 x 305 | ANSI 61 Gray | 14 | 16 | CP3624 | CP3624G | 34.20 x 22.20<br>869 x 564 | 34.50 x 22.50<br>876 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD362412LG | 36.00 x 24.00 x 12.00<br>914 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 16 | CP3624 | CP3624G | 34.20 x 22.20<br>869 x 564 | 34.50 x 22.50<br>876 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363012 | 36.00 x 30.00 x 12.00<br>914 x 762 x 305 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363012LG | 36.00 x 30.00 x 12.00<br>914 x 762 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363612 | 36.00 x 36.00 x 12.00<br>914 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD363612LG | 36.00 x 36.00 x 12.00<br>914 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP3636 | CP3636G | 34.20 x 34.20<br>869 x 869 | 34.50 x 34.50<br>876 x 876 | 2 | Quarter-turn | 5.00<br>127 |
| CSD423612 | 42.00 x 36.00 x 12.00<br>1067 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD423612LG | 42.00 x 36.00 x 12.00<br>1067 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP4236 | CP4236G | 40.20 x 34.20<br>1021 x 869 | 40.50 x 34.50<br>1029 x 876 | 1 | 3-point | 21.00<br>533 |
| CSD482412 | 48.00 x 24.00 x 12.00<br>1219 x 610 x 305 | ANSI 61 Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD482412LG | 48.00 x 24.00 x 12.00<br>1219 x 610 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP4824 | CP4824G | 46.20 x 22.20<br>1173 x 564 | 46.50 x 22.50<br>1181 x 572 | 1 | 3-point | 24.00<br>610 |
| CSD483612 | 48.00 x 36.00 x 12.00<br>1219 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD483612LG | 48.00 x 36.00 x 12.00<br>1219 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| CSD603612 | 60.00 x 36.00 x 12.00<br>1524 x 914 x 305 | ANSI 61 Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD603612LG | 60.00 x 36.00 x 12.00<br>1524 x 914 x 305 | RAL 7035 Lt. Gray | 14 | 14 | CP6036 | CP6036G | 58.20 x 34.20<br>1478 x 869 | 58.50 x 34.50<br>1486 x 876 | 1 | 3-point | 30.00<br>762 |
| CSD242416 | 24.00 x 24.00 x 16.00<br>610 x 610 x 406 | ANSI 61 Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| CSD242416LG | 24.00 x 24.00 x 16.00<br>610 x 610 x 406 | RAL 7035 Lt. Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |

| Catalog Number | AxBxC in./mm | Finish | Door Ga. | Body Ga. | CONCEPT Panel | Conductive CONCEPT Panel | Panel Size D x E in./mm | Mounting G x H in./mm | Latches qty. | Latches style | J in./mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CSD363016** | 36.00 x 30.00 x 16.00<br>914 x 762 x 406 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD363016LG** | 36.00 x 30.00 x 16.00<br>914 x 762 x 406 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD483616** | 48.00 x 36.00 x 16.00<br>1219 x 914 x 406 | ANSI 61 Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| **CSD483616LG** | 48.00 x 36.00 x 16.00<br>1219 x 914 x 406 | RAL 7035 Lt. Gray | 14 | 14 | CP4836 | CP4836G | 46.20 x 34.20<br>1173 x 869 | 46.50 x 34.50<br>1181 x 876 | 1 | 3-point | 24.00<br>610 |
| **CSD242420** | 24.00 x 24.00 x 20.00<br>610 x 610 x 508 | ANSI 61 Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD242420LG** | 24.00 x 24.00 x 20.00<br>610 x 610 x 508 | RAL 7035 Lt. Gray | 14 | 14 | CP2424 | CP2424G | 22.20 x 22.20<br>564 x 564 | 22.50 x 22.50<br>572 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD302420** | 30.00 x 24.00 x 20.00<br>762 x 610 x 508 | ANSI 61 Gray | 14 | 14 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD302420LG** | 30.00 x 24.00 x 20.00<br>762 x 610 x 508 | RAL 7035 Lt. Gray | 14 | 14 | CP3024 | CP3024G | 28.20 x 22.20<br>716 x 564 | 28.50 x 22.50<br>724 x 572 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD363020** | 36.00 x 30.00 x 20.00<br>914 x 762 x 508 | ANSI 61 Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |
| **CSD363020LG** | 36.00 x 30.00 x 20.00<br>914 x 762 x 508 | RAL 7035 Lt. Gray | 14 | 14 | CP3630 | CP3630G | 34.20 x 28.20<br>869 x 716 | 34.50 x 28.50<br>876 x 724 | 2 | Quarter-turn | 5.00<br>127 |

Purchase panels separately.

Optional NEMA-size panels require conversion kit Catalog Number CCPM4.



| Catalog Number | Panel Type | Panel Size D x E (in.) | Panel Size D x E (mm) | Gauge |
|---|---|---|---|---|
| CP3020G | Conductive | 28.20 x 18.20 | 716 x 462 | 12 |
| CP3220 | Painted steel | 30.20 x 18.20 | 762 x 462 | 12 |
| CP4420 | Painted steel | 42.20 x 18.20 | 1072 x 462 | 12 |
| CP5620 | Painted steel | 53.20 x 18.20 | 1351 x 462 | 12 |
| CP2424 | Painted steel | 22.20 x 22.20 | 564 x 564 | 12 |
| CP2424G | Conductive | 22.20 x 22.20 | 564 x 564 | 12 |
| CP3024 | Painted steel | 28.20 x 22.20 | 716 x 564 | 12 |
| CP3024G | Conductive | 28.20 x 22.20 | 716 x 564 | 12 |
| CP3624 | Painted steel | 34.20 x 22.20 | 869 x 564 | 12 |
| CP3624G | Conductive | 34.20 x 22.20 | 869 x 564 | 12 |
| CP4824 | Painted steel | 46.20 x 22.20 | 1173 x 564 | 12 |
| CP4824G | Conductive | 46.20 x 22.20 | 1173 x 564 | 12 |
| CP3030 | Painted steel | 28.20 x 28.20 | 716 x 716 | 12 |
| CP3030G | Conductive | 28.20 x 28.20 | 716 x 716 | 12 |
| CP3630 | Painted steel | 34.20 x 28.20 | 869 x 716 | 12 |
| CP3630G | Conductive | 34.20 x 28.20 | 869 x 716 | 12 |
| CP4230 | Painted steel | 40.20 x 28.20 | 1021 x 716 | 12 |
| CP4230G | Conductive | 40.20 x 28.20 | 1021 x 716 | 12 |
| CP3636 | Painted steel | 34.20 x 34.20 | 869 x 869 | 12 |
| CP3636G | Conductive | 34.20 x 34.20 | 869 x 869 | 12 |
| CP4236 | Painted steel | 40.20 x 34.20 | 1021 x 869 | 12 |
| CP4236G | Conductive | 40.20 x 34.20 | 1021 x 869 | 12 |
| CP4836 | Painted steel | 46.20 x 34.20 | 1173 x 869 | 12 |
| CP4836G | Conductive | 46.20 x 34.20 | 1173 x 869 | 12 |
| CP6036 | Painted steel | 58.20 x 34.20 | 1478 x 869 | 12 |
| CP6036G | Conductive | 58.20 x 34.20 | 1478 x 869 | 12 |
| CP2442 | Painted steel | 22.20 x 40.20 | 564 x 1021 | 12 |
| CP2442G | Conductive | 22.20 x 40.20 | 564 x 1021 | 12 |
| CP3048 | Painted steel | 28.20 x 46.20 | 716 x 1173 | 12 |
| CP3048G | Conductive | 28.20 x 46.20 | 716 x 1173 | 12 |
| CP3060 | Painted steel | 28.20 x 58.20 | 716 x 1478 | 12 |
| CP3060G | Conductive | 28.20 x 58.20 | 716 x 1478 | 12 |
| CP7236 | Painted steel | 70.20 x 34.20 | 1783 x 869 | 12 |

Catalog number CP4230 is used on CONCEPT disconnect enclosures.

## MOUNTING FOOT KITS



Available in stainless steel or composite material. Kit includes four feet and mounting hardware for all ACCESSPLUS™, D-BOX™, L-BOX™ and COMLINE™ cabinets.

BULLETIN: A80

| Catalog Number | Material |
|---|---|
| CMFK | Steel |
| ~~CMFKSS~~ | ~~Stainless Steel~~ |
| CMTGFT | Composite |

## SCREW PACKAGES



Screw Packages are for mounting rack panels and equipment to rack angles.

BULLETIN: A80, DACCY, X20

| Catalog Number | Color | Description | Pkg. Qty. |
|---|---|---|---|
| ES1224 | Silver | 12-24 x 5/8 in. combo head | 20 |
| ES1224250 | Silver | 12-24 x 5/8 in. combo head | 250 |
| ES1224B | Black | 12-24 x 5/8in. combo head | 20 |
| ES1224B250 | Black | 12-24 x 5/8 in. combo head | 250 |
| ASM5 | Silver | M5 x 20 mm Combo Head | 20 |
| ASM6 | Silver | M6 x 16 mm combo head | 20 |
| ASM5T | Silver | M5 x 12 mm thread-forming Phillips hex head screws | 20 |
| ASM6250 | Silver | M6 x 16 mm combo head | 250 |
| AS1032 | Silver | 10-32 x 5/8 in. combo head | 20 |
| AS1032250 | Silver | 10-32 x 5/8 in. combo head | 250 |
| AS1032B | Black | 10-32 x 5/8 in. combo head | 20 |

Use ASM5T on PROLINE™ frame or Net Series extruded holes.

## CAGE NUT PACKAGE

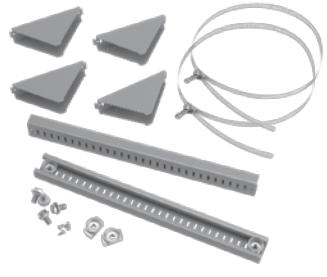


Cage Nut Packages are for use with square-hole rack angles. Cage nuts are plated steel.

BULLETIN: DACCY, P20

| Catalog Number | Color | Description | Pkg. Qty. |
|---|---|---|---|
| PM5CN | Silver | M5 cage nut | 20 |
| PM6CN | Silver | M6 cage nut | 20 |
| PM6CN250 | Silver | M6 cage nut | 250 |
| P1032CN | Silver | 10-32 cage nut | 20 |
| P1032CN250 | Silver | 10-32 cage nut | 250 |
| P1224CN | Silver | 12-24 cage nut | 20 |
| P1224CN250 | Silver | 12-24 cage nut | 250 |

## POLE MOUNTING KITS



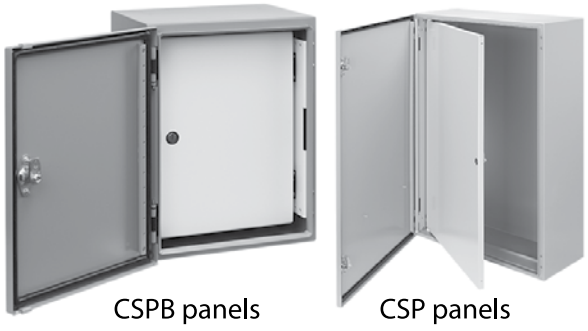


Enable COMLINE™, CONCEPT™, ACCESSPLUS™, D-BOX™ and L-BOX™ enclosures to be mounted to poles of various sizes and shapes. Simply attach the galvanized steel channel bar to the mounting holes at the back of the enclosure, then wrap the stainless steel strap around the pole and through the bar. Kit includes two mounting channels, two straps suitable for up to 12-in. diameter pole, and mounting hardware.

BULLETIN: CWY

| Catalog Number | Fits Enclosure |
|---|---|
| CPMK12 | when B = 12.00 (305) |
| CPMK16 | when B = 16.00 (406) |
| CPMK20 | when B = 20.00 (508) |
| CPMK24 | when B = 24.00 (610) |
| CPMK30 | when B = 30.00 (762) |

## CONCEPT™ SWING-OUT PANELS



CSPB panels CSP panels

Panels swing clear from the front of the enclosure to provide access to mounted internal equipment. For CSPB panels, maximum swing is 94 degrees. For CSP panels, maximum panel swing is 106 degrees. Distance from panel surface to door when in the latched position is 1.71 in. (43 mm) for solid doors and 1.45 in. (37 mm) for window doors. Kits include panel, brackets and hardware to mount to the front flange. Panel is painted white.

*Swing-out panels also can be mounted on front-to-back adjustable rails. CSPB panels require adapter CSPBADB and front-to-back adjustable rails for front-to-back adjustment.*

BULLETIN: CWY

### CSPB Panels

| Catalog Number | Fits Enclosure Size (in.) | Fits Enclosure Size (mm) | Panel Size (in.) | Panel Size (mm) |
|---|---|---|---|---|
| CSPB1212 | 12.00 x 12.00 | 305 x 305 | 9.72 x 9.75 | 247 x 248 |
| CSPB1612 | 16.00 x 12.00 | 406 x 305 | 13.72 x 9.75 | 349 x 248 |
| CSPB1616 | 16.00 x 16.00 | 406 x 406 | 13.72 x 13.75 | 349 x 349 |
| CSPB1620 | 16.00 x 20.00 | 406 x 508 | 13.72 x 17.75 | 349 x 451 |
| CSPB2016 | 20.00 x 16.00 | 508 x 406 | 17.72 x 13.75 | 450 x 349 |
| CSPB2020 | 20.00 x 20.00 | 508 x 508 | 17.72 x 17.75 | 450 x 451 |
| CSPB2024 | 20.00 x 24.00 | 508 x 610 | 17.72 x 21.75 | 450 x 553 |
| CSPB2416 | 24.00 x 16.00 | 610 x 406 | 21.72 x 13.73 | 552 x 349 |
| CSPB2420 | 24.00 x 20.00 | 610 x 508 | 21.72 x 17.75 | 552.452 |
| CSPB2424 | 24.00 x 24.00 | 610 x 610 | 21.72 x 21.75 | 552 x 553 |
| CSPB2430 | 24.00 x 30.00 | 610 x 762 | 21.72 x 27.75 | 552 x 705 |
| CSPB3020 | 30.00 x 20.00 | 762 x 508 | 27.72 x 17.75 | 704 x 451 |
| CSPB3024 | 30.00 x 24.00 | 762 x 610 | 27.72 x 21.75 | 704 x 553 |
| CSPB3030 | 30.00 x 30.00 | 762 x 762 | 27.72 x 27.75 | 704 x 705 |
| CSPB3624 | 36.00 x 24.00 | 914 x 610 | 33.72 x 21.75 | 857 x 553 |
| CSPB3630 | 36.00 x 30.00 | 914 x 762 | 33.72 x 27.75 | 857 x 705 |
| CSPB3636 | 36.00 x 36.00 | 914 x 914 | 33.72 x 33.75 | 857 x 857 |
| CSPB4236 | 42.00 x 36.00 | 1067 x 914 | 39.72 x 33.75 | 1009 x 857 |
| CSPB4824 | 48.00 x 24.00 | 1219 x 610 | 45.72 x 21.75 | 1161 x 553 |
| CSPB4836 | 48.00 x 36.00 | 1219 x 914 | 45.72 x 33.75 | 1161 x 857 |
| CSPB6036 | 60.00 x 36.00 | 1542 x 914 | 57.72 x 33.75 | 1466 x 857 |

### CSP Panels

| Catalog Number | Fits Enclosure (in.) | Fits Enclosure (mm) | Panel Size (in.) | Panel Size (mm) |
|---|---|---|---|---|
| CSP1212 | 12.00 x 12.00 | 305 x 305 | 9.78 x 9.84 | 248 x 250 |
| CSP1612 | 16.00 x 12.00 | 406 x 305 | 13.78 x 9.84 | 350 x 250 |
| CSP1616 | 16.00 x 16.00 | 406 x 406 | 13.78 x 13.84 | 350 x 352 |
| CSP1620 | 16.00 x 20.00 | 406 x 508 | 13.78 x 17.84 | 350 x 453 |
| CSP2016 | 20.00 x 16.00 | 508 x 406 | 17.78 x 13.84 | 452 x 352 |
| CSP2020 | 20.00 x 20.00 | 508 x 508 | 17.78 x 17.84 | 452 x 453 |
| CSP2024 | 20.00 x 24.00 | 508 x 610 | 17.78 x 21.84 | 452 x 555 |
| CSP2416 | 24.00 x 16.00 | 610 x 406 | 21.78 x 13.84 | 553 x 352 |
| CSP2420 | 24.00 x 20.00 | 610 x 508 | 21.78 x 17.84 | 553 x 453 |
| CSP2424 | 24.00 x 24.00 | 610 x 610 | 21.78 x 21.84 | 553 x 555 |
| CSP3020 | 30.00 x 20.00 | 762 x 508 | 27.78 x 17.84 | 706 x 453 |
| CSP3024 | 30.00 x 24.00 | 762 x 610 | 27.78 x 21.84 | 706 x 555 |
| CSP3030 | 30.00 x 30.00 | 762 x 762 | 27.78 x 27.84 | 706 x 707 |
| CSP3624 | 36.00 x 24.00 | 914 x 610 | 33.78 x 21.84 | 858 x 555 |
| CSP3630 | 36.00 x 30.00 | 914 x 762 | 33.78 x 27.84 | 858 x 707 |
| CSP3636 | 36.00 x 36.00 | 914 x 914 | 33.78 x 33.84 | 858 x 860 |

## CONCEPT™ ADAPTER BRACKET

Adapter bracket for use with CONCEPT™ B-style Swing-Out Panels and Adjustable-Depth Mounting Kits. Bracket enables the B-style swing-out panels to be mounted in infinite front-to-back positions within a CONCEPT enclosure.

BULLETIN: CWY

| Catalog Number | Material |
|---|---|
| CSPBADB | Steel |

## HANDLES



Handles can replace the standard slotted insert on all CONCEPT™ wall-mount enclosures. The CONCEPT non-locking handle provides quick and easy access to the enclosure contents. Handle is black plastic. A zinc die-cast keylock handle is available for applications requiring quick access and security. A padlocking handle, also zinc die-cast, accommodates a padlock with up to a 5/16-in. locking bar. Each latch system can be converted from clockwise to counter-clockwise opening. Kit includes all hardware.

BULLETIN: CWY

| Catalog Number | UL Rating | Description |
|---|---|---|
| CWHK | Maintains UL/CSA Type 12 when properly installed | Keylock handle |
| CWHNL | Maintains UL Type 3, 4, 4X, 12 when properly installed | Non-locking handle |
| CWHPTO | Maintains UL/CSA Type 3, 4, 12 when properly installed | Padlock handle |

CWHNL is not suitable for 3-point latch operation.

## COMPACT AXIAL FANS



### INDUSTRY STANDARDS

UL Component Recognized

CSA certified

### APPLICATION

Compact Cooling Fans are ideal for applications where enclosure space is limited and quiet, reliable cooling is required. Engineered for 50,000 hours of continuous operation without lubrication or service.

**Installation**
Can be installed on any surface of an enclosure. With the addition of accessory fan brackets, Compact Cooling Fans can also be installed in any position inside the enclosure for spot cooling or air circulation.

### FEATURES

- Maximum operating temperature is 158 F (70 C)
- 4-in. fan is thermally protected and uses permanently lubricated ball bearings
- 6- and 10-in. fans have ball-bearing construction and split-capacitor motors
- Split-capacitor motors are thermally protected to avoid premature failure
- Dynamically balanced impellers molded from polycarbonate material
- One finger guard is furnished (additional finger guards are available)
- All mounting hardware is provided
- 240 and 560 CFM fans have ball bearing construction and split capacitor motors
- Fans have leadwires with ends stripped 1/2-in. (12-mm) or 6-ft. (1.8-m) cord with polarized plug for power connections

*Fan bracket and additional finger guards must be purchased separately*

### FINISH

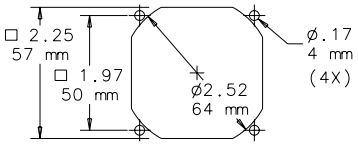
- Fan housing is black.

### ACCESSORIES

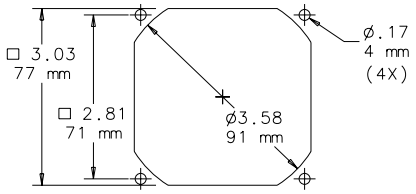
Fan Power Cords
Fan Brackets
Finger Guards
Temperature Control Switch

## Design Data **Compact Axial Fans**

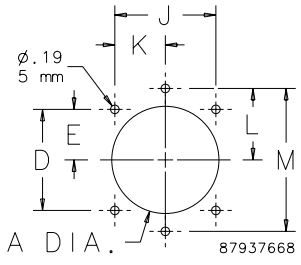
| CATALOG NUMBERS | Nominal Size | Voltage | A in./mm | D in./mm | E in./mm | J in./mm | K in./mm | L in./mm | M in./mm |
|---|---|---|---|---|---|---|---|---|---|
| A2AXFN24 | 2 | 24 VDC | — | 1.97/50 | .98/25 | 1.97/50 | .98/25 | — | — |
| **3-in. Fans** | | | | | | | | | |
| A3AXFN | 3 | 115 VAC | — | 2.81/71 | 1.40/36 | 2.81/71 | 1.40/36 | — | — |
| A3AXFN24 | 3 | 24 VDC | — | 2.81/71 | 1.40/36 | 2.81/71 | 1.40/36 | — | — |
| **4-in. Fans** | | | | | | | | | |
| A4AXFNGQ | 4 | 115 VAC | 4.62/117 | 4.12/105 | 2.06/52 | 4.12/105 | 2.06/52 | — | — |
| A4AXFNPG | 4 | 115 VAC | 4.62/117 | 4.12/105 | 2.06/52 | 4.12/105 | 2.06/52 | | |
| A4AXFN | 4 | 115 VAC | 4.62/117 | 4.12/105 | 2.06/52 | 4.12/105 | 2.06/52 | — | — |
| A4AXFN2 | 4 | 230 VAC | 4.62/117 | 4.12/105 | 2.06/52 | 4.12/105 | 2.06/52 | — | — |
| A4AXFN24 | 4 | 24 VDC | 4.62/117 | 4.12/105 | 2.06/52 | 4.12/105 | 2.06/52 | — | — |
| **6-in. Fans** | | | | | | | | | |
| A6AXFNGQ | 6 | 115 VAC | 5.88/149 | — | — | — | — | 3.19/81 | 6.38/162 |
| A6AXFNPG | 6 | 115 VAC | 5.88/149 | — | — | — | — | 3.19/81 | 6.38/162 |
| A6AXFN | 6 | 115 VAC | 5.88/149 | — | — | — | — | 3.19/81 | 6.38/162 |
| A6AXFN2 | 6 | 230 VAC | 5.88/149 | — | — | — | — | 3.19/81 | 6.38/162 |
| A6AXFN24 | 6 | 24 VDC | 5.88/149 | — | — | — | — | 3.19/81 | 6.38/162 |
| **10-in. Fans** | | | | | | | | | |
| A10AXFNPG | 10 | 115 VAC | 9.00/229 | 6.88/175 | 3.44/87 | 6.88/175 | 3.44/87 | — | — |
| A10AXFN | 10 | 115 VAC | 9.00/229 | 6.88/175 | 3.44/87 | 6.88/175 | 3.44/87 | — | — |
| A10AXFN2 | 10 | 230 VAC | 9.00/229 | 6.88/175 | 3.44/87 | 6.88/175 | 3.44/87 | — | — |




MOUNTING CUTOUT
DIMENSIONS 2 INCH




MOUNTING CUTOUT
DIMENSIONS 3 INCH



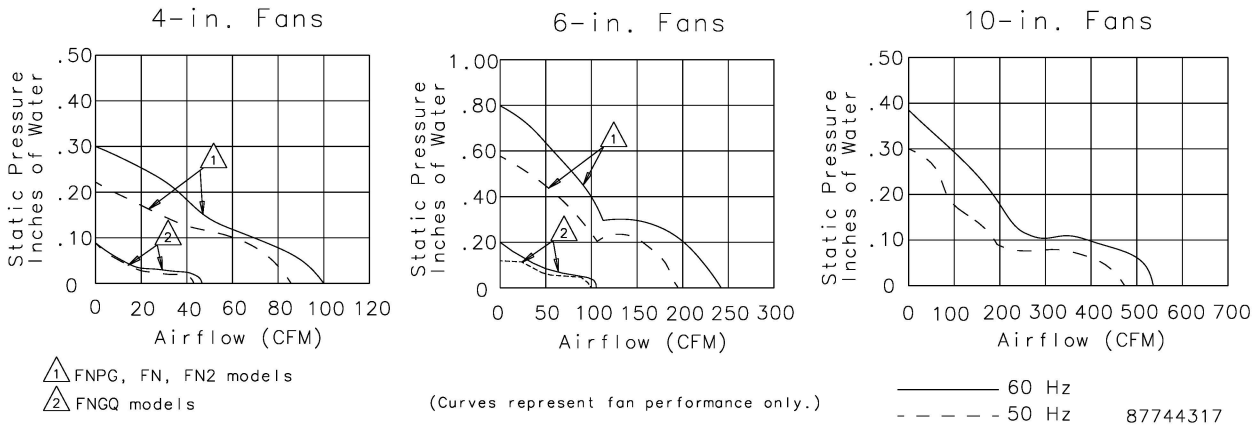

MOUNTING CUTOUT
DIMENSIONS 4,6,10 INCH

## Performance Data **Compact Axial Fans**

| ELECTRICAL DATA | | | | | |
|---|---|---|---|---|---|
| **Rated Voltage** | **24 VDC** | **115 VAC Lead Wires** | **115 VAC Power Cord Quiet Fan** | **115 VAC Power Cord** | **230 VAC Lead Wires** |
| Frequency (Hz) | 50/60 | 50/60 | 50/60 | 50/60 | 50/60 |
| Power Connection | Lead Wires | Lead Wires | Power Cord | Power Cord | Lead Wires |
| **2 inch Nominal-Size Fans** | | | | | |
| Catalog Number | **A2AXFN24** | — | — | — | — |
| Nominal Current Maximum @50/60 Hz (Amps) | .09 | — | — | — | — |
| Power Consumption Maximum @ 50/60 Hz (Watts) | 2.16 | — | — | — | — |
| Free Airflow @ 50/60 Hz (CFM)* | 21.5 | — | — | — | — |
| Free Airflow @ 50/60 Hz ($m^3$/hr.)* | 36.5 | — | — | — | — |
| Noise SIL @ 50/60 Hz (dBA) | 65 | — | — | — | — |
| Maximum RPM @50/60 Hz (RPM) | 4550 | — | — | — | — |
| Fan Size Diameter (in.) | 2.36 | — | — | — | — |
| Fan Depth (in.) | .98 | — | — | — | — |
| **3 inch Nominal-Size Fans** | | | | | |
| Catalog Number | **A3AXFN24** | **A3AXFN** | — | — | — |
| Nominal Current Maximum @50/60 Hz (Amps) | .14 | .09 | — | — | — |
| Power Consumption Maximum @ 50/60 Hz (Watts) | 3.36 | 7 | — | — | — |
| Free Airflow @ 50/60 Hz (CFM)* | 40 | 27 | — | — | — |
| Free Airflow @ 50/60 Hz ($m^3$/hr.)* | 68 | 46 | — | — | — |
| Noise SIL @ 50/60 Hz (dBA) | 35 | 40 | — | — | — |
| Maximum RPM @50/60 Hz (RPM) | 3400 | 2700 | — | — | — |
| Fan Size Diameter (in.) | 3.15 | 3.15 | — | — | — |
| Fan Depth (in.) | .98 | 1.50 | — | — | — |
| **4 inch Nominal-Size Fans** | | | | | |
| Catalog Number | **A4AXFN24** | **A4AXFN** | **A4AXFNGQ** | **A4AXFNPG** | **A4AXFN2** |
| Nominal Current Maximum @50/60 Hz (Amps) | .35 | .26/.21 | .09/.08 | .26/.21 | .14/.11 |
| Power Consumption Maximum @ 50/60 Hz (Watts) | 84 | 17/15 | 6/5 | 17/15 | 16/14 |
| Free Airflow @ 50/60 Hz (CFM)* | 118 | 85/100 | 46/49 | 85/100 | 85/100 |
| Free Airflow @ 50/60 Hz ($m^3$/hr.)* | 200 | 144/170 | 78/83 | 144/170 | 144/170 |
| Noise SIL @ 50/60 Hz (dBA) | 46.5 | 37/41 | 27/28 | 37/41 | 37/41 |
| Maximum RPM @50/60 Hz (RPM) | 3200 | 2415/2900 | 1350/1450 | 2415/2900 | 2415/2900 |
| Fan Size Diameter (in.) | 4.69 | 4.69 | 4.69 | 4.69 | 4.69 |
| Fan Depth (in.) | 1.52 | 1.52 | 1.52 | 1.52 | 1.52 |
| **6 inch Nominal-Size Fans** | | | | | |
| Catalog Number | **A6AXFN24** | **A6AXFN** | **A6AXFNGQ** | **A6AXFNPG** | **A6AXFN2** |
| Nominal Current Maximum @50/60 Hz (Amps) | .88 | .45/.36 | .16/.19 | .45/.36 | .23/.18 |
| Power Consumption Maximum @ 50/60 Hz (Watts) | 21.1 | 36/32 | 16/18 | 36/32 | 39/35 |
| Free Airflow @ 50/60 Hz (CFM)* | 280 | 200/240 | 85/102 | 200/240 | 200/240 |
| Free Airflow @ 50/60 Hz ($m^3$/hr.)* | 476 | 340/408 | 144/173 | 340/408 | 340/408 |
| Noise SIL @ 50/60 Hz (dBA) | 62.5 | 50/56 | 35/38 | 50/56 | 50/56 |
| Maximum RPM @50/60 Hz (RPM) | 3750 | 2670/3200 | 1400/1650 | 2670/3200 | 2670/3200 |
| Fan Size Diameter (in.) | 6.77 | 6.77 | 6.77 | 6.77 | 6.77 |
| Fan Depth (in.) | 2.00 | 1.50 | 1.50 | 1.50 | 1.50 |
| **10 inch Nominal-Size Fans** | | | | | |
| Catalog Number | — | **A10AXFN** | — | **A10AXFNPG** | **A10AXFN2** |
| Nominal Current Maximum @50/60 Hz (Amps) | — | 1.0/.88 | — | 1.0/.88 | .47/.43 |
| Power Consumption Maximum @ 50/60 Hz (Watts) | — | 36/36 | — | 36/36 | 36/36 |
| Free Airflow @ 50/60 Hz (CFM)* | — | 480/560 | — | 480/560 | 480/560 |
| Free Airflow @ 50/60 Hz ($m^3$/hr.)* | — | 816/951 | — | 816/951 | 816/951 |
| Noise SIL @ 50/60 Hz (dBA) | — | 46/49 | — | 46/49 | 46/49 |
| Maximum RPM @50/60 Hz (RPM) | — | 1350/1650 | — | 1350/1650 | 1350/1650 |
| Fan Size Diameter (in.) | — | 10.00 | — | 10.00 | 10.00 |
| Fan Depth (in.) | — | 3.50 | — | 3.50 | 3.50 |

* CFM without exhaust grille

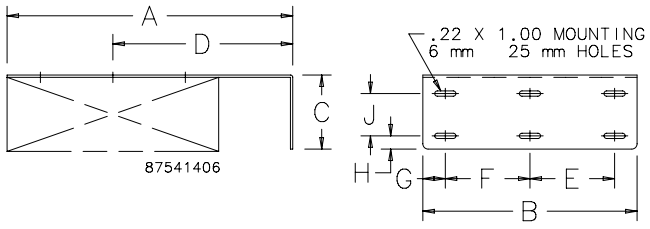
## Performance Curves for Compact Axial Fans



## FAN BRACKETS

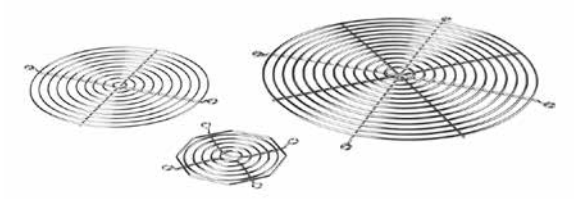


Designed to provide easy mounting of compact axial fans on enclosure panels. Brackets can be used for general air circulation or to direct air at problem areas. All sizes are .100-in. aluminum. Package quantity of 1 bracket. Fans must be ordered separately.




| CATALOG NUMBERS | AxBxC in./mm | Used with Fan Catalog Number | D in./mm | E in./mm | F in./mm | G in./mm | H in./mm | J in./mm |
|---|---|---|---|---|---|---|---|---|
| ABRKT2 | 3.75x2.75x1.50<br>95x70x38 | A2AXFN24 | 2.38/60 | — | 1.75/44 | .50/13 | .37/9 | .62/16 |
| ABRKT3 | 4.50x3.50x1.50<br>114x89x38 | A3AXFN, A3AXFN24 | 2.75/70 | — | 2.50/64 | .50/13 | .37/9 | .62/16 |
| ABRKT4 | 6.00x5.00x1.50<br>152x127x38 | A4AXFNPG, A4AXFNGQ, A4AXFN or A4AXFN2 | 3.50/89 | — | 3.00/76 | 1.00/25 | .38/10 | .62/16 |
| ABRKT6 | 10.00x6.88x2.00<br>254x175x51 | A6AXFNPG, A6AXFNGQ, A6AXFN or A6AXFN2 | 6.50/51 | — | 5.00/127 | .94/24 | .38/10 | 1.00/25 |
| ABRKT10 | 13.50x10.12x3.50<br>343x257x89 | A10AXFNPG, A10AXFNGQ, A10AXFN or A10AXFN2 | 8.50/216 | 4.00/102 | 4.00/102 | 1.06/27 | .62/16 | 2.00/51 |

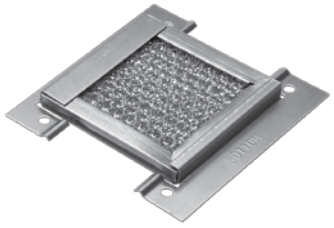
## FINGER GUARDS



One finger guard is included with each Compact Axial Fan and Cooling Fan Package. Additional Finger Guards can be mounted on either side of the fan for maximum safety. All guards are chrome-plated and meet UL 507 .25-in. plug gauge test.

| CATALOG NUMBERS | Use on Compact Axial Fan Catalog Numbers |
|---|---|
| AGARD2 | A2AXFN24 |
| AGARD3 | A3AXFN, A3AXFN24 |
| AGARD4 | A4AXFNPG, A4XFNGQ, A4AXFN, A4AXFN2 |
| AGARD6 | A6AXFNPG, A6AXFNGQ, A6AXFN, A6AXFN2 |
| AGARD10 | A10AXFNPG, A10AXFNQR , A10AXFN, A10AXFN2 |

## LOUVER PLATE KIT FILTERS



**Design**
Designed for use with Louver Plate Kit. Mounting holes on filter bracket align with louver mounting holes. Hardware supplied with louvers also secures filter brackets in place. Aluminum air filters provide good arrestment of airborne dust and dirt.

**Filter Media**
Filter media is composed of layers of slit and expanded aluminum providing hundreds of adhesive coated baffle surfaces for trapping impurities. Impurities are held throughout the depth of the filter. Washing with warm water will keep the filter clean. To achieve best results, Filter Adhesive is recommended.

| CATALOG NUMBERS | Dimensions H x W (in./mm) | Use with Steel Louver | Use with Stainless Steel Louver |
|---|---|---|---|
| AFLT33 | 3.22x 3.25/82 x 83 | AVK33 | AVK33SS6 |
| AFLT34 | 4.09 x 3.25/104 x 83 | AVK34 | AVK34SS6 |
| AFLT43 | 3.84 x 4.25/98 x 108 | AVK43 | AVK43SS6 |
| AFLT44 | 4.97 x 4.25/126 x 108 | AVK44 | AVK44SS6 |
| AFLT64 | 4.45 x 6.25/113 x 159 | AVK64 | AVK64SS6 |
| AFLT66 | 6.72 x 6.25/171 x 159 | AVK66 | AVK66SS6 |
| AFLT84 | 4.64 x 8.25/118 x 210 | AVK84 | AVK84SS6 |
| AFLT86 | 7.02 x 8.25/178 x 210 | AVK86 | AVK86SS6 |
| AFLT88 | 9.39 x 8.25/239 x 210 | AVK88 | AVK88SS6 |
| AFLT812 | 14.14 x 8.25/359 x 210 | AVK812 | AVK812SS6 |

# TEMPERATURE CONTROL SWITCH



## FEATURES

- Additional label for conversion to Celsius scale and blank label to cover set point range label when adjustment after initial setting is not desired are included
- Bimetal temperature sensor
- Plastic housing
- Connections consist of tubular screw terminals for AWG 14 (.04 sq. in.)
- Provision for both panel mounting and DIN rail mounting

## FINISH

- Molded plastic housing is black

## INDUSTRY STANDARDS

cURus; File No. E164102
UL94-VO

Protection rating IEC IP30
CSA Certified, File Number 215952
CE

## APPLICATION

These easy-to-install thermostats regulate and monitor air temperature in enclosures that contain heat-emitting equipment. Thermostats prolong heater and fan life expectancy by controlling operation time and increase electrical component working efficiency by exposing them to fewer environmental contaminants.

Performance Data **Temperature Control Switch**

| CATALOG NUMBERS | ATEMNC | ATEMNO |
|---|---|---|
| **ELECTRICAL DATA** | | |
| Maximum Load (Switching Capacity) | | |
| 120 VAC | 15 A resistive / 2 A inductive @ 120 VAC | |
| 250 VAC | 10 A resistive / 2 A inductive @ 250 VAC | |
| DC | DC 30 W | |
| Minimum load | 20 mA (all voltages) | |
| Contact Type | NC (normally closed), quick acting | NO (normally open), quick acting |
| Control Application | Heater | Fan |
| **UNIT CONSTRUCTION** | | |
| Unit Dimensions - H x W x D (in./mm) | 2.37/60 x 1.31/33 x 1.55/39 | |

# OT100F3

## General Information

| | |
|---|---|
| **Extended Product Type:** | OT100F3 |
| **Product ID:** | 1SCA105004R1001 |
| **EAN:** | 6417019391359 |
| **Catalog Description:** | OT100F3 Switch-disconnector |
| **Long Description:** | Front operated switch-disconnector. Types OT 16...125 include protected terminal clamps, IP 20. |

## Categories

Products » Low Voltage Products and Systems » Switches » Disconnect Switches

## Ordering

| | |
|---|---|
| **EAN:** | 6417019391359 |
| **Minimum Order Quantity:** | 1 piece |
| **Customs Tariff Number:** | 85365080 |

## Dimensions

| | |
|---|---|
| **Product Net Width:** | 70 mm |
| **Product Net Height:** | 100 mm |
| **Product Net Depth:** | 74 mm |
| **Product Net Weight:** | 0.4 kg |

## Container Information

| | |
|---|---|
| **Package Level 1 Units:** | 1 piece |
| **Package Level 1 Width:** | 81 mm |
| **Package Level 1 Height:** | 86 mm |
| **Package Level 1 Length:** | 112 mm |
| **Package Level 1 Gross Weight:** | 0.4 kg |
| **Package Level 1 EAN:** | 6417019391359 |

## Environmental

| | |
|---|---|
| **RoHS Status:** | Planned to follow EU Directive 2002/95/EC August 18, 2005 and amendment after 2006-07-01 |

## Technical UL/CSA

| | |
|---|---|
| **Ampere Rating UL/CSA:** | 100 A |
| **Horse Power Rating UL/CSA:** | acc. to UL 200V 25 Hp<br>acc. to UL 208V 25 Hp<br>acc. to UL 240V 30 Hp<br>acc. to UL 480V 50 Hp<br>acc. to UL 600V 50 Hp |

## Additional Information

| | |
|---|---|
| **Cable Cross-Section:** | 10…70 mm² |
| **Conventional Free-air Thermal Current ($I_{th}$):** | q=40°C 115 A |
| **Conventional Thermal Current ($I_{the}$):** | Fully Enclosed 115 A |
| **IIT Publishing Status:** | Level 0 - Information enabled |
| **Number of Poles:** | 3 |
| **Operating Mechanism:** | Mechanism on top of the switch |
| **Pollution Degree:** | 3 |
| **Position of Line Terminals:** | Top in - bottom out |
| **Power Loss:** | Per Pole 0.36 W |
| **Product Main Type:** | OT100E_100F |
| **Product Name:** | Switch-disconnector |
| **Rated Impulse Withstand Voltage ($U_{imp}$):** | 8 kV |
| **Rated Insulation Voltage ($U_i$):** | 750 V |
| **Rated Operational Current AC-21A ($I_e$):** | (380 ... 415V) 100 A<br>(690V) 100 A<br>(500V) 100 A |
| **Rated Operational Current AC-22A ($I_e$):** | (380 ... 415 V) 100 A<br>(500 V) 100 A<br>(690 V) 100 A |
| **Rated Operational Current AC-23A ($I_e$):** | (690 V) 40 A<br>(380 ... 415 V) 80 A |

| | |
|---|---|
| | (500 V) 60 A |
| **Rated Operational Power AC-23A ($P_e$):** | (220 ... 240V) 22 kW<br>(400V) 37 kW<br>(415V) 37 kW<br>(500V) 37 kW<br>(690V) 37 kW |
| **Rated Operational Voltage ($U_e$):** | 750 V |
| **Rated Short-time Withstand Current ($I_{cw}$):** | for 1.0s 2.5 kiloampere rms |

## Certificates and Declarations (Document Number)

| | |
|---|---|
| **Declaration of Conformity - CE:** | 1SCC301168D0201; |

## Classifications

| | |
|---|---|
| **E-nummer:** | 3170942 |
| **ETIM 5.0:** | EC000216 - Switch disconnector |
| **Object Classification Code:** | Q |



*Product Data Sheet*

# ATV312HD11M3

## AC DRIVE 15 HP 240V 3 PHASE

| | |
|---|---|
| List Price | $1,338.00 USD |
| Availability | **Stock Item: This item is normally stocked in our distribution facility.** |

### Technical Characteristics

| | |
|---|---|
| Approvals | UL Listed, CSA Certified, CE Marked |
| Integrated Communications Ports | Modbus and CANopen |
| Ampere Rating | 54.0A |
| EMC Filter | No Integrated EMC Filter (C2 EMC Filter available as option) |
| Degree of Protection | IP20 |
| Horsepower Rating | 15HP |
| Motor Power Rating | 11kW |
| Operating Temperature | 14°F to 122°F (-10°C to 50°C) |
| Input Voltage | 208/240Vac |
| Marketing Trade Name | Altivar 312 |
| Input Phase | 3-Phase |
| Output Phase | 3-Phase |
| Type | ATV312 |

### Shipping and Ordering

| | |
|---|---|
| Category | 22153 - |
| Discount Schedule | CP4B |
| GTIN | 00785901689379 |
| Package Quantity | 1 |
| Weight | 25.82 lbs. |
| Availability Code | Stock Item: This item is normally stocked in our distribution facility. |
| Returnability | Y |
| Country of Origin | ID |

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



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ENGLISH

# Quick Start Guide - ATV312

S1A1094202

## ⚠⚠ DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand this quick start guide before performing any procedure with this drive.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/- or across the DC bus capacitors.
- Before servicing the drive:
  - Disconnect all power, including external control power that may be present.
  - Place a "DO NOT TURN ON" label on all power disconnects.
  - Lock all power disconnects in the open position.
  - WAIT 15 MINUTES to allow the DC bus capacitors to discharge.
  - Measure the voltage of the DC bus between the PA/+ and PC/- terminals to ensure that the voltage is less than 42 Vdc.
  - If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive
- Install and close all covers before applying power or starting and stopping the drive.

**Failure to follow these instructions will result in death or serious injury.**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this product.

Information below is designed to use **single drive** connected to **single motor with a motor cable length less than 50 meters (164 ft).**
In any other case, consult the ATV312 installation manual (BBV46391) and programming manual (BBV46385) on www.schneider-electric.com.

## ❶ Check the delivery of the drive

- Remove ATV312 from the packaging and check that it has not been damaged.

## ⚠ WARNING

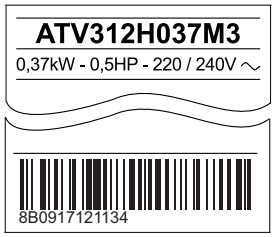
**DAMAGED DRIVE EQUIPMENT**

Do not operate or install any drive or drive accessory that appears damaged.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

- Check that the drive reference printed on the label matches the delivery note and corresponding purchase order.

Write the drive Model Reference: _____ _____and Serial Number: _____

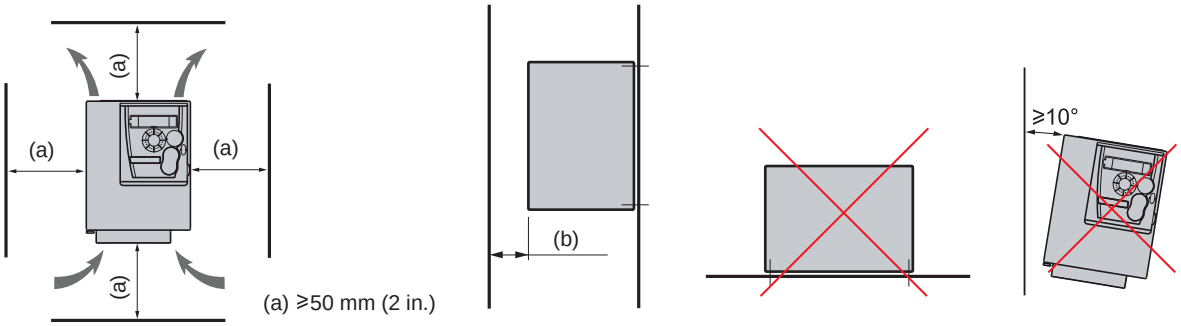



## ❷ Check the line voltage compatibility

- Check that the **line voltage** is compatible with the supply range of the drive.
  Line voltage _____ Volts / Drive voltage range _____ Volts
  Drive range: ATV312••••M2 = 200/240 V single phase / ATV312••••M3=200/240 V three-phase
  ATV312••••N4 = 380/500 V three-phase / ATV312••••S6 = 525/600 V three-phase

## ❸ Mount the drive vertically

For a surrounding air temperature up to 50 °C (122 °F)



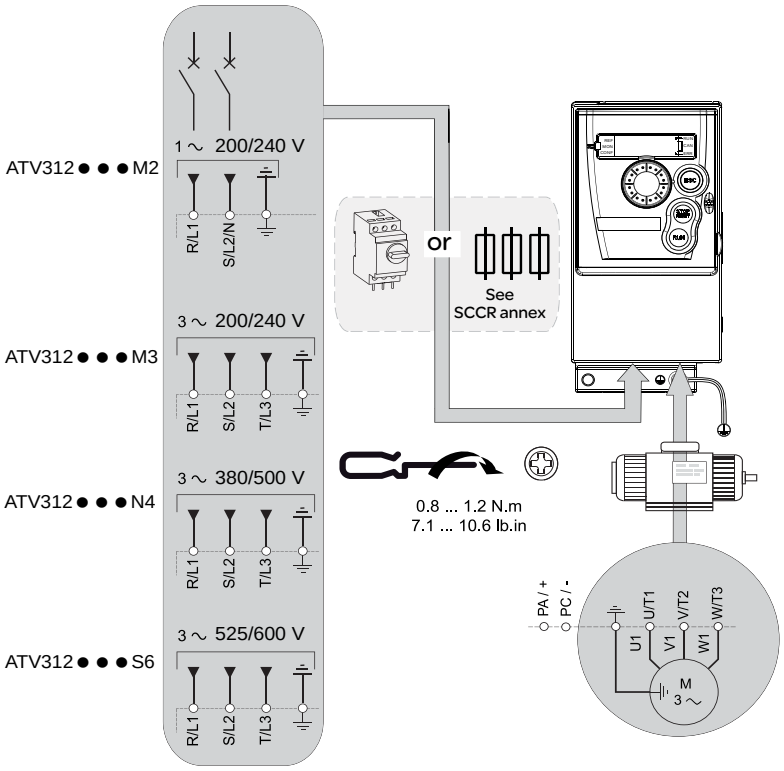

(a) ≥50 mm (2 in.)

(b) ≥ 10 mm (0.4 in.)

See installation manual (BBV46391) on www.schneider-electric.com for other thermal conditions.

# ❹ Connect power wiring

- Wire the drive to the ground.
- Check circuit breaker rating or fuse rating (see SCCR annex)
- Check that the motor voltage is compatible with the drive voltage.
  Motor voltage _____Volts.
- Wire the drive to the motor.
- Wire the drive to the line supply.



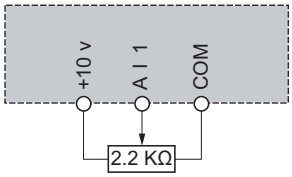

# ❺ Connect control wiring and select control configuration:

## 5.1 or 5.2

### 5.1 [REMOTE configuration] (Control by **external** reference)

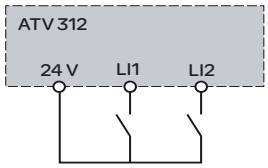
- Ensure SW1 = "SOURCE" 

- **Wire the speed reference:**




- **Wire the command:**

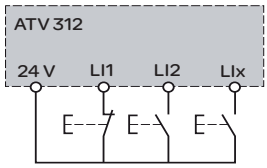
Control command 2-wire:




LI1: forward
LI2: reverse

OR

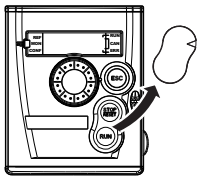
Control command 3-wire:




LI1: stop
LI2: forward
LIx: reverse

- Next steps, do: ❻+❼+❽+9.1

### 5.2 [LOCAL configuration] (control by **internal** reference).



Do: ❻+❼+❽+9.2

# ❻ Apply power to the drive

- Ensure that Logic Inputs are not active (see Li1, Li2, Lix ).
- Apply power to the drive.
- At first power up, the drive displays nSt (3-wire control) or rdY (2-wire control), after pushed ENT drive displays bFr.
- On next start-ups, the drive displays nSt or rdY.

# ❼ Set motor parameters

- Refer to the motor nameplate for the following parameter settings.

| Menu | Code | Description | Factory setting | Customer setting |
|---|---|---|---|---|
| drC - [MOTOR CONTROL] | bFr | [Standard mot. freq]: Standard motor frequency (Hz) | 50. 0 | |
| | UnS | [Rated motor volt.]: Nominal motor voltage on motor nameplate (V) | drive rating | |
| | FrS | [Rated motor freq.]: Nominal motor frequency on motor nameplate (Hz) | 50. 0 | |
| | nCr | [Rated mot. current.]: Nominal motor current on motor nameplate (A) | drive rating | |
| | nSP | [Rated motor speed]: Nominal motor speed on motor nameplate (rpm) | drive rating | |
| | COS | [Motor 1 Cosinus Phi.]: Nominal motor cos φ on motor nameplate | drive rating | |

# 7 Set motor parameters (continued)

- Set tUn parameter to YES.

| Menu | Code | Description | Factory setting | Customer setting |
|---|---|---|---|---|
| drC - [MOTOR CONTROL] | tUn | [Auto Tunning]: Auto-Tunning for UnS, FrS, nCr, nSP, nPr and COS | nO | |

**⚠⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK OR ARC FLASH**

- During auto-tuning, the motor operates at rated current.
- Do not service the motor during auto-tuning.

**Failure to follow these instructions will result in death or serious injury.**

**⚠ DANGER**

**UNINTENDED EQUIPMENT OPERATION**

- The Nominal Motor Parameters UnS, FrS, nCr, nSP, nPr and COS must be correctly configured before starting auto-tuning.
- If one or more of these parameters is modified after auto-tuning has been performed, tUn will return to nO and the procedure must be repeated.

**Failure to follow these instructions will result in death or serious injury.**

# 8 Set basic parameters

| Menu | Code | Description | Factory setting | Customer setting |
|---|---|---|---|---|
| SEt - [SETTINGS] | ACC | [Acceleration]: Acceleration time (s) | 3.0 | |
| | dEC | [Deceleration]: Deceleration time (s) | 3.0 | |
| | LSP | [Low speed]: Motor frequency at minimum reference (Hz) | 0.0 | |
| | HSP | [High speed]: Motor frequency at maximum reference (Hz) | 50.0 | |
| | ItH | [Mot. therm. current]: Nominal current on motor nameplate (A) | drive rating | |
| I-O - [INPUTS / OUTPUTS CFG] | rrS | [Reverse assign.]: Reverse assignment | LI2 | |
| Fun -> PSS - [PRESET SPEEDS] | PS2 | [2 preset speeds]: Preset speeds | LI3 | |
| | PS4 | [4 preset speeds]: Preset speeds | LI4 | |
| Fun -> SAI - [SUMMING INPUTS] | SA2 | [Summing ref. 2] Analog input | AI2 | |

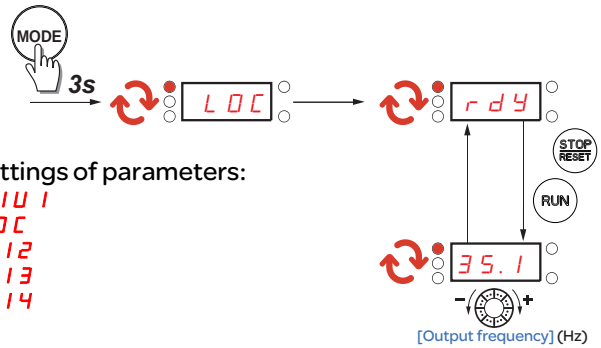
# 9 Set control choice

| Menu | Code | Description | 5.1 [REMOTE configuration] | 5.2 [LOCAL configuration] | Customer Setting |
|---|---|---|---|---|---|
| CtL - [COMMAND] | Fr1 | [Ref.1 channel]: Reference control | AI1 (factory setting), AI2, AI3 | AIU1 | |
| I-O - [INPUTS / OUTPUTS CFG] | tCC | [2/3 wire control]: Command control | 2C : 2-wire (factory setting) 3C : 3-wire | LOC | |

## 9.1 [REMOTE configuration] (Factory setting)

Factory settings of parameters:
Fr1 = AI1
tCC = 2C

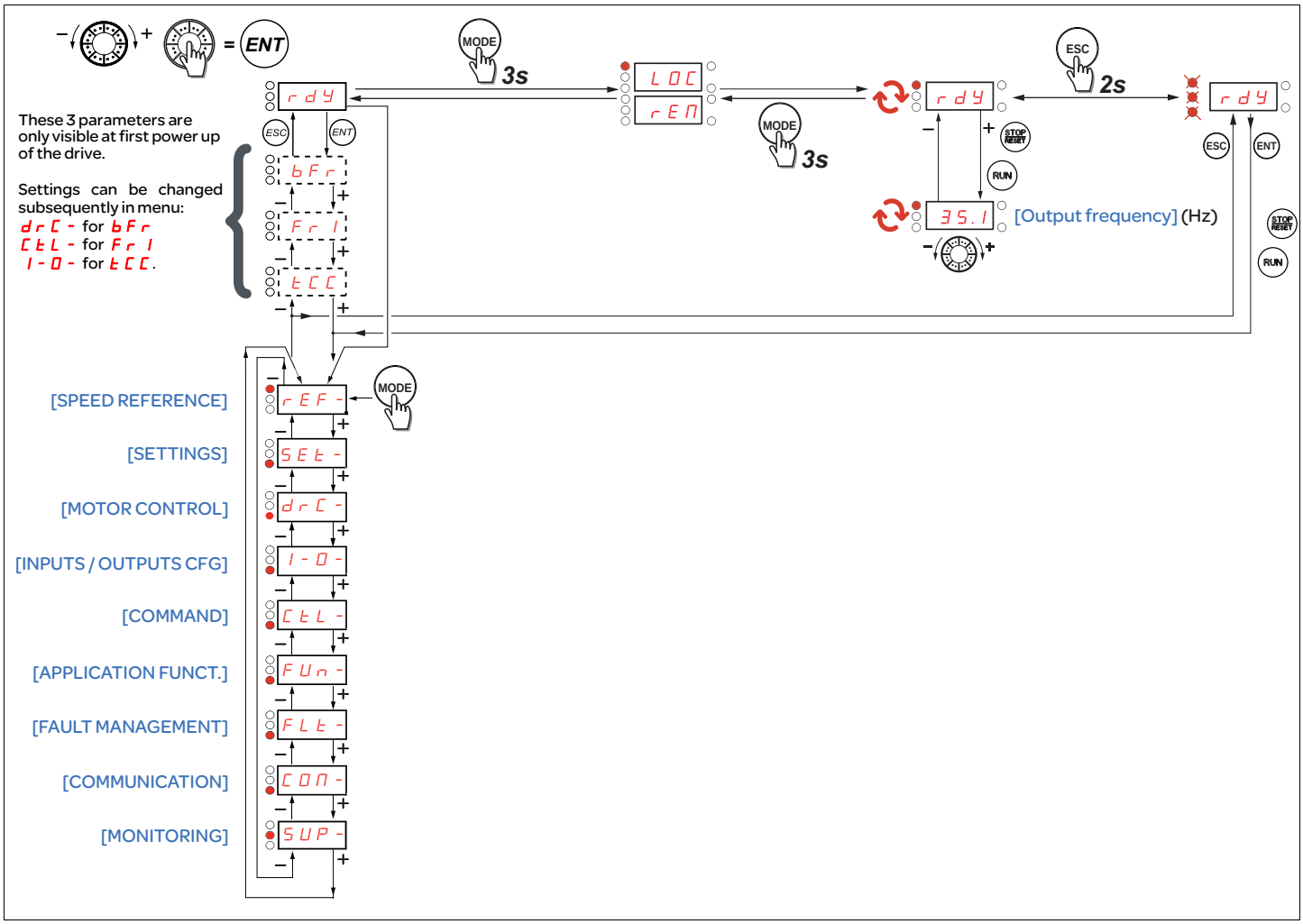
## 9.2 [LOCAL configuration]



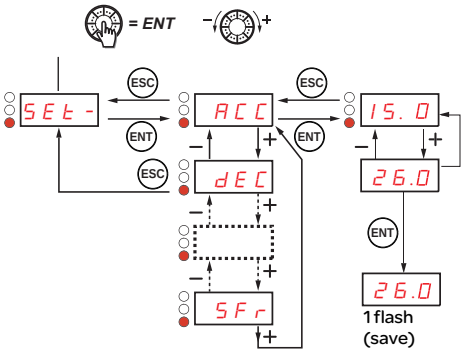

Factory settings of parameters:
Fr1 = AIU1
tCC = LOC
rrS = LI2
PS2 = LI3
PS4 = LI4

# 10 Start the motor

# Menus structure




## Parameter selection




Refer to the programming manual (BBV46385) for comprehensive menu descriptions.

A dash appears after menu codes to differentiate them from parameter codes.
Example:
[SETTINGS] (SEt-), ACC parameter.

# Altivar 312

## Variable speed drives for asynchronous motors

## Installation manual

04/2009




BBV46391

www.schneider-electric.com

Schneider Electric

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# Important Information

## NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

## ⚠ DANGER

**DANGER** indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

## ⚠ WARNING

**WARNING** indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury or equipment damage.

## ⚠ CAUTION

**CAUTION** indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

## CAUTION

**CAUTION,** used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in equipment damage.

## PLEASE NOTE

The word "drive" as used in this manual refers to the controller portion of the adjustable speed drive as defined by NEC.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this product.

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# Before you begin

**Read and understand these instructions before performing any procedure with this drive.**

## ⚠ ⚠ DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand this manual before installing or operating the Altivar 312 drive. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/– or across the DC bus capacitors.
- Before servicing the drive:
  - Disconnect all power, including external control power that may be present.
  - Place a “DO NOT TURN ON” label on all power disconnects.
  - Lock all power disconnects in the open position.
  - WAIT 15 MINUTES to allow the DC bus capacitors to discharge. Then follow the “Bus Voltage Measurement Procedure” page 16 to verify that the DC voltage is less than 42 V. The drive LEDs are not indicators of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the drive.

**Failure to follow these instructions will result in death or serious injury.**

## ⚠ DANGER

**UNINTENDED EQUIPMENT OPERATION**

- Read and understand this manual before installing or operating the Altivar 312 drive.
- Any changes made to the parameter settings must be performed by qualified personnel.

**Failure to follow these instructions will result in death or serious injury.**

## ⚠ WARNING

**DAMAGED DRIVE EQUIPMENT**

Do not operate or install any drive or drive accessory that appears damaged.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## ⚠ WARNING

**LOSS OF CONTROL**

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.[a]

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

a. For additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.”

## ⚠ CAUTION

**INCOMPATIBLE LINE VOLTAGE**

Before turning on and configuring the drive, ensure that the line voltage is compatible with the supply voltage range shown on the drive nameplate. The drive may be damaged if the line voltage is not compatible.

**Failure to follow these instructions can result in injury or equipment damage.**

## CAUTION

**RISK OF DAMAGE TO THE MOTOR**

The use of external overload protection is required under the following conditions:
- Repowering up the product since there is no motor thermal state memory.
- Running multiple motors.
- Running motors rated at less than 0.2 times the nominal drive current.
- Using motor switching.

**Failure to follow these instructions can result in equipment damage**

# Documentation structure

The following Altivar 312 technical documents are available on the Schneider Electric website (www.schneider-electric.com) as well as on DVD-ROM (reference VW3A8200).

## Installation manual

This manual describes how to install and wire the drive.

## Programming manual

This manual describes the functions, parameters and use of the drive terminal (integrated display terminal, optional graphic display terminal and optional remote terminal).

## Simplified manual

This manual is an extract from programming and installation manual. This manual is delivered with the drive.

## Quick Start

The Quick Start describes how to wire and configure the drive to start motor quickly and simply for simple applications. This document is delivered with the drive.

## Communication manuals: Modbus, CANopen, ...

These manual describes the assembly, connection to the bus or network, signaling, diagnostics, and configuration of the communication-specific parameters.
They also describe the protocol communication services.

## Communication variables guide

The Communication variables manual defines the drive control processes and the drive variables which can be accessed by the communication buses: Modbus, CANopen, ...

# INSTALLATION

## 1. Receive and inspect the drive

- ☐ Check that the catalog number printed on the label is the same as that on the purchase order.
- ☐ Remove the Altivar from its packaging and check that it has not been damaged in transit.

## 2. Check the line voltage

- ☐ Check that the voltage range of the drive is compatible with the line voltage (see pages 10 and 11).

Steps **2** to **4** must be performed with the **power off**.

## 3. Mount the drive

- ☐ Mount the drive in accordance with the instructions in this document (see page 14).
- ☐ Install any options required (see option documentation).




## 4. Wire the drive (see page 17)

- ☐ Connect the motor, ensuring that its connections correspond to the voltage.
- ☐ Connect the line supply, after making sure that the power is off.
- ☐ Connect the control part.

# PROGRAMMING

**5. Please refer to the programming manual.**

# Setup - Preliminary recommendations

## Prior to switching on the drive

**⚠ DANGER**

**UNINTENDED EQUIPMENT OPERATION**

Ensure that all logic inputs are inactive to help prevent an accidental startup.

**Failure to follow these instructions will result in death or serious injury.**

## Prior to configuring the drive

**⚠ DANGER**

**UNINTENDED EQUIPMENT OPERATION**

- Read and understand this manual before installing or operating the Altivar 312 drive.
- Any changes made to the parameter settings must be performed by qualified personnel.
- Ensure that all logic inputs are inactive to help prevent an accidental startup when modifying parameters.

**Failure to follow these instructions will result in death or serious injury.**

## Line contactor

**CAUTION**

**RISK OF DAMAGE TO THE DRIVE**

- Avoid operating the contactor frequently to avoid premature aging of the filter capacitors.
- Power cycling must be more than 60 seconds.

**Failure to follow these instructions can result in equipment damage.**

# Drive ratings

## Single phase supply voltage: 200…240 V 50/60 Hz

For three phase output 200/240 V motors

| Motor | | Line supply (input) | | | | | Drive (output) | | Reference | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| Power indicated on plate (1) | | Max. current line (2) | | Apparent power | Max. inrush current (3) | Power dissipated at nominal current | Nominal current (1) | Max. transient current (1) (4) | | |
| | | at 200 V | at 240 V | | | | | | | |
| kW | HP | A | A | kVA | A | W | A | A | | |
| 0.18 | 0.25 | 3.0 | 2.5 | 0.6 | 10 | 24 | 1.5 | 2.3 | ATV312H018M2(5) | 3 |
| 0.37 | 0.5 | 5.3 | 4.4 | 1.0 | 10 | 41 | 3.3 | 5.0 | ATV312H037M2(5) | 3 |
| 0.55 | 0.75 | 6.8 | 5.8 | 1.4 | 10 | 46 | 3.7 | 5.6 | ATV312H055M2(5) | 4 |
| 0.75 | 1 | 8.9 | 7.5 | 1.8 | 10 | 60 | 4.8 | 7.2 | ATV312H075M2(5) | 4 |
| 1.1 | 1.5 | 12.1 | 10.2 | 2.4 | 19 | 74 | 6.9 | 10.4 | ATV312HU11M2(5) | 6 |
| 1.5 | 2 | 15.8 | 13.3 | 3.2 | 19 | 90 | 8.0 | 12.0 | ATV312HU15M2(5) | 6 |
| 2.2 | 3 | 21.9 | 18.4 | 4.4 | 19 | 123 | 11.0 | 16.5 | ATV312HU22M2(5) | 7 |

## Three phase supply voltage: 200…240 V 50/60 Hz

For three phase output 200/240 V motors

| Motor | | Line supply (input) | | | | | Drive (output) | | Reference | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| Power indicated on plate (1) | | Max. current line (2) | | Apparent power | Max. inrush current (3) | Power dissipated at nominal current | Nominal current (1) | Max. transient current (1) (4) | | |
| | | at 200 V | at 240 V | | | | | | | |
| kW | HP | A | A | kVA | A | W | A | A | | |
| 0.18 | 0.25 | 2.1 | 1.9 | 0.7 | 10 | 23 | 1.5 | 2.3 | ATV312H018M3 | 1 |
| 0.37 | 0.5 | 3.8 | 3.3 | 1.3 | 10 | 38 | 3.3 | 5.0 | ATV312H037M3 | 1 |
| 0.55 | 0.75 | 4.9 | 4.2 | 1.7 | 10 | 43 | 3.7 | 5.6 | ATV312H055M3 | 2 |
| 0.75 | 1 | 6.4 | 5.6 | 2.2 | 10 | 55 | 4.8 | 7.2 | ATV312H075M3 | 2 |
| 1.1 | 1.5 | 8.5 | 7.4 | 3.0 | 10 | 71 | 6.9 | 10.4 | ATV312HU11M3 | 5 |
| 1.5 | 2 | 11.1 | 9.6 | 3.8 | 10 | 86 | 8.0 | 12.0 | ATV312HU15M3 | 5 |
| 2.2 | 3 | 14.9 | 13.0 | 5.2 | 10 | 114 | 11.0 | 16.5 | ATV312HU22M3 | 6 |
| 3 | 3 | 19.1 | 16.6 | 6.6 | 19 | 146 | 13.7 | 20.6 | ATV312HU30M3 | 7 |
| 4 | 5 | 24 | 21.1 | 8.4 | 19 | 180 | 17.5 | 26.3 | ATV312HU40M3 | 7 |
| 5.5 | 7.5 | 36.8 | 32.0 | 12.8 | 23 | 292 | 27.5 | 41.3 | ATV312HU55M3 | 8 |
| 7.5 | 10 | 46.8 | 40.9 | 16.2 | 23 | 388 | 33.0 | 49.5 | ATV312HU75M3 | 8 |
| 11 | 15 | 63.5 | 55.6 | 22.0 | 93 | 477 | 54.0 | 81.0 | ATV312HD11M3 | 9 |
| 15 | 20 | 82.1 | 71.9 | 28.5 | 93 | 628 | 66.0 | 99.0 | ATV312HD15M3 | 9 |

(1) These power ratings and currents are for a maximum ambient temperature of 50°C and a switching frequency of 4 kHz in continuous operation.The switching frequency is adjustable from 2 to 16 kHz.
Above 4 kHz, the drive will reduce the switching frequency in the event of excessive temperature rise. The temperature rise is controlled by a sensor in the power module. Nonetheless, the nominal drive current should be derated if operation above 4 kHz needs to be continuous.
Derating curves are shown on page 15 as a function of switching frequency, ambient temperature and mounting conditions.
(2) Current on a line supply with the "Max. prospective line Isc" indicated.
(3) Peak current on power-up, for the max. voltage (240 V + 10%).
(4) For 60 seconds.
(5) These references can be ordered without terminal board in order to integrate an optionnal communication board. Add a B at the end of the reference. For example, ATV312HU11M2 becomes ATV312HU11M2B.

## Three phase supply voltage: 380…500 V 50/60 Hz

For three phase output 380/500 V motors

| Motor | | Line supply (input) | | | | | Drive (output) | | Reference | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| Power indicated on plate (1) | | Max. current line (2) | | Apparent power | Max. inrush current (3) | Power dissipated at nominal current | Nominal current (1) | Max. transient current (1) (4) | | |
| | | at 380 V | at 500 V | | | | | | | |
| kW | HP | A | A | kVA | A | W | A | A | | |
| 0.37 | 0.5 | 2.2 | 1.7 | 1.5 | 10 | 32 | 1.5 | 2.3 | ATV312H037N4(5) | 6 |
| 0.55 | 0.75 | 2.8 | 2.2 | 1.8 | 10 | 37 | 1.9 | 2.9 | ATV312H055N4(5) | 6 |
| 0.75 | 1 | 3.6 | 2.7 | 2.4 | 10 | 41 | 2.3 | 3.5 | ATV312H075N4(5) | 6 |
| 1.1 | 1.5 | 4.9 | 3.7 | 3.2 | 10 | 48 | 3.0 | 4.5 | ATV312HU11N4(5) | 6 |
| 1.5 | 2 | 6.4 | 4.8 | 4.2 | 10 | 61 | 4.1 | 6.2 | ATV312HU15N4(5) | 6 |
| 2.2 | 3 | 8.9 | 6.7 | 5.9 | 10 | 79 | 5.5 | 8.3 | ATV312HU22N4(5) | 7 |
| 3 | 3 | 10.9 | 8.3 | 7.1 | 10 | 125 | 7.1 | 10.7 | ATV312HU30N4(5) | 7 |
| 4 | 5 | 13.9 | 10.6 | 9.2 | 10 | 150 | 9.5 | 14.3 | ATV312HU40N4(5) | 7 |
| 5.5 | 7.5 | 21.9 | 16.5 | 15.0 | 30 | 232 | 14.3 | 21.5 | ATV312HU55N4(5) | 8 |
| 7.5 | 10 | 27.7 | 21.0 | 18.0 | 30 | 269 | 17.0 | 25.5 | ATV312HU75N4(5) | 8 |
| 11 | 15 | 37.2 | 28.4 | 25.0 | 97 | 397 | 27.7 | 41.6 | ATV312HD11N4(5) | 9 |
| 15 | 20 | 48.2 | 36.8 | 32.0 | 97 | 492 | 33.0 | 49.5 | ATV312HD15N4(5) | 9 |

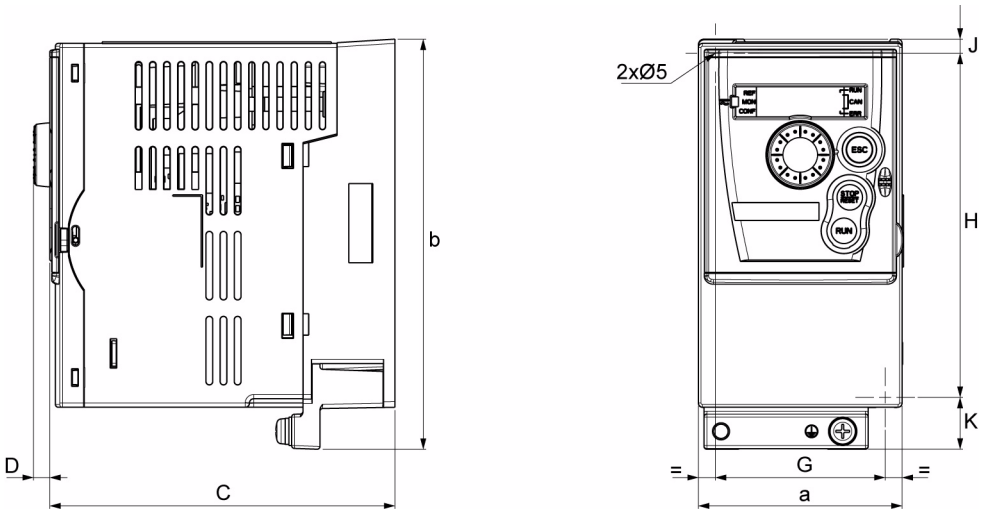
## Three phase supply voltage: 525…600 V 50/60 Hz

For three phase output 525/600 V motors

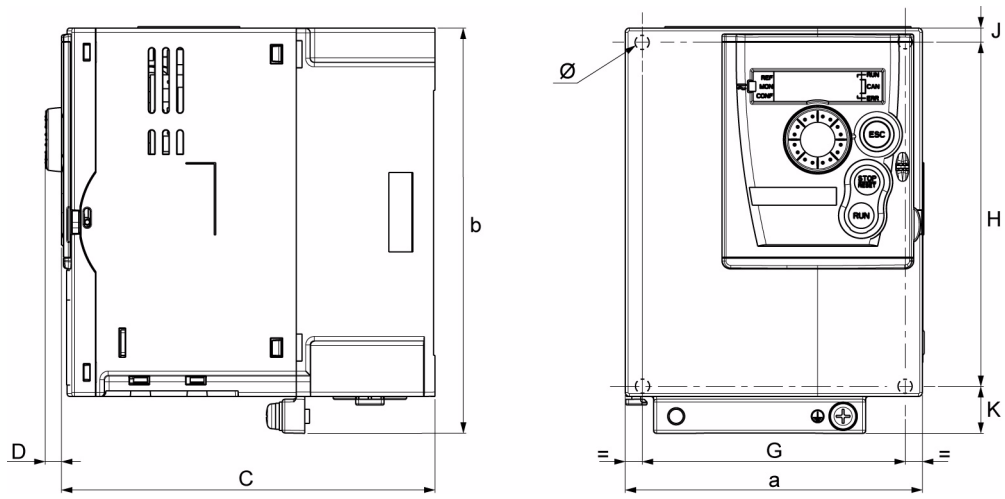
| Motor | | Line supply (input) | | | | | Drive (output) | | Reference | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| Power indicated on plate (1) | | Max. current line (2) | | Apparent power | Max. inrush current (3) | Power dissipated at nominal current | Nominal current (1) | Max. transient current (1) (4) | | |
| | | at 525 V | at 600 V | | | | | | | |
| kW | HP | A | A | kVA | A | W | A | A | | |
| 0.75 | 1 | 2.8 | 2.4 | 2.5 | 12 | 36 | 1.7 | 2.6 | ATV312H075S6(6) | 6 |
| 1.5 | 2 | 4.8 | 4.2 | 4.4 | 12 | 48 | 2.7 | 4.1 | ATV312HU15S6(6) | 6 |
| 2.2 | 3 | 6.4 | 5.6 | 5.8 | 12 | 62 | 3.9 | 5.9 | ATV312HU22S6(6) | 7 |
| 4 | 5 | 10.7 | 9.3 | 9.7 | 12 | 94 | 6.1 | 9.2 | ATV312HU40S6(6) | 7 |
| 5.5 | 7.5 | 16.2 | 14.1 | 15.0 | 36 | 133 | 9.0 | 13.5 | ATV312HU55S6(6) | 8 |
| 7.5 | 10 | 21.3 | 18.5 | 19.0 | 36 | 165 | 11.0 | 16.5 | ATV312HU75S6(6) | 8 |
| 11 | 15 | 27.8 | 24.4 | 25.0 | 117 | 257 | 17.0 | 25.5 | ATV312HD11S6(6) | 9 |
| 15 | 20 | 36.4 | 31.8 | 33.0 | 117 | 335 | 22.0 | 33.0 | ATV312HD15S6(6) | 9 |

(1) These power ratings and currents are for a maximum ambient temperature of 50°C and a switching frequency of 4 kHz in continuous operation. The switching frequency is adjustable from 2 to 16 kHz.
Above 4 kHz, the drive will reduce the switching frequency in the event of excessive temperature rise. The temperature rise is controlled by a sensor in the power module. Nonetheless, the nominal drive current should be derated if operation above 4 kHz needs to be continuous.
Derating curves are shown on page 15 as a function of switching frequency, ambient temperature and mounting conditions.
(2) Current on a line supply with the "Max. prospective line Isc" indicated.
(3) Peak current on power-up, for the max. voltage (500 V + 10%, 600 V + 10%).
(4) For 60 seconds.
(5) These references can be ordered without terminal board in order to integrate an optionnal communication board. Add a B at the end of the reference. For example, ATV312H037N4 becomes ATV312H037N4B.
(6) The use of an AC choke, which must be ordered separately (please refer to the catalog), is mandatory on these drives

# Dimensions and weights

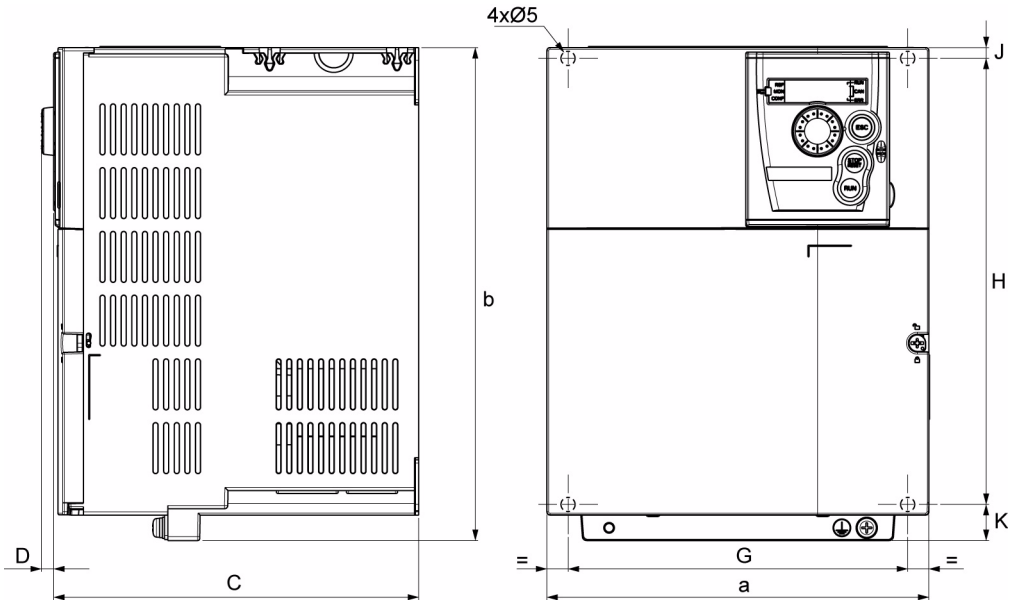



| ATV312H | a<br>mm (in.) | b<br>mm (in.) | C<br>mm (in.) | D<br>mm (in.) | G<br>mm (in.) | H<br>mm (in.) | J<br>mm (in.) | K<br>mm (in.) | Ø<br>mm (in.) | Weight<br>kg (lb) |
|---|---|---|---|---|---|---|---|---|---|---|
| 018M3, 037M3 | 72<br>(2.83) | 145<br>(5.70) | 122<br>(4.80) | 6<br>(0.24) | 60<br>(2.36) | 121.5<br>(4.76) | 2 x 5<br>(2x0.2) | 18.5<br>(0.73) | 2 x 5<br>(2x0.2) | 0.9<br>(1.98) |
| 055M3, 075M3 | 72<br>(2.83) | 145<br>(5.70) | 132<br>(5.19) | 6<br>(0.24) | 60<br>(2.36) | 121.5<br>(4.76) | 2 x 5<br>(2x0.2) | 18.5<br>(0.73) | 2 x 5<br>(2x0.2) | 0.9<br>(1.98) |
| 018M2, 037M2 | 72<br>(2.83) | 145<br>(5.70) | 132<br>(5.19) | 6<br>(0.24) | 60<br>(2.36) | 121.5<br>(4.76) | 2 x 5<br>(2x0.2) | 18.5<br>(0.73) | 2 x 5<br>(2x0.2) | 1.05<br>(2.31) |
| 055M2, 075M2 | 72<br>(2.83) | 145<br>(5.70) | 142<br>(5.59) | 6<br>(0.24) | 60<br>(2.36) | 121.5<br>(4.76) | 2 x 5<br>(2x0.2) | 18.5<br>(0.73) | 2 x 5<br>(2x0.2) | 1.05<br>(2.31) |

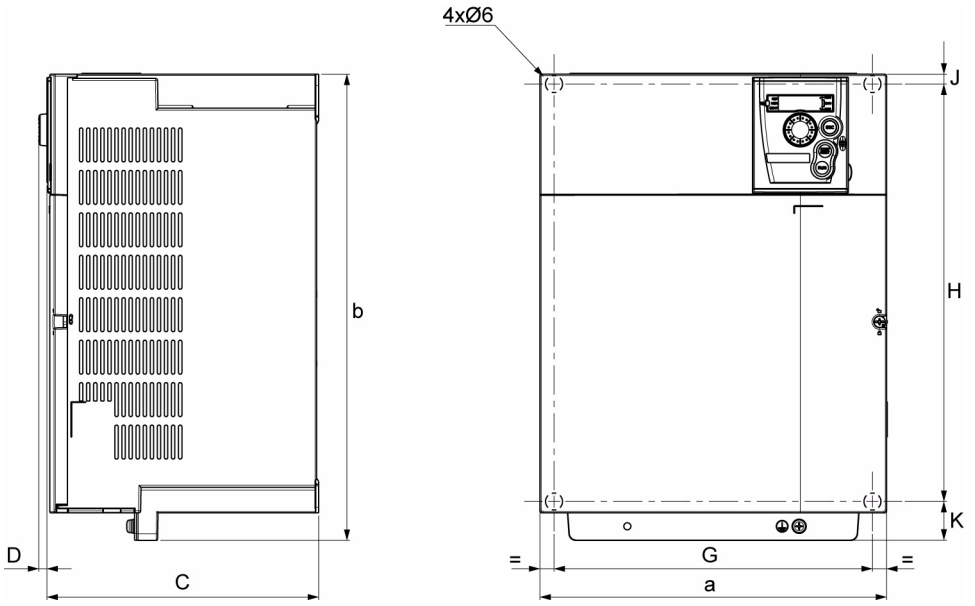



| ATV312H | a<br>mm (in.) | b<br>mm (in.) | C<br>mm (in.) | D<br>mm (in.) | G<br>mm (in.) | H<br>mm (in.) | J<br>mm (in.) | K<br>mm (in.) | Ø<br>mm (in.) | Weight<br>kg (lb) |
|---|---|---|---|---|---|---|---|---|---|---|
| U1●M3 | 105<br>(4.13) | 143<br>(5.63) | 132<br>(5.19) | 6<br>(0.24) | 93<br>(3.66) | 121.5<br>(4.76) | 5<br>(0.2) | 16.5<br>(0.65) | 2 x 5<br>(2x0.2) | 1.25<br>(2.76) |
| U1●M2, U22M3, 037N4 to U15N4 075S6, U15S6● | 107<br>(4.21) | 143<br>(5.63) | 152<br>(5.98) | 6<br>(0.24) | 93<br>(3.66) | 121.5<br>(4.76) | 5<br>(0.2) | 16.5<br>(0.65) | 2 x 5<br>(2x0.2) | 1.35<br>(2.98) |
| U22M2, U●0M3, U22N4 to U40N4, U22S6, U40S6 | 142<br>(5.59) | 184<br>(7.24) | 152<br>(5.98) | 6<br>(0.24) | 126<br>(4.96) | 157<br>(6.18) | 6.5<br>(0.26) | 20.5<br>(0.81) | 4 x 5<br>(4x0.2) | 2.35<br>(5.18) |

# Dimensions and weights (continued)



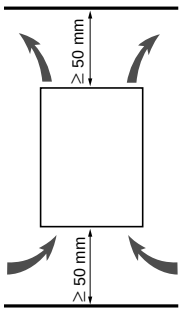

| ATV312H | a mm (in.) | b mm (in.) | C mm (in.) | D mm (in.) | G mm (in.) | H mm (in.) | J mm (in.) | K mm (in.) | Ø mm (in.) | Weight kg (lb) |
|---|---|---|---|---|---|---|---|---|---|---|
| U55M3, U75M3, U55N4, U75N4, U55S6, U75S6 | 180 (7.09) | 232 (9.13) | 172 (6.77) | 6 (0.24) | 160 (6.30) | 210 (8.27) | 5 (0.2) | 17 (0.67) | 4 x 5 (4x0.2) | 4.70 (10.36) |




| ATV312H | a mm (in.) | b mm (in.) | C mm (in.) | D mm (in.) | G mm (in.) | H mm (in.) | J mm (in.) | K mm (in.) | Ø mm (in.) | Weight kg (lb) |
|---|---|---|---|---|---|---|---|---|---|---|
| D1●M3, D1●N4, D1●S6 | 245 (9.65) | 329.5 (12.97) | 192 (7.56) | 6 (0.24) | 225 (8.86) | 295 (11.61) | 7 (0.28) | 27.5 (1.08) | 4 x 6 (4x0.24) | 9 (19.84) |

# Mounting

## Mounting and temperature conditions

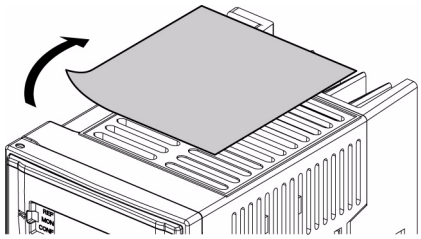



Install the unit vertically, at ± 10°.
Do not place it close to heating elements.
Leave sufficient free space so that the air required for cooling purposes can circulate from the bottom to the top of the unit.

Free space in front of unit: 10 mm (0.39 in.) minimum.

When IP20 protection is adequate, we recommend that the vent cover on the top of the drive be removed, as shown below.

## Removing the vent cover

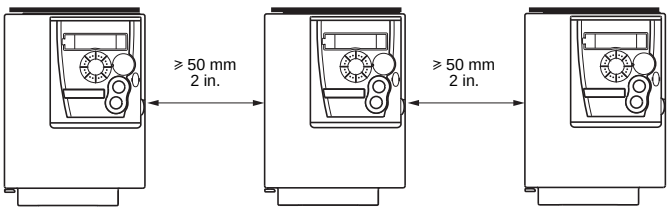


Example ATV312HU11M3

## Mounting types

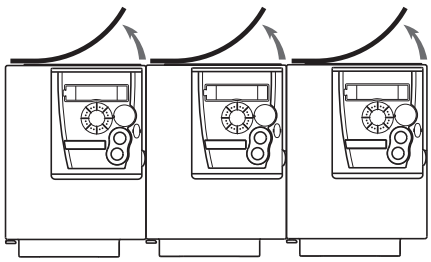
3 types of mounting are possible:

**Type A mounting:**



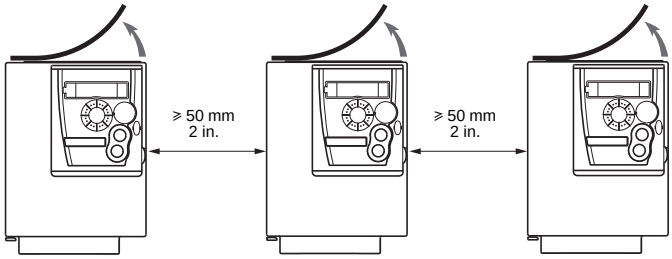

Free space ≥ 50 mm (2 in.) on each side, with vent cover fitted. Mounting type A is suitable for drive operation at surrounding air temperature less or equal to 50°C (122°F).

**Type B mounting:**



Drives mounted side-by-side, vent cover should be removed (the degree of protection becomes IP20).

**Type C mounting:**

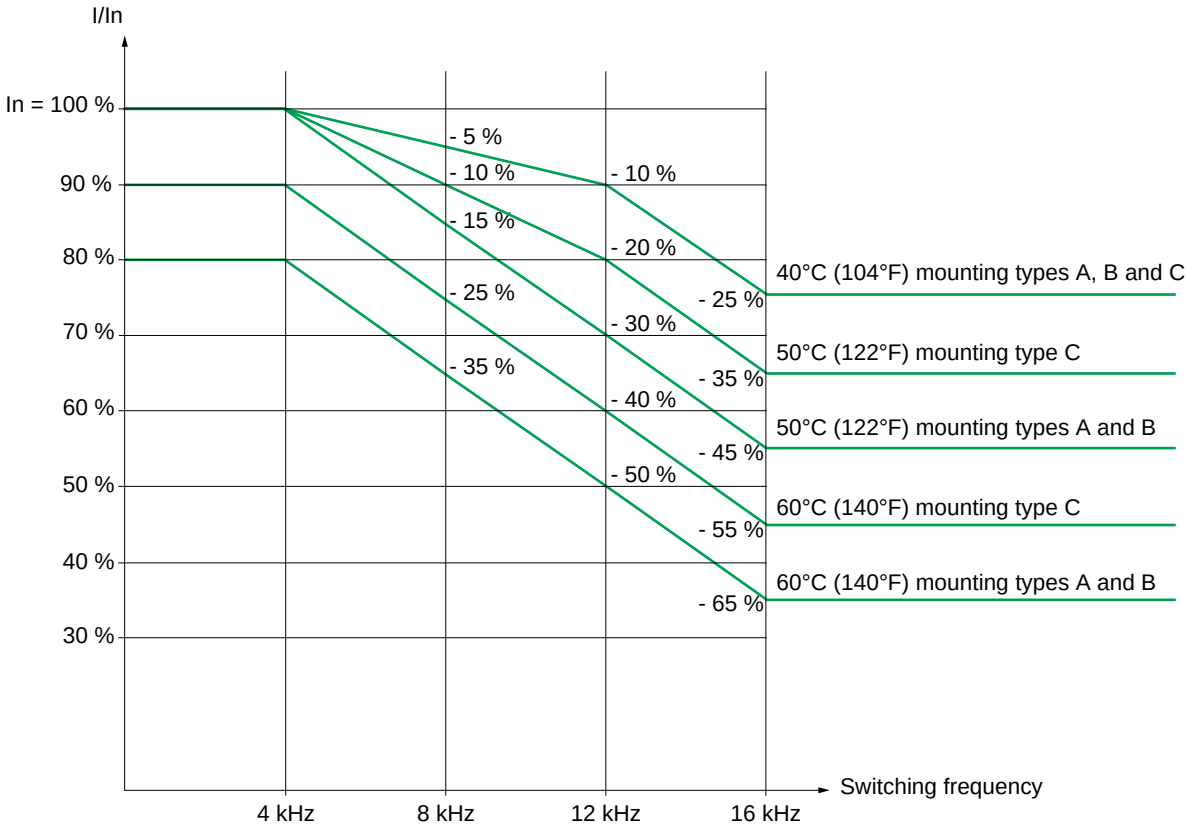



Free space ≥ 50 mm (2 in.) on each side. Vent cover should be removed for operation at surrounding air temperature above 50°C (122°F). The degree of protection becomes IP20

**Note:** For switching frequencies above 4 kHz and derating conditions, please refer to the derating curves for guidelines.

## Derating curves

Derating curves for the drive current In as a function of the temperature, switching frequency and type of mounting.




For intermediate temperatures (e.g. 55°C; 131 °F), interpolate between 2 curves.

## Flow of air

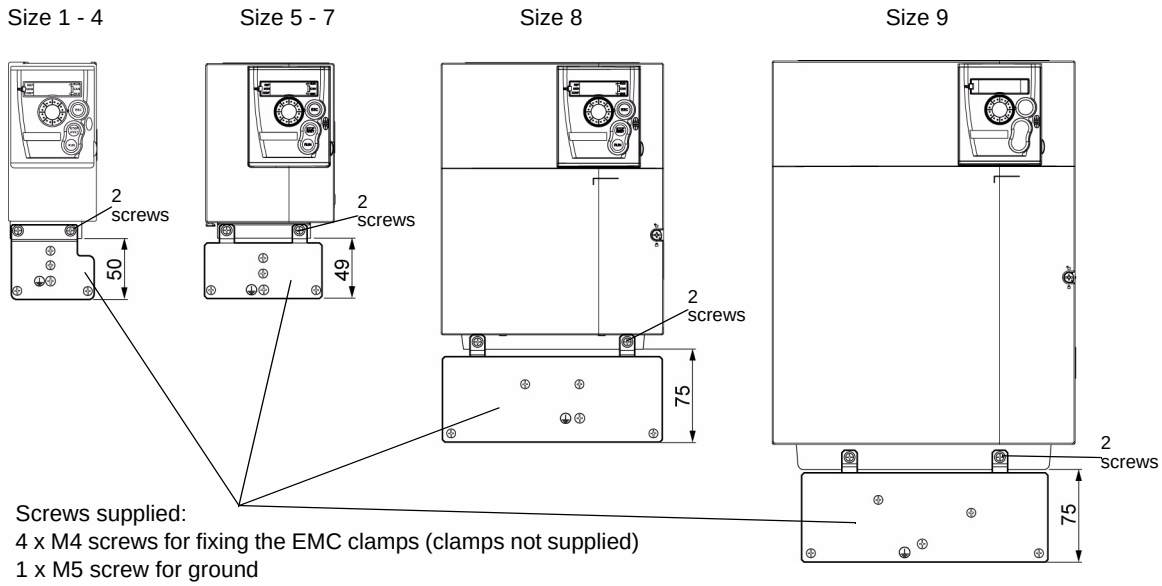
If you are installing the drives in enclosures, make provision for a flow of air at least equal to the value given in the table below for each drive.

| **ATV312H** | **Flow rate** | |
|---|---|---|
| | **$m^3$/hour** | **$ft^3$/min** |
| 018M2, 037M2, 055M2,<br>018M3, 037M3, 055M3,<br>037N4, 055N4, 075N4, U11N4<br>075S6, U15S6 | 18 | 11 |
| 075M2, U11M2, U15M2<br>075M3, U11M3, U15M3<br>U15N4, U22N4<br>U22S6, U40S6 | 33 | 19 |
| U22M2,<br>U22M3, U30M3, U40M3<br>U30N4, U40N4<br>U55S6, U75S6 | 93 | 55 |
| U55M3<br>U55N4, U75N4<br>D11S6 | 102 | 60 |
| U75M3, D11M3,<br>D11N4, D15N4<br>D15S6 | 168 | 99 |
| D15M3 | 216 | 127 |

## Installing the EMC plates

### EMC mounting plate: Supplied with the drive

Fix the EMC equipotentiality mounting plate to the holes in the ATV312 heatsink using the 2 screws supplied, as shown in the drawings below.




Screws supplied:
4 x M4 screws for fixing the EMC clamps (clamps not supplied)
1 x M5 screw for ground

| ATV312H | Size |
|---|---|
| 018M3, 037M3 | 1 |
| 055M3, 075M3 | 2 |
| 018M2, 037M2 | 3 |
| 055M2, 075M2 | 4 |
| U11M3, U15M3 | 5 |
| U11M2, U15M2, U22M3,<br>037N4, 055N4, 075N4, U11N4, U15N4,<br>075S6, U15S6 | 6 |

| ATV312H | Size |
|---|---|
| U22M2, U30M3, U40M3,<br>U22N4, U30N4, U40N4,<br>U22S6, U40S6 | 7 |
| U55M3, U75M3,<br>U55N4, U75N4,<br>U55S6, U75S6 | 8 |
| D11M3, D15M3,<br>D11N4, D15N4,<br>D11S6, D15S6 | 9 |

## Bus voltage measurement procedure

**⚠ ⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Read and understand the precautions in “Before you begin” page 5 before performing this procedure.

**Failure to follow these instructions will result in death or serious injury.**

The DC bus voltage can exceed 933 Vdc. Use a properly rated voltage-sensing device when performing this procedure. To measure the DC bus voltage:

1. Disconnect all power.
2. Wait 15 minutes to allow the DC bus to discharge.
3. Measure the voltage of the DC bus between the PA/+ and PC/– terminals to ensure that the voltage is less than 42 Vdc.
4. If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive.

# Recommendations

## Power and circuit protection

The drive must be grounded to conform with the regulations concerning high leakage currents (over 3.5 mA).

Where local and national codes require upstream protection by means of a residual current device, use a type A device for single-phase drives and a type B device for three-phase drives as defined in the IEC Standard 60755.
Choose a suitable model integrating:

- High frequency current filtering,
- A time delay that helps to prevent tripping caused by the load from stray capacitance on power-up.
  The time delay is not possible for 30 mA devices; in this case, choose devices with immunity against nuisance tripping.

If the installation includes several drives, provide one "residual current device" per drive.

Keep the power cables separate from circuits in the installation with low-level signals (detectors, PLCs, measuring apparatus, video, telephone).

If you are using cables longer than 50 m (164 ft) between the drive and the motor, add output filters (please refer to the catalogue).

## Control

Keep the control circuits away from the power cables. For control and speed reference circuits, we recommend using shielded twisted cables with a pitch of between 25 and 50 mm (1 and 2 in.), connecting the shielding to ground at each end.

## Equipment Grounding

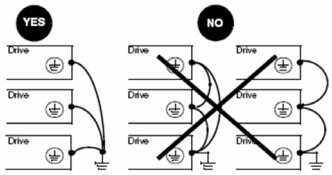
Ground the drive according to local and national code requirements. A minimum wire size of 10 mm² (6 AWG) may be required to meet standards limiting leakage current.

**⚠⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- The drive panel must be properly grounded before power is applied.
- Use the provided ground connecting point as shown in the figure below.

**Failure to follow these instructions will result in death or serious injury.**




- Ensure that the resistance of the ground is one ohm or less.
- When grounding several drives, you must connect each one directly, as shown in the figure to the left.
- Do not loop the ground cables or connect them in series.

**⚠ WARNING**

**IMPROPER WIRING PRACTICES**

- The ATV312 drive will be damaged if input line voltage is applied to the output terminals (U/T1,V/T2,W/T3).
- Check the power connections before energizing the ATV312 drive.
- If replacing another drive, verify that all wiring connections to the ATV312 drive comply with wiring instructions in this manual page 29.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

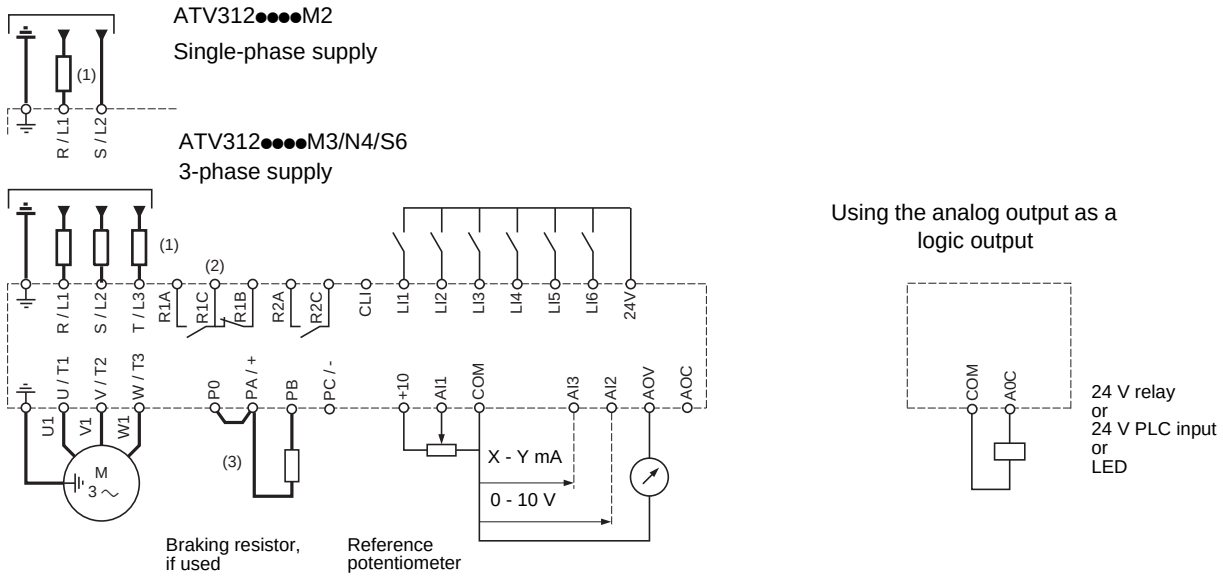
**⚠ WARNING**

**INADEQUATE OVERCURRENT PROTECTION**

- Overcurrent protective devices must be properly coordinated.
- The Canadian Electrical Code and the National Electrical Code require branch circuit protection. Use the fuses recommended in the installation manual.
- Do not connect the drive to a power feeder whose short-circuit capacity exceeds the drive short-circuit current rating listed in this manual page 29.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## General wiring diagram




(1) Line choke, if used (single phase or 3-phase)
(2) Fault relay contacts, for remote indication of the drive status
(3) If a braking resistor is connected, set [Dec ramp adapt.] (brA) parameter to yes (refer to the progamming manual).

**Note 1: Use interference suppressors on all inductive circuits near the drive or coupled to the same circuit (relays, contactors, solenoid valves, etc).**

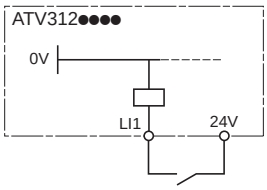
**Note 2:** This diagram is for the standard ATV312 products. Optional communication cards may change the control wiring of the product. Please see the associated documentation for the option cards for details.

**Choice of associated components:**
Please refer to the catalogue.

## Logic input switch

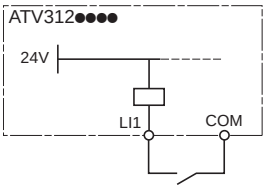
This switch (1) assigns the link to 0V, 24 V or "floating":

**Using volt-free contacts**




Switch in «Source» position (factory setting)

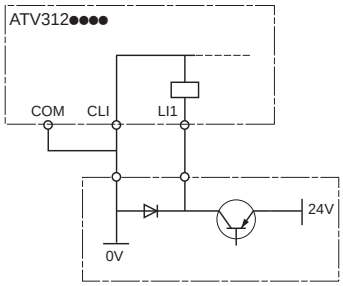



Switch in «Sink» position

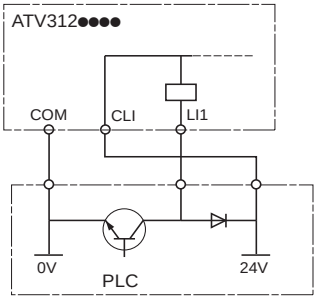



**Using PLC transistor output**




Switch in CLI position




(1) See page 24 to locate the switch on the terminal board.

## ⚠ DANGER

**UNINTENDED EQUIPMENT OPERATION**

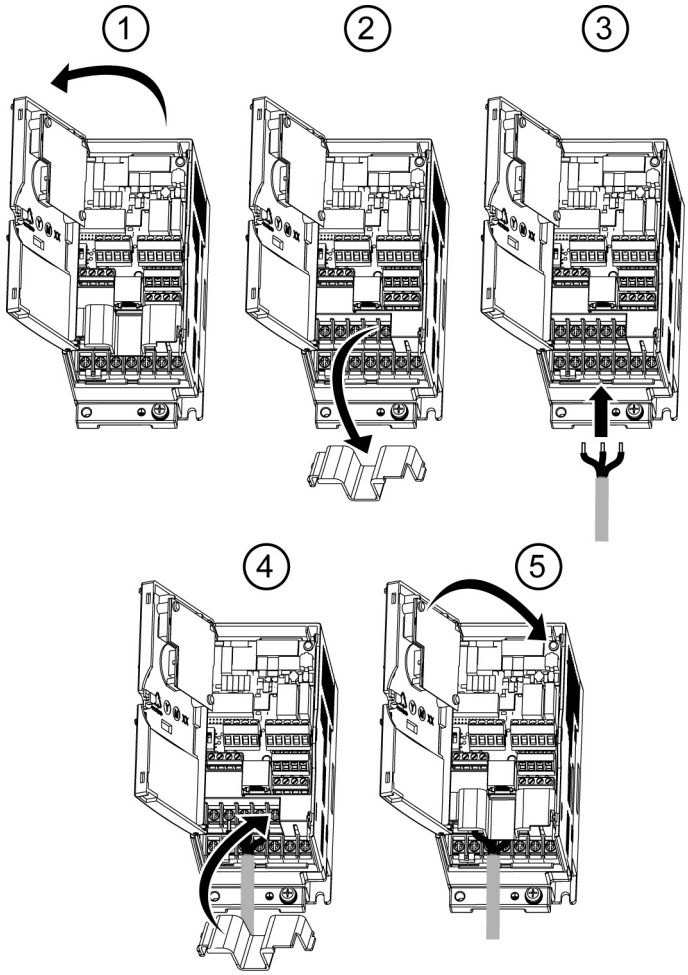
- Prevent accidental grounding of logic inputs configured for sink logic. Accidental grounding can result in unintended activation of drive functions.
- Protect the signal conductors against damage that could result in unintentional conductor grounding.
- Follow NFPA 79 and EN 60204 guidelines for proper control circuit grounding practices.

**Failure to follow these instructions will result in death or serious injury.**

## Power terminals

### Access to the power terminals

To access the terminals, open the cover as shown in the example below.




**⚠ ⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.**

Replace the cover plate on the terminals and close the door before applying power.

**Failure to follow these instructions will result in death or serious injury.**

## Functions of the power terminals

| Terminal | Function | For Altivar 312 |
|---|---|---|
| ⏚ | Ground terminal | All ratings |
| R/L1 - S/L2 | Power supply | ATV312●●●●M2 |
| R/L1 - S/L2 - T/L3 | | ATV312●●●●M3<br>ATV312●●●●N4<br>ATV312●●●●S6 |
| PO | DC bus + polarity | All ratings |
| PA/+ | Output to braking resistor (+ polarity) | All ratings |
| PB | Output to braking resistor | All ratings |
| PC/- | DC bus - polarity | All ratings |
| U/T1 - V/T2 - W/T3 | Outputs to the motor | All ratings |

## Arrangement and caracteristics of the power terminals

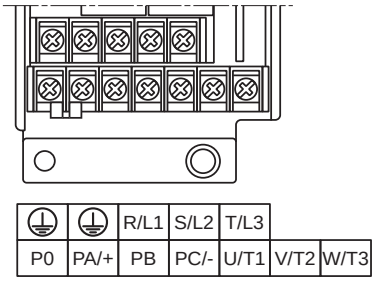
**CAUTION**

**RISK OF DAMAGE TO THE DRIVE**

- Never remove the link between PO and PA/+.
- The PO and PA/+ terminal screws must always be fully tightened as a high current flows through the link.

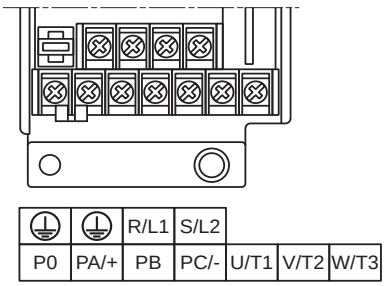
**Failure to follow these instructions can result in equipment damage**

**ATV312H 018M3 ... 075M3**




| ATV312H | Applicable wire size (1) mm² (AWG) | Recommended wire size (2) mm² (AWG) | Tightening torque N·m (lb.in) |
|---|---|---|---|
| 018M3, 037M3<br>055M3, 075M3 | 2.5<br>(14) | 2.5<br>(14) | 0.8<br>(7.1) |

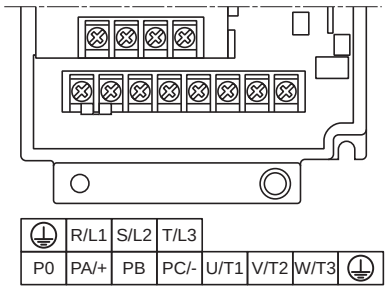
**ATV312H 018M2 ...075M2**




| ATV312H | Applicable wire size (1) mm² (AWG) | Recommended wire size (2) mm² (AWG) | Tightening torque N·m (lb.in) |
|---|---|---|---|
| 018M2, 037M2<br>055M2, 075M2 | 2.5<br>(14) | 2.5<br>(14) | 0.8<br>(7.1) |

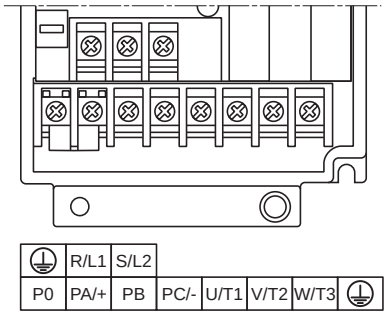
(1) The value in bold corresponds to the minimum wire gauge to permit secureness.
(2) 75°C (167 °F) copper cable (minimum wire size for rated use).

**ATV312H U11M3 ...U40M3**
**ATV312H 037N4 ... U40N4**
**ATV312H 075S6 ... U40S6**



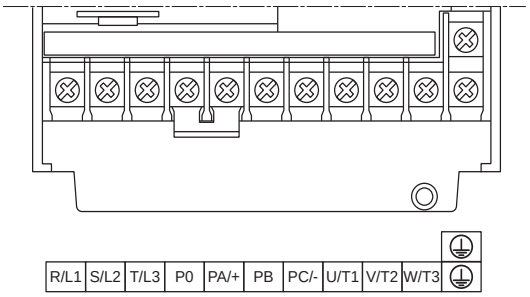

| ATV312H | Applicable wire size (1) mm² (AWG) | Recommended wire size (2) mm² (AWG) | Tightening torque N·m (lb.in) |
|---|---|---|---|
| U11M3, U15M3<br>037N4, 055N4,<br>075N4, U11N4,<br>U15N4<br>075S6, U15S6 | **2.5** to 6<br>(**14** to 10) | 2.5<br>(14) | 0.8<br>(7.1) |
| U22M3 | **2.5** to 6<br>(**12** to 10) | 3.5<br>(12) | 1.2<br>(10.7) |
| U30M3, U40M3 | 6<br>(10) | 6<br>(10) | 1.2<br>(10.7) |
| U22N4, U30N4<br>U22S6, U40S6 | **2.5** to 6<br>(**14** to 10) | 2.5<br>(14) | 1.2<br>(10.7) |
| U40N4 | **4** to 6<br>(**12** to 10) | 4<br>(12) | 1.2<br>(10.7) |

**ATV312H U11M2 ... U22M2**




| ATV312H | Applicable wire size (1) mm² (AWG) | Recommended wire size (2) mm² (AWG) | Tightening torque N·m (lb.in) |
|---|---|---|---|
| U11M2, U15M2 | **2.5** to 6<br>(**12** to 10) | 3.5<br>(12) | 1.2<br>(10.7) |
| U22M2 | **4** to 6<br>(**12** to 10) | 4<br>(12) | 1.2<br>(10.7) |

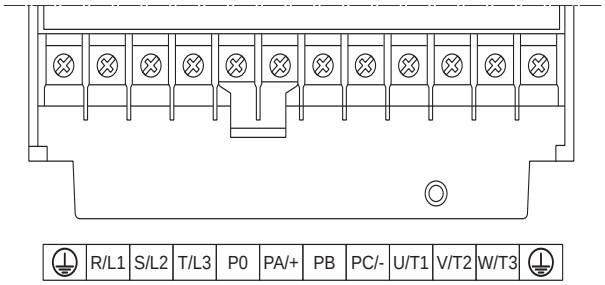
**ATV312H U55M3, U75M3**
**ATV312H U55N4, U75N4**
**ATV312H U55S6, U75S6**




| ATV312H | Applicable wire size (1) mm² (AWG) | Recommended wire size (2) mm² (AWG) | Tightening torque N·m (lb.in) |
|---|---|---|---|
| U55M3 | **10** to 16<br>(**8** to 6) | 10<br>(8) | 2.5<br>(22.3) |
| U75M3 | 16<br>(6) | 16<br>(6) | 2.5<br>(22.3) |
| U55N4, U55S6,<br>U75S6 | **6** to 16<br>(**10** to 6) | 6<br>(10) | 2.5<br>(22.3) |
| U75N4 | **10** to 16<br>(**8** to 6) | 16<br>(8) | 2.5<br>(22.3) |

(1) The value in bold corresponds to the minimum wire gauge to permit secureness.
(2) 75°C (167 °F) copper cable (minimum wire size for rated use).

**ATV312H D11M3, D15M3**
**ATV312H D11N4, D15N4**
**ATV312H D11S6, D15S6**

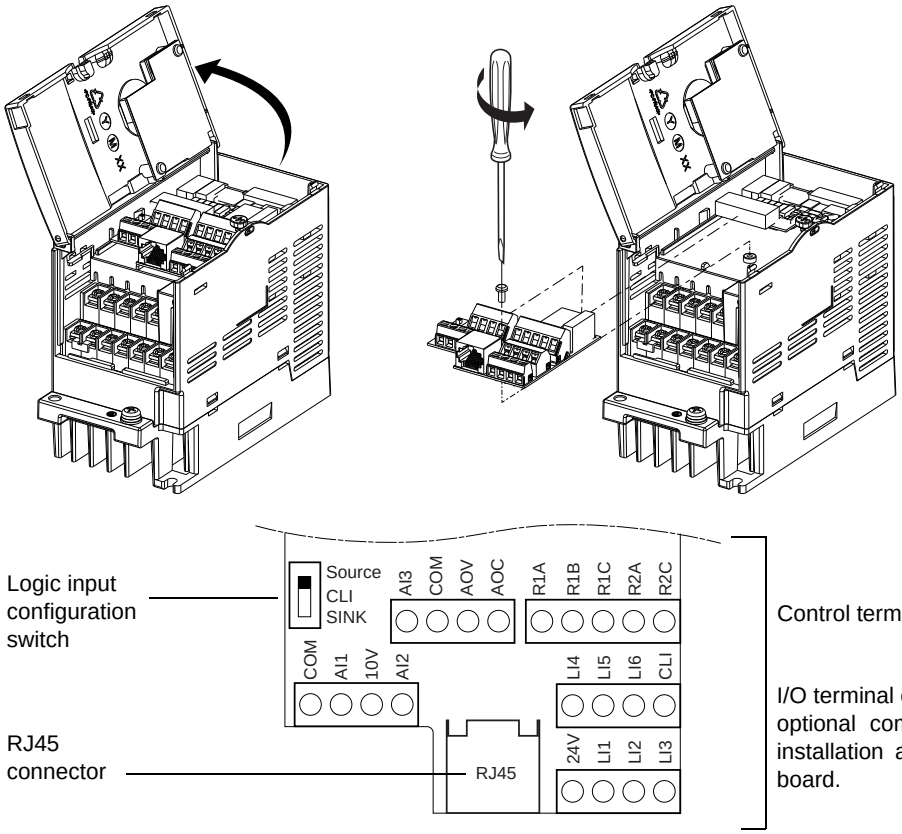



| ATV312H | Applicable wire size (1)<br>mm² (AWG) | Recommended wire size (2)<br>mm² (AWG) | Tightening torque<br>N·m (lb.in) |
|---|---|---|---|
| D11M3 | **10** to 25<br>(**8** to 4) | 25<br>(4) | 4.5<br>(40.1) |
| D15M3, D15N4 | **10** to 25<br>(**8** to 4) | 16<br>(6) | 4.5<br>(40.1) |
| D11N4, D11S6, D15S6 | **10** to 25<br>(**8** to 4) | 10<br>(8) | 4.5<br>(40.1) |

(1) The value in bold corresponds to the minimum wire gauge to permit secureness.
(2) 75°C (167 °F) copper cable (minimum wire size for rated use).

## Control terminals

### Access to the control terminals




## ⚠ DANGER

**UNINTENDED EQUIPMENT OPERATION**

- Do not plug or unplug the terminal board while drive is powered.
- Check the tightening of the fixing screw after any manipulation on the terminal board.

**Failure to follow these instructions will result in death or serious injury.**

## ⚠⚠ DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Do not touch the terminal board before :

- removing power on the drive,
- removing any voltage on input and output terminals.

**Failure to follow these instructions will result in death or serious injury.**

### Arrangement of the control terminals

| ATV312 Control terminals | Applicable wire size (1) mm² (AWG) | Tightening torque (2) N·m (lb.in) |
|---|---|---|
| R1A, R1B, R1C, R2A, R2C | **0.75** to 2.5 (**18** to 14) | 0.5 to 0.6 (4.4 to 5.3) |
| Other terminals | **0.14** to 2.5 (**26** to 16) | |

(1) The value in bold corresponds to the minimum wire gauge to permit secureness.
(2) Recommended to maximum value.

## Characteristics and functions of the control terminals

| Terminal | Function | Electrical characteristics |
|---|---|---|
| R1A<br>R1B<br>R1C | Common point C/O contact (R1C) of programmable relay R1 | • Min. switching capacity: 10 mA for 5 V ⎓<br>• Max. switching capacity on resistive load (cos φ = 1 and L/R = 0 ms):<br>5 A for 250 V ∿ and 30 V ⎓<br>• Max. switching capacity on inductive load (cos φ = 0.4 and L/R = 7 ms):<br>1.5 A for 250 V ∿ and 30 V ⎓<br>• Sampling time 8 ms<br>• Service life: 100,000 operations at max. switching power<br>1,000,000 operations at min. switching power |
| R2A<br>R2C | N/O contact of programmable relay R2 | |
| COM | Analog I/O common | 0 V |
| AI1 | Analog input voltage | Analog input 0 + 10 V (max. safe voltage 30 V)<br>• Impedance 30 kΩ<br>• Resolution 0.01 V, 10-bit converter<br>• Precision ± 4.3%, linearity ± 0.2%, of max. value<br>• Sampling time 8 ms<br>• Operation with shielded cable 100 m max. |
| 10 V | Power supply for reference potentiometer | +10 V (+ 8% - 0%), 10 mA max, protected against short-circuits and overloads |
| AI2 | Analog input voltage | Bipolar analog input 0 ± 10 V (max. safe voltage ± 30 V)<br>**The + or - polarity of the voltage on AI2 affects the direction of the setpoint and therefore the direction of operation.**<br>• Impedance 30 kΩ<br>• Resolution 0.01 V, 10-bit + sign converter<br>• Precision ± 4.3%, linearity ± 0.2%, of max. value<br>• Sampling time 8 ms<br>• Operation with shielded cable 100 m max. |
| AI3 | Analog input current | Analog input X - Y mA. X and Y can be programmed from 0 to 20 mA<br>• Impedance 250 Ω<br>• Resolution 0.02 mA, 10-bit converter<br>• Precision ± 4.3%, linearity ± 0.2%, of max. value<br>• Sampling time 8 ms |
| COM | Analog I/O common | 0 V |
| AOV<br><br>AOC | Analog output voltage AOV<br>or<br>Analog output current AOC<br>or<br>Logic output voltage AOC<br>AOV or AOC can be assigned (either, but not both) | Analog output 0 to 10 V, min. load impedance 470 Ω<br>or<br>Analog output X - Y mA. X and Y can be programmed from 0 to 20 mA, max. load impedance 800 Ω<br>• Resolution 8 bits (1)<br>• Precision ± 1% (1)<br>• Linearity ± 0.2% (1)<br>• Sampling time 8 ms<br>This analog output can be configured as a 24 V logic output on AOC, min. load impedance 1.2 kΩ.<br>(1) Characteristics of digital/analog converter. |
| 24 V | Logic input power supply | + 24 V protected against short-circuits and overloads, min. 19 V, max. 30 V<br>Max. customer current available 100 mA |
| LI1<br>LI2<br>LI3<br>LI4<br>LI5<br>LI6 | Logic inputs | Programmable logic inputs<br>• + 24 V power supply (max. 30 V)<br>• Impedance 3.5 kΩ<br>• State 0 if < 5 V, state 1 if > 11 V (voltage difference between LI- and CLI)<br>• Sampling time 4 ms |
| CLI | Logic input common | See page 19. |
| RJ45 | Communication port | Connection for SoMove software, Modbus and CANopen network, remote display, configuration loader tools, |

## Electromagnetic compatibility (EMC)

**IMPORTANT**: The high frequency equipotential ground connection between the drive, motor, and cable shielding does not eliminate the need to connect the ground (PE) conductors (green-yellow) to the appropriate terminals on each unit.

### Principle and precautions

- Grounds between the drive, motor, and cable shielding must have high frequency equipotentiality.
- When using shielded cable for the motor, use a 4-conductor cable so that one wire will be the ground connection between the motor and the drive. Size of the ground conductor must be selected in compliance with local and national codes. The shield can then be grounded at both ends. Metal ducting or conduit can be used for part or all of the shielding length, provided there is no break in continuity.
- When using shielded cable for Dynamic Brake (DB) resistors, use a 3-conductor cable so that one wire will be the ground connection between the DB resistor assembly and the drive. The size of the ground conductor must be selected in compliance with local and national codes. The shield can then be grounded at both ends. Metal ducting or conduit can be used for part or all of the shielding length, provided there is no break in continuity.
- When using shielded cable for control signals, if the cable is connecting equipment that is close together and the grounds are bonded together, then both ends of the shield can be grounded. If the cable is connected to equipment that may have a different ground potential, then ground the shield at one end only to prevent large currents from flowing in the shield. The shield on the ungrounded end may be tied to ground with a capacitor (for example: 10 nF, 100 V or higher) in order to provide a path for the higher frequency noise. Keep the control circuits away from the power circuits. For control and speed reference circuits, we recommend using shielded twisted cables with a pitch of between 25 and 50 mm (1 and 2 in.) Keep the control circuits away from the power circuits. For control and speed reference circuits, we recommend using shielded twisted cables with a pitch of between 25 and 50 mm (1 and 2 in.)
- Ensure maximum separation between the power supply cable (line supply) and the motor cable.
- The motor cables must be at least 0.5 m (20 in.) long.
- Do not use surge arresters or power factor correction capacitors on the variable speed drive output.
- If using an additional input filter, it should be mounted as closed as possible to the drive and connected directly to the line supply via an unshielded cable. Link 1 on the drive is via the filter output cable.
- For installation of the optional EMC plate and instructions for meeting IEC 61800-3 standard, refer to the section entitled “Installing the EMC plates” and the instructions provided with the EMC plates.

**⚠ ⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Do not expose cable shielding except where connected to ground at the metal cable glands and underneath the grounding clamps.
- Ensure that there is no risk of the shielding coming into contact with live components.

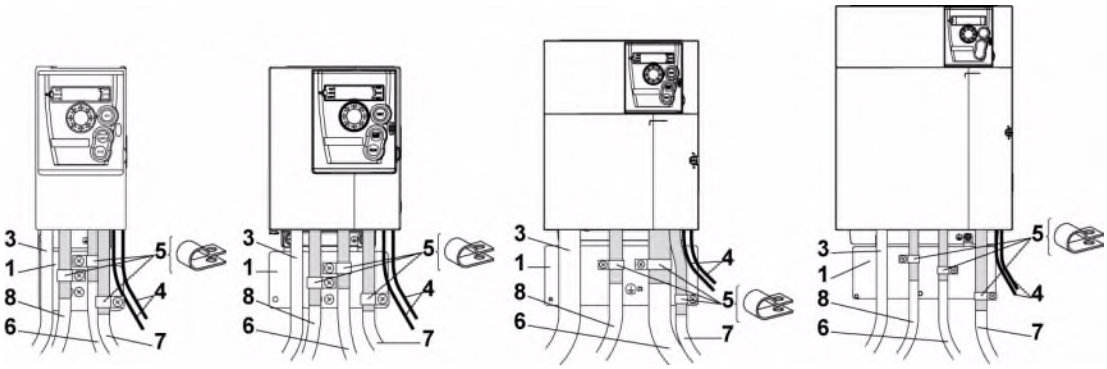
**Failure to follow these instructions will result in death or serious injury.**

## Optional EMC plate installation diagram and instructions (examples)

Installation depends on the drive size. The table below gives the size according to the reference.

| Size 1 | Size 2 | Size 3 | Size 4 | Size 5 | Size 6 | Size 7 | Size 8 | Size 9 |
|---|---|---|---|---|---|---|---|---|
| H018M3, H037M3 | H055M3, H075M3 | H018M2, H037M2 | H055M2, H075M2 | HU11M3, HU15M3 | HU11M2, HU15M2, HU22M3, H037N4, H055N4, H075N4, HU11N4, HU15N4, H075S6, HU15S6 | HU22M2, HU30M3, HU40M3, HU22N4, HU30N4, HU40N4, HU22S6, HU40S6 | HU55M3, HU75M3, HU55N4, HU75N4, HU55S6, HU75S6 | HD11M3, HD15M3, HD11N4, HD15N4, HD11S6, HD15S6 |

Sizes 1 to 4 Size 5 to 7 Size 8 Size 9




1. EMC plate supplied with the drive, to be installed as indicated on the diagram.
2. Altivar 312
3. Non-shielded power supply wires or cable
4. Non-shielded wires for relay contacts
5. Attach and ground the shielding of cables **6**, **7** and **8** as close as possible to the drive:
   - Strip the shielding.
   - Use stainless steel cable clamps of an appropriate size on the parts from which the shielding has been stripped, to attach them to the plate **1**.
   The shielding must be clamped tightly to the metal plate to improve electrical contact.
6. Shielded cable for motor connection with shielding connected to ground at both ends.
   The shielding must be continuous and intermediate terminals must be in EMC shielded metal boxes.
   For 0.18 to 1.5 kW drives, if the switching frequency is higher than 12 kHz, use cables with low linear capacitance: max. 130 pF (picoFarads) per meter.
7. Shielded cable for connecting the control/signalling wiring.
   For applications requiring several conductors, use cables with a small cross-section (0.5 $mm^2$, 20 AWG).
   The shielding must be connected to ground at both ends. The shielding must be continuous and intermediate terminals must be in EMC shielded metal boxes.
8. Shielded cable for connecting braking resistor (if used).
   The shielding must be continuous and intermediate terminals must be in EMC shielded metal boxes.

**Note:**

- If using an additional input filter, it should be mounted under the drive and connected directly to the line supply via an unshielded cable. Link 3 on the drive is then via the filter output cable.
- The HF equipotential ground connection between the drive, motor and cable shielding does not remove the need to connect the PE ground conductors (green-yellow) to the appropriate terminals on each unit.

# Operation on an IT system

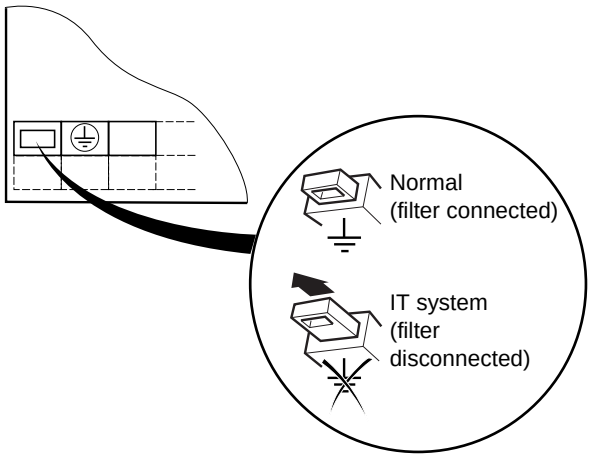
IT system: Isolated or impedance earthed neutral.

ATV312●●●●M2 and ATV312●●●●N4 drives have a built-in EMC filter. As a result they exhibit leakage current to ground. If the leakage current creates compatibility problems with your installation (residual current device or other), then you can reduce the leakage current by opening the IT jumper. In this configuration EMC compliance is not guaranteed.

Use a permanent insulation monitor compatible with non-linear loads (for example Merlin Gerin type XM200).

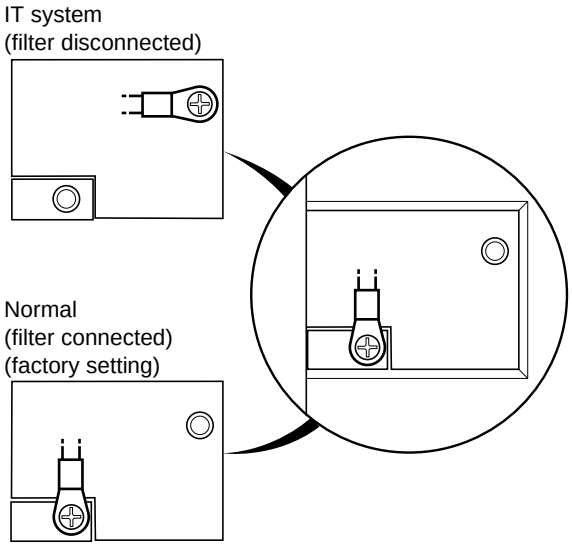
**ATV312H 018M2 to U22M2 and ATV312H 037N4 to U40N4:**

Pull out the jumper on the left of the ground terminal as illustrated below.




**ATV312H U55N4 to D15N4:**

Move the cable tag on the top left of the power terminals as illustrated below (example: ATV312HU55N4):



# Check list

Read carefully the safety information in programming, installation, simplified manuals and the catalogue. Before starting up the drive, please check the following points regarding mechanical and electrical installations, then use and run the drive.
For complete documentation, refer to www.schneider-electric.com.

## 1. Mechanical installation

- For drive mounting types and recommendations on the ambient temperature (see the Mounting instructions on page 14).
- Mount the drive vertically as specified (see the Mounting instructions on page 14).
- The use of the drive must be in agreement with the environments defined by the standard 60721-3-3 and according to the levels defined in the catalogue.
- Mount the options required for your application (see catalogue).

## 2. Electrical installation

- Connect the drive to the ground (see Equipment Grounding on page 17).
- Ensure that the input power voltage corresponds to the drive nominal voltage and connect the line supply as shown on the drawing on page 18.
- Ensure to use appropriate input power fuses and circuit breaker.
- Wire the control terminals as required (see Control terminals on page 24). Separate the power cable and the control cable according to EMC compatibility rules.
- The range ATV312●●●●M2 and ATV312●●●●N4 integrates EMC filter. The leakage current can be reduced using the IT jumper as explained in the paragraph Operating on an IT system on page 28.
- Ensure that motor connections correspond to the voltage (star, delta).

## 3. Use and run the drive (see programming manual)

- Start the drive and you will see [Standard mot. freq] (bFr) at the first power on. Check that the frequency defined by the frequency bFr (the factory setting is 50 Hz) is in accordance with the frequency of the motor.
- On first power-up parameters [Ref.1 channel] (Fr1) and [2/3 wire control] (tCC) appear after bFr. These parameters should be set if you want to control the drive locally, see page «How to control the drive locally» in the programming manual.
- On subsequent power-up, rdy will be displayed on the HMI.
- The [Restore config.] (FCS) function, permits you to reset the drive with factory settings.

# Maintenance

## Servicing

The Altivar 312 does not require any preventive maintenance. However, it is advisable to perform the following checks regularly:

- The condition and tightness of connections.
- Ensure that the temperature around the unit remains at an acceptable level and that ventilation is effective. Average service life of fans: 10 years.
- Remove any dust from the drive.
- Ensure proper fan operation.
- Physical damage to covers.

## Assistance with maintenance, detected fault display

If a problem arises during setup or operation, ensure that the recommendations relating to the environment, mounting and connections have been observed.

The first fault detected is stored and displayed, flashing, on the screen: the drive locks and the status relay (R1) contact opens.

## Clearing the detected fault

Disconnect the drive power supply in the event of a non-resettable fault.
Wait for the display to go off completely.
Find the cause of the detected fault and correct it.
Restore power to the drive.
The detected fault will no longer be present if it's cause has been corrected.
In the event of a non resettable detected fault:

- Remove/cut the power to the drive.
- WAIT 15 MINUTES to allow the DC bus capacitors to discharge. Then follow the “Bus Voltage Measurement Procedure” page 16 to verify that the DC voltage is less than 42 V. The drive LEDs are not indicators of the absence of DC bus voltage.
- Find and correct the detected fault.
- Restore power to the drive to confirm the detected fault has been rectified.

**Certain detected faults can be programmed for automatic restart after the cause has disappeared.**
These detected faults can also be reset by cycling power to the drive or by means of a logic input or control bit.

## Display menu

Use the display menu to show the status of the drive and it's current values as an aid for finding the causes of detected faults.

## Spares and repairs

Serviceable product: replacement of spares following the catalog.

## Procedure after a long time storage

**⚠ WARNING**

**RISK OF EXPLOSION AT THE POWER UP**

The capacitors after a long time storage can have issues. Following a storage time between 2 and 3 years:

- Use one AC supply variable connected between L1, L2 and L3
- Increase AC supply voltage to have:
  - 25% of rated voltage during 30mn
  - 50% of rated voltage during 30mn
  - 75% of rated voltage during 30mn
  - 100% of rated voltage during 30mn

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

# Short-circuit rating and branch circuit protection

## Recommended fuse ratings for UL and CSA requirements

| Reference | Voltage (Y) | Input withstand rating (1) | Output interrupt rating (X)(2) | Enclosure Containment rating (3) (Type 1) | Branch Circuit protection (Z1) | Rating (Z2) |
|---|---|---|---|---|---|---|
| ATV312H018M2 | 200-240 | 1 | 22 | | Class J Fuse | 6 |
| ATV312H037M2 | 200-240 | 1 | 22 | | Class J Fuse | 10 |
| ATV312H055M2 | 200-240 | 1 | 22 | | Class J Fuse | 10 |
| ATV312H075M2 | 200-240 | 1 | 22 | | Class J Fuse | 15 |
| ATV312HU11M2 | 200-240 | 1 | 22 | | Class J Fuse | 20 |
| ATV312HU15M2 | 200-240 | 1 | 22 | | Class J Fuse | 20 |
| ATV312HU22M2 | 200-240 | 1 | 22 | | Class J Fuse | 30 |
| ATV312H018M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 3 |
| ATV312H037M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 6 |
| ATV312H055M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 10 |
| ATV312H075M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 10 |
| ATV312HU11M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 15 |
| ATV312HU15M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 15 |
| ATV312HU22M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 20 |
| ATV312HU30M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 25 |
| ATV312HU40M3X | 200-240 | 5 | 22 | 22 | Class J Fuse | 35 |
| ATV312HU55M3X | 200-240 | 22 | 22 | 22 | Class J Fuse | 50 |
| ATV312HU75M3X | 200-240 | 22 | 22 | 22 | Class J Fuse | 60 |
| ATV312HD11M3X | 200-240 | 22 | 22 | 22 | Class J Fuse | 80 |
| ATV312HD15M3X | 200-240 | 22 | 22 | 22 | Class J Fuse | 110 |
| ATV312H037N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 3 |
| ATV312H055N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 6 |
| ATV312H075N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 6 |
| ATV312HU11N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 10 |
| ATV312HU15N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 10 |
| ATV312HU22N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 15 |
| ATV312HU30N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 15 |
| ATV312HU40N4 | 380-500 | 5 | 22 | 100 | Class J Fuse | 20 |
| ATV312HU55N4 | 380-500 | 22 | 22 | 100 | Class J Fuse | 30 |
| ATV312HU75N4 | 380-500 | 22 | 22 | 100 | Class J Fuse | 35 |
| ATV312HD11N4 | 380-500 | 22 | 22 | 100 | Class J Fuse | 50 |
| ATV312HD15N4 | 380-500 | 22 | 22 | 100 | Class J Fuse | 70 |
| ATV312H075S6X | 575-600 | 5 | 22 | 22 | Class J Fuse | 6 |
| ATV312HU15S6X | 575-600 | 5 | 22 | 22 | Class J Fuse | 6 |
| ATV312HU22S6X | 575-600 | 5 | 22 | 22 | Class J Fuse | 10 |
| ATV312HU40S6X | 575-600 | 5 | 22 | 22 | Class J Fuse | 15 |
| ATV312HU55S6X | 575-600 | 22 | 22 | 22 | Class J Fuse | 20 |
| ATV312HU75S6X | 575-600 | 22 | 22 | 22 | Class J Fuse | 25 |
| ATV312HD11S6X | 575-600 | 22 | 22 | 22 | Class J Fuse | 35 |
| ATV312HD15S6X | 575-600 | 22 | 22 | 22 | Class J Fuse | 45 |

Suitable For Use On A Circuit Capable Of Delivering Not More Than ___X____ rms Symmetrical Amperes, ___Y____ Volts Maximum, When Protected by __Z 1____ with a Maximum rating of__Z 2___.

(1) Input withstand rating is that for which the product has been designed thermally. Installation on a supply greater than this level will require additional inductance to satisfy this level.

(2) Output interrupt rating relies on Integral solid state short circuit protection. This does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. This is dependant on the type of installation.

(3) Enclosure Containment Rating is the maximum input short-circuit current at the drive input terminals with the specific branch Circuit Protection present for which any internal component breakdown, will not create a shock, flame, fire or expulsion hazard outside a specific enclosure structure. The various combinations are indicated in supplementary documents.

BBV46391
ATV312_installation_manual_V1
04/2009

*Product Data Sheet*

# QOU350

Miniature Circuit Breaker (QOU) Standard, 50A, 3-Pole, 240VAC, HACR Rated, 10kA



SQUARE D by Schneider Electric

List Price $285.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

## Technical Characteristics

| | |
|---|---|
| Ampere Rating | 50A |
| Approvals | UL489 Listed - CSA 22.2 #5.1 Certified - IEC Rated 60947-2 |
| Circuit Breaker Type | Standard |
| For Use With | OEM Panels and Enclosures |
| HACR Rated | Yes |
| Marketing Trade Name | QOU |
| Voltage Rating | 240VAC |
| Mounting Type | Flush, Surface or DIN Rail (35mm) |
| Number of Poles | 3-Pole |
| Short Circuit Current Rating | 10kA@240VAC |
| Terminal Type | Line: Box Lug - Load: Box Lug |
| Type | QOU |
| Wire Size | #14-2 AWG(Al/Cu) |
| Depth | 2.98 Inches |
| Width | 2.25 Inches |
| Height | 4.05 Inches |

## Shipping and Ordering

| | |
|---|---|
| Category | 00900 - Circuit Breakers, 1 Pole: 10 - 100 Amp, 2 Pole: 10 - 125 Amp, 3 Pole: 10 -125 Amp, Type QOU |
| Discount Schedule | DE2 |
| GTIN | 00785901418986 |
| Package Quantity | 16 |
| Weight | 1.13 lbs. |
| Availability Code | Stock Item: This item is normally stocked in our distribution facility. |
| Returnability | Y |
| Country of Origin | MX |

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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*Product Data Sheet*

# QOU315

## Miniature Circuit Breaker (QOU) Standard, 15A, 3-Pole, 240VAC, HACR Rated, 10kA



SQUARE D by Schneider Electric

List Price $285.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

### Technical Characteristics

| | |
|---|---|
| Ampere Rating | 15A |
| Approvals | UL489 Listed - CSA 22.2 #5.1 Certified - IEC Rated 60947-2 |
| Circuit Breaker Type | Standard |
| For Use With | OEM Panels and Enclosures |
| HACR Rated | Yes |
| Marketing Trade Name | QOU |
| Voltage Rating | 240VAC |
| Mounting Type | Flush, Surface or DIN Rail (35mm) |
| Number of Poles | 3-Pole |
| Short Circuit Current Rating | 10kA@240VAC |
| Terminal Type | Line: Box Lug - Load: Box Lug |
| Type | QOU |
| Wire Size | #14-2 AWG(Al/Cu) |
| Depth | 2.98 Inches |
| Height | 4.05 Inches |
| Width | 2.25 Inches |

### Shipping and Ordering

| | |
|---|---|
| Category | 00900 - Circuit Breakers, 1 Pole: 10 - 100 Amp, 2 Pole: 10 - 125 Amp, 3 Pole: 10 -125 Amp, Type QOU |
| Discount Schedule | DE2 |
| GTIN | 00785901418863 |
| Package Quantity | 16 |
| Weight | 1.09 lbs. |
| Availability Code | Stock Item: This item is normally stocked in our distribution facility. |
| Returnability | Y |
| Country of Origin | MX |

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*Product Data Sheet*

# QOU115

## Miniature Circuit Breaker (QOU) Standard, 15A, 1-Pole, 120/240VAC, HACR Rated



SQUARE D by Schneider Electric

List Price $40.20 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

### Technical Characteristics

| | |
|---|---|
| Ampere Rating | 15A |
| Approvals | UL489 Listed - CSA 22.2 #5.1 Certified - IEC Rated 60947-2 |
| Circuit Breaker Type | Standard |
| For Use With | OEM Panels and Enclosures |
| HACR Rated | Yes |
| Marketing Trade Name | QOU |
| Voltage Rating | 120/240VAC |
| Mounting Type | Flush, Surface or DIN Rail (35mm) |
| Number of Poles | 1-Pole |
| Short Circuit Current Rating | 5kA@277VAC - 10kA@120/240VAC |
| Switching Duty Rated | Yes |
| Terminal Type | Line: Box Lug - Load: Box Lug |
| Type | QOU |
| Wire Size | #14-2 AWG(Al/Cu) |
| Depth | 2.98 Inches |
| Height | 4.05 Inches |
| Width | 0.75 Inches |

### Shipping and Ordering

| | |
|---|---|
| Category | 00900 - Circuit Breakers, 1 Pole: 10 - 100 Amp, 2 Pole: 10 - 125 Amp, 3 Pole: 10 -125 Amp, Type QOU |
| Discount Schedule | DE2 |
| GTIN | 00785901418504 |
| Package Quantity | 40 |
| Weight | 0.36 lbs. |
| Availability Code | Stock Item: This item is normally stocked in our distribution facility. |
| Returnability | Y |
| Country of Origin | MX |

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*Product Data Sheet*

# QOU120

## Miniature Circuit Breaker (QOU) Standard, 20A, 1-Pole, 120/240VAC, HACR Rated



SQUARE D by Schneider Electric

List Price $40.20 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

### Technical Characteristics

| | |
|---|---|
| Ampere Rating | 20A |
| Approvals | UL489 Listed - CSA 22.2 #5.1 Certified - IEC Rated 60947-2 |
| Circuit Breaker Type | Standard |
| For Use With | OEM Panels and Enclosures |
| HACR Rated | Yes |
| Marketing Trade Name | QOU |
| Voltage Rating | 120/240VAC |
| Mounting Type | Flush, Surface or DIN Rail (35mm) |
| Number of Poles | 1-Pole |
| Short Circuit Current Rating | 5kA@277VAC - 10kA@120/240VAC |
| Switching Duty Rated | Yes |
| Terminal Type | Line: Box Lug - Load: Box Lug |
| Type | QOU |
| Wire Size | #14-2 AWG(Al/Cu) |
| Depth | 2.98 Inches |
| Height | 4.05 Inches |
| Width | 0.75 Inches |

### Shipping and Ordering

| | |
|---|---|
| Category | 00900 - Circuit Breakers, 1 Pole: 10 - 100 Amp, 2 Pole: 10 - 125 Amp, 3 Pole: 10 -125 Amp, Type QOU |
| Discount Schedule | DE2 |
| GTIN | 00785901418535 |
| Package Quantity | 66 |
| Weight | 0.36 lbs. |
| Availability Code | Stock Item: This item is normally stocked in our distribution facility. |
| Returnability | Y |
| Country of Origin | MX |

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Schneider Electric

# Attachment 6

# Agency Correspondence

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation, 11th Floor**
625 Broadway, Albany, New York 12233-7014
**Phone:** (518) 402-9662
**Fax:** (518) 402-9679
**Website: www.dec.ny.gov**

Joe Martens
Commissioner

September 18, 2013

Mr. Michael T. Phelan
Manager, Environmental, Planning and Site Support Services
IBM, Corp.
2455 South Road
Poughkeepsie, NY 12601

Re: SSDS Design/Installation Work Plan
Neptune Commerce Center (Former IBM B952/982)
Poughkeepsie, Dutchess County, Site No. 314076

Dear Mr. Phelan:

The New York State Department of Environmental Conservation (Department), in consultation with the New York State Department of Health (DOH), has reviewed the SSDS Design/Installation Work Plan, dated September 3, 2013, for the former IBM 952/982 (now known as the Neptune Commerce Center), Site # 314076. The work plan is hereby approved with the following modifications:

1. Since the site is listed as a Class 4, meaning that only site management operations remain, the report should not be referring to a Remedial Design/Remedial Action Work Plan. Please re-title the document to refer to the design and installation of the Sub-slab Depressurization System (SSDS).

2. In Section 5.0, Conceptual Design of Remediation System, please remove the reference to a VOC source mass beneath the building, as past sampling has demonstrated that this is not the case. Rather, residual VOCs remain in the soil vapor which the system will address.

3. In Section 8.0, Schedule and Communications, the last sentence should be revised to remove the reference to a final engineering report. Rather, this report should refer specifically to the completion of the SSDS installation.

In accordance with the Order on Consent and 6NYCRR 375-1.6(d), please indicate within 15 days whether you accept the Department's modified work plan. Please ensure that all copies of the final work plan include this approval letter. The final copy of the work plan should be submitted as one electronic copy to both the DOH and the Department.

Please contact me with any questions at 518-402-9662 or via e-mail at sxdeyett@gw.dec.state.ny.us.

Sincerely,

R. Scott Deyette
Chief, Inspection Unit
Remedial Bureau C
Division of Environmental Remediation

ec: T. Perretta, NYSDOH Project Manager
C. Bethoney, NYSDOH
E. Moore, DEC Regional Hazardous Waste Engineer

cc: D. Kaminski, Neptune Capital Investors L.L.C.

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation, 11th Floor**
625 Broadway, Albany, New York 12233-7014
**Phone:** (518) 402-9662
**Fax:** (518) 402-9679
**Website: www.dec.ny.gov**

Joe Martens
Commissioner

April 25, 2014

Mr. Michael T. Phelan
Manager, Environmental, Planning and Site Support Services
IBM, Corp.
2455 South Road
Poughkeepsie, NY 12601

Re: SSDS Start-Up and Performance Testing Report
Neptune Commerce Center (Former IBM B952/982)
Poughkeepsie, Dutchess County, Site No. 314076

Dear Mr. Phelan:

The New York State Department of Environmental Conservation (Department), in consultation with the New York State Department of Health (DOH), has reviewed the SSDS Start-Up and Performance Testing Report, dated February 24, 2014, for the former IBM 952/982 (a/k/a Neptune Commerce Center), Site # 314076. The report is hereby approved.

Please contact me with any questions at 518-402-9662 or via e-mail at sxdeyett@gw.dec.state.ny.us.

Sincerely,

R. Scott Deyette
Chief, Inspection Unit
Remedial Bureau C
Division of Environmental Remediation

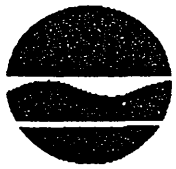
ec: D. Kaminski, Neptune Capital Investors L.L.C.
T. Perretta, NYSDOH Project Manager
M. Schuck, NYSDOH
E. Moore, DEC Regional Hazardous Waste Engineer

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX F
# REGULATORY CORRESPONDENCE

New York State Department of Environmental Conservation
21 South Putt Corners Road
New Paltz, New York 12561-1696
(914) 255-5453



Henry G. Williams
Commissioner

July 6, 1984

IBM
P.O. Box 950
Dept. 771, Bldg. 928
South Road
Poughkeepsie, New York 12602

Attn: J.J. Everhart

Re: IBM-Poughkeepsie Bldg. 952
Site #314001

Dear Mr. Everhart:

This Department has reviewed the proposed remedial project outlined in the "Summary of Work Plan Building 952/982 Remediation Program" dated June, 1984. The work plan is acceptable, including the removal criteria summarized here:

| | GT |
|---|---|
| Total volatile organics | 500 ppb |
| Total phthalates | 20 ppm |
| Base neutrals (excluding phthalates) | 500 ppb |
| Acid extractables | 500 ppb |

Some points relating to the sampling program, post-demolition investigation at 952/982, and future groundwater monitoring will require some discussion in the final report, however they need not interfere with the implementation of the remidial plan. The QA/QC report which we discussed should be submitted as soon as possible to:

Anna Wolfe
NYS Department of Environmental Conservation
Room 414
50 Wolf Road
Albany, New York 12233

The Bureau of Remedial Action and the Region will minitor the operation. Please contact me at 914/255-5453 or Anna Wolfe at 518/457-5637 with scheduling details.

Sincerely,

William G. Sullivan
Assistant Sanitary Engineer
Region 3

WGS/dl
cc: A. Wolfe
J. Hill, D.C.H.D.

New York State Department of Environme
50 Wolf Road, Albany, New York 12233

DEC 13 1993

Thomas C. Jorling
*Commissioner*

South Road Associates
c/o VanDeWater & VanDeWater
P.O. Box 1129
Poughkeepsie, New York 12602

Dear Sir:

As mandated by Section 27-1305 of the Environmental Conservation Law (ECL), the New York State Department of Environmental Conservation (NYSDEC) must maintain a registry of all inactive disposal sites known to contain hazardous waste. The ECL also mandates that this Department notify the owner of all or any part of each site or area included in the Registry of Inactive Hazardous Waste Disposal Sites as to changes in site classification.

Our records indicate that you are the owner or part owner of the site listed below. Therefore, this letter constitutes notification of change in the classification of such site in the Registry of Inactive Hazardous Waste Disposal Sites in New York State.

DEC Site No.: 314076
Site Name: IBM B952/982
Site Address: Neptune Road, Poughkeepsie, New York 12602

Classification Change from 2a to 4

The reason for the change is as follows:

- The source of the contamination and the grossly contaminated soils have been removed. The remaining groundwater contamination is confined to a small area and a pump and treat system is operating at the site. This site appropriately meets the definition of a Class 4 site; the site is properly closed but requires continued management.

Enclosed is a copy of the New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation, Inactive Hazardous Waste Disposal Site Report form as it appears in the Registry and Annual Report, and an explanation of the site classifications. The Law allows the owner and/or operator of a site listed in the Registry to petition the Commissioner of the New York State Department of Environmental Conservation for deletion of such site, modification of site classification, or modification of any information regarding such site, by submitting a written statement setting forth the grounds of the petition. Such petition may be addressed to:

Thomas C. Jorling, Commissioner
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

For additional information, please contact me at (518) 457-0747.

Sincerely,

Robert L. Marino
Chief
Site Control Section
Bureau of Hazardous Site Control
Division of Hazardous Waste Remediation

Enclosures

bcc: w/o Enc.
E. Barcomb
R. Marino
J. Swartwout
[redacted] Bayer

w/Enc. (copy of Site Report form only)
R. Dana
A. Carlson, NYSDOH
L. Concra
S. Swanston
R. Pergadia, R/3
S. Ervolina
J. Rider

WB/srh

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation, Region 3**
21 South Putt Corners Road, New Paltz, New York 12561-1696
**Phone:** (914) 256-3003 • **FAX:** (914) 255-0714
**Website:** www.dec.state.ny.us

John P. Cahill
Commissioner

November 17, 1999

Mr. Joseph L. Ferri
International Business Machines
522 South Road
Poughkeepsie, N.Y. 12601

Re: IBM Bldg 952/982 Site # 314076

Dear Mr. Ferri:

We have reviewed your proposal of 3-31-99 to decrease the monitoring frequency for all monitoring wells from quarterly to twice annually, as outlined in Section 4.2 of the 1998 Annual Groundwater Monitoring Report and find it acceptable. We understand that the pumping well will continue to be monitored on a monthly basis.

Thank you for your patience.

Sincerely

Jim Schreyer
Constuction Inspector

cc
Michael O'Toole NYSDEC Albany
Jerry Rider NYSDEC Albany
Ram Pergadia NYSDEC New Paltz

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation, Region 3**
21 South Putt Corners Road, New Paltz, New York 12561-1696
**Phone:** (845) 256-3003 • **FAX:** (845) 255-4238
**Website:** www.dec.state.ny.us

Erin M. Crotty
Commissioner

April 23, 2004

Mr Steve Brannen P356
International Business Machines
522 South Road
Poughkeepsie New York 12601

Re: IBM Bldg 952/982 #314076 O+M Modifications

We have received your proposal of 3-31-04 to modify the Operation and Maintenance requirements as outlined in section 4.2 of the 2003 Groundwater Monitoring Report.

The following is approved:

a. Remove from sampling plan and decommission wells 952-8R, 952-14S and 952-15RA
b. Reduction in monitoring frequency to once per year for wells 952-10RA, 952-11R, 952-29R and 952-31R
c. Analysis and reporting by SW846 methodologies.

At this time we do not want well 952-15RB removed because it has been one of the more contaminated perimeter wells on site in the past.

All wells should be removed in accordance with the NYSDEC Groundwater Monitoring Well Decommisioning Procedures 1996. Please let me know when this work will be performed.

At the time of closeout for the site or the removal of any additional wells it may be necessary to use original QA/QC procedures to verify qroundwater quality.

If there are any questions or comments please contact me at 845-256-3148.

Sincerely

Jim Schreyer

cc Ram Pergadia NYSDEC Reg 3
Robert Schick NYSDEC Albany

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation, Region 3**
21 South Putt Corners Road, New Paltz, New York 12561-1620
**Phone:** (845) 256-3000 • **Fax:** (845) 255-3414
**Website:** www.dec.ny.gov

Alexander B. Grannis
Commissioner

December 18, 2009

Mr. Joseph L. Ferri
Manager of Facilities and Environmental Services
International Business Machines
2455 South Road
Poughkeepsie New York
12601

Re: IBM B952/982 Site # 314076
Water Treatment System Modification

Dear Mr. Ferri,

The New York State Departments of Environmental Conservation and Health (the "Agencies") have reviewed your October 2009 request for Treatment System Modification and proposed Addendum to the Operation and Maintenance Plan and find it acceptable, contingent upon receipt by the Agencies of written approval from the Arlington Sewer District to accept untreated water from the IBM B952/982 site.

Please submit a copy of the Arlington Sewer District's approval letter to the Agencies before making any modifications.

If there are any questions or comments, please contact me at 845-256-3148.

Sincerely,

Jim Schreyer
Construction Inspector

ecc: D. Desnoyers, Esq., NYSDEC
M. Lesser, Esq., NYSDEC
R. Schick, NYSDEC
M. Ryan, NYSDEC
E. Moore, NYSDEC
J. Brown, NYSDEC
M. VanValkenburg, NYSDOH

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation, 11th Floor**
Remedial Bureau C
625 Broadway, Albany, New York 12233-7014
**Phone:** (518) 402-9662
**Fax:** (518) 402-9679
**Website: www.dec.ny.gov**

Joe Martens
Commissioner

IBM CORPORATION - POUGHKEEPSIE
Michael Domitrovits
2455 South Road
POUGHKEEPSIE, NY 12601

Re: Site Management (SM) Periodic Review Report (PRR) Response Letter
Former IBM B952/982, Poughkeepsie
Dutchess County, Site No.: 314076

Dear Mr. Domitrovits:

The Department has reviewed your Periodic Review Report (PRR) and IC/EC Certification for following period: 01/01/2009 to 12/31/2010.

The Department hereby accepts the PRR and associated Certification. The frequency of Periodic Reviews for this site is 3 year(s), and your next PRR is due on January 30, 2014. You will receive a reminder letter and updated certification form 45-days prior to the due date.

If you have any questions, or need additional forms, please contact me at 518-402-9662 or e-mail: sxdeyett@gw.dec.state.ny.us

Sincerely,

R. Scott Deyette
Chief, Inspection Unit
Remedial Bureau C
Division of Environmental Remediation

cc: SOUTH ROAD ASSOCIATES Inc

ec: Edward Moore, RHWE, Region 3 NYSDEC



Re: Temporary Partial Suspension of Groundwater Monitoring Plan (GMP)for Neptune Rd
Scott Deyette
to:
Stephen Brannen
01/23/2013 01:04 PM
Hide Details
From: "Scott Deyette" <sxdeyett@gw.dec.state.ny.us>
To: Stephen Brannen/Poughkeepsie/IBM@IBMUS,

Steve-

Your request to suspend sampling and gauging of all peripheral wells at the site, until redevelopment of the site is complete, is approved. as stated below, the GWTS will continue to operate and sampling from the extraction well will also continue as required.

R. Scott Deyette
Chief, Inspection Unit
Remedial Bureau C
NYSDEC
(518) 402-9662
>>> Stephen Brannen <spbrann@us.ibm.com> 1/23/2013 12:35 PM >>>

Scott:
IBM is requesting approval to suspend, until redevelopment of the subject site is complete, the requirement to sample the periphery wells at this location. Currently, the monitoring requirements for these wells are: quarterly ground water level determinations and semi annual chemistry sampling and analyses. Historically, these wells have demonstrated that the pumping rate we use at the extraction well is sufficient to maintain hydraulic control and prevent chemical migration from the subject area.
This request does not include a change of the requirements for the pumping well. IBM will continue to operate the pumping well at the withdrawal rate that has been historically achieved and will continue to sample this well in accordance with our approved GMP. Contingent on your approval, IBM plans to reduce all of the sites' periphery well casings to an elevation below the redevelopment elevations and to secure the wells with an appropriate sealing device. This will protect the wells and once the final grading and paving is complete, IBM will expose the wells, extend the casings/piping and install surface mountings to meet regulatory requirements and the redevelopment grades/loading requirements.
Please contact me if you have any questions. Thank you.

Regards,
Steve

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX G
# HISTORICAL GROUNDWATER RESULTS

Table 1
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-006-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/29/11 | 6/15/11 | 10/12/10 | 6/3/10 | 10/13/09 | 6/23/09 | 10/6/08 | 6/17/08 |
| **VOCs in ug/l** | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | 0.42 J | 0.40 J | 1.0 | 0.84 J | 0.80 J | 0.65 J | 0.68 J | 0.51 J | 0.43 J |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | 0.55 J | 0.23 J | 0.55 J | 0.26 J | 0.38 J | 0.61 J | <1 | 0.71 J | 0.56 J |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 0.36 J | 0.36 J | <1 |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 0.35 J |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 2
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-009-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/29/11 | 6/15/11 | 10/11/10 | 6/3/10 | 10/13/09 | 6/23/09 | 10/7/08 | 6/17/08 |
| **VOCs in ug/l** | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | 0.20 J | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 3
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-010-RA | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/12/12 | 6/17/11 | 6/3/10 | 6/23/09 | 6/18/08 |
| **VOCs in ug/L** | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | 1.2 | 0.95 J | 1.1 | 1.2 | 1.3 | 0.94 J |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | 0.83 J | 0.37 J | 0.41 J | 0.63 J | 0.45 J |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | 2.4 | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | 2.6 | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | **31** | **430 D** | **950 D** | **40** | **1,900 D** | **3,000 D** |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | **0.18 J** | <1 |
| 1,2-Dichloroethylene | 5 | -- | 2.6 | 1.1 | 0.47 J | 2.5 | 1.9 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | **9.6** | **110 D** | **240 D** | **24** | **460 D** | **580 D** |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | **10** | **150 D** | **340 D** | **15** | **620 D** | **710 D** |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | 1.1 | 2.0 | <1 | 5.3 | 9.2 |
| 4-Chlorotoluene | 5 | <1 | 0.40 J | 0.99 J | <1 | 2.2 | 3.1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | 0.60 J | <1 | <1 | 1.6 | 2.2 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | 0.30 J | <1 | 0.76 J | 1.0 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | 3.1 | 2.6 | <1 | 4.4 | 3.6 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | 0.21 J | 0.22 J | 0.43 J | 0.19 J | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | 0.24 J | <1 | <1 | 0.67 J |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | 1.0 | 0.15 J | 0.67 J | <1 | 1.2 | 1.0 |
| Toluene | 5 | <1 | <1 | 0.39 J | <1 | 0.51 J | 0.39 J |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | **9.2** | 3.4 | **5.5** | 4.2 | **6.5** | **6.9** |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | 0.96 J | <1 | <1 | 1.0 | 1.0 |
| Xylene, total | 5 + | -- | <1 | 0.55 J | <1 | 2.6 | 2.5 |

ug/l = Micrograms per liter
J = estimated value
D = sample results taken from analysis at a secondary dilution.

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 4
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-011-R | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/30/12 | 6/15/11 | 6/3/10 | 6/22/09 | 6/17/08 |
| **VOCs in ug/l** | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | 0.32 J | 1.1 | <1 | 1.1 | 0.35 J |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | 0.21 J | 0.16 J | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | 0.30 J | 0.17 J | 0.33 J | 0.53 J | 0.39 J |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 5
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-012-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/28/15 | 5/2/12 | 11/30/11 | 6/17/11 | 10/12/10 | 6/3/10 | 10/14/09 | 6/24/09 | 10/7/08 | 6/18/08 |
| **VOCs in ug/l** | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | 0.30 J | 0.43 J | 0.99 J | 0.84 J | 0.62 J | 0.90 J | 0.46 J | 0.63 J | 0.50 J |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | 0.24 J | <1 | 0.25 J | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | 0.31 J | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | 0.56 J | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | 0.17 J | <1 | 0.16 J | <1 | 0.33 J | 0.26 J | <1 | 0.40 J | 0.40 J |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | 1.0 | <1 | <1 | <1 | 0.39 J |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 6
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-013-R | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/29/11 | 6/15/11 | 10/11/10 | 10/13/09 | 6/23/09 | 10/7/08 | 6/17/08 |
| **VOCs in ug/L** | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | 0.66 J | 0.32 J | 1.1 | <1 | 0.57 J | 0.39 J | 0.68 J | 0.74 J |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | <1 | <1 | <1 | <1 |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | < | < | < | < |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | | | | |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 7
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-014-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/28/15 | 4/30/12 | 11/28/11 | 6/16/11 | 10/12/10 | 6/3/10 | 10/13/09 | 6/22/09 | 10/6/08 | 6/17/08 |
| **VOCs in ug/L** | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | >1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | 1.5 | 1.4 | 1.5 | 1.7 | 1.6 | 0.98 | 1.1 | 0.61 J | 1.0 J |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | 0.17 J | 0.16 J | <1 | 0.12 J | 0.15 J | >1 | >1 | >1 | >1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | 0.17 J | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | 0.97 J | 0.97 J | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 8
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-014-RA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/28/15 | 4/30/12 | 11/28/11 | 6/15/11 | 10/12/10 | 6/3/10 | 10/13/09 | 6/22/09 | 10/6/08 | 6/17/08 |
| **VOCs in ug/L** | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | 1.2 | 1.1 | 1.8 | 1.6 | 1.8 | 1.9 | 1.3 | 1.7 | 1.3 |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | 0.15 J | <1 | 0.16 J | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | 1.3 | 1.2 | 1.1 | 1.0 | 1.2 | 1.2 | 0.63 J | 1.3 | 0.90 J |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 9
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-016-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/30/11 | 6/16/11 | 10/12/10 | 6/4/10 | 10/13/09 | 6/22/09 | 10/6/08 | 6/17/08 |
| **VOCs in ug/L** | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | <1 | 0.33 J | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 10
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-029-R | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/30/12 | 11/28/11 | 6/16/11 | 6/3/10 | 6/22/09 | 6/17/08 |
| **VOCs in ug/L** | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethane | 0.6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloroethylene | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2-Dichloropropane | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Chlorotoluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Xylene, total | 5 + | -- | <1 | <1 | <1 | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 11
IBM
Analytical Results – Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-031-R | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/12/12 | 6/17/11 | 6/3/10 | 6/23/09 | 6/19/08 |
| **VOCs in ug/L** | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,1-Trichloroethane | 5 | 2.8 | 3.8 | 4.5 | **5.0** | 3.8 | **5.5** |
| 1,1,2,2-Tetrachloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 1,1,2-Trichloroethane | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,1-Dichloroethane | 5 | **7.3** | **5.9** | **6.9** | **6.5** | 4.8 | **6.8** |
| 1,1-Dichloroethene | 5 | **8.8** | **8.7** | **8.7** | **11** | **8.3** | **13** |
| 1,1-Dichloropropene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2,3-Trichlorobenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2,3-Trichloropropane | 0.04 | <1 | <1 | <1 | <1 | <1 | <1 |
| 1,2,4-Trichlorobenzene | 5 | 3.6 | -- | -- | -- | -- | -- |
| 1,2,4-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dibromo-3-chloropropane | 0.04 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dibromoethane | 0.0006 | <1 | -- | -- | -- | -- | -- |
| 1,2-Dichloro-1,2,2-Trifluoroethane | -- | -- | **0.29 J** | **0.28 J** | **0.27 J** | <1 | 0.33 J |
| 1,2-Dichlorobenzene | 3 ++ | **260 D** | **270 D** | **500 D** | **180 D** | **150 D** | **180 D** |
| 1,2-Dichloroethane | 0.6 | **3.3** | **2.8** | **3.7** | **3.0** | **2.5** | **4.2** |
| 1,2-Dichloroethylene | 5 | -- | **6.2** | **6.8** | **7.9** | **6.0** | **7.9** |
| 1,2-Dichloropropane | 1 | <1 | **1.1** | **1.4** | <1 | **1.5** | 0.86 J |
| 1,3,5-Trimethylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| 1,3-Dichlorobenzene | 3 ++ | **46** | **38** | **62 D** | **30** | **23** | **25** |
| 1,3-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | **73 D** | **61 D** | **130 D** | **44** | **33** | **43** |
| 2,2-Dichloropropane | 5 | <1 | -- | -- | -- | -- | -- |
| 2-Chloroethyl Vinyl Ether | 5 | -- | <1 | <1 | <1 | <1 | <1 |
| 2-Chlorotoluene | 50 | 1.1 | 0.52 J | 0.98 J | <1 | 0.27 J | 0.53 J |
| 4-Chlorotoluene | 5 | <1 | 0.23 J | 0.57 J | <1 | <1 | <1 |
| 4-Isopropyltoluene | 5 | <1 | -- | -- | -- | -- | -- |
| Benzene | 1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzyl Chloride | -- | -- | <1 | <1 | <1 | <1 | <1 |
| Bromobenzene | 5 | <1 | <1 | 0.88 J | <1 | <1 | 0.41 J |
| Bromochloromethane | 5 | <1 | -- | -- | -- | -- | -- |
| Bromodichloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromoform | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Bromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Carbon tetrachloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chlorobenzene | 5 | **7.3** | 4.0 | **9.6** | **5.7** | 2.7 | 3.9 |
| Chloroethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chloroform | 7 | <1 | 0.75 J | 0.85 J | 1.1 | 0.52 J | 0.51 J |
| Chloromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| cis-1,2-Dichloroethene | 5 | **7.0** | -- | -- | -- | -- | -- |
| cis-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromochloromethane | 50 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibromomethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dichlorodifluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethylbenzene | 5 | <1 | <1 | 0.83 J | <1 | <1 | <1 |
| Hexachlorobutadiene | 0.5 | <1 | -- | -- | -- | -- | -- |
| Isopropylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| m,p-Xylene | 5 | <1 | -- | -- | -- | -- | -- |
| Methylene Chloride | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 10 | <1 | -- | -- | -- | -- | -- |
| n-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| n-Propylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| o-Xylene | 5 | <1 | -- | -- | -- | -- | -- |
| sec-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| Styrene | 5 | <1 | -- | -- | -- | -- | -- |
| tert-Butylbenzene | 5 | <1 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 5 | <1 | 0.39 J | 0.55 J | 0.42 J | 0.40 J | 0.64 J |
| Toluene | 5 | <1 | 0.31 J | 1.6 | <1 | <1 | <1 |
| trans-1,2-Dichloroethene | 5 | <1 | -- | -- | -- | -- | -- |
| trans-1,3-Dichloropropene | 0.4 | <1 | <1 | <1 | <1 | <1 | <1 |
| Trichloroethene | 5 | **21** | **19** | **20** | **26** | **18** | **28** |
| Trichlorofluoromethane | 5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Vinyl chloride | 2 | <1 | 1.3 | **3.2** | 1.5 | 0.33 J | 1.2 |
| Xylene, total | 5 + | -- | <1 | 0.83 J | <1 | <1 | <1 |

ug/l = Micrograms per liter
J = estimated value
D = sample results taken from analysis at a secondary dilution.

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 12
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-006-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/29/11 | 6/15/11 | 10/12/10 | 6/3/10 | 10/13/09 | 6/23/09 | 10/6/08 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | -- | <10 | <20 | <19 | <20 | <20 | -- | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 1,3-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <6 | <5.8 | <6 | <6 | <6 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <6 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <51 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <50 | <5 | <50 | <48 | <50 | <50 | <50 | <50 |
| 3-Nitroaniline | 5 | <51 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| 4-Nitroaniline | 5 | <20 | <10 | <10 | <5 | <7 | <6.8 | <7 | <7 | <7 | <20 |
| 4-Nitrophenol | 1 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Acenaphthylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Acetophenone | -- | -- | -- | -- | <5 | <20 | <19 | <20 | <20 | -- | -- |
| Anthracene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <10 | **0.42** | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <10 | **0.47** | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <10 | **0.56** | <0.2 | <0.19 | **0.26** | <0.2 | <5 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <10 | 0.16 J | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Benzoic Acid | -- | -- | -- | -- | -- | -- | <48 | -- | -- | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <20 | <2 | <10 | <9.7 | -- | <10 | <10 | <20 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <10 | <3 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Carbazole | -- | -- | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Chrysene | 0.002 | <10 | <10 | <10 | 0.07 J | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Dibenzofuran | -- | <10 | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Fluoranthene | 50 | <10 | <10 | <10 | 0.08 J | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Fluorene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <10 | <0.8 | <0.8 | <0.78 | <0.8 | <0.8 | <5 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <10 | <0.5 | <0.5 | <0.48 | <0.5 | <0.5 | <10 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <30 | <20 | <30 | <29 | <30 | <30 | <30 | <10 |
| Hexachloroethane | 5 | <10 U Q | <10 | <10 | <0.8 | <0.8 | <0.78 | <0.8 | <0.8 | <5 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <10 | **0.67** | <0.2 | <0.19 | <0.2 | <0.2 | <7 | <10 |
| Isophorone | 50 | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| Naphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <10 | <2 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- | -- | -- | <50 | <20 |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <10 | <5 | <5 | <4.8 | <5 | <5 | <5 | <10 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <15 | <2 | <15 | <14 | <15 | <15 | <15 | <10 |
| Pentachlorophenol | 1 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <10 | 0.06 J | <0.2 | <0.19 | <0.2 | <0.2 | <5 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 13
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-009-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/29/11 | 6/15/11 | 10/11/10 | 6/3/10 | 10/13/09 | 6/23/09 | 10/7/08 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | -- | <10 | <20 | <19 | <20 | <20 | -- | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 1,3-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <6 | <5.8 | <6 | <6 | <5.8 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <5.8 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <50 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <50 | <5 | <50 | <49 | <50 | <50 | <48 | <10 |
| 3-Nitroaniline | 5 | <50 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| 4-Nitroaniline | 5 | <20 | <10 | <10 | <5 | <7 | <6.8 | <7 | <7 | <6.7 | <20 |
| 4-Nitrophenol | 1 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Acenaphthylene | -- | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Acetophenone | -- | -- | -- | -- | <5 | <20 | <19 | <20 | <20 | -- | -- |
| Anthracene | 50 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Benzoic Acid | -- | -- | -- | -- | -- | -- | <49 | -- | -- | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <20 | <2 | -- | <9.7 | -- | <10 | <9.6 | <10 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <10 | <3 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Carbazole | -- | -- | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Chrysene | 0.002 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Dibenzofuran | -- | <10 | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Fluoranthene | 50 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Fluorene | 50 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <10 | <0.8 | <4 | <0.78 | <0.8 | <0.8 | <4.8 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <10 | <0.5 | <2.5 | <0.49 | <0.5 | <0.5 | <9.6 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <30 | <20 | <30 | <29 | <30 | <30 | <29 | <10 |
| Hexachloroethane | 5 | <10 U Q | <10 | <10 | <0.8 | <4 | <0.78 | <0.8 | <0.8 | <4.8 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <6.7 | <10 |
| Isophorone | 50 | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| Naphthalene | 10 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | <0.2 | <4.8 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <10 | <2 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- | -- | -- | <48 | <20 |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <10 | <5 | <5 | <4.9 | <5 | <5 | <4.8 | <10 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <15 | <2 | <15 | <15 | <15 | <15 | <14 | <10 |
| Pentachlorophenol | 1 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | 0.21 | <4.8 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <10 | <0.2 | <1 | <0.19 | <0.2 | 0.29 | <4.8 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 14
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-010-RA | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/12/12 | 6/17/11 | 6/3/10 | 6/23/09 | 6/18/08 |
| **SVOCs in ug/l** | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | <10 | <20 | <20 | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | **28** | **35** | **21** | **70** | **13 J** |
| 1,2-Dichlorobenzene | 3 ++ | **9.7 J Q** | **260 D** | **330 D** | **48** | **1100 D** | **1,500** |
| 1,3-Dichlorobenzene | 3 ++ | <10 Q | **68 J** | **97** | **21** | **180** | **250** |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 Q | **80 J** | **61** | **13** | **290 D** | **320** |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <51 | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <5 | <6 | <6 | <200 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <5 | <5 | <5 | <200 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <51 | <10 | <5 | <5 | <5 | <1,000 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <5 | <50 | <50 | <200 |
| 3-Nitroaniline | 5 | <51 | <10 | <5 | <5 | <5 | <1,000 |
| 4,6-Dinitro-2-methylphenol | 1 | <51 | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <2 | <5 | <5 | <200 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <5 | <5 | <5 | <200 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <2 | <5 | <5 | <200 |
| 4-Nitroaniline | 5 | <20 | <10 | <5 | <7 | <7 | <200 |
| 4-Nitrophenol | 1 | <51 | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Acenaphthylene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Acetophenone | -- | -- | -- | <5 | <20 | <20 | -- |
| Anthracene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Benzo(a)pyrene | ND | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Benzo(ghi)perylene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Benzoic Acid | -- | -- | -- | -- | <50 | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <2 | <10 | <10 | <200 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <5 | <5 | <5 | <200 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <5 | <5 | <5 | <200 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <2 | <5 | <5 | <200 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <2 | <5 | <5 | <200 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <3 | <5 | <5 | <200 |
| Carbazole | -- | -- | <10 | <2 | <5 | <5 | <200 |
| Chrysene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Dibenzofuran | -- | <10 | <10 | <2 | <5 | <5 | <200 |
| Diethyl phthalate | 50 | -- | <10 | <5 | <5 | <5 | <200 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <5 | <5 | <5 | <200 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <5 | <5 | <5 | <200 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <5 | <5 | <5 | <200 |
| Fluoranthene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Fluorene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <0.8 | <0.8 | <0.8 | <200 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <0.5 | <0.5 | <0.5 | <200 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <20 | <30 | <30 | <200 |
| Hexachloroethane | 5 | <10 U Q | <10 | <0.8 | <0.8 | <0.8 | <200 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Isophorone | 50 | <10 | <10 | <5 | <5 | <5 | <200 |
| Naphthalene | 10 | <10 | <10 | <0.2 | <0.2 | 0.54 | <200 |
| Nitrobenzene | 0.4 | <10 | <10 | <2 | <5 | <5 | <200 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <5 | <5 | <5 | <200 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <2 | <15 | <15 | <200 |
| Pentachlorophenol | 1 | <51 | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <200 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 15
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-011-R | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/30/12 | 6/15/11 | 6/3/10 | 6/22/09 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | <10 | <20 | <20 | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <5 | <5 | <5 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <2 | <5 | <5 | 0.85 J |
| 1,3-Dichlorobenzene | 3 ++ | <10 Q | <10 | <2 | <5 | <5 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 Q | <10 | <2 | <5 | <5 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <52 | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <5 | <6 | <6 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <5 | <5 | <5 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <52 | <10 | <5 | <5 | <5 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <5 | <50 | <50 | <10 |
| 3-Nitroaniline | 5 | <52 | <10 | <5 | <5 | <5 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <52 | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <2 | <5 | <5 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <5 | <5 | <5 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <2 | <5 | <5 | <10 |
| 4-Nitroaniline | 5 | <21 | <10 | <5 | <7 | <7 | <20 |
| 4-Nitrophenol | 1 | <52 | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Acenaphthylene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Acetophenone | -- | -- | -- | <5 | <20 | <20 | -- |
| Anthracene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzoic Acid | -- | -- | -- | -- | <50 | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <2 | <10 | <10 | <10 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <2 | <5 | <5 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <2 | <5 | <5 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <3 | <5 | <5 | <10 |
| Carbazole | -- | -- | <10 | <2 | <5 | <5 | <10 |
| Chrysene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Dibenzofuran | -- | <10 | <10 | <2 | <5 | <5 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <5 | <5 | <5 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <5 | <5 | <5 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <5 | <5 | <5 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <5 | <5 | <5 | <10 |
| Fluoranthene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Fluorene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <0.8 | <0.8 | <0.8 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <0.5 | <0.5 | <0.5 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <20 | <30 | <30 | <10 |
| Hexachloroethane | 5 | <10 U Q | <10 | <0.8 | <0.8 | <0.8 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Isophorone | 50 | <10 | <10 | <5 | <5 | <5 | <10 |
| Naphthalene | 10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <2 | <5 | <5 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <5 | <5 | <5 | <20 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <2 | <15 | <15 | <10 |
| Pentachlorophenol | 1 | <52 | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 16
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-013-R | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/27/15 | 5/2/12 | 11/29/11 | 6/15/11 | 10/11/10 | 10/13/09 | 6/23/09 | 10/7/08 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | -- | <10 | <20 | <20 | <20 | -- | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| 1,3-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 2,4-Dinitrophenol | 10 | <52 | -- | -- | -- | -- | -- | -- | | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <6 | <6 | <6 | <5.8 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <5.8 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 2-Nitroaniline | 5 | <52 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | | -- | -- | -- | -- | | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <50 | <5 | <50 | <50 | <50 | <48 | <10 |
| 3-Nitroaniline | 5 | <52 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <52 | -- | -- | -- | -- | -- | -- | | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| 4-Nitroaniline | 5 | <21 | <10 | <10 | <5 | <7 | <7 | <7 | <6.7 | <20 |
| 4-Nitrophenol | 1 | <52 | -- | -- | -- | -- | -- | -- | | -- |
| Acenaphthene | 20 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Acenaphthylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Acetophenone | -- | -- | -- | -- | <5 | <20 | <20 | <20 | -- | -- |
| Anthracene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Benzoic Acid | -- | | | | | | | | | |
| Benzyl Alcohol | -- | <10 | <20 | <20 | <2 | -- | -- | <10 | <9.6 | <10 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <10 | <3 | <5 | <5 | <5 | <4.8 | <10 |
| Carbazole | -- | -- | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| Chrysene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Dibenzofuran | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Fluoranthene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Fluorene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <10 | <0.8 | <0.8 | <0.8 | <0.8 | <4.8 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <10 | <0.5 | <0.5 | <0.5 | <0.5 | <9.6 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <10 | <30 | <20 | <30 | <30 | <30 | <29 | <10 |
| Hexachloroethane | 5 | <10 U Q | <10 | <10 | <0.8 | <0.8 | <0.8 | <0.8 | <4.8 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <6.7 | <10 |
| Isophorone | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <10 |
| Naphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <4.8 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- | -- | <48 | -- |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <4.8 | <20 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <15 | <2 | <15 | <15 | <15 | <14 | <10 |
| Pentachlorophenol | 1 | <52 | -- | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <4.8 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 17
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-014-R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/28/15 | 4/30/12 | 11/28/11 | 6/16/11 | 10/12/10 | 6/3/10 | 10/13/09 | 6/22/09 | 10/6/08 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | -- | <10 | <20 | <20 | <20 | <20 | -- | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 1,3-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <6 | <6 | <6 | <6 | <6 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <6 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <50 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <50 | <5 | <50 | <50 | <50 | <50 | <50 | <10 |
| 3-Nitroaniline | 5 | <50 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 4-Nitroaniline | 5 | <20 | <10 | <10 | <5 | <7 | <7 | <7 | <7 | <7 | <20 |
| 4-Nitrophenol | 1 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Acenaphthylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Acetophenone | -- | -- | -- | -- | <5 | <20 | <20 | <20 | <20 | -- | -- |
| Anthracene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzoic Acid | -- | -- | -- | -- | | <50 | <50 | <50 | <50 | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <20 | <2 | <10 | <10 | <10 | <10 | <10 | <10 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | 2.1 J | <10 | <10 | <3 | <5 | <5 | <5 | <5 | <5 | <10 |
| Carbazole | -- | -- | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Chrysene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Dibenzofuran | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Fluoranthene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Fluorene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <10 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | <5 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <10 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <10 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <30 | <20 | <30 | <30 | <30 | <30 | <30 | <10 |
| Hexachloroethane | 5 | <10 U Q | <10 | <10 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | <5 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <7 | <10 |
| Isophorone | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Naphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- | -- | -- | <50 | -- |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <15 | <2 | <15 | <15 | <15 | <15 | <15 | <20 |
| Pentachlorophenol | 1 | <50 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 18
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-014-RA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4/28/15 | 4/30/12 | 11/28/11 | 6/15/11 | 10/12/10 | 6/3/10 | 10/13/09 | 6/22/09 | 10/6/08 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | -- | <10 | <20 | <20 | <20 | <20 | -- | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 1,3-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <6 | <6 | <6 | <6 | <6 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <6 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <51 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <50 | <5 | <50 | <50 | <50 | <50 | <50 | <10 |
| 3-Nitroaniline | 5 | <51 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| 4-Nitroaniline | 5 | <20 | <10 | <10 | <5 | <7 | <7 | <7 | <7 | <7 | <20 |
| 4-Nitrophenol | 1 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Acenaphthylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Acetophenone | -- | -- | -- | -- | <5 | <20 | <20 | <20 | <20 | -- | -- |
| Anthracene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Benzoic Acid | -- | -- | -- | -- | | <50 | <50 | <50 | <50 | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <20 | <2 | <10 | <10 | <10 | <10 | <10 | <10 |
| Benzyl butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <10 | <3 | <5 | <5 | <5 | <5 | <5 | <10 |
| Carbazole | -- | -- | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Chrysene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Dibenzofuran | -- | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Fluoranthene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Fluorene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <10 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | <5 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <10 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <10 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <30 | <20 | <30 | <30 | <30 | <30 | <30 | <30 |
| Hexachloroethane | 5 | <10 U Q | <10 | <10 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | <5 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <7 | <10 |
| Isophorone | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| Naphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <10 | <2 | <5 | <5 | <5 | <5 | <5 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- | -- | -- | <50 | <20 |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <10 | <5 | <5 | <5 | <5 | <5 | <5 | <10 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <15 | <2 | <15 | <15 | <15 | <15 | <15 | <10 |
| Pentachlorophenol | 1 | <51 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <5 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 19
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-029-R | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 4/28/15 | 4/30/12 | 11/28/11 | 6/16/11 | 6/3/10 | 6/22/09 | 6/17/08 |
| **SVOCs in ug/l** | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | -- | <10 | <20 | <20 | -- |
| 1,2,4-Trichlorobenzene | 5 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <10 |
| 1,2-Dichlorobenzene | 3 ++ | <10 Q | <10 | <10 | <2 | <5 | <5 | <10 |
| 1,3-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <10 |
| 1,3-Dinitrobenzene | -- | <10 | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | <10 | <10 | <10 | <2 | <5 | <5 | <10 |
| 2,4,5-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <10 | -- | -- | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <10 | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <51 | -- | -- | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <6 | <6 | <10 |
| 2,6-Dinitrotoluene | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| 2-Chloronaphthalene | 10 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| 2-Chlorophenol | 1 | <10 | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| 2-Methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <51 | <10 | <10 | <5 | <5 | <5 | <50 |
| 2-Nitrophenol | 1 | <10 | -- | -- | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <10 | <50 | <50 | <5 | <50 | <50 | <10 |
| 3-Nitroaniline | 5 | <51 | <10 | <10 | <5 | <5 | <5 | <50 |
| 4,6-Dinitro-2-methylphenol | 1 | <51 | -- | -- | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <10 | 4.4 J | 4.4 J | <2 | <5 | <5 | <10 |
| 4-Chloro-3-methylphenol | 1 | <10 | -- | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| 4-Chlorophenylphenyl ether | -- | <10 | <10 | <10 | <2 | <5 | <5 | <10 |
| 4-Nitroaniline | 5 | <20 | <10 | <10 | <5 | <7 | <7 | <20 |
| 4-Nitrophenol | 1 | <51 | -- | -- | -- | -- | -- | -- |
| Acenaphthene | 20 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Acenaphthylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Acetophenone | -- | -- | -- | -- | <5 | <20 | <20 | -- |
| Anthracene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(a)anthracene | 0.002 | <10 | <10 | <10 | **0.06 J** | <0.2 | <0.2 | <10 |
| Benzo(a)pyrene | ND | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(b)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(ghi)perylene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzo(k)fluoranthene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Benzoic Acid | -- | -- | -- | -- | -- | <50 | -- | -- |
| Benzyl Alcohol | -- | <10 | <20 | <20 | <2 | <10 | <10 | <10 |
| Benzyl butyl phthalate | 50 | <10 | 4.4 J | 4.4 J | <5 | <5 | <5 | <10 |
| Bis(2-chloroethoxy)methane | 5 | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| Bis(2-chloroethyl)ether | 1 | <10 | <10 | <10 | <2 | <5 | <5 | <10 |
| Bis(2-chloroisopropyl)ether | -- | <10 | <10 | <10 | 4.4 | <5 | <5 | <10 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <10 | <10 | <10 | <3 | <5 | <5 | <10 |
| Carbazole | -- | -- | <10 | <10 | <2 | <5 | <5 | <10 |
| Chrysene | 0.002 | <10 | <10 | <10 | **0.06 J** | <0.2 | <0.2 | <10 |
| Dibenzo(a,h)anthracene | -- | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Dibenzofuran | -- | <10 | <10 | <10 | <2 | <5 | <5 | <10 |
| Diethyl phthalate | 50 | -- | <10 | <10 | <5 | <5 | <5 | <10 |
| Dimethyl phthalate | 50 | <10 U Q | <10 | <10 | <5 | <5 | <5 | <10 |
| Di-n-butyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| Di-n-octyl phthalate | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| Fluoranthene | 50 | <10 | <10 | <10 | 0.09 J | <0.2 | <0.2 | <10 |
| Fluorene | 50 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Hexachlorobenzene | 0.04 | <10 | <10 | <10 | <0.8 | <0.8 | <0.8 | <10 |
| Hexachlorobutadiene | 0.5 | <10 U Q | <10 | <10 | <0.5 | <0.5 | <0.5 | <10 |
| Hexachlorocyclopentadiene | 5 | <10 U Q | <30 | <30 | <20 | <30 | <30 | <10 |
| Hexachloroethane | 5 | <10 U Q | <10 | <10 | <0.8 | <0.8 | <0.8 | <10 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <10 | <10 | <10 | <0.2 | <0.2 | <0.2 | <10 |
| Isophorone | 50 | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| Naphthalene | 10 | <10 | <10 | <10 | 0.10 J | <0.2 | <0.2 | <10 |
| Nitrobenzene | 0.4 | <10 | <10 | <10 | <2 | <5 | <5 | <10 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | -- | -- | <20 |
| N-Nitroso-di-n-propylamine | -- | <10 | <10 | <10 | <5 | <5 | <5 | <10 |
| N-Nitrosodiphenylamine | 50 | <10 | <15 | <15 | <2 | <15 | <15 | <10 |
| Pentachlorophenol | 1 | <51 | -- | -- | -- | -- | -- | -- |
| Phenanthrene | 50 | <10 | <10 | <10 | 0.07 J | <0.2 | <0.2 | <10 |
| Phenol | 1 | <10 U Q | -- | -- | -- | -- | -- | -- |
| Pyrene | 50 | <10 | <10 | <10 | 0.07 J | <0.2 | <0.2 | <10 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 20
IBM
Analytical Results – Groundwater Sampling
Semivolatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Analyte | NYSDEC Class GA Standard or Guidance Value in ug/l | 952-031-R | | | | |
|---|---|---|---|---|---|---|
| | | 4/27/15 | 4/12/12 | 6/17/11 | 6/3/10 | 6/19/08 |
| **SVOCs in ug/l** | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | -- | -- | <10 | <20 | -- |
| 1,2,4-Trichlorobenzene | 5 | <20 | <10 | 2.4 | <5 | 2.5 |
| 1,2-Dichlorobenzene | 3 ++ | 79 D | 110 D | 360 D | 98 | 190 |
| 1,3-Dichlorobenzene | 3 ++ | 9.5 J D | 13 | 37 | 15 | 23 J |
| 1,3-Dinitrobenzene | -- | <20 | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 3 ++ | 16 J D | 21 | 60 | 19 | 35 J |
| 2,4,5-Trichlorophenol | 1 | <20 | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 1 | <20 | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 5 | <20 | -- | -- | -- | -- |
| 2,4-Dimethylphenol | 50 | <20 | -- | -- | -- | -- |
| 2,4-Dinitrophenol | 10 | <100 | -- | -- | -- | -- |
| 2,4-Dinitrotoluene | 5 | <20 | <10 | <5 | <6 | <50 |
| 2,6-Dinitrotoluene | 5 | <20 | <10 | <5 | <5 | <50 |
| 2-Chloronaphthalene | 10 | <20 | <10 | <0.2 | <0.2 | <50 |
| 2-Chlorophenol | 1 | <20 | -- | -- | -- | -- |
| 2-Methylnaphthalene | -- | <20 | <10 | <0.2 | <0.2 | <50 |
| 2-Methylphenol | 1 | <20 | -- | -- | -- | -- |
| 2-Nitroaniline | 5 | <100 | <10 | <5 | <5 | <250 |
| 2-Nitrophenol | 1 | <20 | -- | -- | -- | -- |
| 3,3-Dichlorobenzidine | 5 | <20 | <50 | <5 | <50 | <50 |
| 3-Nitroaniline | 5 | <100 | <10 | <5 | <5 | <250 |
| 4,6-Dinitro-2-methylphenol | 1 | <100 | -- | -- | -- | -- |
| 4-Bromophenyl-phenylether | -- | <20 | 4.4 J | <2 | <5 | <50 |
| 4-Chloro-3-methylphenol | 1 | <20 | -- | -- | -- | -- |
| 4-Chloroaniline | 5 | <20 | <10 | <5 | <5 | <50 |
| 4-Chlorophenylphenyl ether | -- | <20 | <10 | <2 | <5 | <50 |
| 4-Nitroaniline | 5 | <40 | <10 | <5 | <7 | <100 |
| 4-Nitrophenol | 1 | <100 | -- | -- | -- | -- |
| Acenaphthene | 20 | <20 | <10 | <0.2 | <0.2 | <50 |
| Acenaphthylene | -- | <20 | <10 | <0.2 | <0.2 | <50 |
| Acetophenone | -- | -- | -- | <5 | <20 | -- |
| Anthracene | 50 | <20 | <10 | <0.2 | <0.2 | <50 |
| Benzo(a)anthracene | 0.002 | <20 | <10 | <0.2 | <0.2 | <50 |
| Benzo(a)pyrene | ND | <20 | <10 | <0.2 | <0.2 | <50 |
| Benzo(b)fluoranthene | 0.002 | <20 | <10 | <0.2 | <0.2 | <50 |
| Benzo(ghi)perylene | -- | <20 | <10 | <0.2 | <0.2 | <50 |
| Benzo(k)fluoranthene | 0.002 | <20 | <10 | <0.2 | <0.2 | <50 |
| Benzoic Acid | -- | -- | -- | | <50 | -- |
| Benzyl Alcohol | -- | <20 | <20 | <2 | <10 | <10 |
| Benzyl butyl phthalate | 50 | <20 | 4.4 J | <5 | <5 | <50 |
| Bis(2-chloroethoxy)methane | 5 | <20 | <10 | <5 | <5 | <50 |
| Bis(2-chloroethyl)ether | 1 | <20 | <10 | <2 | <5 | <50 |
| Bis(2-chloroisopropyl)ether | -- | <20 | <10 | <2 | <5 | <50 |
| Bis(2-ethylhexyl)phthalate (BEHP) | 5 | <20 | <10 | <3 | <5 | <50 |
| Carbazole | -- | -- | <10 | <2 | <5 | <50 |
| Chrysene | 0.002 | <20 | <10 | <0.2 | <0.2 | <50 |
| Dibenzo(a,h)anthracene | -- | <20 | <10 | <0.2 | <0.2 | <50 |
| Dibenzofuran | -- | <20 | <10 | <2 | <5 | <50 |
| Diethyl phthalate | 50 | -- | <10 | <5 | <5 | <50 |
| Dimethyl phthalate | 50 | <20 | <10 | <5 | <5 | <50 |
| Di-n-butyl phthalate | 50 | <20 | <10 | <5 | <5 | <50 |
| Di-n-octyl phthalate | 50 | <20 | <10 | <5 | <5 | <50 |
| Fluoranthene | 50 | <20 | <10 | <0.2 | <0.2 | <50 |
| Fluorene | 50 | <20 | <10 | <0.2 | <0.2 | <050 |
| Hexachlorobenzene | 0.04 | <20 | <10 | <0.8 | <0.8 | <50 |
| Hexachlorobutadiene | 0.5 | <20 | <10 | <0.5 | <0.5 | <50 |
| Hexachlorocyclopentadiene | 5 | <20 | <30 | <20 | <30 | <50 |
| Hexachloroethane | 5 | <20 | <10 | <0.8 | <0.8 | <50 |
| Indeno(1,2,3-cd)pyrene | 0.002 | <20 | <10 | <0.2 | <0.2 | <50 |
| Isophorone | 50 | <20 | <10 | <5 | <5 | <50 |
| Naphthalene | 10 | <20 | <10 | 0.15 J | <0.2 | <50 |
| Nitrobenzene | 0.4 | <20 | <10 | <2 | <5 | <50 |
| N-Nitrosodimethylamine | -- | -- | -- | -- | -- | <100 |
| N-Nitroso-di-n-propylamine | -- | <20 | <10 | <5 | <5 | <50 |
| N-Nitrosodiphenylamine | 50 | <20 | <15 | <2 | <15 | <50 |
| Pentachlorophenol | 1 | <100 | -- | -- | -- | -- |
| Phenanthrene | 50 | <20 | <10 | <0.2 | <0.2 | <50 |
| Phenol | 1 | <20 | -- | -- | -- | -- |
| Pyrene | 50 | <20 | <10 | <0.2 | <0.2 | <50 |

ug/l = Micrograms per liter
J = estimated value

<1 Compound was analyzed for but not detected
-- No standard or guidance value
\+ Applies to each isomer individually
++ Applies to sum of isomer

***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

**Table 21**
**IBM**
**Analytical Results - Groundwater Sampling**
**Oil and Grease**
**Neptune Road Site**
**Poughkeepsie, New York**

| Sample ID | Sampling Date | Oil and Grease in mg/l |
|---|---|---|
| **952-6R** | 4/27/2015 | 5.2 U |
| | 5/2/2012 | 5.0 U |
| | 11/29/2011 | 5.0 U |
| | 6/15/2011 | 5.0 U |
| | 10/12/2010 | 5.0 U |
| | 6/3/2010 | 5.1 U |
| | 10/13/2009 | 5.0 U |
| | 6/23/2009 | 5.0 U |
| | 10/6/2008 | 5.0 U |
| | 6/17/2008 | 5.0 U |
| **952-9R** | 4/27/2015 | 5.1 U |
| | 5/2/2012 | 5.0 U |
| | 11/29/2011 | 5.0 U |
| | 6/15/2011 | 5.0 U |
| | 10/11/2010 | 5.0 U |
| | 6/3/2010 | 5.0 U |
| | 10/13/2009 | 5.0 U |
| | 6/23/2009 | 5.0 U |
| | 10/7/2008 | 5.0 U |
| | 6/17/2008 | 5.0 U |
| **952-10RA** | 4/27/2015 | 5.2 U |
| | 4/12/2012 | 5.0 U |
| | 6/17/2011 | 5.0 U |
| | 6/3/2010 | 5.0 U |
| | 6/23/2009 | 5.0 U |
| | 6/18/2008 | 5.0 U |
| **952-11R** | 4/27/2015 | 5.2 U |
| | 4/30/2012 | 5.0 U |
| | 6/15/2011 | 5.0 U |
| | 6/3/2010 | 5.0 U |
| | 6/22/2009 | 5.0 U |
| | 6/17/2008 | 5.0 U |
| **952-12R** | 4/28/2015 | 5.2 U |
| | 5/2/2012 | 5.0 U |
| | 11/30/2011 | 5.0 U |
| | 6/17/2011 | 5.0 U |
| | 10/12/2010 | 5.0 U |
| | 6/3/2010 | 5.0 U |
| | 10/14/2009 | 5.0 U |
| | 6/24/2009 | 5.0 U |
| | 10/7/2008 | 5.0 U |
| | 6/18/2008 | 5.0 U |
| **952-13R** | 4/27/2015 | 5.2 U |
| | 5/2/2012 | 5.0 U |
| | 11/29/2011 | 5.0 U |
| | 6/15/2011 | 5.0 U |
| | 10/11/2010 | 5.0 U |
| | 10/13/2009 | 5.0 U |
| | 6/23/2009 | 5.0 U |
| | 10/7/2008 | 5.0 U |
| | 6/17/2008 | 5.0 U |
| **952-31R** | 4/27/2015 | 5.1 U |
| | 4/12/2012 | 5.0 U |
| | 6/17/2011 | 5.0 U |
| | 6/3/2010 | 5.0 U |
| | 6/23/2009 | 5.0 U |
| | 6/19/2008 | 5.0 U |

mg/l Milligrams per liter
U Compound was analyzed for but not detected

Table 22
IBM
Analytical Results - Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Units in ug/l | Sample ID<br>Sample_date | 952-6R<br>10/19/16 | 952-9R<br>10/19/16 | 952-10RA<br>10/19/16 | 952-11R<br>10/20/16 | 952-12R<br>10/19/16 | 952-13R<br>10/19/16 | 952-14R<br>10/20/16 |
|---|---|---|---|---|---|---|---|---|
| COMPOUNDS | NYSDEC Class GA Standard or Guidance Value ug/l | | | | | | | |
| **1,1,1,2-Tetrachloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1,1-Trichloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 0.52 J |
| **1,1,2,2-Tetrachloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1,2-Trichloroethane** | 1 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1-Dichloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1-Dichloroethene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1-Dichloropropene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,3-Trichlorobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,3-Trichloropropane** | 0.04 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,4-Trichlorobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,4-Trimethylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dibromo-3-Chloropropane** | 0.04 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dichlorobenzene** | 3 ++ | 1 U | 1 U | ***1.5*** | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dichloroethane** | 0.6 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dichloroethene** | 5 | 1 U | 1 U | 0.33 J | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dichloropropane** | 1 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,3,5-Trimethylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,3-Dichlorobenzene** | 3 ++ | 1 U | 1 U | ***1.7*** | 1 U | 1 U | 1 U | 1 U |
| **1,3-Dichloropropane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,4-Dichlorobenzene** | 3 ++ | 1 U | 1 U | ***0.83 J*** | 1 U | 1 U | 1 U | 1 U |
| **2,2-Dichloropropane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **2-Chlorotoluene** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **4-Chlorotoluene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **4-Isopropyltoluene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Benzene** | 1 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Bromobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Bromoform** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Bromomethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Carbon tetrachloride** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chlorobenzene** | 5 | 1 U | 1 U | 0.26 J | 1 U | 1 U | 1 U | 1 U |
| **Chlorobromomethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chlorodibromomethane** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chloroform** | 7 | 1 U | 1 U | 1 U | 0.56 J | 1 U | 1 U | 1 U |
| **Chloromethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **cis-1,3-Dichloropropene** | 0.4 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Dibromomethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Dichlorobromomethane** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Dichlorodifluoromethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Ethylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Ethylene Dibromide** | 0.0006 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Hexachlorobutadiene** | 0.5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Isopropylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Methylene Chloride** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Naphthalene** | 10 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **n-Butylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **n-Propylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **sec-Butylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Styrene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **tert-Butylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Tetrachloroethene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Toluene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **trans-1,3-Dichloropropene** | 0.4 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Trichloroethene** | 5 | 1 U | 1 U | 2.4 | 1 U | 1 U | 1 U | 1 U |
| **Trichlorofluoromethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Vinyl chloride** | 2 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Xylenes,Total** | 5 + | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Total Volatile Organic Compounds** | -- | 0 | 0 | 5.02 | 0.56 | 0 | 0 | 0.52 |

ug/l Micrograms per liter
J Estimated value
\+ Applies to each isomer individually
++ Applies to sum of isomer
U Compound was analyzed for but not detected
-- No standard or guidance value
***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

Table 22
IBM
Analytical Results - Groundwater Sampling
Volatile Organic Compounds
Neptune Road Site
Poughkeepsie, New York

| Units in ug/l | Sample ID<br>Sample_date | 952-14RA<br>10/20/16 | 952-16R<br>10/20/16 | 952-29R<br>10/20/16 | 952-31R<br>10/19/16 | Field Blank<br>10/20/16 | Trip Blank<br>10/20/16 |
|---|---|---|---|---|---|---|---|
| COMPOUNDS | NYSDEC Class GA Standard or Guidance Value ug/l | | | | | | |
| **1,1,1,2-Tetrachloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1,1-Trichloroethane** | 5 | 0.56 J | 1 U | 1 U | 1.2 | 1 U | 1 U |
| **1,1,2,2-Tetrachloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1,2-Trichloroethane** | 1 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,1-Dichloroethane** | 5 | 1 U | 1 U | 1 U | 3.3 | 1 U | 1 U |
| **1,1-Dichloroethene** | 5 | 1 U | 1 U | 1 U | 4.3 | 1 U | 1 U |
| **1,1-Dichloropropene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,3-Trichlorobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,3-Trichloropropane** | 0.04 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,4-Trichlorobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2,4-Trimethylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dibromo-3-Chloropropane** | 0.04 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dichlorobenzene** | 3 ++ | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,2-Dichloroethane** | 0.6 | 1 U | 1 U | 1 U | ***1.3*** | 1 U | 1 U |
| **1,2-Dichloroethene** | 5 | 1 U | 1 U | 1 U | 4 | 1 U | 1 U |
| **1,2-Dichloropropane** | 1 | 1 U | 1 U | 1 U | 0.23 J | 1 U | 1 U |
| **1,3,5-Trimethylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,3-Dichlorobenzene** | 3 ++ | 1 U | 1 U | 1 U | ***14*** | 1 U | 1 U |
| **1,3-Dichloropropane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **1,4-Dichlorobenzene** | 3 ++ | 1 U | 1 U | 1 U | ***17*** | 1 U | 1 U |
| **2,2-Dichloropropane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **2-Chlorotoluene** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **4-Chlorotoluene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **4-Isopropyltoluene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Benzene** | 1 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Bromobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Bromoform** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Bromomethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Carbon tetrachloride** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chlorobenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chlorobromomethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chlorodibromomethane** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chloroethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Chloroform** | 7 | 1 U | 1 U | 1 U | 0.74 J | 1 U | 1 U |
| **Chloromethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **cis-1,3-Dichloropropene** | 0.4 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Dibromomethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Dichlorobromomethane** | 50 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Dichlorodifluoromethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Ethylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Ethylene Dibromide** | 0.0006 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Hexachlorobutadiene** | 0.5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Isopropylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Methylene Chloride** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Naphthalene** | 10 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **n-Butylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **n-Propylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **sec-Butylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Styrene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **tert-Butylbenzene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Tetrachloroethene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Toluene** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **trans-1,3-Dichloropropene** | 0.4 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Trichloroethene** | 5 | 1 U | 1 U | 1 U | ***11*** | 1 U | 1 U |
| **Trichlorofluoromethane** | 5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Vinyl chloride** | 2 | 1 U | 1 U | 1 U | 0.32 J | 1 U | 1 U |
| **Xylenes,Total** | 5 + | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| **Total Volatile Organic Compounds** | -- | 0.56 | 0 | 0 | 24.39 | 0 | 0 |

ug/l Micrograms per liter
J Estimated value
\+ Applies to each isomer individually
++ Applies to sum of isomer
U Compound was analyzed for but not detected
-- No standard or guidance value
***Exceeds Class GA Standard/Guidance value***

**Table 23**
**IBM**
**Analytical Results - Groundwater Sampling**
**Semivolatile Organic Compounds**
**Neptune Road Site**
**Poughkeepsie, New York**

| Units in ug/l | Sample ID / Sampling Date | 952-6R 10/19/16 | 952-9R 10/19/16 | 952-10RA 10/19/16 | 952-11R 10/20/16 | 952-12R 10/19/16 | 952-13R 10/19/16 | 952-14R 10/20/16 | 952-14RA 10/20/16 | 952-16R 10/20/16 | 952-29R 10/20/16 | 952-31R 10/19/16 | Field Blank 10/20/16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEMIVOLATILE COMPOUNDS | NYSDEC Class GA Standard or Guidance Value ug/l | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 1,2-Dichlorobenzene | 3 ++ | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | ***51*** | 10 U |
| 1,3-Dichlorobenzene | 3 ++ | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | ***6.6 J*** | 10 U |
| 1,3-Dinitrobenzene | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 1,4-Dichlorobenzene | 3 ++ | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | ***11 J*** | 10 U |
| 2,4,6-Trichlorophenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2,4-Dimethylphenol | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2,4-Dinitrophenol | 10 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2,4-Dinitrotoluene | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2,6-Dinitrotoluene | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2-Chloronaphthalene | 10 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2-Chlorophenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2-Methylnaphthalene | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2-Methylphenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2-Nitroaniline | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 2-Nitrophenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 3,3-Dichlorobenzidine | 5 | 60 U | 54 U | 52 U | 52 U | 52 U | 54 U | 53 U | 53 U | 52 U | 52 U | 56 U | 52 U |
| 3-Nitroaniline | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4,6-Dinitro-2-methylphenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4-Bromophenyl-phenylether | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4-Chloro-3-methylphenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4-Chloroaniline | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4-Chlorophenylphenyl ether | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4-Nitroaniline | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| 4-Nitrophenol | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Acenaphthene | 20 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Acenaphthylene | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Aniline | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Anthracene | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Benzo(a)anthracene | 0.002 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Benzo(a)pyrene | ND | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Benzo(b)fluoranthene | 0.002 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Benzo(ghi)perylene | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Benzo(k)fluoranthene | 0.002 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Benzyl alcohol | -- | 24 U | 22 U | 21 U | 21 U | 21 U | 22 U | 21 U | 21 U | 21 U | 21 U | 22 U | 21 U |
| Butyl benzyl phthalate | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Bis(2-chloroethoxy)methane | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Bis(2-chloroethyl)ether | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| Bis(2-chloroisopropyl)ether | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |

**See next page for Footnotes/Qualifiers**

**Table 23**
**IBM**
**Analytical Results - Groundwater Sampling**
**Semivolatile Organic Compounds**
**Neptune Road Site**
**Poughkeepsie, New York**

| Units in ug/l | Sample ID / Sampling Date | 952-6R 10/19/16 | 952-9R 10/19/16 | 952-10RA 10/19/16 | 952-11R 10/20/16 | 952-12R 10/19/16 | 952-13R 10/19/16 | 952-14R 10/20/16 | 952-14RA 10/20/16 | 952-16R 10/20/16 | 952-29R 10/20/16 | 952-31R 10/19/16 | Field Blank 10/20/16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEMIVOLATILE COMPOUNDS | NYSDEC Class GA Standard or Guidance Value ug/l | | | | | | | | | | | | |
| COMPOUNDS CONTINUED | | | | | | | | | | | | | |
| **Bis(2-ethylhexyl)phthalate (BEHP)** | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Chrysene** | 0.002 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Dibenzo(a,h)anthracene** | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Dibenzofuran** | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Dimethyl phthalate** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Di-n-butyl phthalate** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Di-n-octyl phthalate** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Fluoranthene** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Fluorene** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Hexachlorobenzene** | 0.04 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Hexachlorobutadiene** | 0.5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Hexachlorocyclopentadiene** | 5 | 36 U | 32 U | 31 U | 31 U | 31 U | 32 U | 32 U | 32 U | 31 U | 31 U | 33 U | 31 U |
| **Hexachloroethane** | 5 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Indeno(1,2,3-cd)pyrene** | 0.002 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Isophorone** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Naphthalene** | 10 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Nitrobenzene** | 0.4 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **N-Nitrosodimethylamine** | -- | 60 U | 54 U | 52 U | 52 U | 52 U | 54 U | 53 U | 53 U | 52 U | 52 U | 56 U | 52 U |
| **N-Nitroso-di-n-propylamine** | -- | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **N-Nitrosodiphenylamine** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Pentachlorophenol** | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Phenanthrene** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Phenol** | 1 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Pyrene** | 50 | 12 U | 11 U | 10 U | 10 U | 10 U | 11 U | 11 U | 11 U | 10 U | 10 U | 11 U | 10 U |
| **Total Semivolatile Compounds** | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68.6 | 0 |

ug/l Micrograms per liter
J Estimated value
\+ Applies to each isomer individually
++ Applies to sum of isomer
U Compound was analyzed for but not detected
-- No standard or guidance value
***Exceeds Class GA Standard/Guidance value***

D&B Engineers and Architects, P.C.

**Table 24**
**IBM**
**Analytical Results - Groundwater Sampling**
**Oil and Grease**
**Neptune Road Site**
**Poughkeepsie, New York**

| Sample ID | Sampling Date | Oil and Grease in mg/l |
|---|---|---|
| 952-6R | 10/19/16 | 5.3 U |
| 952-9R | 10/19/16 | 5.3 U |
| 952-10RA | 10/19/16 | 5.6 U |
| 952-11R | 10/20/16 | 5.2 U |
| 952-12R | 10/19/16 | 5.2 U |
| 952-13R | 10/19/16 | 5.2 U |
| 952-14R | 10/20/16 | 5.3 U |
| 952-14RA | 10/20/16 | 5.2 U |
| 952-16R | 10/20/16 | 5.2 U |
| 952-29R | 10/20/16 | 5.4 U |
| 952-31RA | 10/19/16 | 5.2 U |
| Field Blank | 10/20/16 | 6 U |

mg/l Milligrams per liter
U Compound was analyzed for but not detected

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX H
# EXCAVATION WORK PLAN (EWP)

# APPENDIX H
# EXCAVATION WORK PLAN (EWP)

## H-1 GENERAL

This plan shall be followed for intrusive activities conducted within the area designated as the remaining contamination on the Site.

Based on historic sampling data and cleanup criteria provided by the NYSDEC, the remaining contamination appears to meet the soil cleanup criteria for a Restricted Residential Use. Restricted requires that the use of the site has restrictions in the form of an environmental easement, or other land use control and requires a site management plan to manage the exposure to remaining contamination at the site. The remaining contamination is further discussed in Section 2.5 of the SMP and in the Environmental Easement prepared for the Site (Appendix B of the SMP).

Disturbances for removal of the site cover system, discussed within the SMP, shall be covered under a separate Work Plan that will be prepared by IBM, upon notification that the buildings will be removed.

The owner and their representatives shall be responsible for complying with all the requirements of this plan relevant to the work that will be performed. All documentation required by this Excavation Work Plan (EWP) shall be provided to IBM for inclusion into the Periodic Review Report for the site.

## H-2 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the Department. Currently, this notification will be made to:

R. Scott Deyette
Site Control Section
Section Chief, Bureau of Technical Support
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7020

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent, plans for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control,
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work,
- A summary of the applicable components of this EWP,
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120,
- A copy of the contractor's health and safety plan, in electronic format,
- Identification of disposal facilities for potential waste streams,
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

The owner shall also notify IBM a minimum of 15 days prior to any activity that may disturb the areas of remaining contamination. Upon completion of disturbance activities, the owner shall provide the following information to IBM for inclusion into the Periodic Review Report required for the site:

- A detailed description of the work performed, including the location and areal extent, plans for site re-grading, intrusive elements or utilities installed, estimated volumes of contaminated soil excavated and any impacts the work had on an engineering control,
- Identification of the sources of backfill used, along with all required chemical testing results.
- Chemical testing results required by the SMP and this EWP.

In the event of an emergency excavation the owner shall contact both the NYSDEC and IBM immediately upon determining that an emergency excavation is required. If the emergency excavation will impact the operation of the groundwater pump and treatment system or the subslab depressurization system, the owner shall notify IBM immediately upon determining that there is a potential for an impact.

De Minimus activities defined in Section H-3 below require a two week notification to both the NYSDEC and IBM. The following information must be submitted for a de minimus activity:

- A detailed description of the work to be performed, including the location and areal extent, intrusive elements or utilities to be installed, estimated volumes of contaminated soil to be excavated and removed,
- Identification of sources of any anticipated backfill, along with all required chemical testing results.
- Chemical testing results required by the SMP and this EWP.

## H-3 DEMINIMUS ACTIVITIES

The following activities may be considered de minimus and must meet the minimum requirements of this section in order to comply with this EWP:

- Routine landscaping;
- Shallow (less than 5 feet), narrow trenching such as that required to install minor electrical conduits;
- Installation of shallow (less than 5 feet) foundations for small structures, including pipe trestles;
- Installation of fence pots, guardrails, and road signs;
- Installation, repair and resurfacing of paved areas, sidewalks and curbs;
- Installation of outdoor lighting, electrical cables, and telephone wires; and
- Soil sampling required by corrective action activities.

Performances of these de minimus activities, as per prior approval of the NYSDEC are subject, but not limited to:

- Excavation depths may not exceed five feet or extend below the water table; and
- To the maximum extent possible, excavated soil must be returned to the excavation as backfill.

De minimus activities must be completed in accordance with a task specific Health and Safety Plan (HASP) or follow the applicable requirements of the HASP attached as Appendix J to the SMP.

If additional backfill is required for a de minimus activity, it must meet the requirements of Section H-11 of this EWP.

Excess soils requiring off-site disposal must be characterized and disposed of in accordance with Sections H-7 and H-8 of this EWP and all applicable handling and storage requirements discussed in Sections H-5 and H-6 must be followed.

## H-4 SOIL SCREENING METHODS

Visual, olfactory and instrument-based soil screening for volatile organic concentrations will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing, material that can be returned to the subsurface, and material that can be used as cover soil.

## H-5 STOCKPILE METHODS

Soil stockpiles shall not be located within or directly adjacent to any drainage ways or structures. A geo-membrane with a minimum thickness of 30 mils shall be placed underneath stockpiles, unless the stockpile is for uncontaminated soils. Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales or silt fence will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event of 0.5 inches or greater. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC.

## H-6 MATERIALS EXCAVATION AND LOAD OUT

A qualified environmental professional or person under their supervision will oversee all invasive work.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

If excavated soils will not be re-used at the site, the owner shall stockpile the excavated soils in accordance with Section H-5 until waste characterization sampling in accordance with Section H-8 has been completed. Once the excavated soil has been properly characterized, the soil shall be disposed of, in accordance with the load-out and disposal requirements outlined within this EWP.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash/cleaning station will be operated on-site. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed/cleaned at the truck wash/cleaning station before leaving the site until the activities performed under this section are complete.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

## H-7 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks in contact with contaminated soils will be washed/cleaned prior to leaving the site. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance.

## H-8 MATERIALS DISPOSAL OFF-SITE

All soil/fill/solid waste excavated and removed from the site will be sampled and characterized prior to transport and disposal. Waste characterization sampling and disposal shall be in accordance with the NYSDEC Technical Administrative Guidance Memorandum (TAGM) 3028 "Contained-In" Criteria, since soils at the Site are contaminated with F-001 and F-002 listed hazardous wastes. The known chemical constituents are trichloroethylene, methylene chloride, chloroform, trichlorofluoromethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, and 1,1,2trichloroethane. Additionally known hazardous constituents present in the soil include bis-(2-ethylhexyl)phthalate, di-n-butyl phthalate, benzene, and toluene.

TAGM 3028 sets forth action levels, summarized in the table below, required to be met for an environmental media to lose its listing and be disposed of as a nonhazardous waste. In order for soils to meet the criteria the total constituent concentration in the soil must meet the soil action levels and the resultant leachate concentration must be below the corresponding groundwater action level.

**Table 1: "Contained-In" Criteria Action Levels**

| Substance | CAS Number | Groundwater Action Level (µg/L) | Soil/Sediment Action Level (mg/kg) |
|---|---|---|---|
| Benzene | 71-43-2 | 7.0 | 22 |
| Bis-(2-ethylhexyl)phthalate | 117-81-7 | 50.0 | 46 |
| Chloroform (Trichloromethane) | 67-66-3 | 7.0 | 100 |
| Di-n-butyl phthalate | 84-74-2 | 50.0 | 7,800 |
| Toluene | 108-88-3 | 5.0 | 16,000 |
| Methylene Chloride | 75-09-2 | 5.0 | 85 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 5.0 | 3.2 |
| 1,1,1-Trichloroethane (methyl chloroform) | 71-55-6 | 5.0 | 7,000 |
| 1,1,2-Trichloroethane | 79-00-5 | 5.0 | 11 |
| Trichloroethene | 79-01-6 | 5.0 | 58 |
| Trichlorofluoroethane (F-11) | 75-69-4 | 5.0 | 2,3000 |

To demonstrate compliance with the contained-in policy, a minimum of one grab sample and one composite sample shall be collected for every 100 cubic yards of soil stockpiled for offsite disposal, unless otherwise approved by the NYSDEC. Each sample shall be analyzed using EPA Methods 8260 and 8270 to determine the total concentrations of the hazardous constituents summarized above. Samples will also be collected and analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) method 1311 to determine the concentration of each of the above hazardous constituents in leachate from the soil. The results shall be submitted to the NYSDEC with a comparison of the action levels in order for the NYSDEC to determine whether the soil can be managed as a non-hazardous waste in accordance with TAGM 3028.

Soils determined to be contaminated and regulated material will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this site is proposed for unregulated offsite disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility

if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C&D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

## H-9 SOIL REUSE ON-SITE

Soil that will be reused within a cover soil layer (24 inches or less from the surface), within landscaping berms, or as backfill for subsurface utility lines will require chemical testing prior to reuse. Chemical testing results must meet the soil cleanup levels for a restricted residential use listed in Table 376-6.8(b) of Part 375 in order to be reused on site in this manner.

Contaminated soils that will be placed below a demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines, and is not visibly contaminated, will not require chemical testing prior to reuse.

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material that is not chemically tested, including historic fill and contaminated soil, that is acceptable for re-use on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Contaminated soils may not be reused in areas outside the limit of the remaining contamination unless soil chemical testing results meet the soil cleanup levels for an unrestricted use listed in Table 376-6.8(a) of Part 375.

To meet the sampling requirements of this section, a minimum of two composite samples and three grab samples shall be collected for every 300 cubic yards of material proposed for reuse. If material is 100 cubic yards or less then one composite and two grab samples shall be collected for analysis. Samples shall be analyzed for volatile and semi-volatile organic compounds.

## H-10 FLUIDS MANAGEMENT

All liquids to be removed from the site, including excavation dewatering and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, but will be either disposed of off-site to a permitted waste disposal facility or discharged to the sanitary sewer service with prior approval from the Town of Poughkeepsie Arlington Sewer District (ASD).

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

## H-11 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities, the cover system, consisting of the concrete slab for former IBM Building 982 and the structure itself, will be restored in a manner that prevents human and environmental exposures to the "remaining contamination" beneath the building. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the Site Management Plan.

## H-12 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional. Documentation providing the location and description of the origin of the imported soil shall be provided in addition to meeting all other provisions in this SMP prior to receipt at the site. All documentation shall be provided to IBM for inclusion into the Periodic Review Report.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are listed in 6NYCRR 375-6-8(b). At a minimum, one sample shall be collected from each source of backfill. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

## H-13 STORMWATER POLLUTION PREVENTION

Procedures for stormwater pollution prevention should be specified for each individual construction project that requires excavation work. A Stormwater Pollution Prevention Plan (SWPPP) meeting the requirements of NYSDEC Division of Water guidelines and NYS regulations should be prepared at the time of a large excavation (one or more acres of disturbance).

The SWPPP shall include all information required by the current General Permit for Stormwater Associated with Construction Activities.

For smaller excavation (less than one acre) an erosion and sediment control plan should be prepared for the project. The plan shall include the following minimum requirements:

- Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.
- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.
- All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.
- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.
- Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters
- Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

## H-14 CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification

to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. Reportable quantities of a hazardous substance will be reported to the NYSDEC spills hotline and the National Response Center (NRC). These findings will also be included in the periodic reports prepared pursuant to Section 7.2 of the SMP.

## H-15 COMMUNITY AIR MONITORING PLAN

A Community Air Monitoring Plan has been included in Appendix I of the SMP.

## H-16 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors offsite. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all substantiated odor. Implementation of any odor controls, including the halt of work, is the responsibility of the property owner and/or remedial party, depending upon who is performing the work and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

## H-17 DUST CONTROL PLAN

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved though the use of dedicated on-site water truck for road wetting. The truck will be equipped with water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles. Water used will not contain contaminants.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

## H-18 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX I
# COMMUNITY AIR MONITORING PLAN (CAMP)

# APPENDIX I
# COMMUNITY AIR MONITORING PLAN

## Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when soil disturbance activities are in progress at the Site. All plans prepared for Site work must be approved by the NYSDEC and NYSDOH, prior to implementation.

The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The CAMP presented below will be sufficient to cover many, if not most, work anticipated at the Site. A separate task-specific CAMP or supplement may be required. Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

## Community Air Monitoring Plan

Based on the nature of known or potential contaminants at the site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

**VOC Monitoring, Response Levels, and Actions**

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified in the approved Work Plan or task-specific CAMP. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below or as indicated in an approved task specific CAMP.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for NYSDEC and, if requested NYSDOH personnel to review. Instantaneous readings, if any, should also be recorded.

**Particulate Monitoring, Response Levels, and Actions**

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations.

The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate

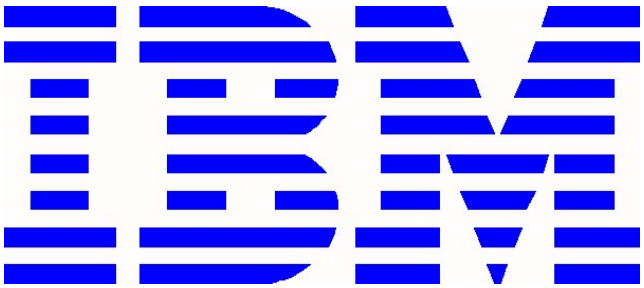
concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for review for NYSDEC and, if requested NYSDOH and Dutchess County Health Department personnel to review.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX J
# HEALTH AND SAFETY PLAN (HASP)



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# HEALTH AND SAFETY PLAN
# EMERGENCY CONTINGENCY PLAN

for the

FORMER IBM B952/982 SITE

**Prepared For:**
International Business Machines Corporation
Poughkeepsie, New York

**Prepared By:**
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**Revised and Updated By:**
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MARCH 2017

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## 1.0 SITE DESCRIPTION

Date: March 2017
Client: IBM Corporation
Location: Former B952/982 Site
Poughkeepsie, New York

Hazards:

- Chemical – Details provided in Section 4.0 Chemical Hazard Evaluation.
- Utilities – Groundwater conveyance piping and electrical lines are exposed throughout the groundwater treatment building.
- Confined space – The building is technically a confined space and should be entered with caution.
- Biological (Insects) – Bees, wasps during spring and summer.
- Eyes – Eye protection should be worn while sampling inside the building to protect from accidental leakage and spraying of untreated groundwater.

Areas Affected: Groundwater treatment building adjacent to Building 982; well 952-30R is inside this building.

Temperature Conditions: Building is heated in winter. No A/C.

Background Information: The B952/982 Site is located near the intersection of Neptune Road and South Road (Route 9) in the Town of Poughkeepsie, Dutchess County, New York. The site had been leased by IBM Corporation. Groundwater monitoring well 952-30R is pumped as a remediation measure. A building which houses a carbon adsorption treatment system has been constructed over this well. This Health and Safety and Emergency Contingency Plan addresses activities in and around this groundwater treatment building.

## 2.0 WORK OBJECTIVES

Work objectives include sampling of influent and effluent groundwater, readings of gauges and meters, and maintenance, including changing of spent carbon, as required.

## 3.0 ON-SITE CONTROL

IBM will coordinate access control to the treatment building. Unauthorized individuals are not permitted inside the treatment building. The building must be locked at all times unless authorized personnel are present. Individuals should not enter the building alone without the knowledge of at least one other person who need not be present at the site.

## 4.0 CHEMICAL HAZARD EVALUATION

The following principal substances have been detected in untreated groundwater. The primary hazards of each are identified. Primary hazards are for the pure phase of each substance.

| Substances Involved | Typical Reported Concentrations (*u*g/l) | Primary Hazards |
|---|---|---|
| *1,2-Dichlorobenzene (12-DCBZ)* | *5,700 - 23,000* | *inhalation, absorption, ingestion, contact (Class IIIA combustible liquid)* |
| *1,3-Dichlorobenzene (13-DCBZ)* | *780 - 2,600* | *similar to 12-DCBZ* |
| *1,4-Dichlorobenzene (14-DCBZ)* | *1,300 - 4,600* | *inhalation, ingestion, contact (combustible solid)* |

12-DCBZ and 13-DCBZ have a pleasant aromatic odor. 14-DCBZ has a mothball-like odor. Hazardous substance information forms or Safety Data Sheets (SDS) for the involved substances are available. TLV-TWAs and STELs for site substances are listed below along with the response characteristics of field monitoring instruments.

**Relative Response of Field Monitoring Equipment to Selected Compounds**

| Species | IP (eV) | PID (<10.2 eV) | CGI | TLV-TWA (ppm) | IDLH (ppm) | STEL (ppm) |
|---|---|---|---|---|---|---|
| 1,2-Dichlorobenzene | 9.06 | + (E) ✔ | + | *C*50 | 1000 | NA |
| 1,3-Dichlorobenzene | 9.12 | + (E) ✔ | + | NA | NA | NA |
| 1,4-Dichlorobenzene | 8.94-9.07 | + (E) ✔ | + | 75 | 1000 | 110 |

IP = ionization potential (electron volts)
PID = photoionization detector (HNu)
CGI = combustible gas indicator
TLV-TWA = threshold limit value - 8-hour time-weighted average (ACGIH)
IDLH = concentration immediately dangerous to life and health
NA = not available
*C* = ceiling value, do not exceed (no TWA)
\+ = positive response
o = no response, not detectable
E = excellent response (relative to methane standard)

## 5.0 PERSONAL PROTECTIVE EQUIPMENT

### 5.1 Levels of Protection

Based on evaluation of potential hazards, the following levels of personal protection have been designated for the applicable work areas or tasks:

| Location | Job Function | Level of Protection |
|---|---|---|
| inside treatment building | sampling | modified D |
| inside treatment building | routine maintenance, meter readings, etc. | D |

Specific protective equipment for each level of protection is as follows:

| Level D: | Modified Level D: |
|---|---|
| ❒ Steel toe and steel shank boots | ❒ Eye protection |
| ❒ Regular work clothing | ❒ Steel toe and steel shank boots. |
| | ❒ Surgical-type gloves for sampling activities |
| | ❒ Regular work clothing or protective clothing as specified below |

Protective goggles will be kept in the treatment building. Steel toe and steel shank boots will be worn at all times. Regular work clothing includes a shirt (preferably long-sleeved) and trousers (no shorts). If the pump is pulled for maintenance, hard hats must be worn during pump pulling activities.

### 5.2 Protective Clothing

The following protective clothing materials are required when sampling:

| Substances | Clothing Material | Glove Material |
|---|---|---|
| Total chlorinated benzenes (>1000 ppb in groundwater) | Tyvek or Saranex suits may be worn as splash protection | Vinyl or latex rubber |

Protective work gloves should be worn when performing maintenance activities such as piping assembly, when operating power equipment, when lifting or moving heavy items, or when performing any task where the potential for abrasion or puncture exists.

**NO CHANGES TO THE SPECIFIED LEVELS OF PROTECTION WILL BE MADE WITHOUT THE APPROVAL OF ACCESS CONTROL PERSONNEL.**

## 6.0 EMERGENCY PROCEDURES AND EQUIPMENT

### A. Emergency Medical Care

Emergency phone numbers:

| Organization | Telephone No. |
|---|---|
| Ambulance | 911 |
| Fire Department | 911 or (845) 486-6300 |
| Police Department | 911 or (845) 485-3666 |
| Poison Control Center | (800) 222-1222 |

HOSPITALS:

Name of hospital: **Vassar Brothers Medical Center**
Phone number: 845-454-8500
Address of hospital: 45 Reade Place, Poughkeepsie
Directions to hospital: Route 9 north to Columbia Street exit, at end of exit ramp turn right, at first stop sign turn right, proceed approximately I block (follow signs for Hospital), Emergency Room entrance sign will be on right and general parking will be on left.

Name of hospital: **MidHudson Regional Hospital of Westchester Medical Center**
Phone number: 845-483-5000
Address of hospital: 241 North Rd, Poughkeepsie
Directions to hospital: Route 9 north one-half mile past Mid-Hudson Bridge, get into right lane, make right turn onto Route 9G, approximately 100 yards, sign on hill for MidHudson Regional Hospital.

First aid equipment is available at the following locations:

| | |
|---|---|
| Fire Extinguisher: | On wall inside treatment building. |
| First-aid kit: | With IBM personnel. |
| Emergency eye wash: | On wall inside treatment building. |

Emergency medical information for selected substances present (excerpted from The NIOSH Pocket Guide to Chemical Hazards):

| Substance | Exposure Symptoms | First-Aid Instructions |
|---|---|---|
| 1,2-Dichlorobenzene (12-DCBZ) | Nasal and eye irritation, liver and kidney damage, skin blisters | **Eye**: wash immediately<br>**Skin**: soap wash promptly<br>**Breath**: Respiratory support<br>**Swallow**: immediate medical attention |
| 1,3-Dichlorobenzene (13-DCBZ) | similar to 12-DCBZ | **Eye**: wash immediately<br>**Skin**: soap wash promptly<br>**Breath**: Respiratory support<br>**Swallow**: immediate medical attention |
| 1,4-Dichlorobenzene (14-DCBZ) | Headache, eye irritation and periorbital swelling, nasal inflammation, anorexia, nausea, vomiting, weight loss, cirrhosis (a NIOSH occupational carcinogen) | **Eye**: wash immediately<br>**Skin**: soap wash promptly<br>**Breath**: Respiratory support<br>**Swallow**: immediate medical attention |

## B. Environmental Monitoring

1. Combustible Gas Indicator (CGI) / Oxygen (O2) Meter will be used as needed inside the groundwater treatment building when strong solvent odors, particularly aromatic or mothball odors, are noticed in the ambient air. These odors may be emitted from the open wellhead. The CGI/O2 meter will be used to determine whether potentially explosive concentrations of gases are present and whether oxygen levels may be deficient.
2. Monitoring should be performed in the breathing zone if strong solvent odors are noticed in the ambient air. If ambient air concentrations exceed the 50-ppm ceiling time-weighted average for 12-DCBZ, then the building must be ventilated until levels drop below 50 ppm. This value (50 ppm) is a time-weighted average for a 10-hour workday and 40-hour work week and is not to be exceeded at any time.

## C. Emergency Procedures (should be modified as required for incident)

The following standard emergency procedures will be used. IBM will be notified of any on-site emergencies, including all accidents and injuries to personnel, and incidents involving damage to IBM property occurring on the job site, regardless of whether or not medical attention is required.

Personnel Injury: Upon notification of an injury, assisting personnel should evaluate the nature of the injury, and the affected person should be decontaminated, if necessary, to the extent possible prior to removal from the site. An EMT or person certified in first aid should initiate the appropriate treatment, and contact should be made for an ambulance and with the designated medical facility (if necessary). No persons will reenter the building until the cause of the injury or symptoms is determined.

Fire/Explosion: IBM Emergency Control and/or the fire department will be alerted and all personnel will be moved to a safe distance from the affected area.

Monitoring Equipment Failure: If a site worker experiences a failure or alteration of monitoring equipment which affects necessary site safety monitoring, all persons will immediately exit the building. Reentry will not be permitted until the equipment has been repaired or replaced.

Other Equipment Failure: If any other equipment on-site fails to operate properly, the appropriate maintenance personnel will be notified and then will determine the effect of this failure on continuing operations on-site. If the failure affects the safety of personnel or prevents completion of the Work Objectives, all personnel will leave the building until the situation is evaluated and corrective actions are taken.

In all situations, when an on-site emergency results in evacuation of the building, personnel will not reenter until:

1. The conditions resulting in the emergency have been corrected.

2. The hazards have been re-assessed.
3. The Site Safety Plan has been reviewed.
4. Site personnel have been briefed on any changes in the Site Safety Plan.

Eating, drinking, and smoking are not permitted at any time inside the groundwater treatment building.

## 7.0 COMMUNICATION PROCEDURES

The following standard hand signals will be used when verbal communication is not possible:

| | |
|---|---|
| Hand gripping throat | Out of air, can't breathe |
| Grip partner's wrist or both hands around waist | Leave area immediately |
| Hands on top of head | Need assistance |
| Thumbs up | OK, I am all right, I understand |
| Thumbs down | No, negative |

## 8.0 DECONTAMINATION PROCEDURES

All purge water is contained and pumped through the onsite treatment system. Spent filter bags will be stored on site until they are properly manifested for transport to the IBM MHV Poughkeepsie main site. Used protective clothing and vinyl gloves will be placed in plastic garbage bags and will be disposed of as directed by IBM.

## 9.0 ACKNOWLEDGEMENT OF PLAN

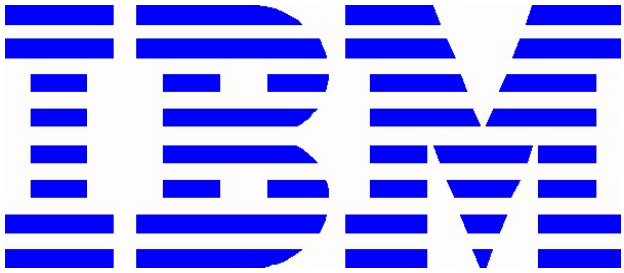
All site personnel have read the above plan and are familiar with its provisions. Site workers should have at least 24 hours of safety training under the requirements of 29 CFR 1910.120.

| (name) | (function) | (signature) |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

**SITE MANAGEMENT PLAN**
**FOR THE FORMER IBM B952/982 SITE**

# APPENDIX K
# QUALITY ASSURANCE PROJECT PLAN (QAPP)



DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# QUALITY ASSURANCE PROJECT PLAN

for the
ANNUAL GROUNDWATER SAMPLING
at the
FORMER IBM B952/982 SITE

**Prepared For:**
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Poughkeepsie, New York

**Prepared By:**
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Woodbury, New York 11797

MARCH 2017

**FORMER IBM B952/982 SITE**
**QUALITY ASSURANCE PROJECT PLAN FOR**
**ANNUAL GROUNDWATER SAMPLING**

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# 1.0 QUALITY ASSURANCE PROJECT PLAN

## 1.1 Project Identification

| | |
|---|---|
| Facility Name: | Former IBM B952/982 Site<br>Poughkeepsie, New York |
| Project Name: | Annual Groundwater Sampling at Monitoring Wells 952-10RA and 952-31R |

## 1.2 Objective and Scope

The objective of this program is to perform annual groundwater sampling for the two existing monitoring wells (952-10RA and 952-31R) at the Former IBM B952/982 Site located in Poughkeepsie, New York. Groundwater samples will be collected annually from the two monitoring wells as part of the Site Management Plan for the Site. The purpose of this Quality Assurance Project Plan (QAPP) is to develop and describe the detailed sample collection and analytical procedures that will ensure high quality data.

## 1.3 Data Usage

The data generated from the field sampling will be used to determine current site conditions and verify the effectiveness of the on-going remedial activities being conducted on-site. The data will also be utilized to monitor for the health and safety of workers at the site and potential off-site receptors.

## 1.4 Sampling Program Design and Rationale

The following presents a general discussion of the sampling to be conducted during the sampling portion of the program.

- Groundwater Samples: Groundwater samples will be collected from two on-site monitoring wells. In addition, one blind duplicate will be collected during each round of sampling.

## 1.5 Analytical Methods

Laboratory analysis of the groundwater samples will consist of analyzing for volatile organic compounds (VOCs), in accordance with the United States Environmental Protection Agency (USEPA) SW-846 methods.

Table 1-1 presents a summary of the parameters/sample fractions to be analyzed for. The table also lists the sample location, type of sample, sample matrix, number of samples and frequency of sample collection, type of sample container, method of preservation, holding time and analytical method.

**Table 1-1**
**FORMER IBM B952/982 SITE**
**ANNUAL GROUNDWATER SAMPLING**
**SUMMARY OF MONITORING PARAMETERS/SAMPLE FRACTIONS**

| Sample Location | Sample Type | Sample Matrix | Sample Fraction | No. of Samples* | Frequency** | Container Type/Size/No. | Sample Preservation | Maximum Holding Time*** | Analytical Method |
|---|---|---|---|---|---|---|---|---|---|
| Monitoring Wells 952-10RA and 952-31R | Grab/PDB | Water | Volatile Organics | 3 | Annual | Glass/40 ml/3 ICHEM 300 series or equivalent | Adjust pH to <2 with $H_2SO_4$, HCl or solid $NaHSO_4$ Cool to 4°C | 14 days | USEPA SW-846 Method 8021 |

*Number of samples includes two monitoring wells and duplicate.

**Frequency is annually.

***Holding times based upon date of collection.

## 1.6 Data Quality Requirements and Assessment

Data quality requirements and assessments are provided in USEPA SW-846 Chapter 1 – Quality Control as well as Section 9.0 of the associated analytical method. Note that quantification limits, estimated accuracy, accuracy protocol, estimated precision and precision protocol are determined by the laboratory and will be in conformance with the requirements of USEPA SW-846, where applicable. Table 1-2 presents a summary of the data quality requirements.

In addition to meeting the requirements provided in USEPA SW-846, the data must also be useful in evaluating the nature and extent of contamination. Data obtained during the field program will be compared to specific Standards, Criteria and Guidelines (SCGs). The SCGs to be utilized include:

| Matrix | SCG |
|---|---|
| Groundwater Sample | NYSDEC Class GA Groundwater Standards found at Division of Water Technical and Operational Guidance Series (1.1.1) dated June 1998. |

### 1.6.1 Data Representativeness

Representative samples will be collected as follows:

- Groundwater (Monitoring Well) – Samples will be collected with a dedicated/disposable bailer or decontaminated low-flow submersible pump after the monitoring well has been purged of three to five well casing volumes until field measurements for pH, conductivity, temperature and turbidity have stabilized, or until the well is purged dry (whichever comes first) and the well has been allowed to recharge.
  or
- Groundwater (Monitoring Well) – Samples will be collected with a passive diffusion bag (PDB) sampler consisting of a low-density polyethylene lay-flat tubing filled with distilled, deionized water and heat-sealed at both ends. The bags will be suspended by a weighted line at the target horizon in monitoring wells 952-10RA and

## Table 1-2

## FORMER IBM B952/982 SITE
## ANNUAL GROUNDWATER SAMPLING
## DATA QUALITY REQUIREMENTS

| Parameter | Sample Matrix | CRDL* (ug/l) | Estimated Accuracy | Accuracy Protocol | Estimated Precision | Precision Protocol |
|---|---|---|---|---|---|---|
| Volatile Organics | Liquid | 5-10<br>5-10 | ND – 9.5 ug/l | SW-846,<br>Method 8021B, Table 2 | 1.5 – 9.9 ug/l | SW-856, Method<br>8021B, Table 2 |

*Contract Required Detection Limits.

**Table 1-2** (continued)

**FORMER IBM B952/982 SITE**
**ANNUAL GROUNDWATER SAMPLING**
**DATA QUALITY REQUIREMENTS**
**OBJECTIVES FOR PRECISION, ACCURACY, AND COMPLETENESS**

| Matrix/Parameter | Precision (%) | Accuracy (%) |
|---|---|---|
| Ground Water | | |
| VOCs(a) | ± 25% | 75-125 |

Notes:

(a) Accuracy will be determined as percent recovery of matrix spikes when appropriate or the percent recovery of a QC sample if spiking is inappropriate. Precision will be determined as relative percent difference of matrix spike duplicate samples, or duplicate samples if spiking is inappropriate.

Source: USEPA SW-856

952-31R and allowed to equilibrate with the surrounding water. Retrieved after the equilibration period (typically two weeks), the enclosed water will be immediately transferred to appropriate sample containers for analysis.

- Equipment Decontamination – Non-sterile sampling equipment will be decontaminated prior to use at each location according to the procedures described in Section 1.8 of this QAPP.

### 1.6.2 Data Comparability

All data will be presented in the units designated by the methods specified by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory and USEPA SW-846. In addition, sample locations, collection procedures and analytical methods from earlier studies will be evaluated for comparability with current procedures/methods.

### 1.6.3 Data Completeness

The acceptability of 100% of the data is desired as a goal for this project. The acceptability of less than 100% complete data, meeting all laboratory Quality Assurance/Quality Control (QA/QC) protocols/standards, will be evaluated on a case-by-case basis.

The laboratory utilized to perform the analyses on the groundwater samples will provide a data package with sample results reported on Laboratory Form 1's.

## 1.7 Detailed Sampling Procedures

Ground water duplicate samples will be collected annually to verify the effectiveness of the remedial activities. One groundwater sample will be collected from each monitoring well as well as one duplicate sample. Sampling procedures and equipment to be utilized are described in this QAPP. Sample collection will be performed in conformance with the procedures outlined in this QAPP.

When collecting the samples, care will be taken to maintain sample integrity by preserving its physical form and chemical composition to as great an extent as possible. First, the equipment utilized to collect the samples must be new and sterile or properly decontaminated. An appropriate piece of sampling equipment (e.g., bailer or PDB) will be utilized to collect the sample and transfer it to the laboratory-supplied sample container. The sample will be transferred into the sample container as quickly as possible.

There are several steps performed after the transfer of the sample into the sample container that are necessary to properly complete the collection activities. Once the sample is transferred into the appropriate container, the container will be capped and, if necessary, the outside of the container will be wiped with a clean paper towel to remove any grime. A clean paper towel moistened with distilled/deionized water will be used for this purpose.

Prior to sample collection, the sample container will be properly labeled. Information such as the sample identification number, location, collection time and sample description will be recorded in the field log book. Associated paper work (e.g., Chain of Custody forms) will then be completed and will stay with the sample. The samples will be packaged in a manner that will allow the appropriate storage temperature to be maintained during transportation to the laboratory. Samples will be delivered to the laboratory within 48 hours of collection.

Proper personal protective equipment and monitoring equipment (if determined to be necessary) will be used at all times during sample collection to further maintain sample integrity and protection of worker health and safety.

### 1.7.1 Sample Identification

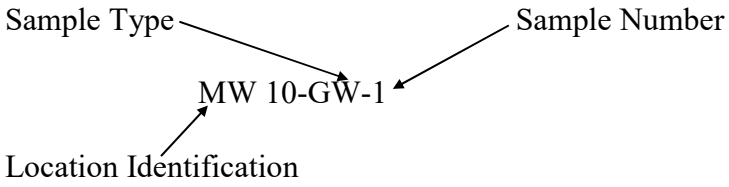
All samples collected during the field activities will be labeled with a sample identification code. The code will identify the sample location, sample type (sample matrix) and series numbers for the sample locations. Samples will be labeled according to the following system:

Location Identification: - The sample location will be assigned an identifier based on the monitoring well from which the sample was collected.

Sample Type: - "GW" for groundwater and duplicate samples.

Sample Number: - In the field, each sample location will be designated with a number. The number will correspond with the number of the sample collected.

Based on the above sample identification procedures, an example of a sample label collected from Monitoring Well number "10", would be:




1.7.2 Sample Handling, Packaging and Shipping

All analytical samples will be placed in the appropriate sample containers as specified in the current version of USEPA SW-846. The holding time criteria identified in USEPA SW-846 will be followed, as specified in Table 1-1.

Prior to packaging any samples for transportation to the laboratory, the sample containers will be checked for proper identification and compared to the field log book for accuracy. The samples will then be wrapped with a cushioning material (e.g., bubble wrap) and placed in a cooler (or laboratory shuttle) with a sufficient quantity of bagged ice or "blue ice" packs to maintain the samples at 4°C until arrival at the laboratory.

All necessary documentation required to accompany the samples during transportation will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The cooler will then be sealed with fiber (duct) tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

All samples will be shipped to ensure receipt at the laboratory within 48 hours of sample collection.

### 1.7.3 Groundwater (Monitoring Well)

Sampling protocols for the collection of groundwater samples from monitoring wells will consist of the following minimum procedures:

1. Measure the depth of water using a decontaminated water level indicator and compute the volume of standing water in the well.

2. Remove three to five times the volume of standing water from the well until field measurements (pH, conductivity, temperature and turbidity) stabilize, or until the well is dry, whichever occurs first. Turbidity should be less than 50 NTUs prior to collection of a sample for metals analysis.

   or

   Fill a diffusive-membrane capsule with deionized distilled water, seal, mount in a suspension device, and lower to a specified depth in each monitoring well. Over time (no less than 72 hours), the VOCs in the groundwater will diffuse across the capsule membrane, and contaminant concentrations in the water inside the sampler attain equilibrium with the ambient groundwater. The sampler will subsequently be removed from the well.

3. Remove the laboratory precleaned sample containers from sample cooler, label container with an indelible marker, fill out Sample Information Record and Chain of Custody Form.

4. Obtain a sample by using a disposable polyethylene bailer

   or

   Transfer the water from the diffusion bag sampler to the sample container.

5. Gently pour the sample into the sample container taking care not to spill on the outside of the container or overfill container and replace the cover on the sample container. Samples for volatile organic analyses will have no air space in the sample vial prior to sealing. This is done by filling the vial such that there is a meniscus on top. Carefully slide the septum, Teflon side down, onto the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If

bubbles appear, reopen the vial, remove the septum and add more sample (or resample). Replace the septum, recap and check for bubbles. Continue until vial is bubble-free.

6. Return sample container to sample cooler.

7. Place all disposable personal protective equipment and disposable sampling equipment into a 55-gallon drum and store in a secure area (fenced, if possible).

## 1.8 Decontamination Procedures

Whenever feasible, all field sampling equipment should be dedicated to a particular sampling location. In instances where this is not possible, a field cleaning (decontamination) procedure will be used in order to reduce the risk of cross-contamination between sample locations. A decontamination station will be established for all field activities if field decontamination is necessary. This will be an area located at some distance from the sampling locations so as not to adversely impact the decontamination procedure while still allowing the sampling team to keep equipment handling to a minimum.

### 1.8.1 Field Decontamination Procedures

All nondisposable equipment will be decontaminated at appropriate intervals (e.g., prior to initial use, prior to moving to a new sampling interval or location, and prior to leaving the site). Different decontamination procedures are used for the various types of equipment utilized to perform the field activities. When designing a field decontamination program, it is advisable to initiate environmental sampling in the area of the site with the lowest contaminant probability and proceed through to the areas of highest suspected contamination.

### 1.8.2 Decontamination Procedure for Sampling Equipment

All Teflon, polyvinyl chloride (PVC), high density polyethylene (HDPE) and stainless steel sampling equipment will be decontaminated utilizing the following procedure:

- Wash thoroughly with nonresidual detergent (e.g., alconox) and clean potable tap water using a brush to remove particulate matter or surface film.
- Rinse thoroughly utilizing distilled or deionized water.
- Wrap completely in clean aluminum foil with dull side against the equipment.

The first step, a soap and water wash, is designed to remove all visible particulate matter and residual oil and grease. The distilled/deionized water rinse ensures complete removal of residual cleaning products and the aluminum wrap protects the equipment from contamination and keeps it clean for use at another sampling location.

## 1.9 Laboratory Sample Custody Procedures

A NYSDOH ELAP certified laboratory meeting the requirements for sample custody procedures, including cleaning and handling sample containers and analytical equipment, will be used. The Standard Operating Procedures of the laboratory selected to undertake the analysis of environmental samples for this program will be available upon request.

## 1.10 Field Management Documentation

Proper management and documentation of field activities is essential to ensure that all necessary work is conducted in accordance with this Quality Assurance Project Plan in an efficient and high quality manner. Field management procedures include following proper chain of custody procedures to track a sample from collection through analysis, noting when and how samples are split (if required), completing Chain of Custody forms and maintaining a daily field log book. Proper completion of the Chain of Custody and the field log book are necessary to support the future actions that may result from the sample analysis. This documentation will support that the samples were properly collected and handled.

### 1.10.1 Location Sketch

Each sampling point shall have its own location sketch with measurements and permanent references if possible. This sketch will be recorded in the field log book.

### 1.10.2 Chain of Custody

A Chain of Custody (COC) form is initiated at the laboratory with container preparation and transportation to the site. The COC must remain with the samples at all times and bear the name of the person assuming responsibility for the samples. This person is tasked with ensuring secure and proper handling of the containers and samples. When the form is complete, it should indicate that there were no lapses in sample accountability.

A sample is considered to be in an individual's custody if any of the following conditions are met:

- It is in the individual's physical possession, or
- It is in the individual's view after being in his or her physical possession, or
- It is secured by the individual so that no one can tamper with it, or
- The individual puts it in a designated and identified secure area.

In general, Chain of Custody forms are provided by the laboratory contracted to perform the analytical services. At a minimum, the following information shall be provided on these forms:

- Project name and address
- Project number
- Sample identification number of each sample contained in the sample cooler
- Date of sample collection

- Time of sample collection
- Sample location
- Sample type/matrix
- Analyses requested
- Number of containers and volume collected
- Remarks (e.g., preservation, special handling, etc.)
- Sampler(s) name(s) and signature(s)
- Spaces for relinquished by/received by signature and date/time.

For this particular study, Chain of Custody forms provided by the laboratory will be utilized.

The Chain of Custody form is completed and signed by the person performing the sampling activities. The original form travels with the samples and is signed and dated each time the samples are relinquished to another party, until it reaches the laboratory or analysis is completed. The field sampler maintains a copy of the Chain of Custody form and a copy is retained for the project file. Each sample container must also be labeled with an indelible marker with a minimum of the following information:

- Sample identification number
- Project name/location
- Analysis to be performed
- Date and time of collection
- Sampler's initials

A copy of the completed Chain of Custody form is returned by the laboratory with the analytical results.

1.10.3 Field Log Book

Field log books must be bound and should have consecutively numbered, water resistant pages. All pertinent information regarding the site, project and sampling procedures must be documented. Notations should be made in log book fashion, noting the time and date of all entries. Information recorded in the log book should include, but is not necessarily be limited to, the following:

The first page of the log contains the following information:

- Project name and address
- Name, address and phone number of field contact
- Name, address and phone number of subcontractors and contact persons

Daily entries are made for the following information:

- Purpose of sampling
- Sampling location
- Number and volume(s) of sample(s) collected
- Description of sample location and sampling methodology
- Date and time of sample collection and personnel arrival and departure
- Geologic description of each sample interval, if applicable
- Collector's sample identification number(s)
- Sample distribution and method of storage and transportation
- References, such as sketches of the sample location or photographs of sample collection with dimensions
- Field observations such as weather conditions, visual signs of staining and/or stressed vegetation

- Signature of personnel responsible for completing log entries

## 1.11 Calibration Procedures and Preventive Maintenance

The following information regarding equipment will be maintained at the project site if monitoring is deemed necessary for health and safety purposes:

1. Equipment calibration and operating procedures which will include provisions for documentation of frequency, conditions, standards and records reflecting the calibration procedures, methods of usage and repair history of the measurement system. Calibration of field equipment will be completed daily at the sampling site so that any background contamination can be taken into consideration and the instrument calibrated accordingly.

2. A schedule of preventive maintenance tasks, consistent with the instrument manufacturer's specific operation manuals, that will be carried out to minimize down time of the equipment.

3. Critical spare parts, necessary tools and manuals will be on hand to facilitate equipment maintenance and repair.

## 1.12 Performance of Field Audits

During field activities, if determined to be necessary, the QA/QC Officer will accompany sampling personnel into the field, verify that the site sampling program is being properly implemented and detect and define problems so that resolutions can be determined and implemented. All findings will be documented and provided to the Field Operations Manager.

## 1.13 Control and Disposal of Contaminated Material

Contaminated materials generated during this field program will primarily be limited to spent protective clothing, spent disposable sampling equipment and wastes generated as a result of equipment decontamination.

Any contaminated materials generated as a result of the field program will be contained in U.S. Department of Transportation (DOT) 55-gallon drums and staged in a designated area for subsequent waste characterization. Each drum will be identified by the type of material contained.

Decisions regarding the disposal of drummed material will be made, at least in part, based on the analytical results of the samples collected during this program. At the present time, there is no provision for separate analysis of contained material.

Decontamination water and sediment, if any, will be contained in 55-gallon drums. A decision regarding disposal of this material will be made following receipt of the sample results. Analysis of decontamination water/sediment may be required for proper management.

DOT-approved 55-gallon drums will be available for disposal of spent protective clothing and disposable sampling equipment, if any. These drums will be marked and labeled as containing personnel protective and sampling equipment. These drums will not be sampled. All drums will be sealed and staged on site to await proper off-site disposal.

### 1.14 Data Validation

Due to the mature nature of the program and the degree of certainty of the data collected, data validation of the data is not required.

### 1.15 Performance and System Audits

A NYSDOH ELAP certified laboratory, which has satisfactorily completed performance audits and performance evaluation samples, shall be used on this project.

## 1.16 Corrective Action

A NYSDOH ELAP certified laboratory shall meet the requirements for corrective action protocols, including sample "cleanup" to attempt to eliminate/mitigate "matrix interference." Sample "cleanup" is not required for samples to be analyzed for volatile organic compounds or select metals. However, sample "cleanup" is required for samples to be analyzed for semivolatile organic compounds.

## 1.17 Duplicate

The primary purpose of a duplicate sample is to determine the analytical precision of the laboratory contracted to perform the sample analyses. A duplicate sample is collected in the same manner as one of the environmental samples and analyzed for the same constituents. In this manner, the precision of the laboratory can be checked. One duplicate sample will be collected and analyzed during sample collection activities.

DUTCHESS COUNTY
POUGHKEEPSIE, NEW YORK

# SITE MANAGEMENT PLAN
# FOR THE FORMER IBM B952/982 SITE

## APPENDIX L
## SITE MANAGEMENT FORMS

IBM POUGHKEEPSIE
INSPECTION OF GROUNDWATER TREATMENT SYSTEM
FORMER IBM B952/982 SITE

| | | Yes | No |
|---|---|---|---|
| 1. | OVERFILL/SPILL CONTROL EQUIPMENT | | |
| 1a. | Is equipment (e.g. waste-feed cutoff systems, bypass systems and drainage s stems etc. in good working order? | | |
| 2. | ABOVE GROUND PORTIONS OF TREATMENT SYSTEM INTEGRITY | | |
| | Is treatment system tanks, piping and supports in good condition and not apt to fail and/or leak I.e. - no rusting, cracks, dents, punctures or bulges? | | |
| 3. | MONITORING EQUIPMENT AND LEAK DETECTION EQUIPMENT | | |
| 3a. | Are systems in normal operation mode with no malfunctions or alarm conditions? | | |
| 4. | SECONDARY CONTAINMENT SYSTEM INTEGRITY | | |
| 4a. | Is the secondary containment system free from damaged (i.e. coating not cracking/peeling/blistering, seams intact)? | | |
| 4b. | Is the secondary containment system clean (i.e. no signs of wet spots, free liquids and/or debris present)? | | |
| 5. | ENTRANCES/EXITS | | |
| 5a. | Are entrances/exits clear for emergency egress (at least 3-ft wide aisle space and all door areas must be clear? | | |
| 6. | WARNING SIGNS/ LABELS | | |
| 6a. | Are all required signs/labels present and legible on exterior door and treatment system? | | |
| 7. | FIRE EXTINGUISHERS | | |
| 7a. | Is fire extinguisher readily available in case of emergency? | | |

| ADDITIONAL COMMENTS: |
|---|
| |
| |
| |
| |
| |

Inspection deficiencies ( if checked "no" above) must be described in comment section. Promptly contact the Program Engineer to initiate the corrective action process.

DATE OF INSPECTION: _____ TIME: _____

SIGNATURE OF INSPECTOR: _____

PRINT NAME: _____

NOTE: ANY LEAK OR OTHER RELEASE OF WASTE MATERIAL TO THE AIR, LAND, SURFACE WATER OR GROUNDWATER SHOULD BE IMMEDIATELY REPORTED TO IBM ENVIRONMENTAL PROGRAM ENGINEERING.

952 / 982
GROUND WATER TREATMENT SYSTEM

| INT | | DATE | TIME | TOTAL | GPM | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Former IBM B952/982 Site SSDS - Vapor Extraction System**

**Operations Monitoring Logsheet**

| HMI | Reading | Comments |
|---|---|---|
| **Sub Slab System** | | |
| **Main Screen** | | |
| B-101 Hz | | |
| B-102 Hz | | |
| TT-101 Pre-Carbon Temp | | |
| TT-102 Post Carbon Temp | | |
| TT-103 Post Blower Temp | | |
| TT-104 Room Temp | | |
| VIT 101 Pre-Carbon Vacuum | | |
| VIT 102 Post Carbon Vacuum | | |
| FI 101 Flow Differential Pressure | | |

$$A = 14.7 - \frac{Blower\ Vacuum\ (in.wc)}{27.7}$$

B = Post Carbon Temperature (deg F) + 460

$$C = \frac{A * Flow\ DP\ (in.wc)}{B}$$

$$Flow\ (cfm) = 3273.6 * \sqrt{C}$$

Calculated Flow (cfm): _____

Date: _____ Time: _____ Name: _____

**Former IBM B952/982 Site SSDS - Vapor Extraction System**

**Setpoint Monitoring Logsheet**

| ALARM / SYSTEM SET POINTS | Set Point | Comments |
|---|---|---|
| **Sub Slab System** | | |
| IT-103 (180 DEG)) | | |
| IT-104 HIGH SETPOINT (105 DEG) | | |
| IT-104 LOW SETPOINT (40 DEG.) | | |
| EXHAUST FAN ON SETPOINT (80 DEG.) | | |
| EXHAUST FAN OFF SETPOINT (70 DEG.) | | |
| VIT-101 LOW WARN SP (5" WC) | | |
| VIT-102 HIGH VAC ALARM SP (90" WC) | | |
| B-101 SPEED SETPOINT (45 Hz) | | |
| B-102 SPEED SETPOINT (45 Hz) | | |
| TEMP DIFF SETPOINT (10 DEG) | | |

Date: _____ Time: _____ Operator: _____

# Former IBM B952/982 Site SSDS - Vapor Extraction System
# Performance Monitoring Logsheet

**Date:** _____

**Time:** _____

**Personnel:** _____

**System Operating Data**

| Pre-Carbon Vacuum VIT-101 (in. wc) | Pre-Carbon Temp TT-101 (°F) | Post-Carbon Vacuum VIT-102 (in. wc) | Post-Carbon Temp TT-102 (°F) | Flow DP FI-101 (in. wc) | Calculated Flow (See Formula Below) | Blower B-101 Motor Speed (Hz) | Blower B-102 Motor Speed (Hz) | Blower Discharge Temp TT-103 (°F) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**Extraction Port (EP)/Suction Pit (SP)* Vacuum (in. wc) with Typical Operating Range**

| EP-01 | SP-01 | SP-02 | EP-02 | SP-03 | EP-03 | SP-04 | EP-04 | SP-05 | SP-06 | EP-05 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | -40 to -45 | -40 to -45 | 0 | -40 to -45 | 0 | -40 to -45 | 0 | -40 to -45 | -42 to -47 | -5 to -10 |
| | | | | | | | | | | |

**Subslab Vapor Implant (SSV) Vacuum (in. wc)***

| SSV-1001 | SSV-1002 | SSV-1003 | SSV-1004 | SSV-1006 | SSV-1008 | SSV-1009 | SSV-1010 | SSV-1012 | SSV-1016 | SSV-1017 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **SSV-1018** | **SSV-1019** | **SSV-1020** | **SSV-1021** | **SSV-1024** | **SSV-1025** | **SSV-1026** | **SSV-1027** | **SSV-1030** | **SSV-1031** | **SSV-1032** |
| | | | | | | | | | | |

| SSV-1033 | SSV-1028R | SSV-1029R | N. Brass | S. Brass |
|---|---|---|---|---|
| | | | | |

A = 14.7 - (Blower Vacuum (in.wc))/27.7

B = Post Carbon Temperature (deg F) + 460

C = (A*Flow DP (in.wc))/B

Flow (cfm) = 3273.6 * √C

Notes:

* See Figure 1 for EP, SP, and SSV locations.

# Property Owner Annual Site Wide Inspection Form

**Site Information:**

**Site No.** 314076

**Site Name:** Former IBM B952/982

**Site Address:** 2277 South Road
Poughkeepsie, NY 12601

**Reporting Period:** _____

**Inspection Results:**

| | No | Yes |
|---|---|---|
| Has some or all the property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period? | | |
| Have any federal, state, and/or local permits been issued for the property during this reporting period? | | |
| If Yes, is documentation (or evidence that documentation has been previously submitted) included with the completed inspection form? | | |
| Is the current use of the site consistent with a Restricted Residential use? | | |
| If No, is an explanation included with the completed inspection form? | | |
| Has there been a change in any institutional controls employed at this site during the reporting period? | | |
| If Yes, is documentation (or evidence that documentation has been previously submitted) included with the completed inspection form? | | |
| Have there been any changes to the cover system (i.e. is the structure intact and buildings unoccupied)? | | |
| If Yes, what was the change and was the concrete slab repaired and sealed as required by the Site Management Plan to continue to provide an effective barrier? | | |
| Is the cover system working as anticipated, and providing an effective barrier to the remaining contamination beneath the buildings? | | |
| Has anything occurred during the reporting period that would constitute a violation or failure to comply with the Site Management Plan for the cover system? | | |
| Have all the requirements of the Monitoring Plan relevant to the cover system been met for the reporting period? | | |

*Attached additional pages as needed to provide documentation required to support any answers to the above questions.